INTERNATIONAL STANDARD

ISO 13216-1

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Road vehicles — Anchorages in vehicles and attachments to anchorages for child restraint systems —

Part 1: Seat bight anchorages and attachments

Véhicules routiers — Ancrages dans les véhicules et attaches aux ancrages pour systèmes de retenue pour enfants —

Partie 1: Ancrages près de la jonction dossier-coussin d'assise et attaches

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 3.

Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

Attention is drawn to the possibility that some of the elements of this part of ISO 13216 may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

International Standard ISO 13216-1 was prepared by Technical Committee ISO/TC 22, *Road vehicles*, Subcommittee SC 12, *Restraint systems*.

ISO 13216 consists of the following parts, under the general title *Road vehicles — Anchorages in vehicles and attachments to anchorages for child restraint systems*:

— *Part 1: Seat bight anchorages and attachments*

— *Part 2: Top tether anchorages and attachments*

— *Part 3: Classification of child restraint dimensions and vehicle space*

Annexes A and B form a normative part of this part of ISO 13216.

Introduction

This part of ISO 13216 describes a universal system for anchoring child restraint systems to vehicles.

The purpose of this system is to improve the overall safety performance of child restraints, particularly by improving the convenience of installation and reducing the risk of misuse.

INTERNATIONAL STANDARD ISO 13216-1:1999(E)

Road vehicles — Anchorages in vehicles and attachments to anchorages for child restraint systems —

Part 1: Seat bight anchorages and attachments

1 Scope

This part of ISO 13216 specifies the dimensions, general requirements and static strength requirements of rigid anchorages for anchoring child restraint systems (CRS) in vehicles. It is applicable to fittings for the installation of CRSs for children with a mass of up to 22 kg, by means of two rigid anchorages positioned in the seat bight area, in passenger carrying vehicles.

NOTE 1 This mass limit applies to CRSs where the inertia forces of the child and CRS are transferred via the anchorage system for the CRS. The anchorages may be used for systems for larger children, such as seats where the main forces are transferred through the adult seat belt, provided that the forces applied to the anchorages and the resulting excursions (see 4.2) do not exceed the limits in this part of ISO 13216.

To assure compatibility with the anchorages, this part of ISO 13216 also specifies important features of CRSs equipped with rigid attachments, such as critical dimensions of the attachments and general requirements for handling. Supplementary devices, such as tether straps and reaction bars, which may be necessary for specific vehicle configurations or to fulfil performance criteria included in national and international standards and regulations, are not specified in this part of ISO 13216.

An interim anchorage system that employs semi-rigid anchorages in the vehicle is described in annex A. Requirements for optional non-rigid attachments on the CRS are given in annex B.

NOTE 2 Performance and strength requirements for the homologation of CRSs using attachments according to this part of ISO 13216 are presumed to be specified in other standards and regulations.

2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this part of ISO 13216. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this part of ISO 13216 are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. For undated references, the latest edition of the normative document referred to applies. Members of ISO and IEC maintain registers of currently valid International Standards.

ISO 4130, *Road vehicles — Three-dimensional reference system and fiducial marks — Definitions.*

ISO 6487, *Road vehicles — Measurement techniques in impact tests — Instrumentation.*

ISO 6549, *Road vehicles — Procedure for H- and R-point determination.*

ISO 13215-2[1)], *Road vehicles — Reduction of misuse risk of child restraint systems — Part 2: Requirements and test procedures for correct installation (panel method).*

3 Terms and definitions

For the purposes of this part of ISO 13216, the following terms and definitions apply.

3.1
anchorage
one of two (2) prescribed 6 mm diameter round horizontal bars, in accordance with this part of ISO 13216, provided at a vehicle seating position and extending from vehicle or seat structure to accept and restrain a **child restraint system** (3.3) with prescribed **attachments** (3.2)

NOTE Anchorages may be rigid, or semi-rigid according to annex A.

3.2
attachment
one of two (2) prescribed connections, in accordance with this part of ISO 13216, extending from the **child restraint system** (3.3) structure, and compatible with an **anchorage** (3.1)

NOTE Attachments may be rigid, or non-rigid according to annex B.

3.3
child restraint system
CRS
free-standing device intended to provide child vehicle occupants with an approved restraint

NOTE CRSs comprise various categories such as car beds, infant restraints, toddler seats (forward and rearward facing), booster cushions, and booster seats. Combination products may cover two or more of these product categories.

3.4
child restraint fixture
CRF
fixture which simulates the maximum external dimensions of the child restraint, and which is used to determine the space required by the **child restraint system** (3.3) and the location and access to the **anchorages** (3.1), but not the space required for ingress to the vehicle

See Figures 1 and 2.

NOTE Forward and upward limitations are not specified in this part of ISO 13216.

3.5
CRS connector
attachment (3.2) with certain specified dimensions designed to be rigidly supported

See Figure 8.

NOTE When designed according to annex B, a CRS connector may be flexibly supported.

3.6
ISOFIX
system for the connection of **child restraint systems** (3.3) to vehicles which has two rigid **anchorages** (3.1) in a vehicle seating position located near the seat bight, corresponding rigid **attachments** (3.2) on the child restraint system, and a means to limit the pitch rotation of the CRS

1) To be published.

3.7
non-rigid attachment
one of two (2) prescribed connections, in accordance with annex B, flexibly supported from the **child restraint system** (3.3) structure, between a CRS and an **anchorage** (3.1)

NOTE A non-rigid attachment may consist of a CRS connector or hook supported by webbing or the equivalent.

3.8
seat bight
area close to the intersection of the surfaces of the vehicle seat cushion and the seat back or squab

3.9
semi-rigid anchorage
anchorage (3.1) fulfilling the requirements in annex A

3.10
static force application device
S-FAD
test fixture that engages the vehicle **anchorages** (3.1) and that is used to confirm their strength and stiffness, as well as the CRS interaction with the vehicle seat, in a static test

See Figures 4 and 5.

3.11
vehicle seat fixture
VSF
fixture which simulates the minimum dimensions of the available space provided by the vehicle seat and the location of the **anchorages** (3.1), and which is used by the child restraint manufacturer to determine the appropriate dimensions of the child restraint and the location of and access to the anchorages

See Figures 6 and 7.

NOTE Forward and upward limitations are not specified in this part of ISO 13216.

