TECHNICAL REPORT

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Road vehicles — Child restraint systems — Compilation of regulations and standards

Véhicules routiers — Systèmes de retenue pour enfants — Compilation des règlements et des normes

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Foreword

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The main task of technical committees is to prepare International Standards, but in exceptional circumstances a technical committee may propose the publication of a Technical Report of one of the following types:

— type 1, when the required support cannot be obtained for the publication of an International Standard, despite repeated efforts;

— type 2, when the subject is still under technical development or where for any other reason there is the future but not immediate possibility of an agreement on an International Standard;

— type 3, when a technical committee has collected data of a different kind from that which is normally published as an International Standard ("state of the art", for example).

Technical Reports of types 1 and 2 are subject to review within three years of publication, to decide whether they can be transformed into International Standards. Technical Reports of type 3 do not necessarily have to be reviewed until the data they provide are considered to be no longer valid or useful.

ISO/TR 13214, which is a Technical Report of type 3, was prepared by Technical Committee ISO/TC 22, *Road vehicles*, Subcommittee SC 12, *Restraint systems*.

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Road vehicles — Child restraint systems — Compilation of regulations and standards

1 Scope

This ISO Technical Report is a compilation of major regulations and standards in the field of Child Restraint Systems (CRS) for road vehicles. The aim is to show similarities and differences at a detailed level for specified items.

Annexes to the standard cover a compilation of

- crash pulses (deceleration curves),
- approval procedures for different countries/markets,
- restraint requirements in different countries, and
- definitions used in regulations and standards.

2 References

Note: This compilation is valid only for the versions and issues given below.

Europe — **ECE Regulation No.44**

United Nations Agreement Concerning the Adoption of Uniform Conditions of Approval and Reciprocal Recognition of Approval for Motor Vehicle Equipment and Parts.
Uniform Provisions concerning the approval of restraining devices for child occupants of power-driven vehicles ("Child Restraint Systems")
First published: February 1, 1981
Latest revision: September 11, 1992

USA — **FMVSS 213**

Federal Motor Vehicle Safety Standards and Related Materials. Requirements for Child Restraint Systems Used in Motor Vehicles and Aircraft.
First published: May 1, 1980.
Latest revision: October 1, 1992.

United Kingdom — **British Standard, BS**

British Standard - Seat Belt Assemblies for Motor Vehicles Specification for restraining devices for children.
First published: 1960
Latest revisions:
BS 3254:Part 2:1988 and 1991, Specification for child restraint systems which are forward facing
BS AU 185:1983, Specification for seat belt booster cushions
BS AU 202a:1988, Specification for rearward facing infant restraint systems

Denmark — **Danish Standard, DS**

DS 2190, Child restraint Systems for Automobiles.
First published: March, 1983.
(Apart from the deviations mentioned in annex N this standard is technically equivalent with the European Regulation No 44).

Japan — **Japanese Industrial Standard, JIS**

JIS D 0401, Child Restraints for Automobiles.
First published: December 31, 1987
Latest revision: April 1, 1990

Sweden — **T-SB**

Swedish National Approval Requirements.
Child Restraint Systems for Automobiles.
First published: July 1, 1985

Canada — **CMVSS 213**

Canadian Motor Vehicle Safety Standards:
a) CMVSS 213 Child Restraint Systems (for forward facing seats)
First published: December 1, 1982
b) CMVSS 213.1 Infant Seating and Restraint Systems (for rear facing infant carriers)
First published 3 June 1982
c) CMVSS 213.2 Booster cushions
First published 18 February 1983
d) CMVSS 213.3 Restraint Systems for Disabled Persons
First published 25 July 1989

Australia — **Australian Standard, AS**

AS 1754-1991, Child Restraint Systems for Use in Motor Vehicles
AS 3629.1-1991, Methods of testing child restraints. Part 1 - Dynamic testing
AS 3629.2-1991, Methods of testing child restraints. Part 2: Determination of hazardous throat contacts in abnormal situations
AS 3629.3-1991, Methods of testing child restraints. Part 3 - Dynamic testing of upper anchorage components
AS 3629.4-1991, Methods of testing child restraints. Part 4 - Determination of adjustment device forces

France — **AR 19850611A**
First published: September 2, 1975
Latest revisions: June 11, 1985
Withdrawn: May 1, 1992
Note: The new regulation has been recognizing ECE R.44 as the only approval regulation since May 1992.

