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Regulation No. **Synthesis DRAFT 2009\_12**  
UNIFORM PROVISIONS CONCERNING THE APPROVAL OF CHILD RETRAINT SYSTEMS USED  
ONBOARD OF MOTOR VEHICLES.

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## 1. SCOPE

This Regulation applies to ISOFIX Universal Integral child restraint systems for child occupants of power driven vehicles.

## 2. DEFINITIONS

For the purposes of this Regulation,

- 2.1. “Child Restraint System” means a device offering the child occupant the possibility to sit on, to sit in and/or to lay in. It is so designed as to diminish the risk of injury to the wearer, in the event of a collision or of abrupt deceleration of the vehicle, by limiting the mobility of the child’s body.
- 2.2. “ISOFIX” is an indication for the system of connection of a Child Restraint System to vehicles. It is based on two vehicle anchorages and two corresponding attachments on the Child Restraint System.
- 2.3. “ISOFIX Universal” is an indication for the system of connection of a Child Restraint System to vehicles. It is based on two vehicle anchorages and two corresponding attachments on the Child Restraint System in conjunction with an anti rotation device meant to limit the pitch rotation of the Child Restraint System, attached to, or supported by, the corresponding vehicle anchorage point. All three vehicle anchorages [and the vehicle floor reception area] are to be approved according Regulation No.14.
- 2.4. “NON-ISOFIX” is an indication for the system of connection of a child restraint to vehicles meaning that for its fixation no use is made of the ISOFIX anchorage.
- 2.5. “Integral” is a class indication for the retention of the child occupant in the child restraint, meaning that the child is restrained by means that make part only of the child restraint (strap harness, shield, etc.).
- 2.6. “Non-integral” is a class indication for the retention of the child occupant in the child restraint, meaning that the child has to be restrained by means not making part only of this child restraint (adult safety belt, etc.).
- 2.7. “[IUI]” (Integral Universal Isofix CRS) is a category indication for a child restraint meaning it is for use in all vehicles, not necessarily on all vehicle positions, approved according Regulation No.16 (to be amended) including its suitability for such a category of child restraint.
- 2.8. “Size” is a stature indication for a child restraint providing information for which range of child occupants it is meant. It is primarily based on stature, in order to facilitate proper use, but also based on maximum mass to provide manufacturers information that is related to expect maximum loads. Child restraint systems may cover any size range provided that all requirements are fulfilled.
- 2.9. “Orientation” is the indication that a child restraint system can be used forward-facing and/or rearward-facing, the following distinction is made:

- forward-facing means facing in the normal direction of travel of the vehicle;
  - Rearward-facing means facing in the direction opposite to the normal direction of travel of the vehicle.
- 2.10. "Special Needs Restraint" is a child restraint system designed for children who have special needs as a result of either a physical or mental challenge; this device may in particular permit additional restraining devices for any part of the child, but it must contain as a minimum a primary means of restraint which complies with the requirements of this Regulation.
- 2.11. "Restraint anchorages" means these parts of the vehicle structure or seat structure to which the child-restraint attachments are secured;
- 2.12. "ISOFIX anchorage system" means a system made up of 2 Isofix low anchorages fulfilling the requirements of regulation N°14 which is designed for attaching an Isofix child restraint system in conjunction with an anti-rotation device.
- 2.12.1. "ISOFIX low anchorage" means one 6 mm diameter rigid round horizontal bar, extending from vehicle or seat structure to accept and restrain an ISOFIX child restraint system with ISOFIX attachments.
- 2.13. "Anti-rotation device" is intended to limit the rotation of the Child Restraint System during an impact consisting in:  
(a) a top-tether strap.  
or  
(b) a support leg.  
meeting the requirements of this regulation, and fitted to ISOFIX anchorages system and ISOFIX top tether anchorages [or vehicle floor reception area] meeting the requirements of Regulation N°14.
- 2.14. "ISOFIX top tether strap" means a webbing strap (or equivalent) which extends from the top of an ISOFIX child restraint system to the ISOFIX top tether anchorage, and which is equipped with an adjustment device, a tension-relieving device, and an ISOFIX top tether connector.
- 2.14.1. "ISOFIX top tether anchorage" means a feature fulfilling the requirements of Regulation No. 14, such as a bar, located in a defined zone, designed to accept an ISOFIX top tether strap connector and transfer its restraint force to the vehicle structure.
- 2.14.2. "ISOFIX top tether connector" means a device intended to be attached to an ISOFIX top tether anchorage.
- 2.14.3. "ISOFIX top tether hook" means an ISOFIX top tether connector typically used to attach an ISOFIX top tether strap to an ISOFIX top tether anchorage as defined in Figure 3 of Regulation No. 14.
- 2.14.4. "ISOFIX top tether attachment" is a device to secure the ISOFIX top tether strap to the ISOFIX child restraint system.
- 2.15. "Universal Support leg" means a permanent attachment to a child restraint creating a compressive load path between the child restraint and a vehicle structure in order to by-pass seat cushion effects

during deceleration; a support leg must have a pushing surface with a minimum size and an adjustable length with a minimum and a maximum size.

- 2.15.1. "Universal Support Leg Foot" means a pushing surface intended to be applied to the car floor and to transmit a part of the CRS loading during a frontal impact to the car body structure.
- 2.15.2. "Reception area" means a part of the car floor intended to receive/support one or several Universal Support Leg Foot, as defined in ECE14/16.
- 2.16. "Vehicle seat fixture (VSF)" means a fixture, according to ISOFIX size classes defined in paragraph 2.1.1.7. and whose dimension are given in Figures 1 to 6 of Annex 17 Appendix 2 of Regulation No. 16, used by a child restraint manufacturer to determine the appropriate dimensions of an ISOFIX child restraint system and the location of its ISOFIX attachments

### 3. APPLICATION FOR APPROVAL

Tbd

### 4. MARKINGS

Tbd

### 5. APPROVAL

Tbd

### 6. GENERAL SPECIFICATIONS

6.1. Positioning and securing on the vehicle

6.1.1. The use of child restraints in the "IUI" category is permitted in any seat positions if the child restraints are fitted in conformity with the vehicle manufacturer's instructions.

[The use of child restraints in the "specific vehicle" category is permitted only for ISOFIX CRS in all seat positions and also in the luggage area if the restraints are fitted in conformity with the vehicle manufacturer's instructions.]

6.1.2. According to the category which it belongs to, the child restraint shall be secured to the vehicle structure or to the vehicle seat structure.

#### POSSIBLE CONFIGURATIONS FOR APPROVAL

##### TYPE / CATEGORIES TABLE

| TYPE / CATEGORY | Universal ISOFIX CRS <sup>(1)</sup> | Semi-universal ISOFIX CRS | Restricted ISOFIX CRS | Specific Vehicle ISOFIX CRS |
|-----------------|-------------------------------------|---------------------------|-----------------------|-----------------------------|
|-----------------|-------------------------------------|---------------------------|-----------------------|-----------------------------|

|                                  |    |    |    |    |
|----------------------------------|----|----|----|----|
| Lateral facing<br>(Carry-cot)    | A  | NA | A  | A  |
| Rearward facing                  | A  | NA | A  | A  |
| Forward facing<br>(integral)     | A  | NA | A  | A  |
| Forward facing<br>(non integral) | NA | NA | NA | NA |

With:

CRS: Child restraint system

A: Applicable

NA: Not Applicable

<sup>(1)</sup>IUI CRS means forward, rearward or lateral facing restraints for use in vehicles with positions equipped with ISOFIX anchorages system and an anti-rotation device.

- 6.1.2.1. For ISOFIX "universal" integral child restraint systems (IUI) by means of ISOFIX attachments and an anti-rotation device.
- 6.1.2.2. For the ISOFIX "specific vehicle" category: by means of the ISOFIX anchorages designed by the manufacturer of the vehicle or the manufacturer of the child restraint;
- 6.1.3. The child restraint manufacturer has to declare in written form that the toxicity of materials used in the manufacture of restraint systems and accessible to the restrained child is in conformity with the relevant parts of CEN Safety of Toys, part 3 (June 1982). <sup>1/</sup> Tests confirming the validity of the declaration may be carried out at the discretion of the test authority.
- 6.1.4. The child restraint manufacturer has to declare in written form that the flammability of materials used to manufacture the restraint system is in conformity with the relevant paragraphs of the ECE Consolidated Resolution on the Construction of Vehicles (R.E.3) (document TRANS/WP.29/78/Rev.1, paragraph 1.20.). Tests confirming the validity of the declaration may be carried out at the discretion of the test authority.
- 6.1.5. For children under the age of [15 or 18] months only carry-cot or rearward facing CRS must be used. The use of rearward facing CRS is authorised for any age.
- 6.1.6. With the exception of carry cots as defined in paragraph 2.4.1., all child restraint systems defined for sizes smaller than [105 cm] shall belong to the integral class.

## 6.2 Configuration of the Child Restraint

<sup>1/</sup> The address to obtain the relevant CEN standards is: CEN, 2 rue Bréderode, B.P. 5, B 1000 Bruxelles, Belgium.

- 6.2.1. The configuration of the child restraint shall be such that
- 6.2.1.1. The restraint of the child shall give the required protection in any intended position of the child restraint system; for "Special Needs Restraints" the primary means of restraint shall give the required protection in any intended position of the child restraint system without the use of the additional restraining devices which may be present.
- 6.2.1.2. The child is easily and quickly restrained and removed; in the case of a child restraint system in which the child is restrained by means of a harness belt or a Y-shaped belt without a retractor each shoulder restraint and lap strap shall be capable of movement relative to each other during the procedure prescribed in paragraph **7.2.1.4. - (to be defined in a next step)**
- In these cases the belt assembly of the child restraint may be designed with two or more connecting parts. For "Special Needs Restraints" it is recognized that the additional restraining devices will restrict the speed by which a child can be restrained and removed. However, the additional devices shall be designed to release quickly so far as possible.
- 6.2.1.3. If it is possible to change the inclination of the child restraint system, this change in inclination shall not require manual readjustment of any other part of the child restraint system. A deliberate hand-action is required in order to change the inclination of the child restraint system.
- 6.2.1.4. To prevent submarining, either by impact or through restlessness, a crotch strap shall be required on all forward-facing restraints incorporating an integral harness belt system. With the crotch strap attached and in its longest position if adjustable, it shall not be possible to adjust the lap strap to lie above the pelvis of the dummy.
- 6.2.1.5. To prevent excessive rotation an anti-rotation device shall be required on all forward and rearward facing child restraint systems.
- 6.2.1.6. The assembly shall not subject weak parts of the child's body (abdomen, crotch, etc.) to excessive stresses. The design shall be such that compression loads shall not be imposed on the crown of the child's head in the event of a collision.
- 6.2.2. The child restraint system shall be so designed and installed as:
- 6.2.2.1. not to exhibit sharp edges or protrusions liable to cause damage to vehicle-seat covers or to occupant's clothing;
- 6.2.2.2. To ensure that its rigid parts do not, at points where they are in contact with straps, exhibit sharp edges capable of abrading the straps.
- 6.2.3. **[Any components shall be so designed as to avoid any risk of incorrect assembly and use. Any separable part shall need special tools to be detached or fixed.]**
- 6.2.4. "Special Needs Restraints" may have additional restraining devices; these shall be designed to avoid any risk of incorrect assembly and that their means of release and mode of operation is immediately obvious to a rescuer in an emergency.

6.2.5. A child restraint system may be designed for use in range of size specified by the manufacturer, provided that it is able to satisfy the requirements laid down in this regulation.

6.3. ISOFIX restraint specifications

6.3.1. General characteristics

6.3.1.1. Dimensions

The maximum lateral, downward, and rearward dimensions for the ISOFIX child restraint system and the locations of the ISOFIX anchorages system with which its attachments must engage are defined for the ISOFIX child restraint system manufacturer by the Vehicle Seat Fixture (VSF) as defined in [paragraph 2.18](#) of this Regulation.

6.3.1.2. Mass

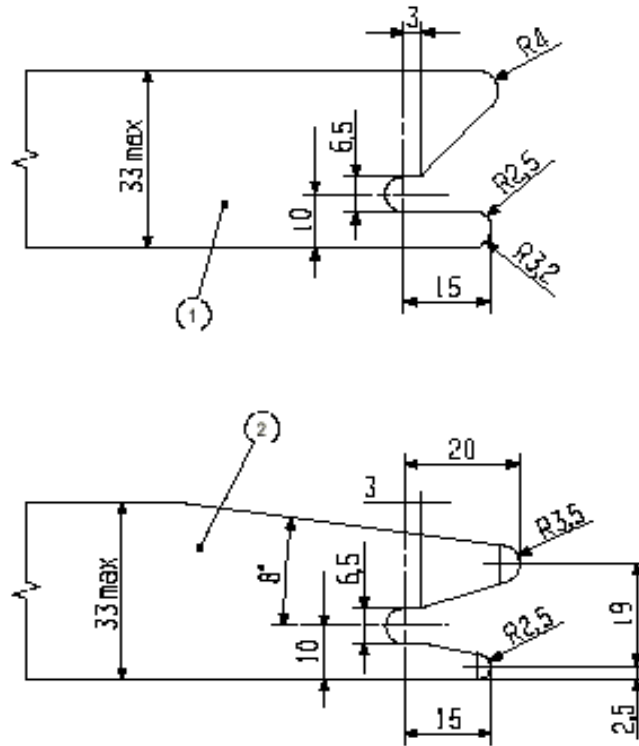
The mass of an ISOFIX child restraint system associated to the mass of the biggest child intended to use the child restraint system shall not exceed **[32]** kg.

6.3.2. ISOFIX Attachments

6.3.2.1. Type

ISOFIX Attachments may be according to examples shown in Figure 0 (a), or other appropriate designs that are part of a rigid mechanism having provision for adjustment, the nature of which is determined by the ISOFIX child restraint system manufacturer.





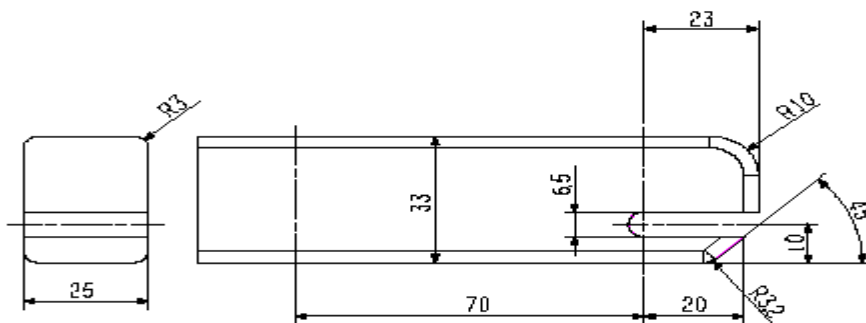
Dimensions in mm  
 Figure 0 (a)

Key

- 1 ISOFIX child restraint system attachment - example 1
- 2 ISOFIX child restraint system attachment - example 2

6.3.2.2. Dimensions

Dimensions for the portion of the ISOFIX child restraint system attachment that engages the ISOFIX anchorage system must not exceed the maximum dimensions given by the envelope in figure 0 (b)



Dime

Figure 0 (b)

6.3.2.3. Partial latching indication

The ISOFIX child restraint system shall incorporate means by which there is a clear indication that both of the ISOFIX attachments are completely latched with the corresponding ISOFIX lower anchorages. The indication means may be audible, tactile or visual or a combination of two or more. In case of visual indication it must be detectable under all normal lighting conditions.

6.3.3. ISOFIX child restraint top tether strap specifications

6.3.3.1. Top tether connector

The top tether connector should be ISOFIX top tether hook as shown in figure 0 (c), or similar devices that fit within the envelope given by figure 0 (c).

6.3.3.2. ISOFIX Top tether strap features

The ISOFIX top tether strap shall be supported by webbing (or its equivalent), having a provision for adjustment and release of tension.

6.3.3.2.1. ISOFIX Top tether strap length

ISOFIX Child restraint top tether strap length shall be at least 2,000 mm.

6.3.3.2.2. No-slack indicator

The ISOFIX top tether strap or the ISOFIX child seat shall be equipped with a device that will indicate that all slack has been removed from the strap. The device may be part of adjustment and tension relieving device.

6.3.3.2.3. Dimensions

Engagement dimensions for ISOFIX top tether hooks are shown in figure 0 (c).

Dimensions in millimetres

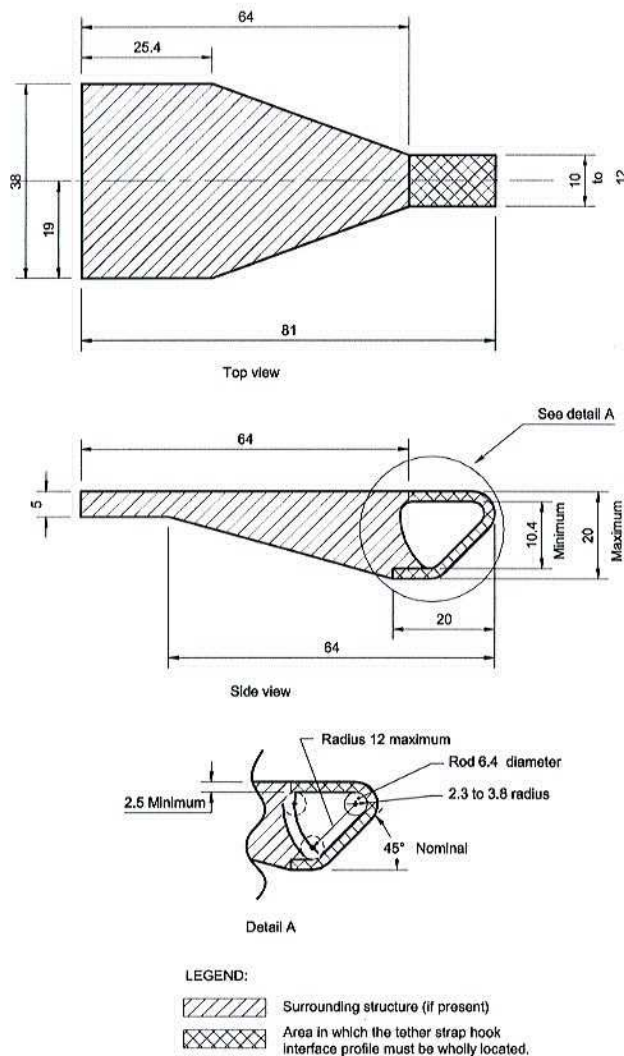


Figure 0 (c): ISOFIX Top tether connector (hook type) dimensions

#### 6.3.4. ISOFIX child restraint universal support leg specifications

A Universal Support leg shall fulfill both of the following requirements:

- a) Geometrical requirements:
  - a. Longitudinal and transversal positions adjustments
  - b. Leg length adjustment
  - c. Inclination
  - d. One (or several) universal support leg foot (feet)

b) Mechanical requirement: a maximum load to the vehicle floor reception area

*Note: Geometrical and mechanical requirements need to be defined (Reception area, Maximum Load acceptable, adjustment limits).*

#### 6.3.4.2. Universal Support Leg Adjustment

The Support Leg adjustment, measured at the level of the Support Leg Foot shall be:

- In longitudinal  $[535 \text{ mm}] < L < \text{XXX mm}$  from the ISOFIX low anchorages as defined in [§ 2.11.1](#)
- In transversal  $\pm \text{YYY mm}$  from the medium axis of ISOFIX low anchorages as defined in [§2.11.1](#).

*Pictures to be added*

The support leg may have more than only one pushing surfaces. Each pushing surfaces must fulfill the above requirements.

*Nota:*

- *In particular, the position adjustment requirements are needed to define a reception area on the vehicle floor.*
- *The values 535 mm and 550 mm are the size in X-direction of the gabarits defined in ECE16 for rearward and forward CRS.*
- *The maximum values in X and Y Directions are under discussion with CRS manufacturers.*

#### 6.3.4.3. Universal Support Leg Inclination

The support leg shall have an angle of  $[90^\circ \pm 5^\circ]$ , measured relatively to the plane defined by the bottom surface of the CRS.

*Nota: the value of 90° for the inclination is proposed because the majority of the support legs on the market have a support leg inclination around 90° (except one!). Today all the work done is based on a horizontal reception area.*

*The tolerance on the value is under discussion with CRS manufacturers.*

#### 6.3.4.4. Universal Support Leg Pushing Surface

The pushing surface must have a minimum size of  $[100 \text{ mm}^2]$  and a shape as defined in the following picture (*to be defined*).