4 Vehicle anchorage specifications

4.1 Dimensions and installation requirements

4.1.1 General

The vehicle anchorages are positioned near the seat bight. The location of the anchorages is defined with respect to the CRF as described in Figures 1, 2 and 3. The purpose of the CRF is to ensure that a child restraint system will fit in the designated seating position with regard to the anchorage positioning and the surrounding vehicle interior.[2)]

The anchorages shall be positioned so that no parts of the vehicle interior are in conflict with the boundary surfaces given by the CRF. If the vehicle seat is adjustable, it shall be adjusted as recommended by the vehicle manufacturer for use with child restraint systems.

2) An amendment specifying the tolerances in order to use the CRF as a checking tool for homologation purposes is in preparation.

4.1.2 Anchorage dimensions and location

The anchorages shall be 6 mm ± 0,1 mm diameter transverse horizontal round bars with a minimum effective length of 25 mm. The transverse spacing of the bars shall be 280 mm, centre-to-centre. They shall be supported so as to extend from the adjacent vehicle or seat structure such that the anchorages are readily accessible (when deployed for use, if storable, or if and when equipped with removable physical guidance features such as those described in 4.4).

NOTE 1 The actual length of the anchorages is given by the CRF, considering the manufacturing tolerances for the 280 mm anchorage spacing in the vehicle.

The anchorage bars are located at the vehicle seating position with the aid of and with respect to the CRF rearward extensions as shown in Figures 1, 2 and 3, with the CRF placed against or near the vehicle seat back.

With the CRF attached to the anchorages and resting on the seat cushion, the bottom surface shall have attitude angles within the following limits, angles measured relative to the vehicle reference planes according to ISO 4130:

— pitch: 15° ± 10°

— roll: 0° ± 5°

— yaw: 0° ± 10°

NOTE 2 An explanation of the above angles is given in Figure 1.

The anchorage bars shall be located within the following limits:

— most rearward (determined by the CRF): shall be not more than 70 mm behind the rearmost lower corner of the CRF (point Z), measured parallel to the bottom surface and to the centre of the bar, with the CRF rear surface against the seat back;

— most forward: shall be not less than 120 mm behind the vehicle seating reference point (R-point according to ISO 6549), measured horizontally, and to the centre of the bar.

NOTE 3 In case of storable supports, the requirements of this part of ISO 13216 apply to the deployed position.

NOTE 4 For reasons of safety and comfort for the adult seat occupant, it is desirable to locate the anchorage bars as far rearward as possible, but for anchorage bar accessibility, it is desirable to have the anchorage bars as far forward as possible. Adjustable rearward extensions can be used to find the most appropriate position of the anchorage bars within the limits given above.

NOTE 5 The positioning of the anchorage bars is dependent on the vehicle seat cushion and seat back characteristics, and should be determined considering the mass range for typical CRSs (approximately 5 kg to 8 kg). Handling of the CRF, the intended use of physical guidance features, etc., should be taken into account for the final positioning of the bars.

NOTE 6 To facilitate installation of the CRF in a vehicle seat, the CRF may be constructed of smaller separable parts and assembled in the vehicle seat. Alternatively, vehicle components may be removed to allow access.

The minimum dimensions for the opening or soft area surrounding an anchorage bar for access by the attachment are determined by using the checking device shown in Figure 3. The checking device may be designed as a detachable part of the CRF for checking angular tolerance. A pitch tolerance of not less than 5° (relative to the pitch angle chosen) is recommended to facilitate mounting of a CRS.

4.1.3 CRS dimensions and space in the vehicle

A classification according to the space needed in the forward and upward direction to accommodate forward-facing and rearward-facing child restraint systems relating to different age groups is given in ISO 13216-3.