3 Compilation of regulations and standards

3.1 CLASSES

The term "CLASSES" indicates how dependent the CRS is on the vehicle belt (as defined in ECE R.44)

Europe
- Integral systems
- Non-integral systems

USA
- Add-on systems
- Built-in systems
- Factory-installed built-in systems

UK
- Integral systems
- Non-integral systems

Denmark
- As ECE R.44

Japan
- Not specified

Sweden
- Not specified

Canada
- Currently must use vehicle belt system (change in progress to allow integral system)
- The CR must be capable of being restrained against forward movement solely by means of a specified seat belt assembly or by means of a seat belt assembly together with a tether strap supplied with the CR.

Australia
- All devices use a combination of car seat belts and top tether strap except booster's which can operate with either a three (3) point seat belt or a child harness. (Figures showing the top tether anchor fitting are included in the standard.) The specification ensures compatibility with the North American top tether attachment clips.

3.2 CONFIGURATIONS

Europe
- Infant carrier /rear-facing
- Carry-cot
- Child safety chair /rear- and forward-facing
- Booster cushion/seat

USA
- Rear-facing child restraint system
- Car-bed
- Forward-facing child restraint system
- Booster seat

UK
- Infant carrier /rear-facing
- Carry-cot
- Child safety chair /rear- and forward-facing
- Booster cushion/seat
- Belt only system

Denmark
- As ECE R.44

Japan
- As ECE R.44

Sweden
- Child safety chair /rear- and forward-facing

Canada
- Infant carrier /rear-facing
- Child restraint systems
- Booster cushion/seat
- Restraint systems for disabled persons

Australia
- Infant carrier /rear-facing or laterally mounted on rear seat
- Child safety chair /rear- or forward-facing
- Booster cushion and chaises
- Child harness

3.3 CATEGORIES

The term "CATEGORIES" indicates how vehicle specific the CR is (as defined in ECE R.44)

Europe	-	Universal - Semi-universal - Specific vehicle
USA	-	All add-on systems must be "universal" - All built-in systems are "specific vehicle" - For add-on CR, the instructions shall specify in general terms the types of vehicles, the types of seating positions, the types of vehicle safety belts with which the system can or cannot be used.
UK	-	Not stated but the Standard capable of dealing with all categories.
Denmark	-	As ECE R.44
Japan	-	Universal
Sweden	-	Not specified
Canada	-	Add-on systems are universal - Built-in systems are vehicle specific
Australia	-	Requirements for integrated child restraint systems being developed.

3.4 MASS GROUPS

Europe
- Group 0: < 10 kg
- Group 1: 9 kg to 18 kg
- Group 2: 15 kg to 25 kg
- Group 3: 22 kg to 36 kg

USA
- < 9 kg (20 lb)
- 9 kg to 23 kg (20 lb to 50 lb)

UK
- Group 0: < 10 kg
- Group A: 9 kg to 18 kg
- Group B: 18 kg to 36 kg
- People of small stature of mass 15 kg or more

Denmark
- As ECE R.44

Japan
- As ECE R.44

Sweden
- "Sitting without support" to 35 kg

Canada
- 0 - 9 kg
- 9 - 18 kg
- more than 22 kg

Australia
- Type A1 - Rearward facing infant restraints: 3 kg - 9 kg
- Type A2 - Laterally mounted infant restraints: 3 kg - 9 kg
- Type B - Forward facing child seat: 8 kg - 18 kg
- Type C1 and C2 - Child harness: 14 kg - 21 kg
- Type D - Rearward facing child seat: 8 kg - 18 kg
- Type E - Booster cushion/chaise: 14 kg - 32 kg.