*Picture of the pushing surface to be added*

In some cases, the support leg may have more than only one pushing surface. Each pushing surface must fulfill with the above requirements of size and shape.

The pushing surface measurement is presented in annex.

#### 6.3.4.5. Universal Support Leg length

The Universal Support Leg Length shall be between [MIN and MAX] (*values and tolerances have to be defined*).

*Picture to explain how to measure the length to be included.*

#### 6.3.4.6. Universal Support Leg Loading

The maximum load apply by a Universal Support Leg on a vehicle floor must be less than [XXX daN] (*value between 200 daN and 400 daN to be defined*).

#### 6.3.4.7. Adjustment provisions

The ISOFIX attachments, or the ISOFIX child restraint system itself, shall be adjustable to accommodate the range of ISOFIX anchorage locations and/or vehicle floor described in Regulation No. 14 (following ISO recommendations).

#### 6.4. Control of Markings

6.4.1. The Technical Service conducting the approval tests shall verify that the markings conform to the requirements of [paragraph 4](#).

#### 6.5. Control of Instructions on Installation and the Instructions for Use

6.5.1. The Technical Service conducting the approval tests shall verify that the instructions on installation and the instructions for use conform to [paragraph 14](#).

#### 6.6. Provisions applicable to the assembled child restraint

##### 6.6.1. Resistance to corrosion

6.6.1.1. A complete child restraint system, or the parts thereof that are liable to corrosion, shall be subject to the corrosion test specified in [paragraph 7.1.1](#). below.

6.6.1.2. After the corrosion test as prescribed in [paragraphs 7.1.1.1.](#) and [7.1.1.2.](#), no signs of deterioration likely to impair the proper functioning of the child restraint system, and no significant corrosion, shall be visible to the unaided eye of a qualified observer.

##### 6.6.2. Energy absorption

6.6.2.1. For all devices with backrests there shall be internal surfaces, defined in [Annex 18](#) to this Regulation, comprising material with a peak acceleration of less than 60 g when measured in accordance with [Annex 17](#) to this Regulation. This requirement applies also to areas of impact shields which are in the head strike area.

6.6.2.2. In the case of child restraint systems with permanent mechanically attached adjustable head support devices, in which the height of the child harness is directly controlled by the adjustable

head support, it is not necessary to demand energy absorbing material in areas as defined in Annex 18, which are not contactable by the manikin's head, i.e. behind the head support.

### 6.6.3. Overturning

6.6.3.1. The child restraint shall be tested as prescribed in paragraph 7.1.3.; the manikin shall not fall out of the device and, when the test seat is in the upside down position the manikin's head shall not move more than 300 mm from its original position in a vertical direction relative to the test seat.

### 6.6.4. Dynamic test

6.6.4.1. General. The child restraint shall be subjected to dynamic tests in conformity with paragraph 7.1.4. below.

6.6.4.1.1. Child restraints of the "universal" category shall be tested on the test trolley by means of the test seat prescribed in paragraph 6 Annex 6, and in conformity with paragraph 7.1.4.1.

6.6.4.1.2. Child restraints of the "specific vehicle" category shall be tested with each vehicle model for which the child restraint is intended. The Technical Service responsible for conducting the test may reduce the number of vehicle models tested if they do not differ greatly in the aspects listed in paragraph 6.6.4.1.2.3. The child restraint may be tested in one of the following ways:

6.6.4.1.2.1. On a complete vehicle, as prescribed in paragraph 7.1.4.3

6.6.4.1.2.2. In a vehicle body shell on the test trolley, as prescribed in paragraph 7.1.4.2.; or,

6.6.4.1.2.3. In sufficient parts of the vehicle body shell to be representative of the vehicle structure and impact surfaces. If the child restraint is intended for use in the rear seat, these shall include the back of the front seat, the rear seat, the floor pan, the B and C pillars and the roof. If the child restraint is intended for use in the front seat, the parts shall include the dashboard, the A pillars, the windscreen, any levers or knobs installed in the floor or on a console, the front seat, the floor pan and the roof. Furthermore, if the child restraint is intended for use in combination with the adult safety belt, the parts shall include the appropriate adult belt(s). The Technical Service responsible for conducting the test may permit items to be excluded if they are found to be superfluous. Testing shall be as prescribed in paragraph 7.1.4.2.

6.6.4.1.3. The dynamic test shall be performed on child restraints which have not previously been under load.

6.6.4.1.4. If a "specific vehicle" child restraint system is installed in the area behind the rearmost forward facing adult seat positions (for example, the luggage area), one test with the largest dummy/dummies on a complete vehicle as prescribed in paragraph 7.1.4.3.3. shall be performed. The other tests, including the conformity of production, may be done as prescribed in paragraph 7.1.4.3.2., if the manufacturer so wishes.

- 6.6.4.1.5. In the case of a "Special Needs Restraint" every dynamic test specified by this Regulation for the range of size specified by the manufacturer each test shall be performed twice: first, using the primary means of restraint and second, with all restraining devices in use. In these tests, special attention shall be given to the requirements in paragraphs 6.2.1.6. and 6.2.4.
- 6.6.4.1.6. In the case of an iSize child restraint with a support leg as an anti-rotation device the hereafter mentioned dynamic tests shall be carried out as follows:
- a) The tests for frontal impact shall be conducted with the support leg adjusted to its maximum adjustment compatible with the positioning of the trolley floor pan. The tests for rear impact shall be conducted with the worst case position selected by the Technical Service. During the tests the support leg shall be supported by the trolley floor pan as described in Annex 6, Appendix 3, Figure 2.
  - b) In the case of support legs out of the plane of symmetry, the worst case shall be selected by the Technical Service for the test.
  - c) In the case of specific vehicle category, the support leg shall be adjusted as specified by the child restraint manufacturer.
  - d) The leg length of a support leg must be adjustable in such a way that it is able to cover the complete span of floor pan levels that are allowed for in Regulation No.16, Annex 17 for car seats to be approved for the installation of ISOFIX Universal Integral Child Restraints Systems.
- 6.6.4.1.7. In the case of an iSize Child Restraint System making use of a top tether strap as an anti-rotation device, the dynamic test shall be carried out as follows:
- 6.6.4.1.7.1. With the anti-rotation device in use, [and]
- 6.6.4.1.7.2. [Without the anti-rotation device in use.]
- 6.6.4.2. During the dynamic tests, no part of the child restraint actually helping to keep the child in position shall break, and no buckles or locking system or displacement system shall release. It is permissible for parts of the seat to deform provided in doing so it does not directly affect the integrity of the seat to protect the occupant.
- 6.6.4.3. Dummy criteria for frontal and rear impact
- 6.6.4.3.1. Abdominal penetration: During the frontal impact the "Resultant of Fx and Fz registered in the lower lumbar spine shall not exceed [xx] percent of the lap belt force; this ratio shall be measured instantaneous with respect to time.
- 6.6.4.3.2. Injury assessment criteria for frontal and rear impact

#### **Injury assessment criteria per dummy**

| <b>Criterion</b>   | <b>Abbreviation</b> | <b>Q0</b> | <b>Q1</b> | <b>Q1.5</b> | <b>Q3</b>  | <b>Q6</b>   | <b>Q10</b> |
|--|---------------------|-----------|-----------|-------------|------------|-------------|------------|
| Head Impact Criterion (only in case of hard contact during in-vehicle testing) | HIC                 | 523 - 671 | 491 - 629 | 578 - 741   | 780 - 1000 | 1083 - 1389 |            |
| Head Acceleration 3ms  | A head 3ms          | 85        | 72        | 76          | 81         | 89          |            |
| [ Upper Neck Tension Force   | Fz                  | 546       | 1201      | 1364        | 1705       | 2304 ]      |            |
| [ Upper Neck Flexion Moment  | My                  | 17        | 53        | 61          | 79         | 118 ]       |            |
| Thorax Chest Deflection  | D chest             | NA        | 40        | 38          | 36         | 33          |            |
| Chest Acceleration 3 ms  | A chest 3ms         | 55        | 55        | 55          | 55         | 55          |            |

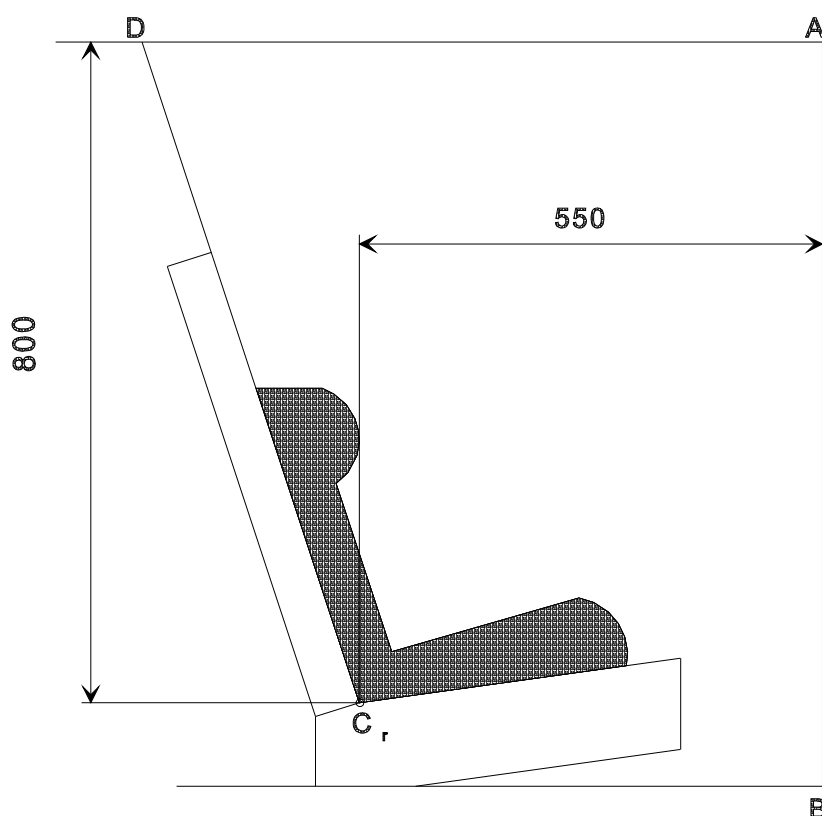
6.6.4.4. Manikin's head displacement for frontal and rear impact

6.6.4.4.1. Child restraints of the "universal" category:

6.6.4.4.1.1. Forward facing child restraints:

Head excursion: no part of the head of the manikin shall pass beyond the planes BA, ~~and~~ DA and DE as defined in Figure 1 below. This shall be judged up to 300 ms or the moment that the manikin has come to a definitive standstill whatever occurs first.





Dimensions in mm

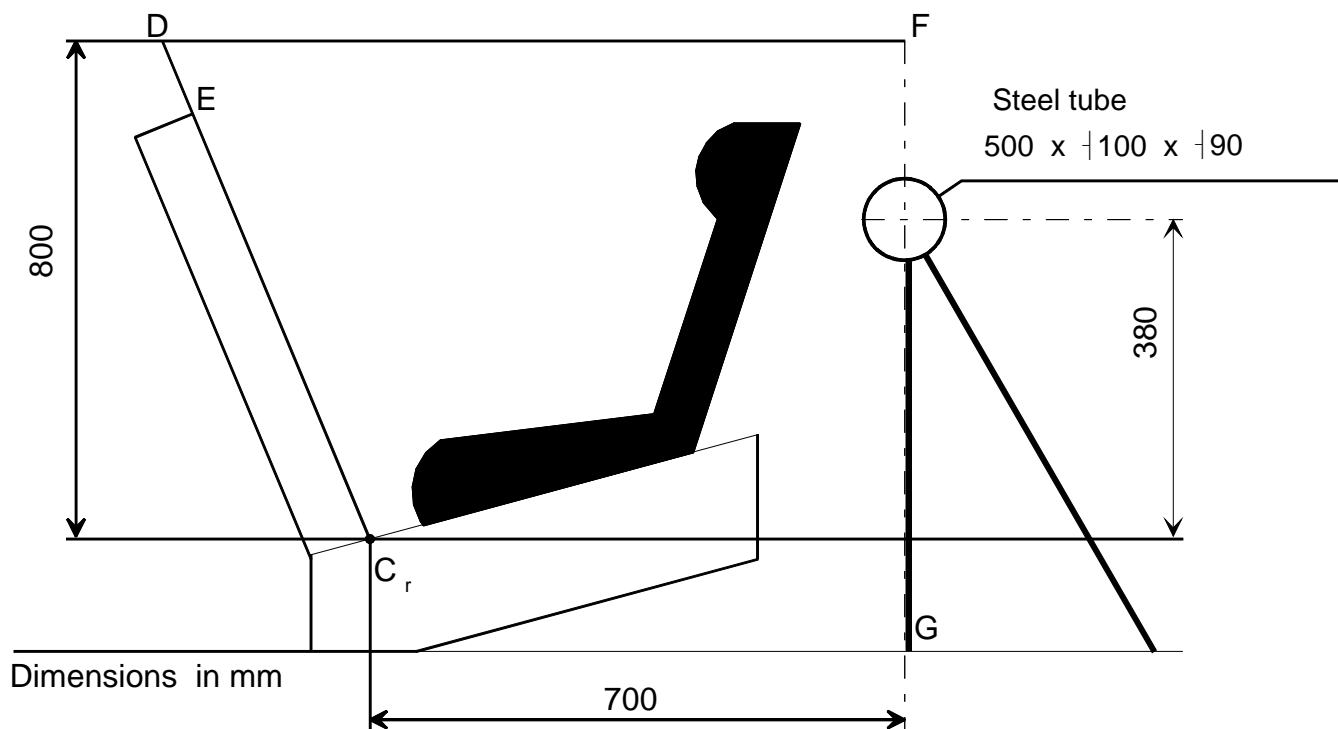
Figure 1 -  
Arrangement for testing a forward-facing device

6.6.4.4.1.2. Rearward-facing child restraints and carrycots:

6.6.4.4.1.2.1. **Head exposure:** during the dynamic tests the head must remain fully contained within the child restraint shell (i.e. the top of the head must not be exposed to the possibility of direct contact with surfaces of the vehicle).

6.6.4.4.1.2.2. **Head excursion:** no part of the head of the manikin shall pass beyond the planes FD, FG and DE, as shown in Figure 4 below. This shall be judged up to 300 ms or the moment that the manikin has come to a definitive standstill whatever occurs first.

In the case there is a contact of such a child restraint with the 100 mm diameter bar and all injury assessment and manikin's head displacement criteria are met, there shall be one further dynamic test (front impact) with the heaviest dummy intended for the given iSize indication and without the 100 mm diameter bar; the requirements for this test are that the criteria of paragraph 7.1.4.2. (child restraint integrity) and paragraph 7.1.4.4.1.2.1. (head exposure) are met.



**Figure 4:**  
Arrangement for testing rearward-facing devices, except group 0,  
not supported by the dashboard

6.6.4.4.2. Child restraints of the "specific vehicle" category: when tested in a complete vehicle or a vehicle body shell, the head shall not come into contact with any part of the vehicle. However, if there is contact, the head impact criterion HIC and the Head Acceleration 3ms shall be used as assessment criteria. In tests with complete vehicles it shall be possible to remove the manikins from the child restraint without the use of tools after the test.

6.6.4.5. Dummy criteria for lateral impact

6.6.4.5.1. Main injury assessment criterion - Head containment  
During the loading phase of lateral impact testing, up to [80] ms, side protection shall always be positioned at the level at the dummy's head centre of gravity perpendicular to the direction of the door intrusion. This containment will be assessed by a video analysis. Front-on and overhead camera views are assessed.

- 6.6.4.5.2. During the dynamic tests, no part of the child restraint actually helping to keep the child in position shall break, and no buckles or locking system or displacement system shall release. It is permissible for parts of the seat to deform provided in doing so it does not directly affect the integrity of the seat to protect the occupant.
- 6.6.4.5.3. Additional Injury assessment criteria  
Knowing that the Q Dummy family was not designed for side impact assessment adding other parameters might be useless. However in order to comply with the Informal group goal to ensure energy absorption within the CRS, head acceleration resultant acceleration could be considered.
- 6.6.5. Resistance to temperature
- 6.6.5.1. Buckle assemblies, retractors, adjusters and lock-off devices that are liable to be affected by temperature, shall be subject to the temperature test specified in paragraph **7.2.x.** below.
- 6.6.5.2. After the temperature test as prescribed in paragraph **7.2.x.x.**, no signs of deterioration likely to impair the proper functioning of the child restraint, shall be visible to the unaided eye of a qualified observer.
- 6.7. Provisions applicable to individual components of the restraint
- 6.7.1. Buckle
- 6.7.1.1. The buckle shall be so designed as to preclude any possibility of incorrect manipulation. This means, inter/alia, that it must not be possible for the buckle to be left in a partially closed position; it must not be possible to exchange the buckle parts inadvertently when the buckle is being locked; the buckle must only lock when all parts are engaged. Wherever the buckle is in contact with the child, it shall not be narrower than the minimum width of strap as specified in paragraph **6.7.4.1.1** below. This paragraph is not applicable to belt assemblies already approved according to ECE Regulation No. 16 or any equivalent standard in force. In the case of a "Special Needs Restraint" only the buckle on the primary means of restraint need comply with the requirements of paragraphs **6.7.1.2.** to **6.7.1.8.** inclusive.
- 6.7.1.2. The buckle, even when not under tension, shall remain closed whatever its position. It shall be easy to operate and to grasp. It shall be possible to open it by pressure on a button or on a similar device. The surface to which this pressure must be applied must have in the position of actual unlocking and when projected into a plane perpendicular to the button's initial direction of motion: for enclosed devices, an area of not less than 4.5 cm<sup>2</sup> with a width of not less than 15 mm; for non-enclosed devices, an area of 2.5 cm<sup>2</sup> and a width of not less than 10 mm. The width shall be the smaller of the two dimensions forming the prescribed area and shall be measured rectangular to the direction of movement of the release button.
- 6.7.1.3. The buckle release area shall be coloured red. No other part of the buckle shall be of this colour.
- 6.7.1.4. It shall be possible to release the child from the restraint by a single operation on a single buckle. It is allowed to remove the child together with devices such as infant carrier/carry-

cot/carry-cot restraints if the child restraint system can be released by operation of a maximum of two buckles.

- 6.7.1.4.1. A clip connection between the shoulder straps of a harness belt is deemed not to comply with the single operation requirement given in paragraph 6.7.1.4. above.
- 6.7.1.5. Opening of the buckle shall enable the child to be removed independently of the "chair", "chair support" or "impact shield", if fitted, and if the device includes a crotch strap the crotch strap shall be released by operation of the same buckle.
- 6.7.1.6. The buckle shall be capable of withstanding the temperature test operation requirements given in paragraph 7.2 (to be defined – tests of individual components / paragraph for temperature test) and repeated operation, and shall, before the dynamic test prescribed in paragraph 7.1.4. undergo a test comprising  $5,000 \pm 5$  opening and closing cycles under normal conditions for use.
- 6.7.1.7. The buckle shall be subjected to the following tests of opening:
  - 6.7.1.7.1. Test under load
    - 6.7.1.7.1.1. A child restraint having already undergone the dynamic test prescribed in paragraph 7.1.4. below shall be used for this test.
    - 6.7.1.7.1.2. The force required to open the buckle in the test prescribed in paragraph 7.2 (to be defined – tests of individual components) shall not exceed 80 N.
  - 6.7.1.7.2. No-load test
    - 6.7.1.7.2.1. A buckle which has not previously been subjected to a load shall be used for this test. The force needed to open the buckle when it is not under load shall be in the range of 40-80 N in the tests prescribed in 7.2 (to be defined – tests of individual components)
- 6.7.1.8. Strength.
  - 6.7.1.8.1. During the test in accordance with paragraph 7.2 (to be defined – tests of individual components), no part of the buckle or the adjacent straps or adjusters shall break or be detached.
  - 6.7.1.8.2. A harness buckle shall withstand [4,000 N-10,000 N].
  - 6.7.1.8.3. The competent authority may dispense with the buckle strength test if information already available renders the test superfluous.
- 6.7.2. Adjusting device
  - 6.7.2.1. The range of adjustment shall be sufficient to permit correct adjustment of the child restraint with all size for which the device is intended and to permit satisfactory installation in all specified vehicle models.