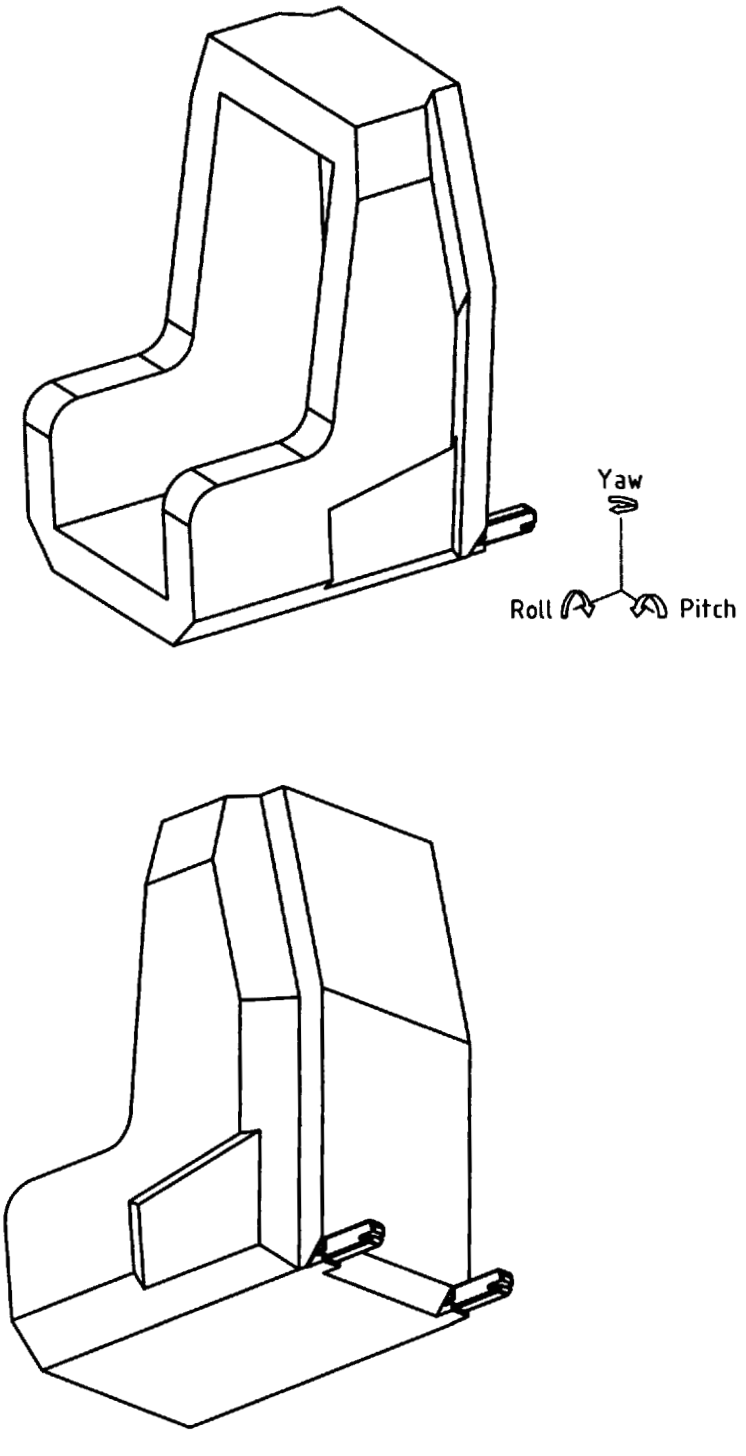
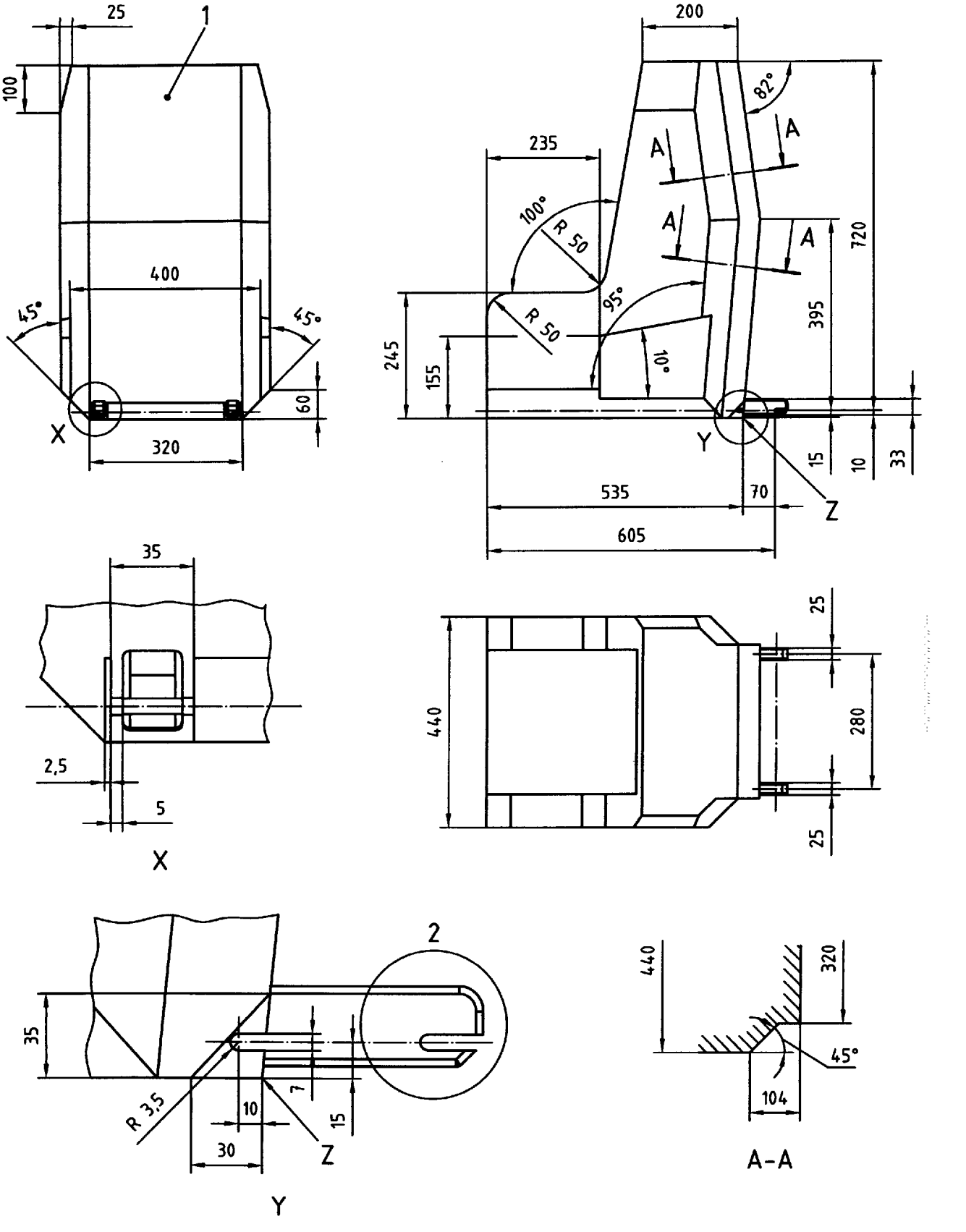


Figure 1 — Child restraint fixture (CRF), isometric views

Dimensions in millimetres



Key

1 Side, back, and top frames may be removable for installation in vehicle

2 See Figure 3

Figure 2 — Child restraint fixture (CRF), dimensions

Dimensions in millimetres

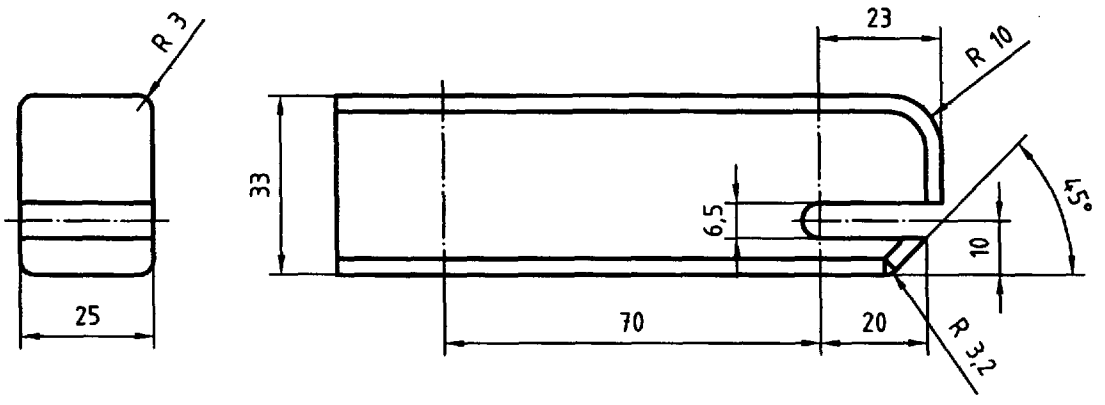


Figure 3 — Checking device for minimum space around anchorage bars

4.2 Static strength requirements

4.2.1 General

The strength of the anchorages shall be determined using the procedure of 4.2.3 to apply forces to the static force application device (S-FAD) described in Figures 4 and 5, installed in the vehicle seating position and engaged with the anchorages.