3.5 DUMMIES

Europe
- Newborn (3,4 kg)
- 9-month (9,0 kg)
- 3-year (15,0 kg)
- 6-year (22,0 kg)
- 10-year (32,0 kg)

USA
- Newborn (3,4 kg, 7,5 lb)*
- 6-month (8 kg, 17,4 lb)
- 9-month (9 kg, 20 lb)*
- 3-year (15 kg, 33,3 lb)
- 6-year (21,4 kg, 47 lb)*

*) Included in "Part 572" as official NHTSA dummy, but use not yet specified in FMVSS 213

UK
- Newborn
- 9 kg
- 15 kg
- 32 kg

Denmark
- As ECE R.44

Japan
- 7,7 or 9 kg
- 9 and 15 kg
- 15 and 22 kg
- 22 and 32 kg

Sweden
- ECE R.44 or FMVSS 213 of "suitable size"

Canada
- 6-month
- 3-year

Australia
- Newborn (TNO-P0)
- 9-month (TNO-P3/4)
- 3-year (TNO-P3)
- 6-year (TNO-P6)
- 10-year (TNO-P10)

3.6 INJURY CRITERIA AND RELATED REQUIREMENTS

Europe

- Chest resultant < 55g/3 ms
- Chest vertical < 30g/3 ms
- Head displacement within certain planes
- No head contact above 24 km/h with any part of the vehicle (Specific vehicle category CR)
- Abdominal penetration

USA

- Chest resultant < 60g/3 ms (forward facing CR)
- HIC < 1000 (forward facing CR)
- Head displacement (forward facing add-on systems)
- Head retention within the system (car beds)
- Head target not pass beyond top of restraint back surface (rear-facing CRS)
- Knee displacement (forward facing CR)
- Torso retention within the system
- Limit of angle of back support surface, 70° from vertical (rear-facing CRS).
- Perform in any adjustment position and with any belt routing path (add-on systems).

UK

- Webbing restraining the child shall ensure that the major part of the impact confined to the chest and pelvis, and there should be no localised forces inflicted on the child. (Forward-facing CR)
- The maximum resultant acceleration of the chest of the dummy shall not exceed 60g (1991 revision)
- No loading of abdomen. Detection is made using bubble film analysis or photographically (1991 revision)
- Head displacement not greater than 500 mm (1991 revision)
- Torso must not create an angle of less than 20 deg. during impact. No total failure of any component. No contact on crown of head. (Rear-facing CR)
- In side elevation the lap belt shall be at an angle greater than 45 degrees (Boosters)
- Hip forward movement
- Limit of angle of back support surface, 70 degrees from vertical

Denmark

- Head resultant acceleration max 80g/3 ms
- Internal height for chair back group II min 580 mm.

Optional requirements:

- Head resultant acceleration max 50g/3 ms
- Vertical head acceleration max 20g/3 ms

Japan

Forward-facing CR:

- Chest resultant acceleration max 60g/3 ms
- Head resultant acceleration max 80g/3 ms
- Head displacement
- Knee displacement
- The dummy shall not be released from the apparatus

Rear-facing CR:

- The position of the head gravity centre of the dummy shall not exceed the upper behaviour limit of the seat
- The dummy shall not be released from the apparatus
- Limit of angle of back support surface 60 degrees from vertical

Bed for suckling:
- Head and trunk be kept within the restraint

Seat for school child:
- Dummy or apparatus shall not be released from seat belt

Sweden
- Chest resultant acceleration max 40g
- Head resultant acceleration max 50g/3 ms
- Head vertical acceleration max 20g/3 ms

Canada

Forward facing:
- Chest resultant acceleration < 60g/3 ms
- Maximum head excursion limits, head must not pass through specified vertical transverse plane
- Head resultant < 80g (at present built-in systems only)