- 6.7.2.2. All adjusting devices shall be of the "quick adjuster" type, except that adjusting devices used only for the initial installation of the restraint in the vehicle may be of other than the "quick adjuster" type.
- 6.7.2.3. Devices of the "quick adjuster" type shall be easy to reach when the child restraint is correctly installed and the child or manikin is in position.
- 6.7.2.4. A device of the "quick adjuster" type shall be easily adjustable to the child's physique. In particular, in a test performed in accordance with paragraph 7.2 (to be defined – tests of individual components), the force required to operate a manual adjusting device shall not exceed 50 N.
- 6.7.2.5. Two samples of the child-restraint adjusting devices shall be tested as prescribed by the temperature test operation requirements given in paragraph 7.2 (to be defined – tests of individual components)
- 6.7.2.5.1. The amount of strap slip shall not exceed 25 mm for one adjusting device or 40 mm for all adjusting devices.
- 6.7.2.6. The device must not break or become detached when tested as prescribed in paragraph 7.2 (to be defined – tests of individual components).
- 6.7.2.7. An adjuster mounted directly on the child restraint shall be capable of withstanding repeated operation and shall, before the dynamic test prescribed in paragraph 7.1.4. undergo a test comprising  $5,000 \pm 5$  cycles as specified in paragraph 7.2 (to be defined – tests of individual components).
- 6.7.3. Retractors
- 6.7.3.1. Automatically-locking retractors
- 6.7.3.1.1. The strap of a safety-belt equipped with an automatically-locking retractor shall not unwind by more than 30 mm between locking positions of the retractor. After a rearward movement of the wearer the belt must either remain in its initial position or return to that position automatically on subsequent forward movement of the wearer.
- 6.7.3.1.2. If the retractor is part of a lap belt, the retracting force of the strap shall be not less than 7 N as measured in the free length between the manikin and the retractor as prescribed in paragraph 7.2 (to be defined – tests of individual components) below. If the retractor is part of a chest restraint, the retracting force of the strap shall be not less than 2 N or more than 7 N as similarly measured. If the strap passes through a guide or pulley, the retracting force shall be measured in the free length between the manikin and the guide or pulley. If the assembly incorporates a device, manually or automatically operated, that prevents the strap from being completely retracted, that device shall not be in operation when these measurements are effected.

- 6.7.3.1.3. The strap shall be repeatedly withdrawn from the retractor and allowed to retract, in the conditions prescribed in paragraph 7.2 (to be defined – tests of individual components) below, until 5,000 cycles have been completed. The retractor shall then be subjected to the temperature test operation requirements given in paragraph 7.2 (to be defined – tests of individual components), and corrosion test described in paragraph 7.1.1 and the dust-resistance test described in paragraph 7.2 (to be defined – tests of individual components). It shall then satisfactorily complete a further 5,000 cycles of withdrawal and retraction. After the above tests the retractor shall continue to operate correctly and to meet the requirements of paragraphs 6.7.3.2.1.1. and 6.7.3.2.1.2. above.
- 6.7.3.2. Emergency-locking retractors
- 6.7.3.2.1. An emergency-locking retractor shall when tested as prescribed in paragraph 7.2 (to be defined – tests of individual components), satisfy the conditions below:
- 6.7.3.2.1.1. It shall be locked when the deceleration of the vehicle reaches 0.45 g.
- 6.7.3.2.1.2. It shall not lock for strap accelerations of less than 0.8 g as measured in the axis of strap extraction.
- 6.7.3.2.1.3. It shall not lock when its sensing device is tilted by not more than 12° in any direction from the installation position specified by its manufacturer.
- 6.7.3.2.1.4. It shall lock when its sensing device is tilted by more than 27° in any direction from the installation position specified by its manufacturer.
- 6.7.3.2.2. Where the operation of a retractor depends on an external signal or power source, the design shall ensure that the retractor locks automatically upon failure or interruption of that signal or power source.
- 6.7.3.2.3. A multiple-sensitivity emergency-locking retractor shall meet the requirements set out above. In addition, if one of the sensitivity factors relates to strap extraction, locking must have occurred at a strap acceleration of 1.5 g as measured in the axis of strap extraction.
- 6.7.3.2.4. In the tests referred to in paragraphs 6.7.3.2.1.1. and 6.7.3.2.1.3. above, the amount of strap extraction occurring before the retractor locks shall not exceed 50 mm, starting at the length of unwinding specified in paragraph 7.2 (to be defined – tests of individual components). In the test referred to in paragraph 7.2 (to be defined – tests of individual components), above, locking shall not occur during the 50 mm of strap extraction starting at the length of unwinding specified in paragraph 7.2 (to be defined – tests of individual components), below.
- 6.7.3.2.5. If the retractor is part of a lap belt, the retracting force of the strap shall be not less than 7 N as measured in the free length between the manikin and the retractor as prescribed in paragraph 7.2 (to be defined – tests of individual components). If the retractor is part of a chest restraint, the retracting force of the strap shall be not less than 2 N or more than 7 N as similarly measured. If the strap passes through a guide or pulley, the retracting force shall be measured in the free length between the manikin and the guide or pulley. If the assembly incorporates a

device, manually or automatically operated, that prevents the strap from being completely retracted, that device shall not be in operation when these measurements are effected.

6.7.3.2.6. The strap shall be repeatedly withdrawn from the retractor and allowed to retract, in the conditions prescribed in paragraph 7.2 (to be defined – tests of individual components), until 40,000 cycles have been completed. The retractor shall then be subjected to the temperature test operation requirements given in paragraph 7.2 (to be defined – tests of individual components), and corrosion test described in paragraph 8.1.1 and to the dust-resistance test described in paragraph 7.2 (to be defined – tests of individual components). It shall then satisfactorily complete a further 5,000 cycles of withdrawal and retraction (making 45,000 in all). After the above tests the retractor shall continue to operate correctly and to meet the requirements of paragraphs 6.7.3.2.1. to 6.7.3.2.5. above.

#### 6.7.4. Straps

##### 6.7.4.1. Width

6.7.4.1.1. The minimum width at the child-restraint straps which contact the dummy shall be 25 mm. These dimensions shall be measured during the strap strength test prescribed in paragraph 7.2 (to be defined – tests of individual components), without stopping the machine and under a load equal to 75 percent of the breaking load of the strap.

##### 6.7.4.2. Strength after room conditioning

6.7.4.2.1. On two sample straps conditioned as prescribed in paragraph 7.2 (to be defined – tests of individual components), the breaking load of the strap shall be determined as prescribed in paragraph 7.2 (to be defined – tests of individual components). below.

6.7.4.2.2. The difference between the breaking loads of the two samples shall not exceed 10 percent of the greater of the two breaking loads measured.

##### 6.7.4.3. Strength after special conditioning

6.7.4.3.1. On two straps conditioned as prescribed in one of the provisions of paragraph 7.2.X.x. (except paragraph 7.2.X.x.), the breaking load of the strap shall be not less than 75 percent of the average of the loads determined in the test referred to in paragraph 7.2.X.x. below.

6.7.4.3.2. In addition, the breaking load shall be not less than 3.6 kN for the restraints of IUI child restraint systems.

6.7.4.3.3. The competent authority may dispense with one or more of these tests if the composition of the material used, or information already available, renders the test or tests superfluous.

6.7.4.3.4. The abrasion conditioning procedure of type 1 defined in paragraph 7.2.X.x. shall only be performed when the microslip test defined in paragraph 7.2.X. below gives a result above 50 percent of the limit prescribed in paragraph 6.7.2.5.1. above.

6.7.4.4. It shall not be possible to pull the complete strap through any adjusters, buckles or anchoring points.

6.7.5. Lock-off device

6.7.5.1. The lock-off device must be permanently attached to the child restraint.

6.7.5.2. The lock-off device must not impair the durability of the adult belt and undergo temperature test operation requirements given in paragraph 7.2.X.x.

6.7.5.3. The lock-off device must not prevent the rapid release of the child.

6.7.5.4. Class A devices.

The amount of slip of the webbing shall not exceed 25 mm after the test prescribed in paragraph 7.2.X.x.

6.7.5.5. Class B devices.

The amount of slip of the webbing shall not exceed 25 mm after the test prescribed in paragraph 7.2.X.x.

6.7.6. ISOFIX attachment specifications

"ISOFIX attachments" and latching indicators shall be capable of withstanding repeated operations and shall, before the dynamic test prescribed in paragraph 7.1.4., undergo a test comprising  $2000 \pm 5$  opening and closing cycles under normal conditions of use.

**6.8. Hans Classification**

6.8.1. Child restraint systems may cover more than one size provided that the requirements of each size are fulfilled. Moreover each size separately has to be indicated on the child restraint and at least the shoulder heights belonging to these sizes are to be visible for the user.

6.8.2. Forward-facing is not permitted for size 50-74 and size 50-80.

6.8.3. There are no restrictions with regard to forward-facing for sizes above size 50-80, however for size 74-98 the orientation rearward-facing is strongly recommended.

6.8.4. The class integral is required for size 50-74, size 50-80 and size 74-98.

6.8.5. The class integral for an ISOFIX child restraint is restricted to size 50-74, size 50-80 and size 74-98.

6.8.6. ISOFIX child restraints of sizes above size 74-98 shall be of the class non-integral.

6.8.7. The mass of an ISOFIX child restraint shall not exceed 15 kg.



**The previous is written with the understanding that both the proposed third anchorage point and the testing with better dummies could make that ISOFIX (as fixation system) with the indication Rxxx-UNIVERSAL can be used in more orientations and spread over more sizes**

## 7. TESTS

### 7.1. Tests of the assembled child restraint system

#### 7.1.1. Corrosion

7.1.1.1. The metal items of the child restraint shall be positioned in a test chamber as prescribed in [Annex 4](#). In the case of a child restraint incorporating a retractor, the strap shall be unwound to full length less  $100 \pm 3$  mm. Except for short interruptions that may be necessary, for example, to check and replenish the salt solution, the exposure test shall proceed continuously for a period of  $50 \pm 0.5$  hours.

7.1.1.2. On completion of the exposure test the metal items of the child restraint shall be gently washed, or dipped, in clean running water with a temperature not higher than  $38^{\circ}\text{C}$  to remove any salt deposit that may have formed and then allowed to dry at room temperature of 18 to  $25^{\circ}\text{C}$  for  $24 \pm 1$  hours before inspection in accordance with paragraph [6.6.1.2](#). above.

#### 7.1.2. Energy absorption

**To be defined**

#### 7.1.3. Overturning

7.1.3.1. The manikin shall be placed in the restraints installed in accordance with this Regulation and taking into account the manufacturer's instructions and with the standard slack as specified in paragraph [7.1.3.6](#). **below – to be defined**

7.1.3.2. The restraint shall be fastened to the test seat or vehicle seat. The whole seat shall be rotated around a horizontal axis contained in the median longitudinal plane of the seat through an angle of  $360^{\circ}$  at a speed of 2-5 degrees/second. For the purposes of this test, devices intended for use in specific cars may be attached to the test seat described in [Annex 6](#).

7.1.3.3. This test shall be carried out again rotating in the reverse direction after having replaced, if necessary, the manikin in its initial position. With the rotational axis in the horizontal plane and at  $90^{\circ}$  to that of the two earlier tests, the procedure shall be repeated in the two directions of rotation.

7.1.3.4. These tests shall be carried out using both the smallest and the largest appropriate manikin of the size range for which the restraining device is intended.

#### 7.1.4. Dynamic tests– for frontal, rear and side impact

##### 7.1.4.1. Tests on the trolley and test seat

###### 7.1.4.1.1. Frontal impact

7.1.4.1.1.1. The trolley and test seat used in the dynamic test shall meet the requirements of [Annex 6](#) to this Regulation, and the dynamic crash test installation procedure is to be in accordance with [Annex 21](#).

7.1.4.1.1.2. The trolley shall remain horizontal throughout deceleration or acceleration.

###### 7.1.4.1.1.3. Deceleration or acceleration devices

The applicant shall choose to use one of the two following devices:

###### 7.1.4.1.1.3.1. Deceleration test device:

The deceleration of the trolley shall be achieved by using the apparatus prescribed in [Annex 6](#) to this Regulation or any other device giving equivalent results. This apparatus shall be capable of the performance specified in paragraph 7.1.4.4. and hereafter specified:

Calibration procedure:

The deceleration curve of the trolley, in the case of child restraint tests performed in accordance with paragraph 7.1.4.1., ballasted with inert masses up to 55 kg in order to reproduce one occupied child restraint, and in the case of child restraint tests in a vehicle body shell performed in accordance with paragraph 7.1.4.2., where the trolley is ballasted with the vehicle structure and inert masses up to x times 55 kg reproducing the number of x occupied child restraint systems, must remain, in the case of frontal impact, within the hatched area of the graph [in Annex 7, Appendix 1](#) of this Regulation, and, in the case of rear impact, within the hatched area of the graph in [Annex 7, Appendix 2](#) of this Regulation.

During calibration of the stopping device, the stopping distance shall be  $650 \pm 30$  mm for frontal impact, and  $275 \pm 20$  mm for rear impact.

Dynamic testing conditions during testing:

For frontal and rear impact the deceleration shall be achieved with the apparatus calibrated as stated above, however:

- a) The deceleration curve shall not have a more than 3 ms time duration exceedence of the lower borders of the performance requirements;
- b) If the tests above were performed at a higher speed and/or the deceleration curve has exceeded the upper level of the hatched area and the child restraint meets the requirements, the test shall be considered satisfactory.

###### 7.1.4.1.1.3.2. Acceleration test device

Dynamic testing conditions:

For frontal impact, the trolley shall be so propelled that, during the test, its total velocity change  $\Delta V$  is  $52 + 0 - 2$  km/h and its acceleration curve is within the hatched area of the graph in Annex 7, Appendix 1 and stay above the segment defined by the coordinates (5g, 10ms) and (9g, 20ms). The start of the impact (T0) is defined, according to ISO 17 373 for a level of acceleration of 0.5g.

For rear impact, the trolley shall be so propelled that, during the test, its total velocity change  $\Delta V$  is  $32 + 2 - 0$  km/h and its acceleration curve is within the hatched area of the graph in Annex 7, Appendix 2 and stay above the segment defined by the coordinates (5g, 5ms) and (10g, 10ms). The start of the impact (T0) is defined, according to ISO 17 373 for a level of acceleration of 0.5g.

Despite the fulfilment of the above requirements, the Technical Service shall use a mass of trolley (equipped with its seat), as specified in paragraph 1. of [Annex 6](#), superior to 380 kg.

However, if the tests above were performed at a higher speed and/or the acceleration curve has exceeded the upper level of the hatched area and the child restraint meets the requirements, the test shall be considered satisfactory.

7.1.4.1.1.4. The following measurements shall be made:

7.1.4.1.1.4.1. The trolley speed immediately before impact (only for deceleration sleds, needed for stopping distance calculation),

7.1.4.1.1.4.2. The stopping distance (only for deceleration sleds), which may be calculated by double integration of the recorded sled deceleration,

7.1.4.1.1.4.3. The displacement of the manikin's head in the vertical and horizontal direction of the tests with all Q-dummies necessary for the given iSize indication for at least the first 300 ms,

7.1.4.1.1.4.4. The lower lumbar spine loads  $F_x$  and  $F_z$  [and  $M_y$ ], the lap belt force at both sides [and the pelvis angular velocities  $\omega_y$  and  $\omega_z$ ] for at least the first 300 ms,

7.1.4.1.1.4.5. The parameters required to perform the injury assessment against the criteria as mentioned in paragraph 7.1.4.3.2. for at least the first 300 ms,

7.1.4.1.1.4.6. The trolley acceleration or deceleration for at least the first 300 ms.

7.1.4.1.1.5. After impact, the child restraint shall be inspected visually, without opening the buckle, to determine whether there has been any failure or breakage.

7.1.4.1.2. Rear impact

7.1.4.1.2.1. The test seat shall be rotated  $180^\circ$  when testing in compliance with the requirements of the rear impact test.

- 7.1.4.1.2.2. When testing a rearward-facing child restraint intended for use in the front seating position, the vehicle fascia shall be represented by a rigid bar attached to the trolley in such a way that all the energy absorption takes place in the child restraint.
- 7.1.4.1.2.3. The deceleration conditions shall satisfy the requirements of paragraph [7.1.4.1.1.3.1](#).
- The acceleration conditions shall satisfy the requirements of paragraph [7.1.4.1.1.3.2](#).
- 7.1.4.1.2.4. The measurements to be made shall be similar to those listed in paragraphs [7.1.4.1.1.4](#) to [7.1.4.1.1.4.6](#) above.
- 7.1.4.1.2.5. The deceleration conditions shall satisfy the requirements of paragraph [7.1.4.1.1.3.1](#).
- The acceleration conditions shall satisfy the requirements of paragraph [7.1.4.1.1.3.2](#).
- 7.1.4.2. Test on trolley and vehicle body shell
- 7.1.4.2.1. Lateral impact (for ISOFIX only)
- 7.1.4.2.1.1. The test seat shall be rotated 90° when testing in compliance with the requirements of the lateral impact test.
- 7.1.4.2.1.2. The lower ISOFIX anchorages should be movable in the Y direction to avoid damage of the attachments and to the test equipment. The ISOFIX anchorages are individually fixed to a sliding system allowing a movement up to [X] mm.
- 7.1.4.2.1.3. The lateral impact loading to the CRS is generated by a door panel as defined in Annex X. [The stiffness and strength of the door panel shall be sufficient to avoid excessive oscillation or significant deformation during lateral dynamic test]. The surface of the panel is covered with padding as specified in Annex X
- 7.1.4.2.1.4. The test rig shall reproduce a relative velocity between the door panel and the test bench in compliance with [Annex 7 Appendix 3](#). The initial relative velocity between the door panel and the bench is 7 m/s +/- 0.2 m/s. The maximum intrusion depth of the door panel is defined in Annex 7 Appendix 3. The relative velocity between the door panel and the test bench shall not be affected by contact with the CRS and shall remain within the corridor defined in Annex 7 appendix 3.  
The corresponding velocity – time corridor remains to be established.
- 7.1.4.2.1.5. The CRS is tested in its most upright position.
- 7.1.4.2.1.6. At time t0 defined [Annex 7 Appendix 3](#), the dummy must be in its initial position as defined in Annex 21.
- 7.1.4.2.1.7. Test set-up
- CRS Simulation
  - Dummy installation

7.1.4.2.2. Frontal impact

- 7.1.4.2.2.1. The method used to secure the vehicle during the test shall not be such as to strengthen the anchorages of the vehicle seats, adult safety belts and any additional anchorages required to secure the child restraint or to lessen the normal deformation of the structure. No part of the vehicle shall be present which, by limiting the movement of the manikin, would reduce the load imposed on the child restraint during the test. The parts of the structure eliminated may be replaced by parts of equivalent strength, provided they do not hinder the movement of the manikin.
- 7.1.4.2.2.2. A securing device shall be regarded as satisfactory if it produces no effect on an area extending over the whole width of the structure and if the vehicle or structure is blocked or fixed in front at a distance of not less than 500 mm from the anchorage of the restraint system. At the rear the structure shall be secured at a sufficient distance behind the anchorages to ensure that all requirements of [paragraph 8.1.3.2.1.1.](#) above are fulfilled.
- 7.1.4.2.2.3. The vehicle seat and child restraint shall be fitted and shall be placed in a position chosen by the Technical Service conducting approval tests to give the most adverse conditions in respect of strength, compatible with installing the manikin in the vehicle. The position of the vehicle seat-back and child restraint shall be stated in the report. The vehicle seat-back, if adjustable for inclination, shall be locked as specified by the manufacturer or, in the absence of any specification, at an actual seat-back angle as near as possible to 25°.
- 7.1.4.2.2.4. Unless the instructions for fitting and use require otherwise, the front seat shall be placed in the most forward normally used position for child restraints intended for use in the front seating position, and in the rearmost normally used position for child restraints intended for use in the rear seating position.
- 7.1.4.2.2.5. The deceleration conditions shall satisfy the requirements of [paragraph 7.1.4.4.](#) below. The test seat will be the seat of the actual vehicle.
- 7.1.4.2.2.6. The following measurements shall be made:
  - 7.1.4.2.2.6.1. The trolley speed immediately before impact (only for deceleration sleds, needed for stopping distance calculation),
  - 7.1.4.2.2.6.2. The stopping distance (only for deceleration sleds), which may be calculated by double integration of the recorded sled deceleration,
  - 7.1.4.2.2.6.3. Any contact of the manikin's head with the interior of the vehicle body shell;
  - 7.1.4.2.2.6.4. The lower lumbar spine loads  $F_x$  and  $F_z$  [and  $M_y$ ], the lap belt force at both sides [and the pelvis angular velocities  $\omega_y$  and  $\omega_z$ ] for at least the first 300 ms lower lumbar spine loads,

- 7.1.4.2.2.6.5. The parameters required to perform the injury assessment against the criteria as mentioned in paragraph 7.1.4.3.2. for at least the first 300 ms,
- 7.1.4.2.2.6.6. The trolley and vehicle body shell acceleration or deceleration for at least the first 300 ms.
- 7.1.4.2.2.7. After impact, the child restraint shall be inspected visually, without opening the buckle, to determine whether there has been any failure.
- 7.1.4.2.3. Rear impact -
  - 7.1.4.2.3.1. For rear impact tests the vehicle body shell shall be rotated 180° on the test trolley.
  - 7.1.4.2.3.2. Same requirements as for frontal impact.
- 7.1.4.3. Test with complete vehicle
  - 7.1.4.3.1. The deceleration conditions shall satisfy the requirements of paragraph 7.1.4.4. below.
  - 7.1.4.3.2. For frontal impact tests the procedure shall be that set out in [Annex 9](#) to this Regulation.
  - 7.1.4.3.3. For rear impact tests the procedure shall be that set out in [Annex 10](#) to this Regulation.
  - 7.1.4.3.4. The following measurements shall be made:
    - 7.1.4.3.4.1. The speed of the vehicle/impactor immediately before impact;
    - 7.1.4.3.4.2. Any contact of the manikin's head with the interior of the vehicle;
    - 7.1.4.3.4.3. The lower lumbar spine loads  $F_x$  and  $F_z$  [and  $M_y$ ], the lap belt force at both sides [and the pelvis angular velocities  $\omega_y$  and  $\omega_z$ ] for at least the first 300 ms lower lumbar spine loads,
    - 7.1.4.3.4.4. The parameters required to perform the injury assessment against the criteria as mentioned in paragraph 7.1.4.3.2. for at least the first 300 ms.
  - 7.1.4.3.5. The front seats, if adjustable for inclination, shall be locked as specified by the manufacturer or, in the absence of any specification, at an actual seat-back angle as near as possible to 25°.
  - 7.1.4.3.6. After impact, the child restraint shall be inspected visually, without opening the buckle, to determine whether there has been any failure or breakage.