4.2.2 Stiffness of S-FAD

When attached to rigid anchorage bars with the front cross member of the S-FAD supported by a rigid bar that is held at the centre by a longitudinal pivot 25 mm below the S-FAD base (to allow bending and twisting of the S-FAD base), the movement of point X shall not be greater than 2 mm in any direction when forces are applied in accordance with 4.2.3. Any deformation of the anchorage bars shall be excluded from the measurements.

NOTE The stiffness requirements above will be fulfilled when using a securely welded construction consisting of rectangular 3 mm steel tubing, and a 6 mm thick load application plate.

The vehicle seat shall be installed in the vehicle, or in sufficient parts of the vehicle so as to be representative of the strength and rigidity of the vehicle structure. At the option of the vehicle manufacturer, new components may be installed between successive force application tests. If the seat is adjustable, it shall be placed in the position recommended by the vehicle manufacturer for use with child restraint systems. If no adjusted position is recommended, the seat shall be placed in the position that provides the most adverse conditions with respect to the ultimate strength of the system. The excursion limits for point X on the S-FAD in the course of force application are shown in Table 2.

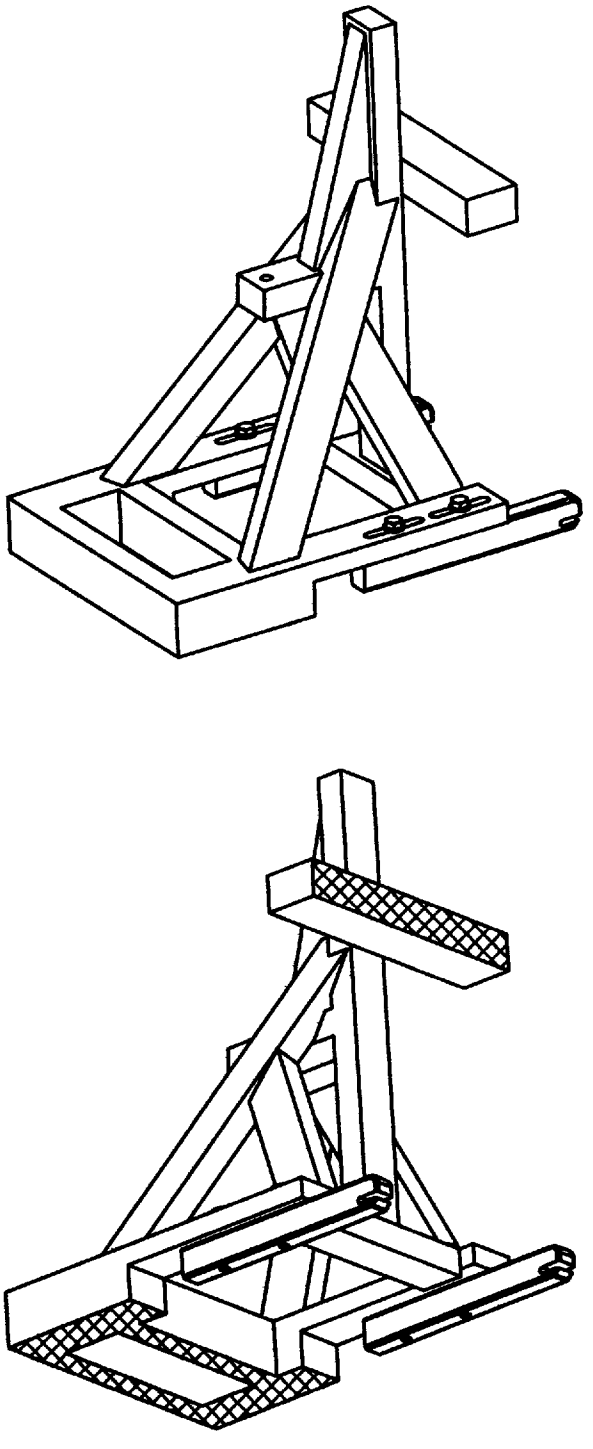
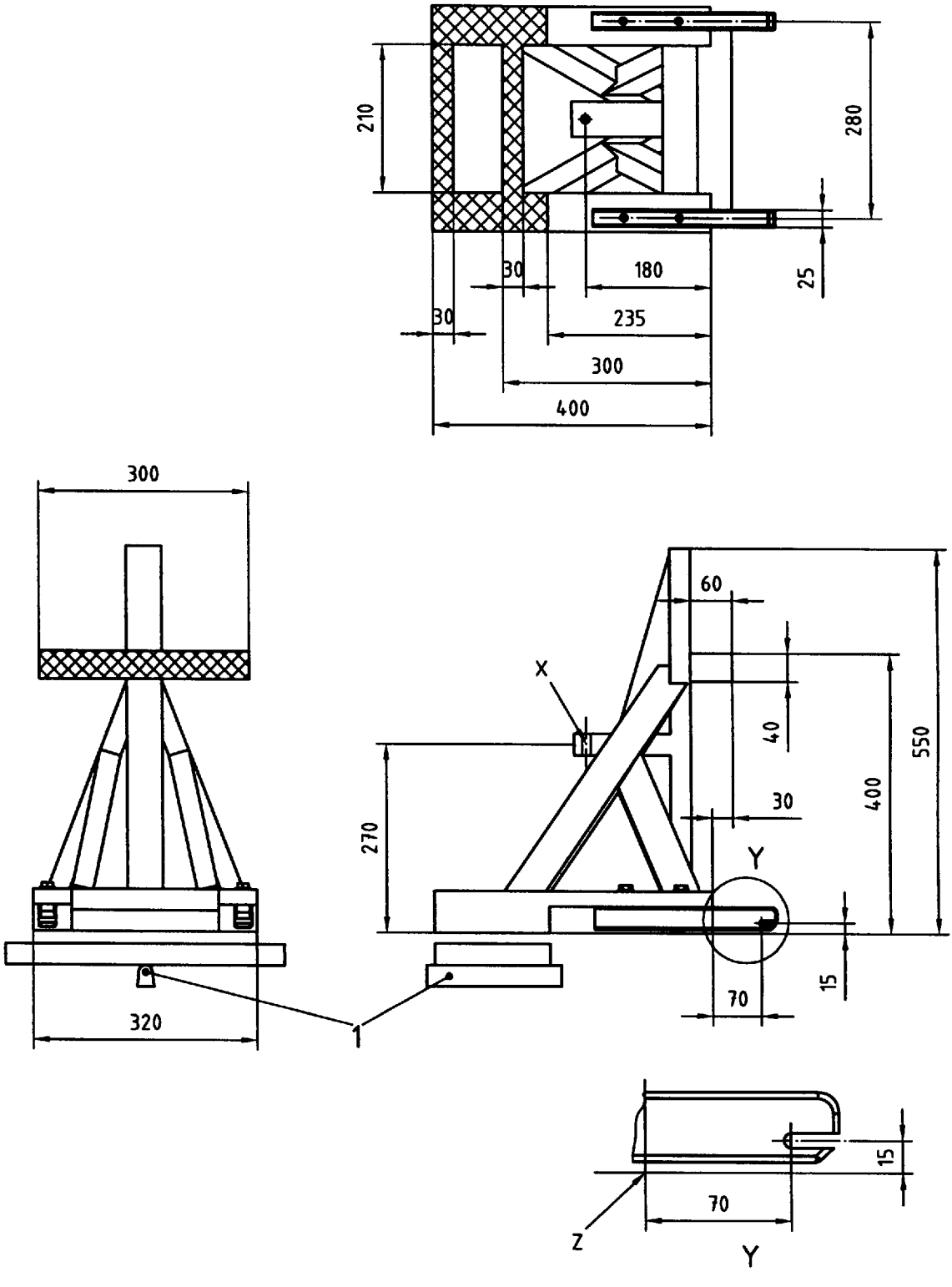