Rear facing:
- Provide restraint against rearward head movement towards front of vehicle by integral continuous seat back of specified height and width
- Torso must be retained within CR
- Limit of angle of back support surface 70 degrees from vertical during impact test

Australia
- Each child restraint shall be capable of protecting the wearer under dynamic test conditions specified in AS 3629.1-1991
- The child restraint must minimise lateral and vertical motion and submarining of the child during impact
- Any harness shall be designed so that the average pressure exerted on the occupant, under a deceleration of 20 g, must be not more than 175 kPa, the average pressure being calculated using the total solid area of material in contact with a specified body block.
- Resultant head acceleration for Type A1, Type A2, and Type D devices must not exceed 150g in frontal tests. The 150g upper limit is under review, as is the need for head acceleration upper limits for Type B and Type C devices, and the chest acceleration upper limits for Type A1, Type A2, Type B, Type C and Type D devices. Dummy excursion limits are also being considered, but are not being proceeded with because of the inappropriate size range of dummies for Type B devices.
- The child restraint must not permit impact of any portion of the wearers head, neck and torso with any tensioned adult seat belt used for securing the child restraint, except for Type C1, Type C2 and Type E restraints.
- The child restraint must minimise the possibility of hazardous impact with the interior of the vehicle.
- For Type B devices, no genital area contact with a crotch strap, in frontal testing.

3.7 OTHER DYNAMIC REQUIREMENTS

Europe

- No buckle, locking system, adjuster system, or displacement system shall break or release

USA

- No complete separation of load-bearing structures or partial separations exposing edges and protrusions
- No change in angle-adjustment position
- Angle between back and seating surface not be less than 45 degrees after impact test
- No loading of the dummy allowed from any restraining belt due to the mass of the system or the seat on which it is placed
- Belt tension pre-impact 53 to 67 N
- Harness tension pre-impact: Application of 9 N force pulls webbing 6,4 mm (0,25 in) from dummy.

UK

- No buckle, locking system or displacement system shall break or release.
- Restrict the total amount of slip of the webbing through load carrying buckles to 25 mm for each buckle, and the total amount of slipping of the webbing assembly to 50 mm.
- The securing buckle shall be capable of normal release after testing
- Either:
  1) There shall have been no significant failure of stitching
  2) If significant failure of stitching has occurred, when retested as described in Appendix D, the stitching shall not fail completely.
- The sides of the chair shall remain sufficiently rigid that they do not distort to the extent of touching the sides of the body block.
- 50 mm slack is introduced into the adult reference belt after it has been tightened.

Denmark

- As ECE R.44

Japan

- The buckle shall not be dissociated during the dynamic test. Respective parts having the strength keeping performance shall not be broken and shall be free from the generation of harmful cracks, deformations, etc, likely to injure children.

Sweden

- No buckle, locking system or displacement system shall break or release.

Canada

- No separation of any load bearing structural elements.

Australia

- Retain the dummy in the child restraint, and the child restraint, including any additional parts, in the rig
- Show no complete separation of any load carrying part or parts and no fragmentation of any rigid components
- Restrict slip at any load carrying part to 25 mm, and the total slip at all parts to 50 mm (excluding extending energy absorbing devices)
- Allow test dummy to be released by operation of a single quick-release device, with a force of not more than 110 N, with a 200 N static load on the dummy

3.8 TEST SET-UP

Europe

Test on a trolley with test seat:
- In the rear-facing case the dashboard is represented by a rigid bar attached to the trolley

Test on a trolley with vehicle body shell:
- Special requirements for securing the body shell

Test with complete vehicle:
- Frontal impact against a rigid barrier, 50 -2 km/h, unladen service weight
- Rear impact by an impactor (moving barrier), 30 +2 km/h, reduced mass 1100 +20 kg
- Additional measurement: Contact of the dummies head with the interior of the vehicle

USA

Add-on systems:
- Test on a trolley with standard seat assembly; no "dashboard".