7.1.4.4. The conditions for dynamic test are summarized in the table below:

| Test                       | Restraint  | FRONTAL IMPACT |                   |                                    | REAR IMPACT  |            |                                    |
|----------------------------|--|----------------|-------------------|------------------------------------|--------------|------------|------------------------------------|
|                            |  | Speed (km/h)   | <i>Test</i> pulse | Stopping distance during test (mm) | Speed (km/h) | Test pulse | Stopping distance during test (mm) |
| Trolley with test seat     | Forward facing front and rear seats universal, semi-universal or restricted */   | 50+0<br>-2     | 1                 | 650±50                             | -            | -          | -                                  |
|                            | Rearward facing front and rear seats universal, semi-universal or restricted **/ | 50+0<br>-2     | 1                 | 650±50                             | 30+2<br>-0   | 2          | 275±25                             |
| Vehicle body on trolley    | Forward facing */  | 50+0<br>-2     | 1 or 3            | 650±50                             | -            | -          | -                                  |
|                            | Rearward facing */   | 50+2<br>-2     | 1 or 3            | 650±50                             | 30+2<br>-0   | 2 or 4     | 275±25                             |
| Whole vehicle barrier test | Forward facing   | 50+0<br>-2     | 3                 | not specified                      | -            | -          | -                                  |
|                            | Rearward facing  | 50+0<br>-2     | 3                 | not specified                      | 30+2<br>-0   | 4          | not specified                      |

LEGEND:

Test Pulse No. 1 - As prescribed in Annex 7 - frontal impact.

Test Pulse No. 2 - As prescribed in Annex 7 - rear impact.

~~Test Pulse No. 3 - Deceleration pulse of vehicle subjected to frontal impact.~~

~~Test Pulse No. 4 - Deceleration pulse of vehicle subjected to rear impact.~~

*Test Pulse No. 5 Deceleration pulse of vehicle subjected to side impact to be defined.*

7.1.4.5. Test manikins

\*/ During calibration, the stopping distance should be  $650 \pm 30$  mm.

\*\*/ During calibration, the stopping distance should be  $275 \pm 20$  mm.

7.1.4.5.1. The child restraint shall be tested using the manikins prescribed in [Annex 8](#) to this Regulation.

7.1.4.5.2. Installation of the manikin

7.1.4.5.2.1. The manikin shall be placed so that the gap is between the rear of the manikin and the restraint. In the case of carry-cots the manikin is placed in a straight horizontal position as close as possible to the centre line of the carry-cot.

7.1.4.5.2.2. Place the child chair on the test seat.

Place the manikin in the child chair, such that:

-the dummy head is horizontal following the ...

-the arms of the dummy are placed following the ....

Place a hinged board or a similar flexible device 2.5 cm thick and 6 cm wide and of length equal to the shoulder height (sitting, Annex 8) less the hip centre height (sitting, in Annex 8 popliteus height plus half of thigh height, sitting) relevant to the manikin size being tested between the manikin and the seat back of the chair. The board should follow as closely as possible the curvature of the chair and its lower end should be at the height of the manikin's hip joint.

Adjust the belt in accordance with the manufacturer's instructions, but to a tension of  $250 \pm 25$  N above the adjuster force, with a deflection angle of the strap at the adjuster of  $45 \pm 5^\circ$ , or alternatively, the angle prescribed by the manufacturer.

Complete the installation of the child chair to the test seat in accordance with Annex 21 to this Regulation.

Remove the flexible device.

This only applies to harness restraints and to restraints where the child is restrained by the adult three-point belt and where a lock-off device is used and does not apply to child restraining straps connected directly to a retractor.

7.1.4.5.2.3. The longitudinal plane passing through the centre line of the dummy shall be set midway between the two lower belt anchorages, however note shall also be taken of paragraph [8.1.3.2.1.3](#). In case of booster cushions to be tested with the manikin representing a 10-year-old child, the longitudinal plane passing through the centre line of the manikin shall be positioned  $75 \pm 5$  mm to the left or right with regard to the point midway between the two lower belt anchorages.

7.1.4.5.2.4. In the case of devices requiring the use of a standard belt, the shoulder strap may be positioned on the manikin prior to the dynamic test by the use of a light-weight masking tape of sufficient length and width. In the case of rear-facing restraints, it is permitted to use a light-weight masking tape to connect the dummy's head to the 100 mm bar or the back of the restraint during the sled acceleration.

7.1.4.6.

iSize indication



The manikin(s) that are used in testing will be the nominator for the iSize indication that the child restraint may carry, in the following way:

*Remark: so the classification of groups will be left and an iSize indication will be introduced. The table below is inspired by the segmentation presented in the German document CRS-07-04, that is to say that a test with a certain Q-dummy will provide the indication and that tests with more Q-dummy will simply extend the indication.  
A certain restriction with respect to mass is not (yet?) taken on board!*

7.1.4.6.1. Q0, iSize 40-60,

7.1.4.6.2. Q1, iSize 60-80,

7.1.4.6.3. Q1,5, iSize 70-90,

7.1.4.6.4. Q3, iSize 85-105,

7.1.4.6.5. Q6, iSize 105-130,

7.1.4.6.6. Q10, iSize 130-[150]

7.1.4.6.7. If the child restraint system is suitable for wider iSize indications than stated above for one dummy, the tests shall be carried out using all manikins specified above to create a complete cover of this larger indication.

7.1.4.6.8. If the child restraint system is designed for two or more children, one test shall be carried out with the heaviest manikins occupying all seat positions. A second test with the lightest and the heaviest manikins specified above shall be carried out. The tests shall be conducted using the test seat as shown in [Annex 6, Appendix 3, Figure 3](#). The laboratory conducting the tests may, if it deems it advisable, add a third test with any combination of manikins or empty seat positions.

7.1.4.6.9. If the ISOFIX child restraint system must use a top tether, one test shall be carried out with the smallest dummy with the shorter distance of the top tether (anchorage point G1). A second test shall be carried out with the heavier dummy with the longer distance of the top tether (anchorage point G2). Adjust the top tether to achieve a tension load of  $50 \pm 5$  N.

7.1.4.6.10. The test specified in paragraph [7.1.4.1.10.1.2 \(doesn't exist\)](#), need only be carried out with the largest manikin for which the child restraint is designed.

#### 7.1.5. Restraint of booster cushions

Place a cotton cloth on the seating surface of the test bench. Position the booster cushion on the test bench, position the lower torso body block as described in Annex 22, Figure 1, on the seating surface, fit and apply the 3-point adult safety-belt and tension as prescribed in Annex 21. With a piece of 25 mm width webbing or similar tied round the booster, apply a

load of  $250 \pm 5$  N in the direction of arrow A, see Annex 22, Figure 2, in line with the seating surface of the test bench.

7.2. Tests of individual components

*Remark: the contents of paragraph 7.2. concern all kinds of tests for several components and is not taken on board in this piece of work.*

7.3. Certification of Test Bench Cushion

*Remark: the contents of 7.3. will be replaced by the certification derived from the work done by NPACS.*

7.4. Registration of dynamic behaviour

7.4.1. In order to determine the behaviour of the manikin and its displacements, all dynamic tests shall be registered according to the following conditions:

7.4.1.1. Filming and recording conditions:

- (a) The frequency shall be at least 1000 frames per second;
- (b) The test shall be recorded on video or digital data carrier over at least the first 300 ms;

7.4.1.2. Estimation of uncertainty:

Testing laboratories shall have and shall apply procedures for estimating uncertainty of measurement of the displacement of the manikin's head. The uncertainty shall be within  $\pm 25$  mm.

Examples of international standards of such procedure are EA-4/02 of the European Accreditation Organization or ISO 5725:1994 or the General Uncertainty Measurement (GUM) method.

7.5. The measuring procedures shall correspond to those defined in ISO 6487: 2002. The channel frequency class shall be:

| <u>Type of measurement</u> | <u>CFC(<math>F_H</math>)</u> | <u>Cut-off frequency (<math>F_N</math>)</u> |
|----------------------------|------------------------------|---|
| Trolley acceleration       | 60                           | see ISO 6487:2002 Annex A                   |
| Belt loads                 | 600                          | see ISO 6487:2002 Annex A                   |
| Chest acceleration         | 600                          | see ISO 6487:2002 Annex A                   |
| Head acceleration          | 1000                         | [1650]                                      |
| Upper neck force           | 600                          |   |
| Upper neck moment          | 600                          |   |
| Chest deflection           | 600                          |   |

The sampling rate should be a minimum of 10 times the channel frequency class (i.e. in installations with channel frequency class of 1000, this corresponds to a minimum sampling rate of 10000 samples per second per channel). ]

## **8. TEST REPORTS OF TYPE APPROVAL AND OF PRODUCTION QUALIFICATION**

- 8.1. The test report shall record the results of all tests and measurements including the following test data:
- (a) the type of device used for the test (acceleration or deceleration device),
  - (b) the total velocity change,
  - (c) the trolley speed immediately before impact only for deceleration sleds,
  - (d) the acceleration or deceleration curve during all the velocity change of the trolley and at least 300 ms,
  - (e) the time (in ms) when the head of the manikin reaches its maximum displacement during the performance of the dynamic test,
  - (f) the place occupied by the buckle during the tests, if it can be varied,
  - (g) any failure or breakage, ,
  - (h) the following dummy criteria: HIC, Head Acceleration 3ms, Upper Neck Tension Force, Upper Neck Moment, Thorax Chest Deflection and Lower Lumbar Load Cel Force, and
  - (i) the lap belt force

Remark: the list of data above could be replaced by the requirement that the test report must be formulated according a harmonized test report given in Annex so and so!

- 8.2. If provisions relating to anchorages contained in Annex 6, Appendix 3, to this Regulation have not been respected, the test report shall describe how the child restraint is installed and shall specify important angles and dimensions.

- 8.3. When the child restraint is tested in a vehicle or vehicle structure, the test report shall specify the manner of attaching the vehicle structure to the trolley, the position of the child restraint and vehicle seat and the inclination of the vehicle seat-back.
- 8.4. The test reports of type approval and of production qualification shall record the verification of markings and of instructions on installation and use.

## **9. PRODUCTION QUALIFICATION**

## **10.CONFORMITY OF PRODUCTION AND ROUTINE TESTS**

## **11.MODIFICATION AND EXTENSION OF APPROVAL OF A CHILD RESTRAINT SYSTEM**

## **12.PENALTIES FOR NON-CONFORMITY OF PRODUCTION**

## **13.PRODUCTION DEFINITELY DISCONTINUED**

## **14.INFORMATION FOR USERS**

## **15.TRANSITIONAL PROVISIONS**

## **16.NAMES AND ADDRESSES OF TECHNICAL SERVICES RESPONSIBLE FOR CONDUCTING APPROVAL TESTS, AND OF ADMINISTRATIVE DEPARTMENTS**

The Parties to the 1958 Agreement applying this Regulation shall communicate to the United Nations Secretariat the names and addresses of the technical services responsible for conducting approval tests and of the administrative departments which grant approval and to which forms certifying approval or extension or refusal or withdrawal of approval, or production definitely discontinued, issued in other countries, are to be sent.

**Annex 1 A**

**Annex 1 B**

**Annex 2 A**

**Annex 2 B**

## Annex 4

### CORROSION TEST

#### 1. Test apparatus

- 1.1. The apparatus shall consist of a mist chamber, a salt solution reservoir, a supply of suitably conditioned compressed air, one or more atomizing nozzles, sample supports, provision for heating the chamber, and necessary means of control. The size and detailed construction of the apparatus shall be optional, provided that the test conditions are met.
- 1.2. It is important to ensure that drops of solution accumulated on the ceiling or cover of the chamber do not fall on test samples.
- 1.3. Drops of solution which fall from test samples shall not be returned to the reservoir for respraying.
- 1.4. The apparatus shall not be constructed of materials that will affect the corrosiveness of the mist.

#### 2. Location of test samples in the mist cabinet

- 2.1. Samples, except retractors, shall be supported or suspended between 15° and 30° from the vertical and preferably parallel to the principal direction of horizontal flow of mist through the chamber, based upon the dominant surface being tested.
- 2.2. Retractors shall be supported or suspended so that the axes of the reel for storing the strap shall be perpendicular to the principal direction of horizontal flow of mist through the chamber. The strap opening in the retractor shall also be facing in this principal direction.
- 2.3. Each sample shall be so placed as to permit free settling of mist on all samples.
- 2.4. Each sample shall be so placed as to prevent salt solution from one sample dripping on to any other sample.

#### 3. Salt solution

- 3.1. The salt solution shall be prepared by dissolving  $5 \pm 1$  parts by mass of sodium chloride in 95 parts of distilled water. The salt shall be sodium chloride

- 3.2. substantially free of nickel and copper and containing not more than 0.1 percent of sodium iodide and not more than 0.3 percent of total impurities in the dry state. The solution shall be such that, when atomized at 35°C, the collected solution is in the pH range of 6.5 to 7.2.

4. Compressed air

- 4.1. The compressed air supply to the nozzle or nozzles for atomizing the salt solution shall be free of oil and dirt, and maintained at a pressure between 70 kN/m<sup>2</sup> and 170 kN/m<sup>2</sup>.

5. Conditions in the mist chamber

- 5.1. The exposure zone of the mist chamber shall be maintained at 35 ± 5°C. At least two clean mist collectors shall be placed within the exposure zone, so that no drops of solution from the test samples or any other sources are collected. The collectors shall be placed near the test samples, one as near as possible to any nozzle and one as far as possible from all nozzles. The mist shall be such that, for each 80 cm<sup>2</sup> of horizontal collecting area, from 1.0 to 2.0 ml of solution per hour, when measured over an average of at least 16 hours, is collected in each collector.
- 5.2. The nozzle or nozzles shall be directed or baffled, so that the spray does not impinge directly on the test samples.

## Annex 5

### Annex 6 (to be revised)

#### DESCRIPTION OF TROLLEY

1. Trolley
  - 1.1. For tests on child restraints, the trolley, carrying the seat only, shall have a mass greater than 380 kg. For tests on child restraint systems in the vehicle specific category, the trolley with the attached vehicle structure shall have a mass greater than 800 kg.
2. Calibration screen
  - 2.1. A calibration screen shall be attached firmly to the trolley with a movement limit line plainly marked on it to enable compliance with forward movement criteria to be determined from photographic records.
3. Seat
  - 3.1. The seat shall be constructed as follows:
    - 3.1.1. A rigid back, fixed, dimensions of which are given in Appendix 1 to this annex. The lower part and the upper part is made of a 20 mm diameter tube;
    - 3.1.2. Rigid seating, dimensions of which are given in Appendix 1 to this annex. The rear part of the seating is made from a rigid sheet metal, the upper edge of which is a 20 mm diameter tube. The front part of the seating is also made of a 20 mm diameter tube;
    - 3.1.3. For access to the anchor brackets, openings shall be made at the rear of the cushion of the seat, as prescribed in Appendix 1 to this annex;
    - 3.1.4. The width of the seat shall be 800 mm;
    - 3.1.5. The back and the seating shall be covered with polyurethane foam, the characteristics of which are given in Table 1. The dimensions of the cushion are given in Appendix 1 to this annex;



Table 1:

|   |     |
|---|-----|
| Density according to ISO 485 (kg/m <sup>3</sup> )     | 43  |
| Bearing strength according to ISO 2439B (N)           |     |
| p - 25 percent  | 125 |
| p - 40 percent  | 155 |
| Bearing strength factor according to ISO 3386 (kPa)   | 4   |
| Elongation at rupture according to ISO 1798 (percent) | 180 |
| Breaking strength according to ISO 1798 (kPa)         | 100 |
| Compression set according to ISO 1856 (percent)       | 3   |

- 3.1.6. The polyurethane foam shall be covered with a sun shade cloth, made of polyacrylate fibre, the characteristics of which are given in Table 2.

Table 2:

|   |     |
|---|-----|
| Specific mass (g/m <sup>2</sup> )                                     | 290 |
| Breaking strength according to DIN 53587 on test specimen 50 mm wide: |     |
| lengthwise (kg):  | 120 |
| breadth wise (kg):  | 80  |

- 3.1.7. Covering the seat and the seat back<sup>2/</sup>

- 3.1.7.1. The seat foam cushion is produced out of a square foam block (800 x 575 x 135 mm) in such a way (see Figure 1 of Appendix 1 to this annex) that its shape resembles the shape of the aluminium bottom-plate specified in Figure 2 of Appendix 1 to this annex.
- 3.1.7.2. Six holes are drilled in the bottom-plate in order to fasten it to the trolley with bolts. The holes are drilled alongside the longest side of the plate, three on each side, their position being dependent on the construction of the trolley. Six bolts are put through the holes. It is recommended to glue the bolts on the plate with an appropriate adhesive. Afterwards, the bolts are fastened with nuts.
- 3.1.7.3. The cover material (1250 x 1200 mm, see Figure 3 of Appendix 1 to this annex) is cut across the width in such a way that it is not possible for the material to overlap after covering. There should be a gap of about 100 mm between the

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<sup>2/</sup> Details of materials used in this process can be obtained from TNO (Research Institute for Road Vehicles), Schoemakerstraat 97, 2628 VK Delft, The Netherlands.

edges of the cover material. Therefore the material has to be cut at about 1200 mm.

- 3.1.7.4. The cover material is marked with two lines which run across the width. They are drawn 375 mm from the centreline of the cover material. (See Figure 3 of Appendix 1 to this annex)
- 3.1.7.5. The seat foam cushion is placed upside down on the cover material with the aluminium bottom-plate on top.
- 3.1.7.6. On both sides the cover material is stretched until the lines drawn on it match the edges of the aluminium bottom-plate. At each bolt position, small incisions are made and the cover material is pulled over the bolts.
- 3.1.7.7. At the position of the grooves in the bottom-plate and in the foam, the cover material should be incised.
- 3.1.7.8. The cover is glued to the aluminium plate with a flexible glue. The nuts have to be removed before gluing.
- 3.1.7.9. The flaps on the side are folded onto the plate and are glued as well.
- 3.1.7.10. The flaps in the grooves are folded inside and taped with a strong tape.
- 3.1.7.11. The flexible glue has to dry for at least 12 hours.
- 3.1.7.12. The seat back cushion is covered in exactly the same way as the seat, only the lines on the cover material (1250 x 850 mm) are drawn 320 mm apart from the centreline of the material.
- 3.1.8. Line Cr is coincident with the intersection line between the top plane of the seat and the front lane of the seat back.
- 3.2. Test of rearward-facing devices
  - 3.2.1. A special frame shall be fitted on the trolley in order to support the child restraint as shown in Figure 1.
  - 3.2.2. A steel tube shall be attached firmly to the trolley in such a way that a load of  $5,000 \pm 50$  N applied horizontally to the centre of the tube does not cause a movement greater than 2 mm.
  - 3.2.3. The dimensions of the tube shall be: 500 x 100 x 90 mm.