Figure 4 — Static force application device (S-FAD), isometric views

Dimensions in millimetres



Key

1 Pivot arrangement for stiffness testing (see 4.2.2)

Figure 5 — Static force application device (S-FAD), dimensions

4.2.3 Forces, directions and excursion limits

A rearward force of 135 N ± 15 N shall be applied to the centre of the lower front crossbar of the S-FAD to press the device against the seat back as the fore-aft position of the rearward extensions of the S-FAD is adjusted to remove any slack or tension.

Forces shall be applied to the static force application device (S-FAD) in forward and lateral directions according to Table 1.

Table 1 — Directions of test forces

Direction	Angle	Force
Forward	0° ± 5°	8 kN ± 0,25 kN
Lateral	75° ± 5° (to both sides of straight forward)	5 kN ± 0,25 kN

Forces in the forward direction shall be applied with an initial force application angle of 10° ± 5° above the horizontal. Lateral forces shall be applied horizontally (0° ± 5°). A preload force of 500 N ± 25 N shall be applied at the prescribed loading point (point X) in Figure 5. The force shall be increased to 8 kN ± 0,25 kN for forward tests, or to 5 kN ± 0,25 kN for lateral tests. Full application of the force shall be achieved within a time period of 2 s or less. The force shall be maintained for a period of 0,25 s ± 0,05 s.

Reduced forces may be applied for homologation of anchorages in vehicles exceeding 3 500 kg maximum mass. These reduced forces are to be decided by the national regulatory bodies.

Horizontal excursion (after preload) of point X during application of the 8 kN and 5 kN forces shall be within the limits specified in Table 2. Rotation (yaw) of the fixture during application of the forward force shall not exceed 15°. All measurements shall be made according to ISO 6487.

Table 2 — Force directions and excursion limits

Force direction (see 4.2.2)	Maximum allowable excursion of point X
0° ± 5°	125 mm
75° ± 5°	125 mm

Any deformation in the S-FAD itself shall be excluded from the above measurements; see also 4.2.2.

4.2.4 Additional forces

4.2.4.1 Seat inertia forces

For installation positions where the load is transferred into a vehicle seat assembly (e.g. in the front passenger seat), and not directly into the vehicle structure, a test shall be carried out to ensure that the strength of the vehicle seat attachment to the vehicle structure is sufficient. In this test, in addition to the force of 8 kN ± 0,25 kN applied to point X, a force equal to 20 times the mass of the relevant parts of the seat assembly shall be applied horizontally and longitudinally through the centre of gravity of the seat assembly in a forward direction. No breakdown shall occur.

NOTE This test does not have to be performed in case any anchorage of the vehicle seat belt system is integral with the vehicle seat structure, and the vehicle seat is already tested and approved to meet at least the above requirement.

4.2.4.2 Simultaneous force application

If anchorages for more than one CRS are installed in the vehicle seat assembly as in 4.2.4.1, the forces described in 4.2.3 shall be applied simultaneously to S-FADs engaged with the anchorages at each seating position along with the force specified in 4.2.4.1.

4.3 Positions in vehicle

The number and location of seating positions to be equipped with anchorages are not specified in this part of ISO 13216, since other international or national standards or regulations should specify them.

NOTE It is recommended that all passenger seating positions suitable for installation of a CRS be considered.

4.4 Marking and guidance

At least one anchorage bar (when deployed for use), one guidance fixture (when installed), or one seat marking feature shall be readily visible to the CRS installer. The vehicle seat cushion or seat back should include markings or features to assist in the correct lateral positioning of the CRS as it is moved rearward to engage the anchorages.

The incorporation of physical guidance features adjacent to the anchorages should be considered, based on an ISO 13215-2 evaluation of the installation. Storable anchorages shall be provided with a telltale or label that is visible when the anchorage is stored.

Any physical guidance features recommended by the vehicle manufacturer to facilitate access to anchorage bars shall be provided by the vehicle manufacturer, and may be installed by the vehicle manufacturer, or, if designed for installation and removal without tools, by the vehicle owner. If such features are to be installed by the vehicle owner, anchorage bars should be usable without the features installed.

4.5 Contamination of anchorage bars and guidance features

Contamination of anchorage hardware by foreign materials may lead to the inability to engage the attachment with the anchorage bar. Anchorage hardware shall be designed for easy and frequent cleaning or washing, including the temporary removal of physical guidance features, if necessary, for that purpose.

4.6 Instructions

The vehicle owner's handbook shall indicate the seating positions equipped with anchorages, including any restrictions as to the simultaneous use of those positions. There should be installation instructions with regard to the features described in 4.4. There shall be instructions regarding the type and categories of products that are suitable for use with the type of anchorages installed.

5 Child restraint system specifications

5.1 Dimensions

The maximum lateral, downward, and rearward dimensions for the CRS and the locations of the anchorages with which its attachments must engage are defined for the CRS manufacturer by the Vehicle Seat Fixture (VSF), shown in Figures 6 and 7.[3)] Additional specifications relating to the CRS dimensions in the forward and upward directions for forward-facing and rearward-facing systems relating to different age groups are given in ISO 13216-3.