Built-in systems:
- Test in specific vehicle or in specific vehicle shell mounted on trolley.

UK

- Test on a trolley with test seat, as per ECE R.44, but with a hinged back
- The seat back is free to rotate at its base and has a mass of 16 kg (forward-facing)
- Asymmetric anchorages are used, the outboard anchorage being 115 mm higher and 195 mm forward of the normal ECE R.44 anchorage position. The inboard anchorage is as R.44 (forward-facing).

Denmark

- As ECE R.44

Japan

- Test on a trolley with standard seat assembly, no "dashboard".

Sweden

- As ECE R.44 or relevant parts of vehicle body

Canada

Add-on systems:
- Test on a trolley with standard seat assembly, no "dashboard"

Built-in systems:
- Test in specific vehicle or in specific vehicle shell mounted on trolley

Australia

- A test rig of mass not less than 380 kg, comprising a trolley, a test seat, and a structure for providing seat belt anchorages and top tether strap anchorages.

3.9 CRASH PULSE

Europe

- Different deceleration curves for frontal and rear impact done on a trolley, max 28g and 21g respectively, lower limit 20g and 14g respectively. See annex A.
- Test speed: 50 -2 km/h and 30 +2 km/h.

Note: Acceptable simulation of real vehicle deceleration curves, identical to ISO 7862.

USA

Configuration I (for proper restraint use)
- 30 mph, frontal impact, within specified deceleration curve for tests on trolleys, or natural deceleration of specific vehicle if used (built-in systems only). See annex A.

Configuration II (for specified misuse)
- 20 mph, frontal impact, within specified deceleration curve for tests on trolleys, or natural deceleration of specific vehicle if used (built-in systems only). See annex A.

UK

- Deceleration curves as for ECE R.44 frontal impact. See Annex A.

Denmark

- As ECE R.44. See Annex A.
- Test speed: 48.3 -3 km/h and 50 -2 km/h

Japan

- Deceleration curves, see annex A
- Test speed: 50 -2 km/h.

Sweden

- Deceleration pulse increase max 10.000 m/s^2 during the first 10 ms. Then constant deceleration max 200 m/s^2. Stopping distance < 0.7 m.
- Test speed: 50 ± 2 km/h

Canada

- Test speed: 48 km/h, see Annex A

Australia

- For AS3629:

Frontal - When subject to a velocity change of not less than 49 km/h, a deceleration of between 24g and 34 g shall be achieved within 30 ms. The deceleration shall remain within the range 24g to 34g for not less than 20 ms, but deceleration values outside this range that occur for periods of not greater than 1 ms may be disregarded.

Sideways and rearwards - When subject to a velocity change of not less than 32 km/h, a deceleration of between 14g and 20g shall be achieved within 30 ms. The deceleration shall remain within the range 14g to 20g for not less than 20 ms, but deceleration values outside this range that occur for periods of not greater than 1 ms may be disregarded.

3.10 OVERTURNING

Europe
- The dummy shall not fall out of the CR when the test seat is in an upside-down position - different dummies. Requirement: Head displacement < 300 mm

USA

For aircraft certification only:
- Install on aircraft seat, rotate forward 180° at 35-45 °/s, hold 3 s; repeat for sideways rotation.
- Neither dummy nor CR shall "fall out".

UK
- As ECE R.44 (Rear-facing CR), except that 50 mm slack is introduced into the adult reference belt
- Restraint must be designed to restrain child in rollover (Forward-facing CR)

Denmark
- As ECE R.44

Japan
- Not included

Sweden
- Not included

Canada
- For aircraft certification only

Australia
- **Inverted** - When subject to a velocity change of not less than 16 km/h, a deceleration of between 8g and 15g shall be achieved within 30 ms. The deceleration shall remain within the range 8g to 15g for not less than 20 ms, but deceleration values outside this range that occur for periods of not greater than 1 ms may be disregarded.