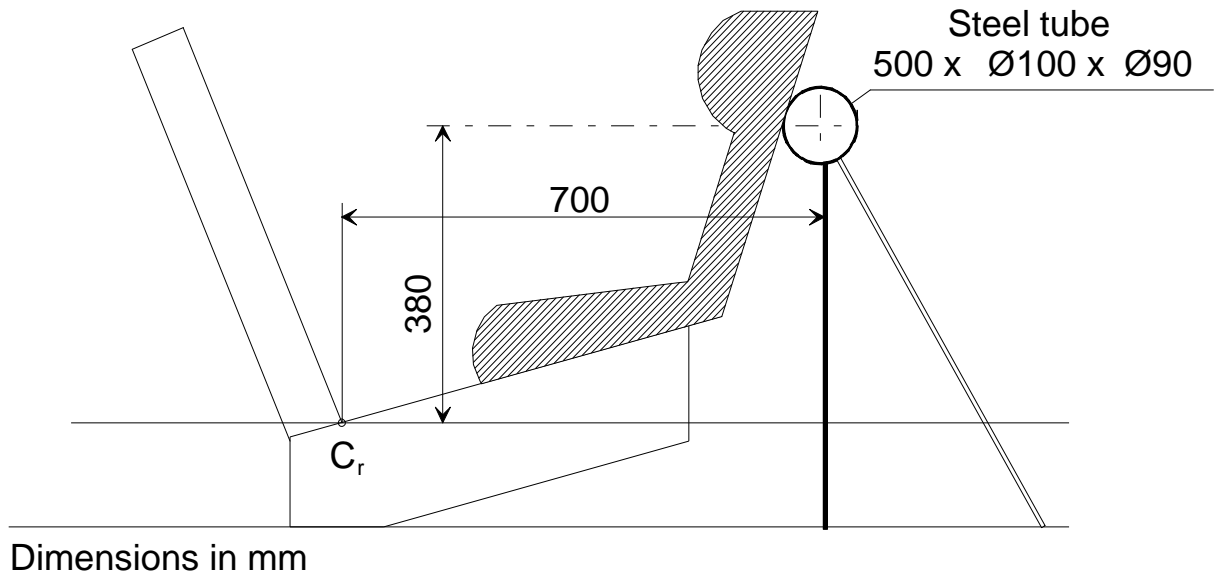


Figure 1

Arrangement for testing a rearward-facing device

- 3.3. Trolley floor pan
- 3.3.1. The floor pan of the trolley shall be constructed of a flat sheet of metal of uniform thickness and material, see Figure 2 of Appendix 3 to this annex.
- 3.3.1.1. The floor pan shall be rigidly mounted on the trolley. The height of the floor pan relative to the Cr axis projection point, dimension X<sup>3/</sup> in Figure 2, shall be adjusted to meet the requirements of paragraph 7.1.4.1.9.
- 3.3.1.2. The floor pan shall be designed so that the surface hardness should not be below 120 HB, according to EN ISO 6506-1:1999.
- 3.3.1.3. The floor pan shall withstand an applied vertical concentrated load of 5 kN without causing a vertical movement greater than 2 mm referring to Cr axis and without any permanent deformation occurring.
- 3.3.1.4. The floor pan shall have a surface roughness not exceeding Ra 6,3 according to ISO 4287:1997.

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<sup>3/</sup> The dimension X shall be of 210 mm with an adjustment range of  $\pm 70$  mm.

- 3.3.1.5. The floor pan shall be designed so that no permanent deformation is occurring after a dynamic test of a child restraint system, according to this Regulation.
4. Stopping device
- 4.1. The device consists of two identical absorbers mounted in parallel.
- 4.2. If necessary, an additional absorber shall be used for each 200 kg increase in nominal mass. Each absorber shall comprise:
- 4.2.1. an outer casing formed from a steel tube;
- 4.2.2. a polyurethane energy-absorber tube;
- 4.2.3. a polished-steel olive-shaped knob penetrating into the absorber; and
- 4.2.4. a shaft and an impact plate.
- 4.3. The dimensions of the various parts of this absorber are shown in the diagram reproduced in Appendix 2 to this annex.
- 4.4. The characteristics of the absorbing material are given in table 3 and table 4 of this annex.
- 4.5. The stopping device assembly shall be maintained for at least 12 hours at a temperature between 15 ° and 25 °C before being used for the calibration tests described in Annex 7 to this Regulation. The stopping device shall, for each type of test, meet the performance requirements laid down in Annex 7, Appendices 1 and 2. For dynamic tests of a child restraint, the stopping device assembly shall be maintained for at least 12 hours at the same temperature, to within  $\pm 2$  °C, as that of the calibration test. Any other device giving equivalent results can be accepted.

Table 3

CHARACTERISTICS OF THE ABSORBING MATERIAL "A" <sup>4/</sup>

(ASTM Method D 735 unless otherwise stated)

**Shore hardness A: 95 ± 2 at 20 ± 5 °C temperature**

Breaking strength:  $R_o \geq 350 \text{ kg/cm}^2$

Minimum elongation:  $A_o \geq 400 \text{ percent}$

Module at 100 percent elongation:  $\geq 110 \text{ kg/cm}^2$

at 300 percent elongation:  $\geq 240 \text{ kg/cm}^2$

Low temperature brittleness (ASTM Method D 736): 5 hours at - 55 °C

Compression set (Method B): 22 hours at 70 °C ≤ 45 percent

Density at 25 °C: 1.05 to 1.10

Ageing in air (ASTM Method D 573):

70 hours at 100 °C: Shore hardness: max. variation ± 3  
breaking strength: decrease < 10 percent of  $R_o$   
elongation: decrease < 10 percent of  $A_o$   
weight: decrease < 1 percent

Immersion in oil (ASTM Method No. 1 Oil):

70 hours at 100 °C: Shore hardness: max. variation ± 4  
breaking strength: decrease < 15 percent of  $R_o$   
elongation: decrease < 10 percent of  $A_o$   
volume: swelling < 5 percent

Immersion in oil (ASTM Method No. 3 Oil):

70 hours at 100 °C: breaking strength: decrease < 15 percent of  $R_o$   
elongation: decrease < 15 percent of  $A_o$   
volume: swelling < 20 percent

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<sup>4/</sup> The address to obtain the relevant ASTM standards is: ASTM, 1916 Race Street, Philadelphia, USA PA 19 103.

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Immersion in distilled water:

1 week at 70 °C:

breaking strength: decrease < 35 percent of  $R_o$

elongation: increase < 20 percent of  $A_o$

Table 4

CHARACTERISTICS OF THE ABSORBING MATERIAL "B"

(ASTM Method 2000 (1980) unless otherwise stated)

|                                   |   |
|-----------------------------------|---|
| Shore hardness A:                 | $88 \pm 2$ at $20 \pm 5$ °C temperature |
| Breaking strength:                | $R_o \geq 300$ kg/cm <sup>2</sup>       |
| Minimum elongation:               | $A_o \geq 400$ percent                  |
| Module at 100 percent elongation: | $\geq 70$ kg/cm <sup>2</sup>            |
| at 300 percent elongation:        | $\geq 130$ kg/cm <sup>2</sup>           |

Low temperature brittleness (ASTM Method D 736): 5 hours at - 55 °C

Compression set (Method B): 22 hours at 70 °C  $\leq 45$  percent

Density at 25 °C: 1.08 to 1.12

Ageing in air (ASTM Method D 573 (1981)):

|                     |   |
|---------------------|---|
| 70 hours at 100 °C: | Shore hardness: max. variation $\pm 3$<br>breaking strength: decrease $< 10$ percent of $R_o$<br>elongation: decrease $< 10$ percent of $A_o$<br>weight: decrease $< 1$ percent |
|---------------------|---|

Immersion in oil (ASTM Method D 471 (1979) Oil No. 1):

|                     |   |
|---------------------|---|
| 70 hours at 100 °C: | Shore hardness: max. variation $\pm 4$<br>breaking strength: decrease $< 15$ percent of $R_o$<br>elongation: decrease $< 10$ percent of $A_o$<br>volume: swelling $< 5$ percent |
|---------------------|---|

Immersion in oil (ASTM Method D 471 (1979) Oil No. 3):

|                     |  |
|---------------------|--|
| 70 hours at 100 °C: | breaking strength: decrease $< 15$ percent of $R_o$<br>elongation: decrease $< 15$ percent of $A_o$<br>volume: swelling $< 20$ percent |
|---------------------|--|

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Immersion in distilled water:

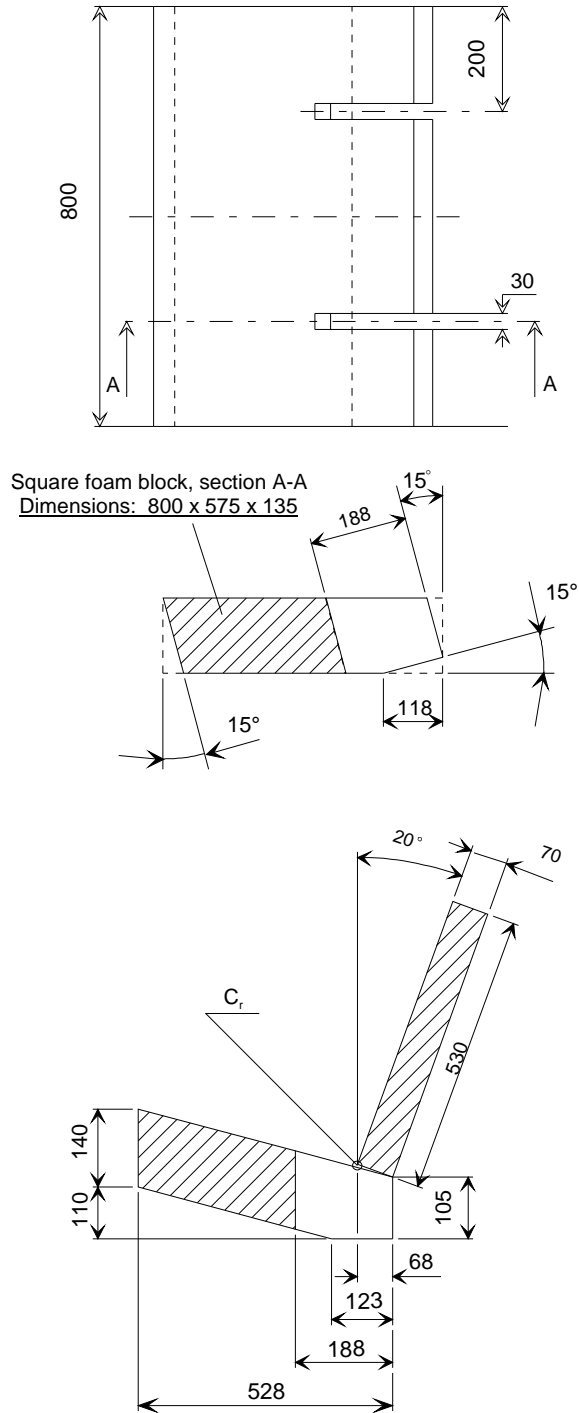
1 week at 70°C:

breaking strength: decrease < 35 percent of  $R_o$

elongation: increase < 20 percent of  $A_o$



**Annex 6 - Appendix 1 to be reviewed**



**Figure 1**  
 Dimensions of the seat and the seat cushions

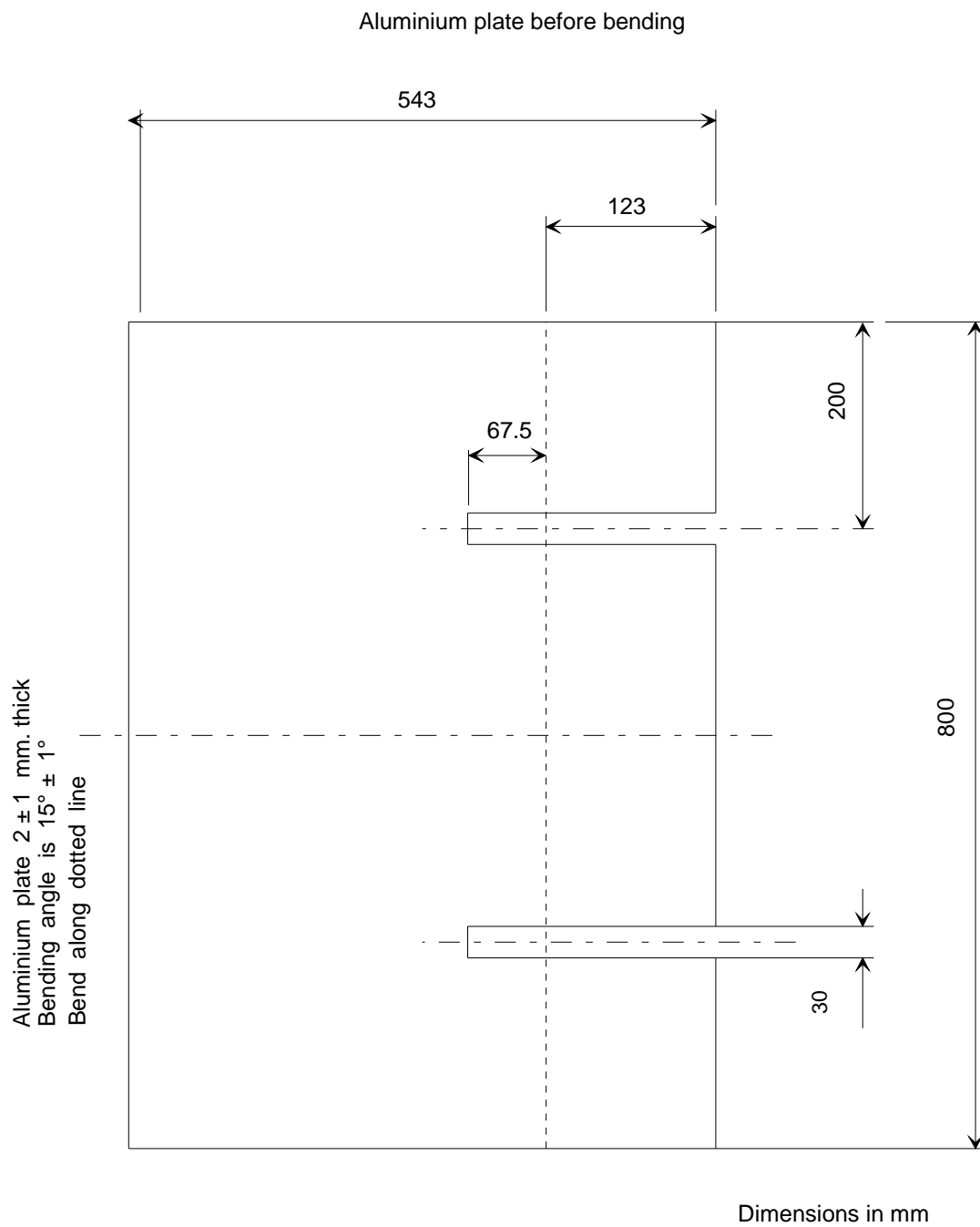


Figure 2: Dimensions of the aluminium bottom-plate

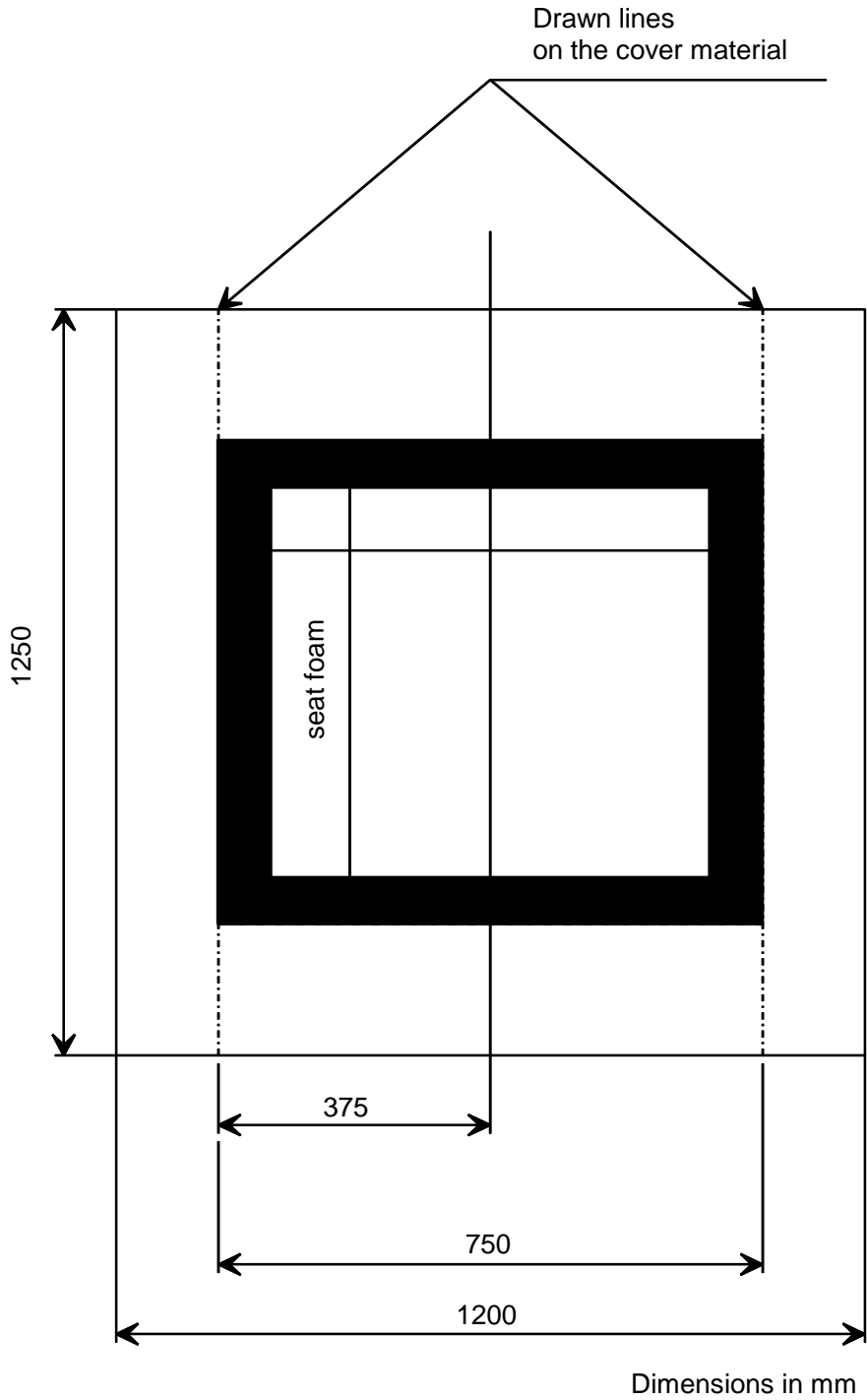


Figure 3: Dimensions of the cover material

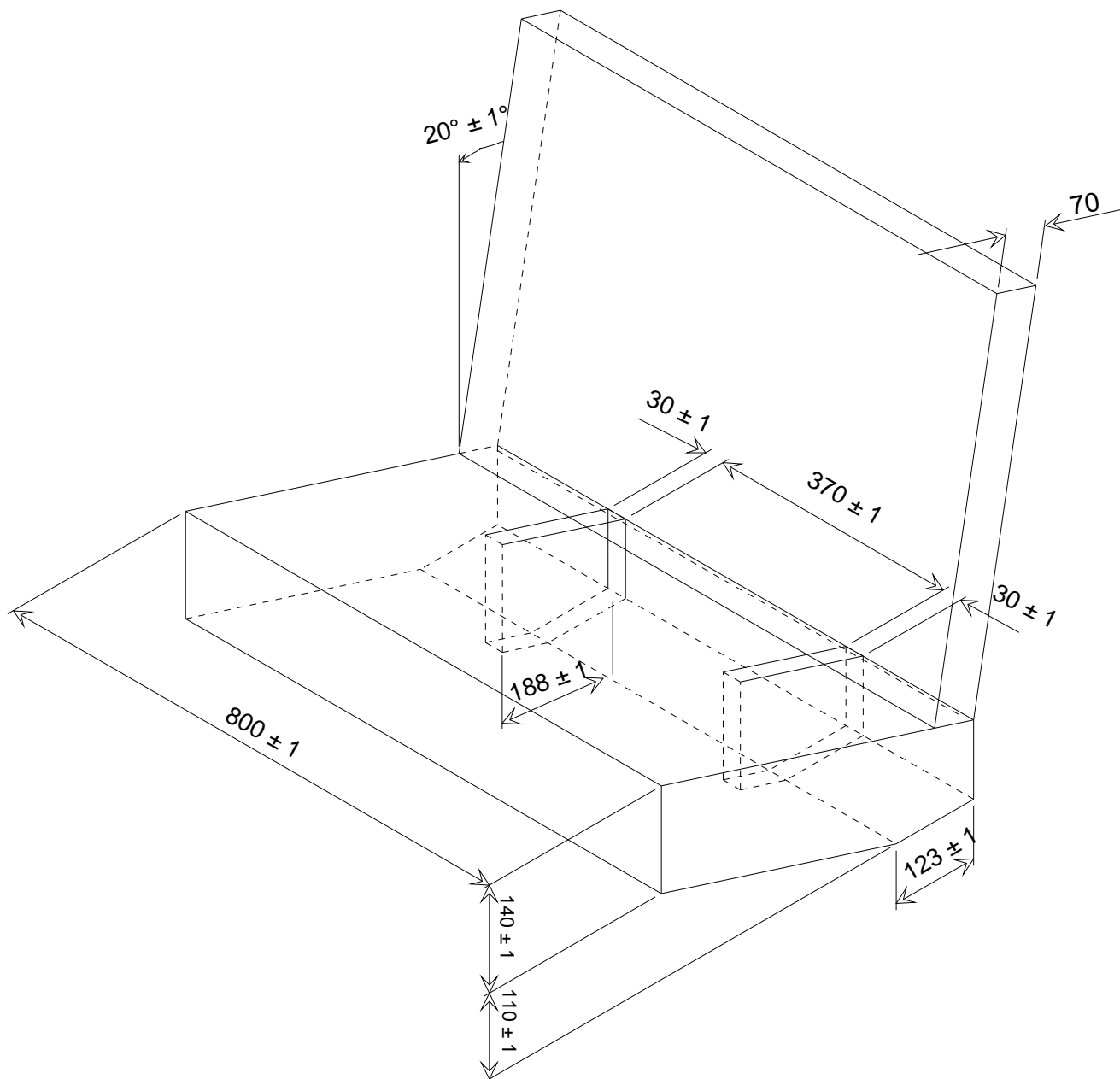
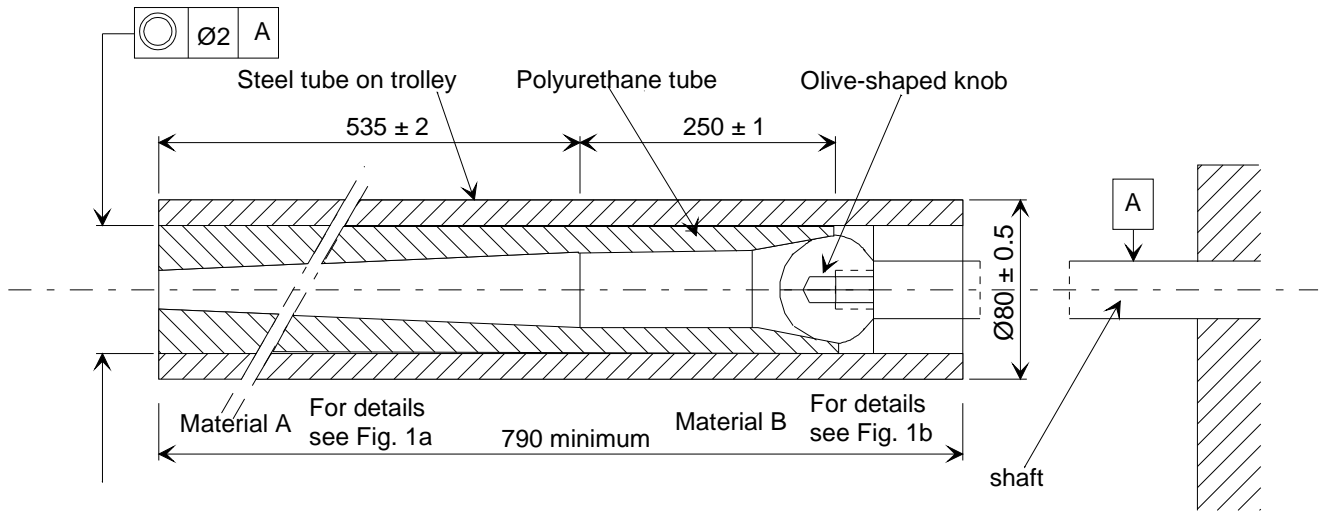


Figure 4:  
3- Dimensional view of seat

Annex 6 - Appendix 2  
 Stopping device  
 Frontal Impact dimensions (in mm)



Play defined according to external diameter of polyurethane tube (light push fit)

Figure 1

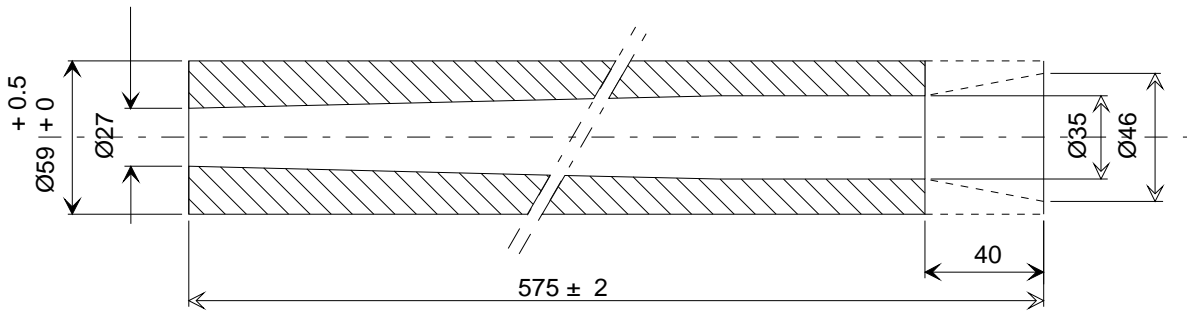


Figure 1a: Material A

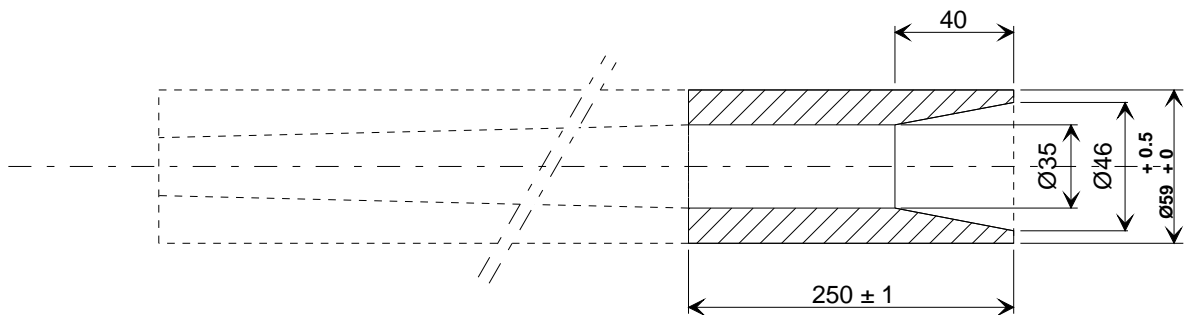
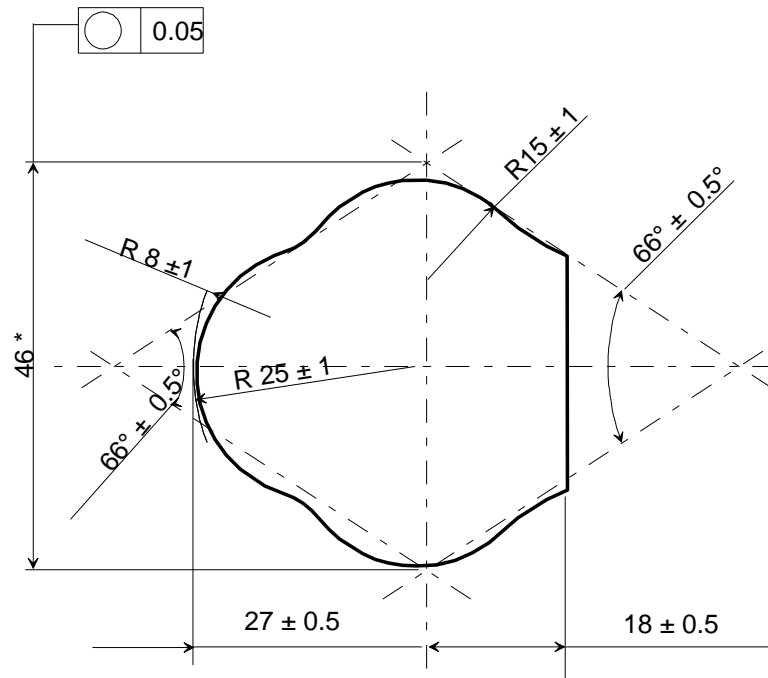


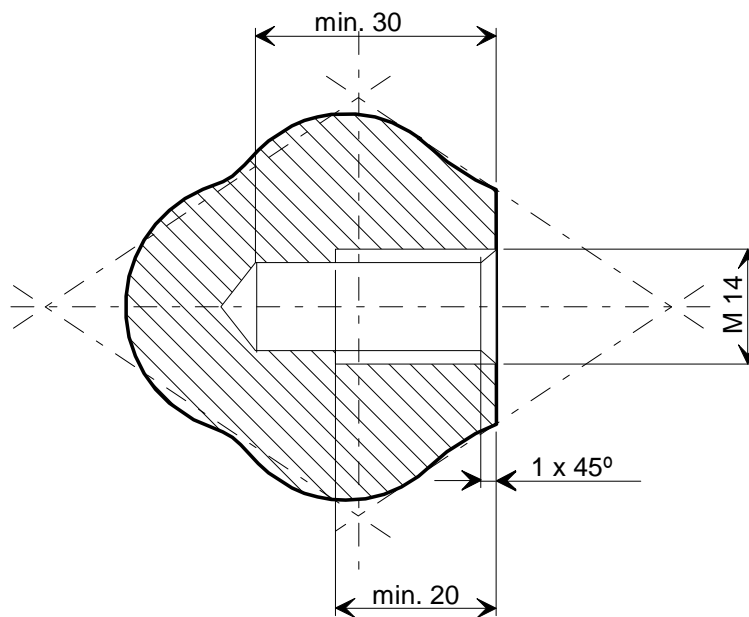
Figure 1b: Material B



\* This dimension can vary between 43 and 49 mm

Dimensions in mm

Figure 2:  
 Stopping device olive-shaped knob



Dimensions in mm

Figure 3:  
 Stopping device olive-shaped knob

Stopping device  
 (assembled)  
 Rear impact  
 dimensions in mm

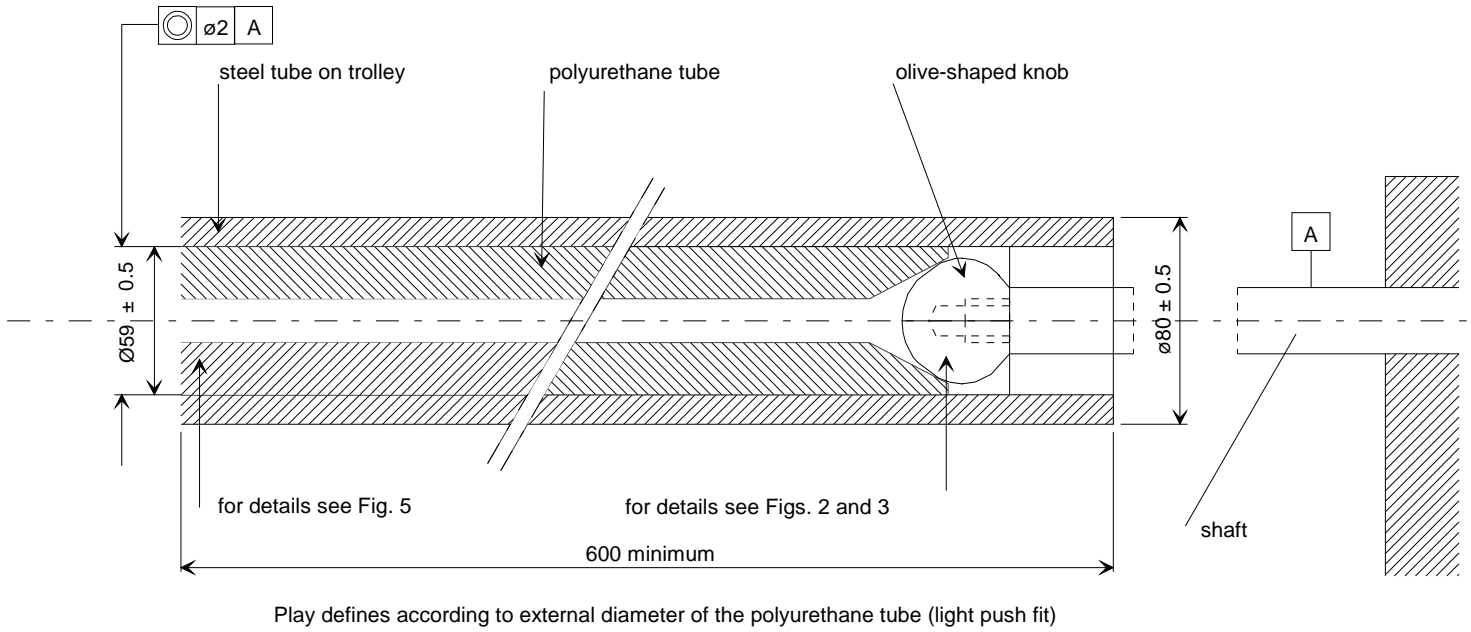


Figure 4

Stopping device  
polyurethane tube  
Rear impact  
dimensions in mm

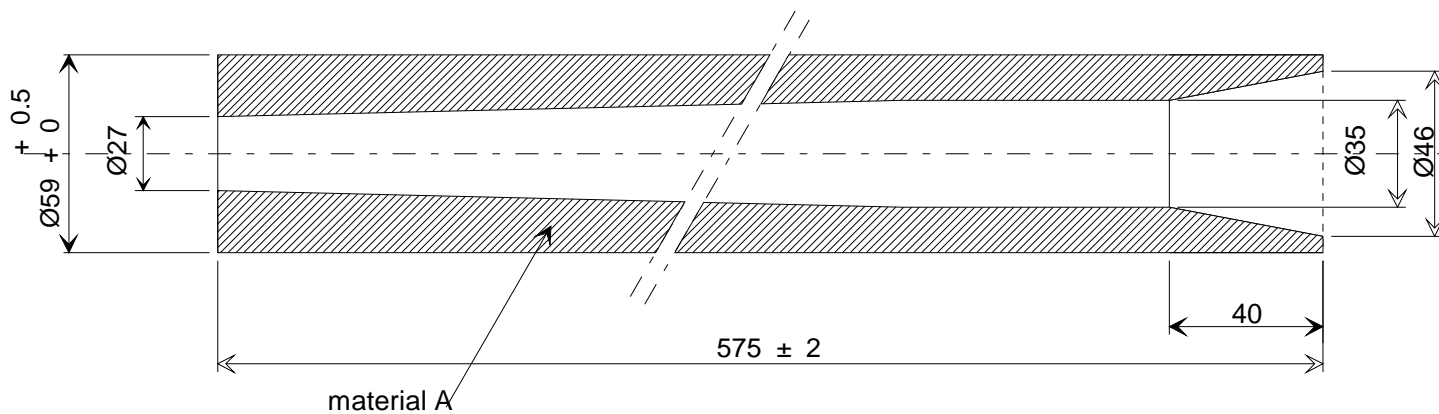


Figure 5



## ARRANGEMENT AND USE OF ANCHORAGES ON THE TEST TROLLEY

1. The anchorages shall be positioned as shown in the figure below.  
When attaching the standard anchorage plate to the anchorage points A and B or B0 the plates shall be mounted with the bolt in the transverse horizontal direction with the angled surface facing inboard and shall be free to rotate about the axis
2. Child restraints in the "universal" and "restricted" categories shall use the following anchorage points:
  - 2.1. For child restraint using lap belts, points A and B;
  - 2.2. For child restraint using lap and diagonal belts, points A, B0 and C.
  - 2.3. For child restraints using ISOFIX attachment, rearmost point H1 and H2.
3. Anchorages A, B and/or (rearmost) H<sub>1</sub> H<sub>2</sub> and D shall be used for child restraints in the "semi-universal" category having only one additional upper anchorage.
4. Anchorages A, B and/or (rearmost) H<sub>1</sub> H<sub>2</sub>, E and F shall be used for child restraints in the "semi-universal" category having only one additional upper anchorages.
5. Anchorage points R<sub>1</sub>, R<sub>2</sub>, R<sub>3</sub>, R<sub>4</sub> and R<sub>5</sub> are the additional anchorage points for rearward-facing child restraint systems in the "semi-universal" category having one or more additional anchorages (see paragraph 8.1.3.5.3.).
6. Except in the case of point C, (which represents the pillar loop position) the points, which correspond to the arrangement of the anchorages show where the ends of the belt are to be connected to the trolley or to the load transducer, as the case may be. The structure carrying the anchorages shall be rigid. The upper anchorages must not be displaced by more than 0.2 mm in the longitudinal direction when a load of 980 N is applied to them in that direction. The trolley shall be so constructed that no permanent deformation shall occur in the parts bearing the anchorages during the test.
7. For carry-cots, the points A<sub>1</sub> and/or B<sub>1</sub> can be used alternatively, as specified by the manufacturer of the restraint systems. A<sub>1</sub> and B<sub>1</sub> are located on a transverse line through R<sub>1</sub> at a distance of 350 mm from R<sub>1</sub>.
8. For testing of child restraints in the "universal" and "restricted" categories, a standard retractor belt, as specified in Annex 13, shall be fitted to the test seat.

The webbing used between the retractor and the anchorage plate  $A_1$  of the standard safety belt shall be renewed for each dynamic test.

9. For testing of child restraints with top tether, the anchorage  $G_1$  or  $G_2$  shall be used.
10. In the case of child restraints utilising a support leg, the Technical Service shall select the anchorages to be used according to paragraphs 2., 3., 4. or 5. above and with the support leg adjusted as specified in paragraph 7.1.4.1.9.