3) An amendment specifying the tolerances in order to use the VSF as a checking tool for homologation purposes is in preparation.

The purpose of the VSF is to ensure that a child restraint system will fit in designated seating positions with regard to the anchorage positioning and the surrounding vehicle interior. No parts of the child restraint system are allowed to be in conflict with the boundary surfaces given by the VSF.

5.2 Attachments

5.2.1 Type

Attachments to anchorages may be according to examples shown in Figure 9, or other appropriate designs that are part of a rigid mechanism having provision for adjustment, the nature of which is determined by the CRS manufacturer.

5.2.2 Dimensions

Dimensions for the portion of the CRS connector that engages the anchorage bar must not exceed the maximum dimensions given by the envelope in Figure 8.

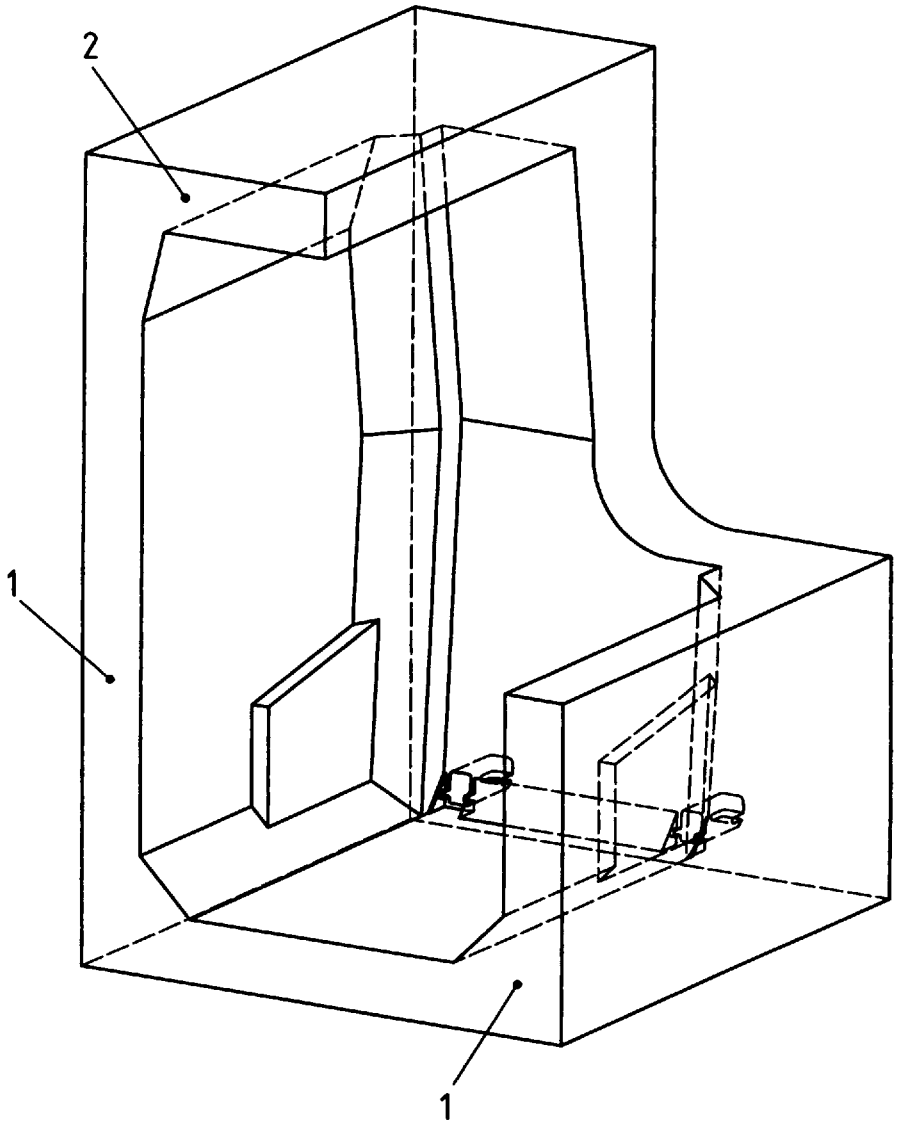
5.2.3 Partial latching indication

The CRS shall incorporate means by which there is clear indication that all attachments are fully latched. The indication means may be audible, tactile or visual or a combination of two or more. It shall be detectable under all normal lighting conditions.

5.3 Adjustment provisions

The CRS attachments, or the CRS itself, shall be adjustable so as to limit rotation (pitch) of the CRS in either direction. The adjustment range shall accommodate the range of anchorage locations specified in 4.1.2.

NOTE To ensure full compatibility with interim semi-rigid anchorages designed according to annex A, the range of anchorage locations specified in A.2.1 should be considered.