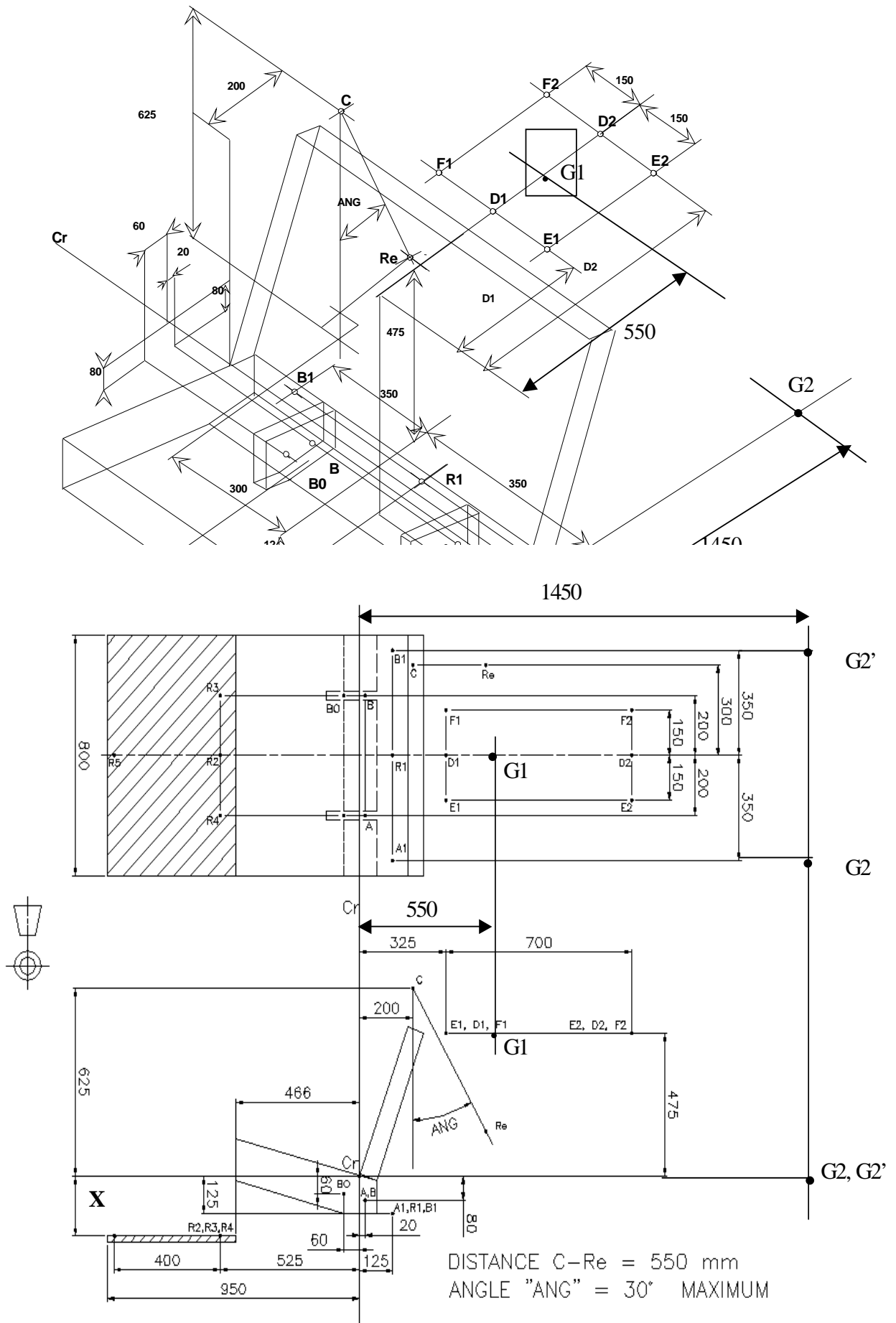
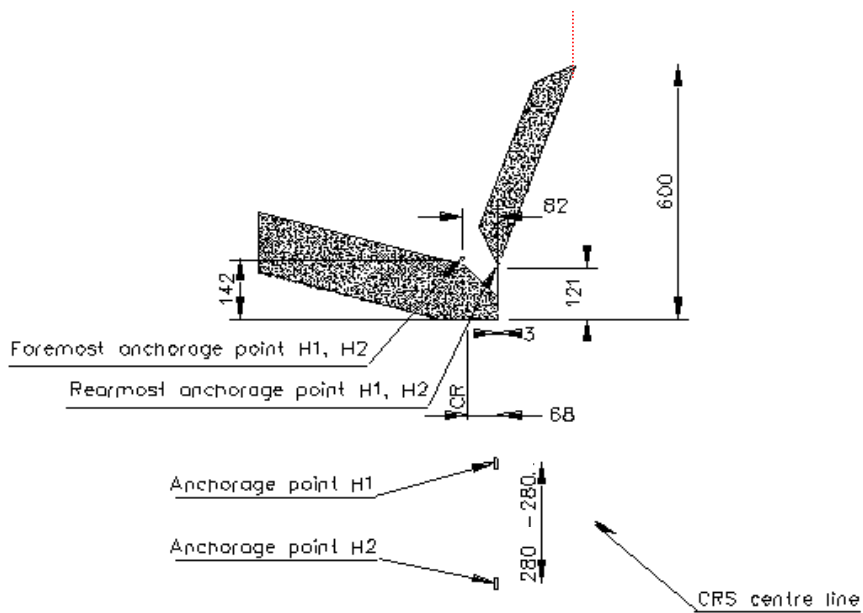


Figure 2

FLOOR AREA IS HATCHED

DISTANCE C -  $R_e$  = 530 mm

$R_e$  is located on the centerline of the retractor spool  
 ANGLE "ANG" = 30° MAXIMUM



Anchorage points H1 & H2 – 6 mm ± 0.1 mm

Figure 3

## **Annex 7**

### **CURVE OF TROLLEY'S DECELERATION OR ACCELERATION, AS FUNCTION OF TIME**

In all cases the calibration and measuring procedures shall correspond to those defined in the International Standard ISO 6487:2002; the measuring equipment shall correspond to the specification of a data channel with a channel frequency class (CFC) 60.

Annex 7 - Appendix 1

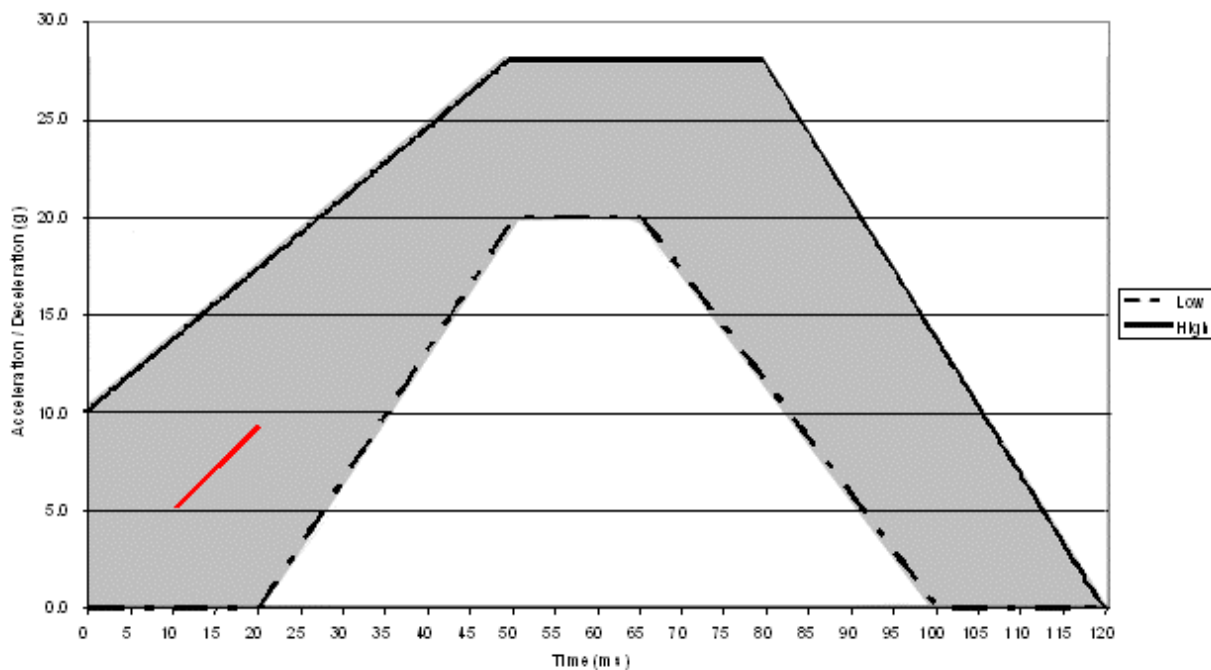
CURVE OF TROLLEY'S DECELERATION OR ACCELERATION,  
 AS FUNCTION OF TIME

FRONTAL IMPACT

Definition of the different curves

| Time (ms) | Acceleration (g)<br>Low corridor | Acceleration (g)<br>High corridor |
|-----------|----------------------------------|-----------------------------------|
| 0         | -                                | 10                                |
| 20        | 0                                | -                                 |
| 50        | 20                               | 28                                |
| 65        | 20                               | -                                 |
| 80        | -                                | 28                                |
| 100       | 0                                | -                                 |
| 120       | -                                | 0                                 |

Regulation No. 44 Frontal impact



The additional segment (see paragraph 7.1.4.1.1.3.2.) applies only for the acceleration sled

Annex 7 - Appendix 2

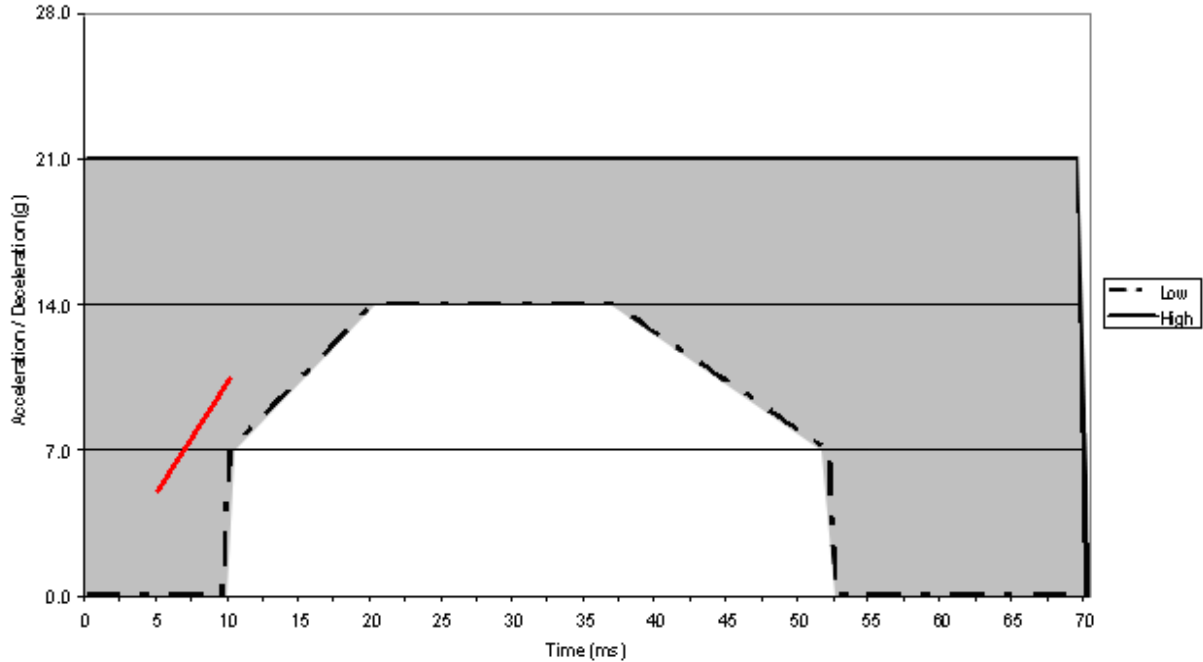
CURVES OF TROLLEY'S DECELERATION OR ACCELERATION,  
 AS FUNCTION OF TIME

REAR IMPACT

Definition of the different curves

| Time (ms) | Acceleration (g)<br>Low corridor | Acceleration (g)<br>High corridor |
|-----------|----------------------------------|-----------------------------------|
| 0         | -                                | 21                                |
| 10        | 0                                |                                   |
| 10        | 7                                | -                                 |
| 20        | 14                               | -                                 |
| 37        | 14                               | -                                 |
| 52        | 7                                | -                                 |
| 52        | 0                                |                                   |
| 70        | -                                | 21                                |
| 70        | -                                | 0                                 |

Regulation No. 44 Rear impact



The additional segment (see paragraph 7.1.4.1.1.3.2.) applies only for the acceleration sled



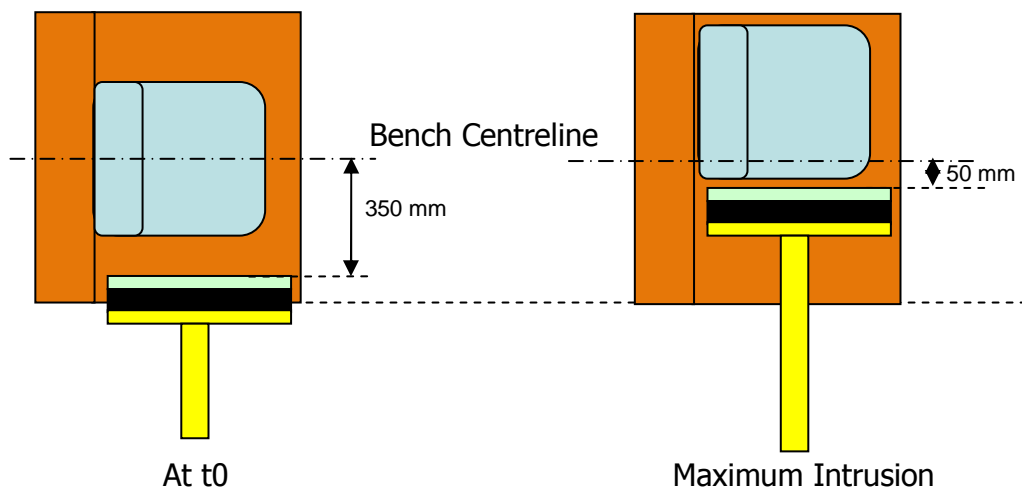
Annex 7 - Appendix 3

**SIDE IMPACT**

CURVE OF RELATIVE VELOCITY BETWEEN TROLLEY AND DOOR PANEL AS  
FUNCTION OF TIME

Remark: The corridor must be defined on experiences of respective test labs.

Definition of Door maximum intrusion



## Annex 7 – Appendix 4

### 1. Door panel Definition

*The door panel geometry must be in line with the bench definition  
Drawing to describe the door will be proposed in line with the NPACS Bench*

### 2. Panel padding specification

#### 2.1 General

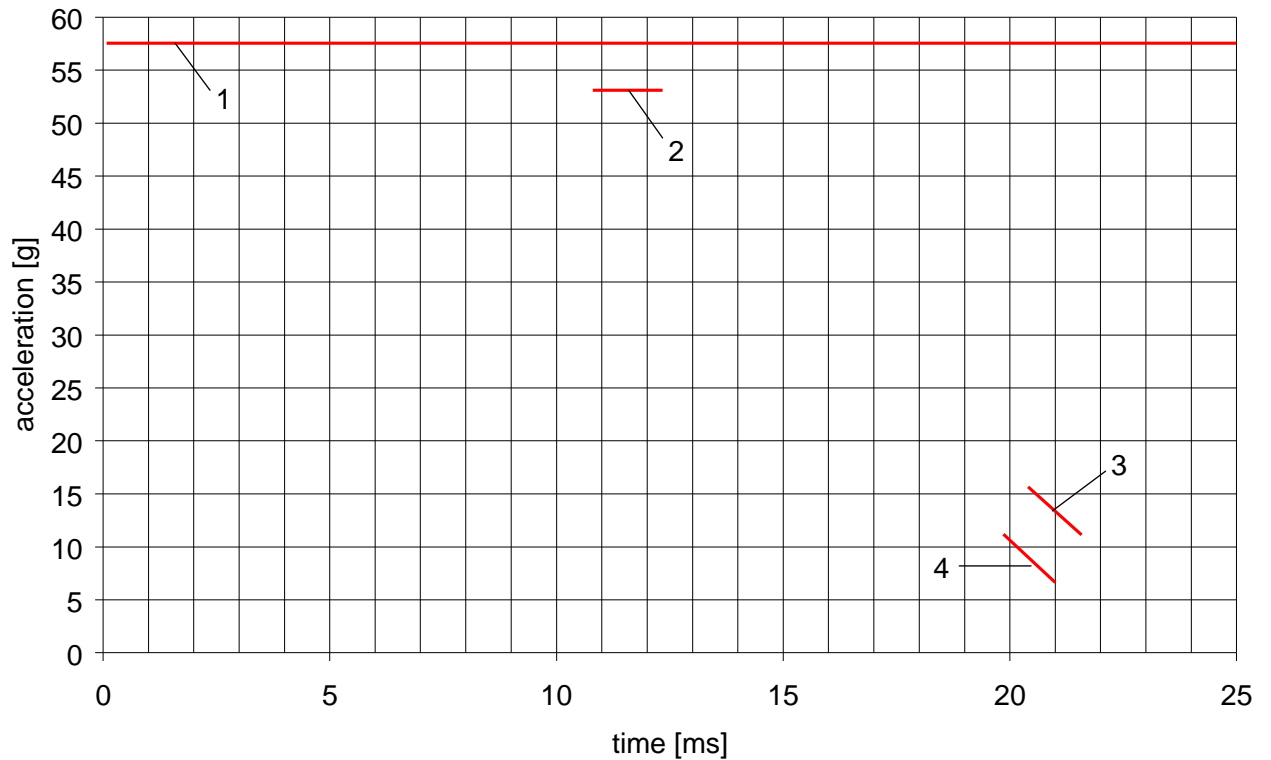
The door panel is padded with 55 mm padding material, which has to comply with the performance criteria as described in Annex X 2.3 realised in a test set up as described in Annex X 2.2. Finally an example for material meeting the requirements is described in Annex X 2.4.

#### 2.2 Test procedure for the assessment of panel padding material

The test set up consists of a simple drop test using a spherical head form. The spherical head form has a diameter of 150 mm and a mass of 6 kg ( $\pm 0,1$  kg). The impact speed is 4 m/s ( $\pm 0,1$  m/s). The instrumentation should allow the assessment of the time of first contact between the impactor and the sample as well as the head form acceleration at least in direction of impact (Z-direction). The material sample should have the dimensions of 400 X 400 mm. The sample should be impacted in its centre.

#### 2.3 Performance criteria for the padding material

The time of first contact between sample material and head form ( $t_0$ ) is 0 ms.  
The impactor acceleration shall not exceed 58 g.



**Key**

- 1 Upper limit of 58 g
- 2 Lower limit for the maximum peak at 53 g (11 to 12 ms)
- 3 Upper limit for the decline of acceleration (15 g at 20,5 ms to 10 g at 21,5 ms)
- 4 Lower limit for the decline of acceleration (10 g at 20 ms to 7 g at 21 ms)

Figure B.1 — Corridor for the padding material

2.4 Example of material meeting the test requirements.

Using 35 mm rubber cell foam Polychloropren CR4271 at the side of the panel structure and 20 mm Styrodur C2500 on top guarantees to meet the requirements. The Styrodur needs to be replaced after each test.

*Remark: [Styrodur C2000 is not available, but 2500 could be an acceptable alternative as is available and used for current testing.]*

Overall Test Rig Lay Out

## **Annex 8**

### **DESCRIPTION OF MANIKINS**

#### **1. General**

- 1.1. The manikins prescribed in this Regulation are described in this annex, in technical drawing held by First Technology Safety Systems and in the user manuals delivered with the dummies.
- 1.2. Alternative manikins may be used provided that:
  - 1.2.1. Their equivalence can be demonstrated to the satisfaction of the competent authority, and
  - 1.2.2. Their use is recorded in the test report, and in the communication form described in Annex 1 to this Regulation.

#### **2. Description of the Manikins**

- 2.1. The dimensions and masses of the manikins called Q0, Q1, Q1.5, Q3 and Q6 [and Q10] described below are based on the anthropometry of 50th percentile children aged 0, 1, 1.5, 3 and 6 [and 10.5] years respectively.
- 2.2. The manikins consist of a metal and plastic skeleton covered with plastic skinned foam parts to complete body components.
- 2.3. For overview of the manikins, see below.



Q-dummy family from left to right: Q1.5, Q3, Q0, Q6 and Q1  
[Q10 dummy, being under development, not yet shown]

### 3. Construction

#### 3.1. Head

The head is largely made from synthetics. The head cavity is large enough to allow use of several instruments, including linear accelerometers and angular velocity sensors.

#### 3.2. Neck

The neck is flexible and allows shear and bending in all directions. The segmented design allows a realistic rotational behaviour. The neck is equipped with low stretch neck-cord in order to prevent excessive elongation. The neck-cord is also designed to act as a safety cord in case of rubber failure. A six channel load cell can be mounted at the neck-head and neck-torso interface. The Q0, Q1 and Q1.5 cannot accommodate the load cell between neck and torso

#### 3.3. Thorax

The thorax of the child is represented by a single rib-cage. The deformation can be measured with a string potentiometer in Q1 and Q1.5 and an IR-TRACC sensors in Q3 and Q6 [and Q10]. The shoulders are connected with a flexible joint to the thorax, allowing deformation forwards.

3.4. Accelerometers can be mounted on the spine to measure linear accelerations. The Q0 thorax has a simplified layout with an integral foam part for the complete torso.

### 3.5. Abdomen

The abdomen is foam covered with skin. Biomechanical data from children has been used to determine the required stiffness. The Q0 abdomen has a simplified layout with an integral foam part for the complete torso.

### 3.6. Lumbar

The lumbar spine is a flexible rubber column, which allows shear and bending in all directions. A six channel load cell can be mounted between the lumbar spine and the pelvis, except for the Q0.