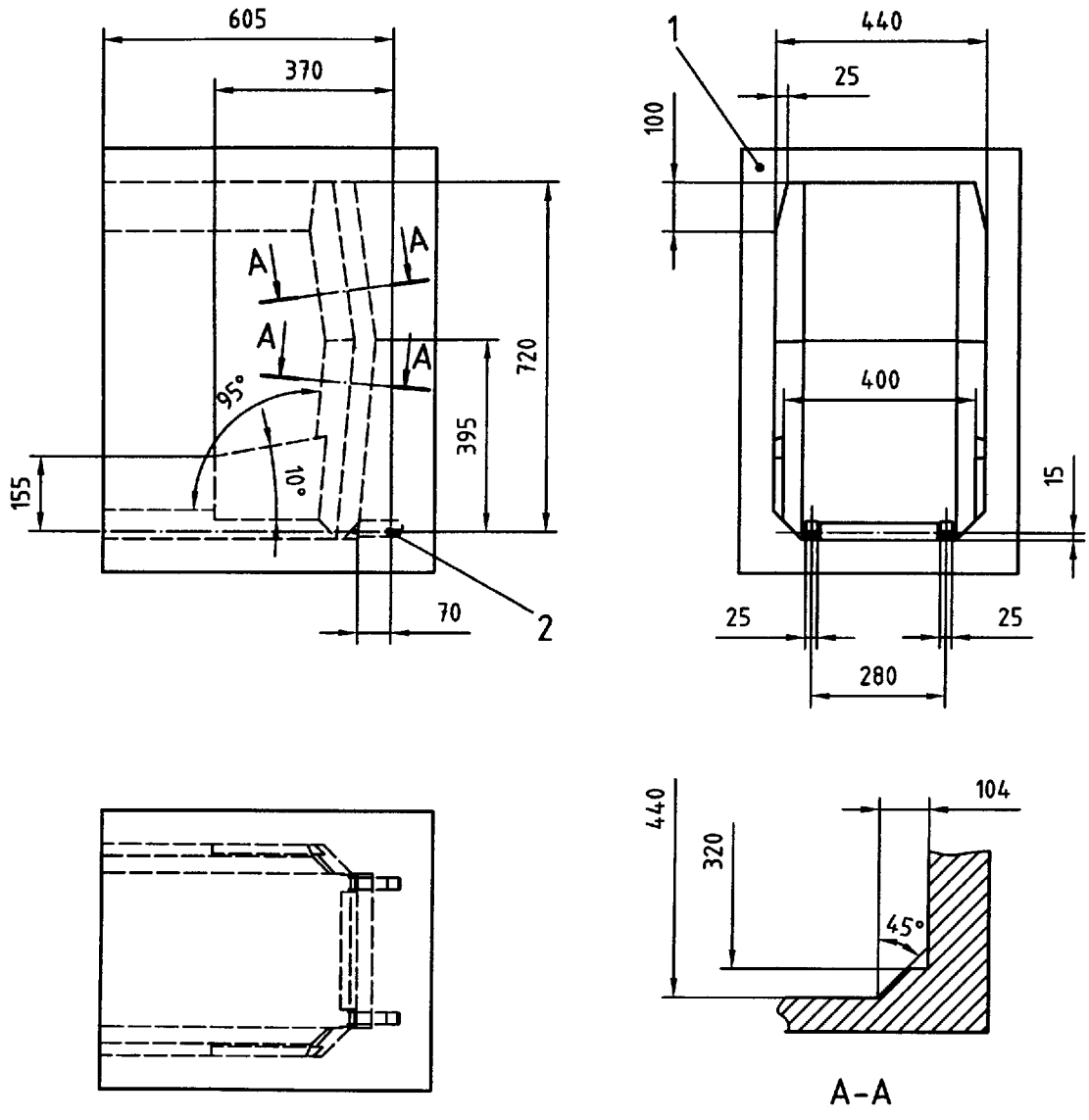
Key

1 Side frames removable (one side frame may be removed when testing a child restraint system)

2 Top frame removable

Figure 6 — Vehicle seat fixture (VSF), isometric view

Dimensions in millimetres



Key

1 Side and top frames removable for installation

2 Rearmost anchorage location

Figure 7 — Vehicle seat fixture (VSF), dimensions

Dimensions in millimetres

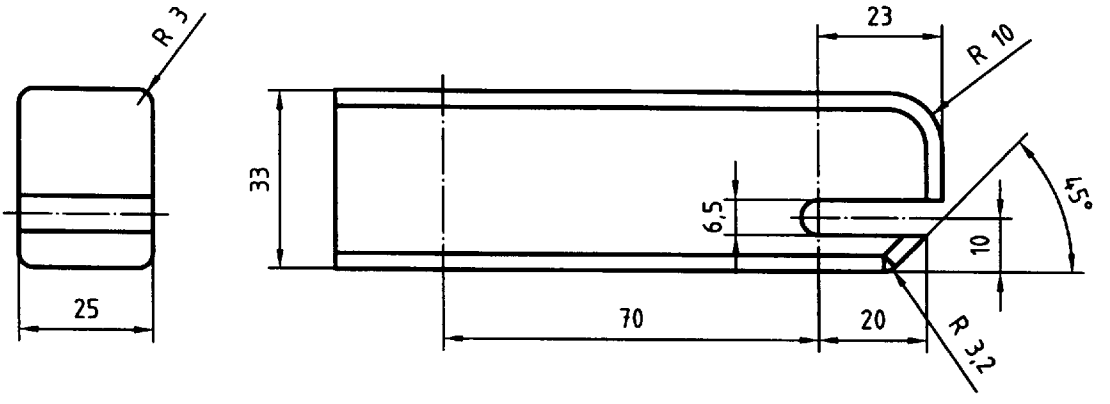
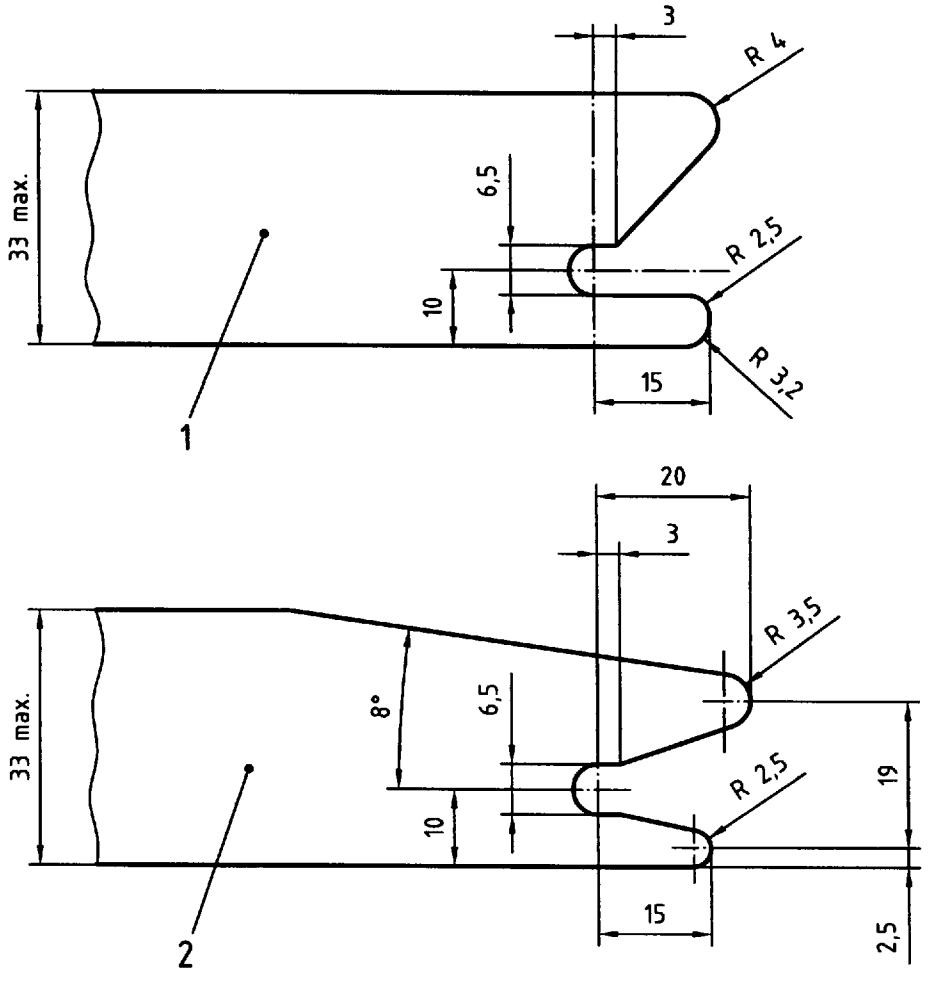