### 3.7. Pelvis

The pelvis is constructed from a iliac-sacrum bone part covered with a plastic flesh outer contour simulation. In the bone part removable hip joints are inserted. An accelerometer array can be mounted in the pelvis. Special hip joints are available that allow to position the dummy in a standing position. The Q0 pelvis has a simplified layout with an integral foam part for the complete torso.

### 3.8. Legs

The legs are constructed with metal reinforced plastic bones cover with PVC skinned foam parts that represent the upper and lower flesh. The knee joints can be locked in any position. This feature can be used to facilitate positioning the dummy in a standing position. (Note that the dummy does not have the ability to stand without external support.) The Q0 legs have a simplified layout with one integral part per leg with a fixed angle at the knee.

### 3.9. Arms

The arms are constructed with plastic bones cover with PVC skinned foam parts that represent the upper and lower flesh. The elbow joints can be locked in any position. The Q0 arms have a simplified layout with one integral part per leg with a fixed angle at the knee.

## 4. Main characteristics

### 4.1. Mass

Table 1:Q-dummy manikin mass distributions

|   | <b>Q0</b>        | <b>Q1</b>       | <b>Q1.5</b>       | <b>Q3</b>         | <b>Q6</b>         | <b>[Q10]<br/>(design targets)</b> |
|---|------------------|-----------------|-------------------|-------------------|-------------------|-----------------------------------|
|   | Mass in [kg]     |                 |                   |                   |                   |                                   |
| Head + Neck<br>(incl. acc. mount)                       | 1.10±0.10        | 2.41±0.10       | 2.80±0.10         | 3.17±0.10         | 3.94±0.10         | [4.19]                            |
| Torso<br>(incl. acc. mount and chest deflection sensor) | 1.50±0.15        | 4.21±0.25       | 4.74±0.25         | 6.00±0.30         | 9.07±0.40         | [14.85]<br>(incl. suit)           |
| Legs (together)   | 0.58±0.06        | 1.82±0.10       | 3.06±0.10         | 3.54±0.10         | 6.90±0.10         | [12.50]                           |
| Arms (together)   | 0.28±0.03        | 0.89±0.10       | 1.20±0.10         | 1.48±0.10         | 2.49±0.10         | [4.00]                            |
| Suit  | 0.27±0.05        | 0.27±0.05       | 0.30±0.05         | 0.40±0.10         | 0.55±0.10         | (see torso)                       |
| <b>Total</b>  | <b>3.46±0.34</b> | <b>9.6±0.30</b> | <b>11.10±0.40</b> | <b>14.60±0.40</b> | <b>22.90±0.40</b> | <b>[35.50]</b>                    |

#### 4.2. Principal dimensions

Table 2:Q-dummy manikin dimensions

|   | <b>Q0</b>          | <b>Q1</b> | <b>Q1.5</b> | <b>Q3</b> | <b>Q6</b> | <b>[Q10]<br/>(design targets)</b> |
|---|--------------------|-----------|-------------|-----------|-----------|-----------------------------------|
|   | Dimensions in [mm] |           |             |           |           |                                   |
| Seating height<br>(head tilted forward) | 355                | 479       | 499         | 544       | 601       | < 748                             |
| Shoulder height<br>(sitting)            | 225                | 298       | 309         | 329       | 362       | 473                               |
| Stature<br>(head tilted forward)        | -                  | 740       | 800         | 985       | 1143      | < 1443                            |
| Chest depth                             | -                  | 114       | 113         | 146       | 141       | 171                               |
| Shoulder width                          | 230                | 227       | 227         | 259       | 305       | 338                               |
| Hip width                               | -                  | 191       | 194         | 200       | 223       | 270                               |
| Back of buttocks to front<br>of knees   | 130                | 211       | 235         | 305       | 366       | 488                               |
| Back of buttocks to<br>popliteus        | -                  | 161       | 185         | 253       | 299       | 418                               |

**OLD TEXT (based on Annex 8 Appendix 1)**  
**TO BE RECONSIDERED**

4. Adjustment of joints
- 4.1. General
  - 4.1.1. In order to achieve reproducible results using the manikins, it is essential to specify and adjust the friction in the various joints, the tension in the neck and lumbar cables, and the stiffness of the abdominal insert.
- 4.2. Adjustment of the neck cable
  - 4.2.1. Place the torso on its back in a horizontal plane.
  - 4.2.2. Mount the complete neck assembly without the head.
  - 4.2.3. Tighten the tensioner nut on the Atlas-Axis block.
  - 4.2.4. Place a suitable bar or bolt through the Atlas-Axis block.
  - 4.2.5. Loosen the tensioner nut until the Atlas-Axis block is lowered by  $10 \pm 1$  mm when a load of 50 N directed downwards is applied to the bar or bolt through the Atlas-Axis block (see Figure 2).
- 4.3. Atlas-Axis joint
  - 4.3.1. Place the torso on its back in a horizontal plane.
  - 4.3.2. Mount the complete neck and head assembly.
  - 4.3.3. Tighten the bolt and adjustment nut through the head and the Atlas-Axis block with the head in a horizontal position.  
50 N  
Figure 2
  - 4.3.4. Loosen the adjustment nut until the head starts moving (see Figure 3).
- 4.4. Hip joint
  - 4.4.1. Place the pelvis on its front in a horizontal plane.
  - 4.4.2. Mount the upper leg without the lower leg.
  - 4.4.3. Tighten the adjustment nut with the upper leg in a horizontal position.
  - 4.4.4. Loosen the adjustment nut until the upper leg starts moving.
  - 4.4.5. The hip joint should be checked frequently in the initial stages because of "running-in" problems (see Figure 4).  
Figure 3  
Figure 4
- 4.5. Knee joint
  - 4.5.1. Place the upper leg in a horizontal position.
  - 4.5.2. Mount the lower leg.
  - 4.5.3. Tighten the adjustment nut of the knee joint with the lower leg in a horizontal position.
  - 4.5.4. Loosen the adjustment nut until the lower leg starts moving (see Figure 5).
- 4.6. Shoulder joint
  - 4.6.1. Place the torso upright.
  - 4.6.2. Mount the upper arm without the lower arm.
  - 4.6.3. Tighten the adjustment nuts of the shoulder with the upper arm in a horizontal position.  
Figure 5
  - 4.6.4. Loosen the adjustment nuts until the upper arm starts moving (see Figure 6).



- 4.6.5. The shoulder joints should be checked frequently in the initial stages because of "running-in" problems.
- 4.7. Elbow joint
  - 4.7.1. Place the upper arm in a vertical position.
  - 4.7.2. Mount the lower arm.
  - 4.7.3. Tighten the adjustment nut of the elbow with the lower arm in a horizontal position.  
Figure 6
  - 4.7.4. Loosen the adjustment nut until the lower arm starts moving (see Figure 7).
- 4.8. Lumbar cable
  - 4.8.1. Assemble the upper torso, lumbar vertebrae, lower torso, abdominal insert, cable and spring.
  - 4.8.2. Tighten the cable adjustment nut in the lower torso until the spring is compressed to 2/3 of its unloaded length (see Figure 8).
- 4.9. Calibration of the abdominal insert
  - 4.9.1. General
    - 4.9.1.1. The test shall be carried out by means of a suitable tension-producing machine.  
Figure 7  
Figure 8
  - 4.9.2. Place the abdominal insert on a rigid block with the same length and width as the lumbar spinal column. The thickness of this block shall be at least twice the thickness of the lumbar spinal column (see Figure 9).
  - 4.9.3. An initial load of 20 N shall be applied.
  - 4.9.4. A constant load of 50 N shall be applied.
  - 4.9.5. The deflection of the abdominal insert after 2 minutes shall be:  
for the 9 months dummy :  $11.5 \pm 2.0$  mm  
3 years dummy:  $11.5 \pm 2.0$  mm  
6 years dummy:  $13.0 \pm 2.0$  mm  
10 years dummy:  $13.0 \pm 2.0$  mm
- 5. Instrumentation
  - 5.1. General
    - 5.1.1. The calibration and measuring procedures shall be based upon the international standards ISO 6487 (1980).
  - 5.2. Installation of the accelerometer in the chest  
The accelerometer shall be mounted in the protected cavity in the chest.  
Figure 9
  - 5.3. Indication of abdominal penetration
    - 5.3.1. A sample of modelling clay shall be vertically connected to the front of the lumbar vertebrae by means of thin adhesive tape.
    - 5.3.2. A deflection of the modelling clay does not necessarily mean that penetration has taken place.
    - 5.3.3. The modelling clay samples shall be of the same length and width as the lumbar spinal column; the thickness of the samples shall be  $25 \pm 2$  mm.
    - 5.3.4. Only the modelling clay supplied with the manikins shall be used.
    - 5.3.5. The temperature of the modelling clay during the test shall be  $30 \pm 5^{\circ}\text{C}$ .

## Annex 9

### FRONTAL IMPACT TEST AGAINST A BARRIER

#### 1. Installations, procedure and measuring instruments

##### 1.1. Testing ground

The test area shall be large enough to accommodate the run-up track, barrier and technical installations necessary for the test. The last part of the track, for at least 5 m before the barrier, must be horizontal, flat and smooth.

##### 1.2. Barrier

The barrier consists of a block of reinforced concrete not less than 3 m wide at the front and not less than 1.5 m high. The barrier must be of such thickness that it weighs at least 70 tonnes. The front face must be vertical, perpendicular to the axis of the run-up track, and covered with plywood boards  $20 \pm 1$  mm thick in good condition. The barrier shall be either anchored in the ground or placed on the ground with, if necessary, additional arresting devices to limit its displacement. A barrier with different characteristics, but giving results at least equally conclusive, may likewise be used.

##### 1.3. Propulsion of the vehicle

At the moment of impact, the vehicle must no longer be subjected to the action of any additional steering or propelling device or devices. It must reach the obstacle on a course perpendicular to the collision wall; the maximum lateral disalignment permitted between the vertical median line of the front of the vehicle and the vertical median line of the collision wall is  $\pm 30$  cm.

##### 1.4. State of the vehicle

1.4.1. The vehicle under test must either be fitted with all the normal components and equipment included in its unladen service weight or be in such a condition as to fulfil this requirement in so far as the components and equipment of concern to the passenger compartment and the distribution of the service weight of the vehicle as a whole are concerned.

1.4.2. If the vehicle is driven by external means, the fuel installation must be filled to at least 90 percent of its capacity, either with fuel or with a non-inflammable liquid, having a density and a viscosity close to those of the fuel normally used. All other systems (brake-fluid containers, radiator, etc.) must be empty.

1.4.3. If the vehicle is driven by its own engine, the fuel tank must be at least 90 percent full. All other liquid-holding tanks must be filled to capacity.

1.4.4. If the manufacturer so requests, the Technical Service responsible for conducting the tests may allow the same vehicle as is used for tests prescribed by other Regulations

(including tests capable of affecting its structure) to be used also for the tests prescribed by this Regulation.

1.5. Impact velocity

The impact velocity must be 50 +0/-2 km/h. However, if the test has been carried out at a higher impact velocity and the vehicle has satisfied the conditions prescribed, the test is considered satisfactory.

1.6. Measuring instruments

The instrument used to record the speed referred to in paragraph 1.5. above shall be accurate within 1 percent.

## Annex 10

### REAR IMPACT TEST PROCEDURE

#### 1. Installations, procedures and measuring instruments

##### 1.1. Testing ground

The test area shall be large enough to accommodate the propulsion system of the impactor and to permit after-impact displacement of the vehicle impacted and installation of the test equipment. The part in which vehicle impact and displacement occur shall be horizontal. (The slope shall be less than 3 percent measured over any length of one metre.)

##### 1.2. Impactor

1.2.1. The impactor shall be of steel and of rigid construction.

1.2.2. The impacting surface shall be flat and at least 2,500 mm wide and 800 mm high. Its edges shall be rounded to a radius of curvature of between 40 and 50 mm. It shall be clad with a layer of plywood  $20 \pm 1$  mm thick.

1.2.3. At the moment of impact the following requirements shall be met:

1.2.3.1. the impacting surface shall be vertical and perpendicular to the median longitudinal plane of the impacted vehicle;

1.2.3.2. the direction of movement of the impactor shall be substantially horizontal and parallel to the median longitudinal plane of the impacted vehicle;

1.2.3.3. the maximum lateral deviation permitted between the median vertical line of the surface of the impactor and the median longitudinal plane of the impacted vehicle shall be 300 mm. In addition, the impacting surface shall extend over the entire width of the impacted vehicle;

1.2.3.4. the ground clearance of the lower edge of the impacting surface shall be  $175 \pm 25$  mm.

##### 1.3. Propulsion of the impactor

The impactor may either be secured to a carriage (moving barrier) or form part of a pendulum.

##### 1.4. Special provisions applicable where a moving barrier is used

1.4.1. If the impactor is secured to a carriage (moving barrier) by a restraining element, the latter must be rigid and be incapable of being deformed by the impact; the carriage shall, at the moment of impact, be capable of moving freely and no longer be subject to the action of the propelling device.

- 1.4.2. The combined mass of carriage and impactor shall be  $1,100 \pm 20$  kg.
- 1.5. Special provisions applicable where a pendulum is used
- 1.5.1. The distance between the centre of the impacting surface and the axis of rotation of the pendulum shall be not less than 5 m.
- 1.5.2. The impactor shall be freely suspended by rigid arms, rigidly secured to it. The pendulum so constituted shall be substantially incapable of being deformed by the impact.
- 1.5.3. A stopping device shall be incorporated in the pendulum to prevent any secondary impact by the impactor on the test vehicle.
- 1.5.4. At the moment of impact, the velocity of the centre of percussion of the pendulum shall be between 30 and 32 km/h.
- 1.5.5. The reduced mass " $m_r$ " at the centre of percussion of the pendulum is defined as a function of the total mass " $m$ ", of the distance " $a$ "<sup>\*</sup> between the centre of percussion and the axis of rotation, and of the distance " $l$ " between the centre of gravity and the axis of rotation, by the following equation:

$$m_r = m \cdot \frac{l}{a}$$

- 1.5.6. The reduced mass " $m_r$ " shall be  $1,100 \pm 20$  kg.
- 1.6. General provisions relating to the mass and velocity of the impactor
- If the test has been conducted at an impact velocity higher than those prescribed in paragraph 1.5.4. and/or with a mass greater than those prescribed in paragraphs 1.5.3. or 1.5.6., and the vehicle has met the requirements prescribed, the test shall be considered satisfactory.
- 1.7. State of the vehicle during the test
- The vehicle being tested shall either be fitted with all the normal components and equipment included in its unladen service weight or be in such condition as to fulfil this requirement in so far as the distribution of the service weight of the vehicle as a whole is concerned.
- 1.8. The complete vehicle with the child restraint installed in accordance with the fitting instructions shall be placed on a hard, flat and level surface, with the handbrake off and in neutral gear. More than one child restraint may be tested in the same impact test.

## Annex 11

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<sup>\*</sup>/ The distance " $a$ " is equal to the length of the synchronous pendulum under consideration.

**Annex 12**

**Annex 13**

**Annex 14**

**Annex 15**

**Annex 16**

## Annex 17

### TEST OF ENERGY ABSORBING MATERIAL

#### 1 Headform

- 1.1 The headform shall consist of a solid wooden hemisphere with an added smaller spherical segment as shown in Figure A below. It shall be constructed so that it can be dropped freely along the axis marked and it shall have provision for mounting an accelerometer in order to measure the acceleration along the direction of fall.
- 1.2 The headform shall have a total mass, including the accelerometer of  $2.75 \pm 0.05$  kg.

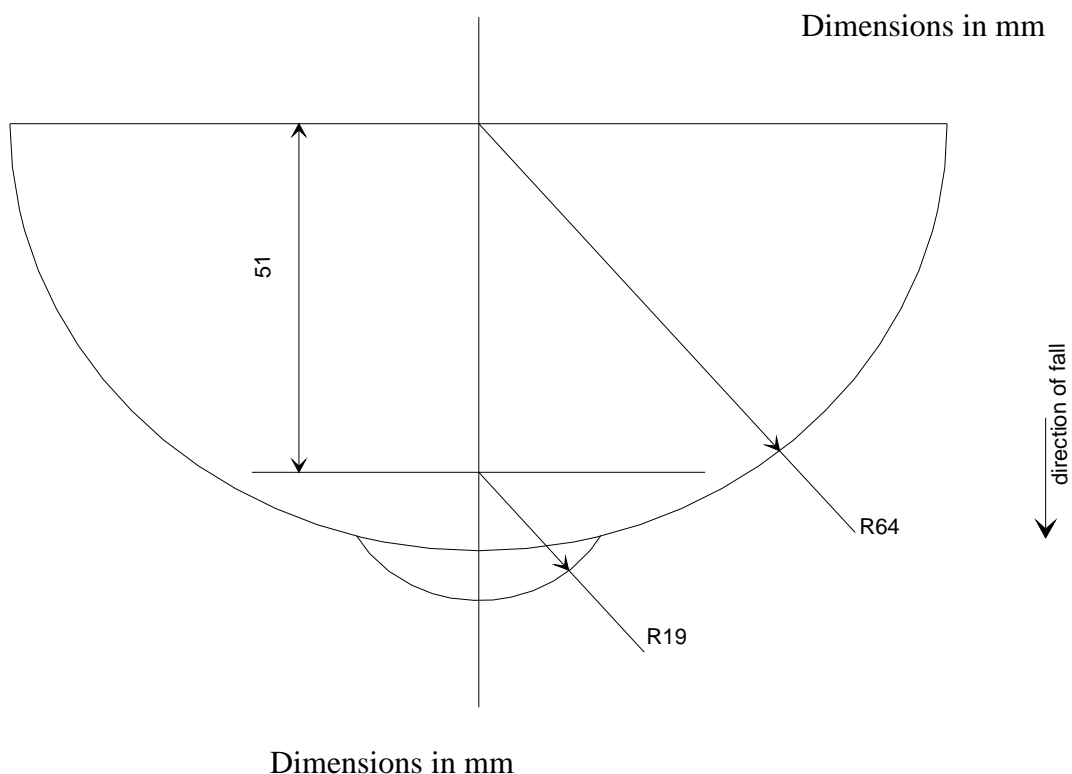


Figure A: Headform

#### 2 Instrumentation

The acceleration shall be recorded during the test, using equipment in accordance with channel frequency class 1000 as specified in the latest version of ISO 6487.

#### 3 Procedure

- 3.3 The test shall be conducted on a completely assembled child restraint with a minimum of modification only where necessary to ensure access for the support (directly beneath the

point of impact) and for the impactor device and such that there is minimal effect on the performance by the modification.

- 3.4** The assembled child restraint shall be fully supported on its outer surface in the region of impact and be supported directly beneath the point of impact on a smooth rigid base, for example a solid concrete plinth.
- 3.5** Raise the headform to a height of  $100 -0/+5$  mm from the respective upper surfaces of the assembled child restraint to the lowest point on the headform, and allow it to fall. Record the acceleration experienced by the headform during impact.



## Annex 18

### METHOD OF DEFINING HEAD IMPACT AREA OF DEVICES WITH BACKRESTS AND FOR REARWARD-FACING DEVICES DEFINING THE MINIMUM SIZE OF SIDE WINGS

1. Place the device on the test seat described in Annex 6. Reclinable devices shall be set in the most upright position. Place the smallest manikin in the device in accordance with the manufacturer's instructions. Mark a point "A" on the backrest on the same horizontal level as the shoulder of the smallest manikin at a point 2 cm inside the outer edge of the arm. All internal surfaces above the horizontal plane passing through point A shall comprise special energy-absorbing material tested in accordance with Annex 17. This material shall cover the internal surfaces of the backrest and side wings, including the inner edges (zone of radius) of the side wings. The energy absorbing material may be an integral part of the child seat. In the case of carry cot devices where a symmetrical installation of the dummy is not possible according to the device and manufacturer instructions, the lower limit of area at which material complying with Annex 17 shall be used, shall be all areas beyond dummy's shoulder in the head direction, when measured with this dummy in the carry cot in its worst position consistent with the manufactures instructions and the carry cot positioned on the test bench.

If a symmetrical installation of the dummy in the carry-cot may be possible, the whole inner surfaces shall be covered with material complying with Annex 17; this material has to fulfill its purpose together with the inner side structure; the Technical Service may assess this aspect with further tests.

2. For rearward-facing devices there shall be side wings with a depth of minimum 90 mm measured from the median of the surface of the backrest. These side wings shall start at the horizontal plane passing through point "A" and continue to the top of the seat back. Starting from a point 90 mm below the top of the seat back, the depth of the side wing may be gradually reduced.