Figure 8 — CRS connector, envelope dimensions

Dimensions in millimetres



Key

1 CRS connector – example 1

2 CRS connector – example 2

Figure 9 — CRS connector, design examples

Annex A
(normative)

Requirements for interim semi-rigid anchorages in vehicle

A.1 Introduction

This annex describes the general requirements for semi-rigidly supported anchorage bars for use with the anchorage system for child restraints.

This interim alternative to the rigidly supported anchorages of ISO 13216-1 is included to encourage the rapid introduction of anchorage bars in motor vehicles where the use of rigidly supported bars is not feasible in the short term, or in locations in a vehicle which are not appropriate for the installation of rigid anchorages.

A.2 Vehicle semi-rigid anchorage specifications

A.2.1 Anchorage dimensions and location

The anchorages shall be 6 mm ± 0,1 mm diameter transverse horizontal round bars with a minimum effective length of 25 mm. The transverse spacing of the bars shall be 280 mm, centre-to-centre. They shall be supported so as to extend from the adjacent vehicle or seat structure such that the anchorages are readily accessible for the installation of a CRS with rigidly supported CRS connectors.

The anchorage bars are located at the vehicle seating position with the aid of and with respect to the CRF rearward extensions as shown in Figures 1, 2 and 3, with the CRF placed against or near the vehicle seat back.

With the CRF attached to the anchorages and resting on the seat cushion, the bottom surface shall have attitude angles within the following limits, angles measured relative to the vehicle reference planes according to ISO 4130:

— pitch: 15° ± 10°

— roll: 0° ± 5°

— yaw: 0° ± 10°

NOTE An explanation of the above angles is given in Figure 1.

Anchorage bars that are semi-rigidly supported shall be located within the following limits, in each case with the CRF rear surface against the seat back:

— most rearward (determined by the CRF): shall be not more than 70 mm rearward of the rearmost lower corner of the CRF (point Z), measured parallel to the bottom surface and to the centre of the bar;

— most forward: shall be not more than 10 mm forward of the rearmost lower corner of the CRF (point Z), measured parallel to the bottom surface and to the centre of the bar.

The minimum dimensions for the opening or soft area surrounding an anchorage bar for access by the attachment are determined by using the checking device shown in Figure 3.

A.2.2 Static strength requirements

The strength of the anchorages shall be determined using the procedure of 4.2.3 to apply forces to the static force application device (S-FAD) described in Figures 4 and 5, installed in the vehicle seating position and engaged with the anchorages.

A.2.2.1 Forces, directions and excursion limits

The procedure and requirements in 4.2.3 apply, with the following exception.

Because of the probable inability of semi-rigid anchorages to meet the lateral excursion requirements in clause 4.2.3, they are exempt from the lateral excursion limit requirement in Table 2. Instead, it is required that semi-rigid anchorages shall not break in the lateral test.

A.2.2.2 Additional forces

The requirements given in 4.2.4 apply.

A.2.3 Installation requirements

It shall be possible to assemble a CRS attachment to a semi-rigidly supported anchorage by a motion of one hand of the installer, while holding only the CRS or the attachment. Semi-rigidly supported anchorage bars shall be displaced not more than 70 mm behind point Z when a rearward horizontal force of 50 N is applied to the bar.

In order to assure that semi-rigid lower anchorages will maintain a lateral separation of 280 mm and necessary co-linearity for the installation of a CRS with rigidly supported connectors, it may be necessary for the vehicle manufacturer to provide a means to fix the separation while the CRS is being installed and is in use.

Annex B
(normative)

Requirements for optional non-rigid attachments on child restraint system

B.1 Introduction

This annex describes the general requirements for child restraint systems with optional non-rigid attachments for use with anchorages according to this standard. The critical geometry of the child restraint and its attachments, and certain general requirements for the attachments are given.

B.2 Child restraint specifications

B.2.1 Dimensions

The maximum lateral, downward, and rearward dimensions for the CRS and the locations of the anchorages with which its attachments must engage are defined for the CRS manufacturer by the Vehicle Seat Fixture (VSF), shown in Figures 6 and 7. Additional specifications relating to the CRS dimensions in the forward and upward directions for forward-facing and rearward-facing systems relating to different age groups are given in ISO 13216-3.

B.2.1.1 Type

Attachments for anchorages may be according to examples shown in Figure 9, or other appropriate designs supported by webbing (or its equivalent) fastened to and extending from the CRS and having provision for adjustment and release of tension.

B.2.1.2 Dimensions

Dimensions for the portion of the CRS connector that engages the anchorage bar must not exceed the maximum dimensions given by the envelope in Figure 8.

B.2.1.3 Latching indication

The CRS shall incorporate means by which there is clear indication that attachments are fully latched. The indication means may be audible, tactile or visual or a combination of two or more of these. It must be detectable under all normal lighting conditions.

B.2.2 Adjustment provisions

The CRS attachments, or the CRS itself, shall be adjustable so as to limit rotation (pitch) of the CRS in the forward and rearward direction. The adjustment range shall accommodate the range of anchorage locations described in A.2.1.

Bibliography

[1] ISO 2575, *Road vehicles — Symbols for controls, indicators and tell-tales.*

[2] ISO 13215-3, *Road vehicles — Reduction of misuse risk of child restraint systems — Part 3: Prediction and assessment of misuse by Misuse Mode and Effect Analysis (MMEA).*

[3] ISO 13216-2, *Road vehicles — Anchorages in vehicles and attachments to anchorages for child restraint systems — Part 2: Top tether anchorages and attachments.*

[4] ISO 13216-3[4)], *Road vehicles — Anchorages in vehicles and attachments to anchorages for child restraint systems — Part 3: Classification of child restraint dimensions and vehicle space.*

4) To be published.

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