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

## Part 4: Lower tether anchorages

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

*Partie 4: Ancrages pour fixation des sangles inférieures*



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# Foreword

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The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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This document was prepared by Technical Committee ISO/TC 22 *Road vehicles*, Subcommittee SC 36 *Safety and impact testing*.

A list of all parts in the ISO 13216 series can be found on the ISO website.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.



# Introduction

Lower tether anchorages (LTA), for rearward facing child restraint systems (CRSs) in passenger cars, are used to enhance protection of children in cars. The lower tethers help to reduce CRS rotation in rear impacts, during the rebound phase in frontal impacts, and in rollover events. Lower tethers, attached to the LTA, may be used together with seat bight anchorages according to ISO 13216-1 (ISOFIX), or with other methods for mounting rearward facing CRS in road vehicles, mainly using the vehicle seat belt.

In line with ISOFIX, standardization of LTA enables pre-installed anchorages with adequate performance within a designated zone. Pre-installed anchorages will improve the usability and reliability of attaching the lower tethers. In addition, having dedicated anchorages reduces the risk of tethers routed in a way that can damage the car interior, seat chassis, cables under the seat, etc.

Dedicated pre-installed anchorages will ensure ease-of-use, reduce risk of misuse and simplify the mounting of a rearward facing CRS. With the use of lower tethers and specified LTA and tether connectors (click-in function in analogy with ISOFIX connectors) the CRS can be easily attached.

This document provides requirements and guidelines to facilitate the introduction of lower tether anchorages in passenger cars contributing to ease-of-use, reduction of potential damage to vehicle interior, and increased safety by facilitating increased use of rearward facing CRSs.

**Background**

Rearward facing CRSs have been available on the market since late 1960s and are used for infants as well as toddlers. In the Nordic countries, they have been used since their introduction as the main CRS for children up to approximately four years of age and have provided evidence of excellent occupant protection.

Most of the large rearward facing CRSs use lower tethers, which are attached to the floor area or seat in front of or below the seating position of the CRS. There is more than 40 years of experience of lower tether usage. Some cars have pre-installed anchorages in which the lower tethers can easily be attached. The most common positions of the anchorages are on the seat rails in front of the CRS (inside, outside, or end of seat rails), but alternative placements are also used.

However, the majority of the vehicles have no pre-installed anchorages, as a consequence the tethers are instead routed around the seat chassis, the seat cushion or other parts that can be accessed.

The primary attachment of the rearward facing CRS is the ISOFIX or the vehicle seat belt. In addition, a support leg is usually used together with the lower tethers. An alternative to the lower tether is to use a bar pressed against the vehicle seat backrest (so-called rebound bar). The rebound bar provides some effect to reduce rotation in rear-end impacts and the rebound phase in frontal impacts, however it is not sufficient for the large rearward facing CRSs, especially when attached using the vehicle seat belt. The lower tethers also provide superior protection in rollover or turnover events.

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

# Part 4:
# Lower tether anchorages

## 1 Scope

This document establishes the positioning zones, dimensions and general and static strength requirements for lower tether anchorages.

Lower tether anchorages can be used together with seat bight anchorages according to ISO 13216-1, or with other methods for anchoring child restraint systems (CRS) in road vehicles.

This document is applicable to all seating positions, intended by the vehicle manufacturer, for use with rearward-facing CRSs. These seating positions can include outer and mid positions in rear seats (second and third row), as well as the front passenger seat.

This document also specifies requirements and strength testing of retrofit lower tether anchorages.

## 2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 13216-2:2004, *Road vehicles — Anchorages in vehicles and attachments to anchorages for child restraint systems — Part 2: Top tether anchorages and attachments*

ISO 13216-3, *Road vehicles — Anchorages in vehicles and attachments to anchorages for child restraint systems — Part 3: Classification of child restraint system and space in vehicle*

## 3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 13216-2 and ISO 13216-3, and the following apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at http://www.electropedia.org/

**3.1**
**lower tether anchorage**
**LTA**
anchorage on the vehicle seat track or on or close to the vehicle floor to which a *lower tether* (3.4) can be attached

[SOURCE: ISO 29061-1:2010, 3.15, modified — The term "rebound tether anchorage" has been deleted and the phrase "rebound tether" has been deleted in the definition before "lower tether".]

**3.2**
**retrofit lower tether anchorage**
**retrofit LTA**
*lower tether anchorage* (3.1) for after-market installation in the vehicle

Note 1 to entry: Retrofit LTAs can be provided by OEMs or CRS manufacturers.

**3.3**
**LTA mounting point**
mounting point prepared by the vehicle manufacturer for installation of *retrofit LTA* (3.2)

**3.4**
**lower tether**
type of anti-rotational device intended to restrict the rearward rotation of a rearward-facing CRS

Note 1 to entry: It usually comprises a tether strap or other hardware attached near the back or base of the CRS that connects to a lower tether anchorage. It incorporates a device to enable it to be connected to such an anchorage.

[SOURCE: ISO 29061-1:2010, 3.14, modified — The term "rebound tether" has been deleted.]

## 4 Dimensions and installation requirements

### 4.1 Description and applicability of lower tether anchorages or LTA mounting points

Lower tethers are used to increase installation stability and to reduce rotation in a rear impact as well as rebound effects in a frontal impact. The usability and reliability of lower tether attachments can be greatly improved when lower tether anchorages are pre-installed in the vehicle.

Lower tether anchorages for rearward facing CRSs are similar to, and for most aspects comparable to, the top tether anchorages for forward facing CRSs.

The most common positions of lower tether anchorages are on the seat rails in front of the CRS (inside, outside, or end of seat rails), but alternative methods are also used. For most vehicles it is relatively easy to introduce lower tether anchorages, since there are already seat rails or other appropriate structures available in the applicable zones. Example installations are shown in Annex C. A summary of the background feasibility study is given in Annex D.

The requirements and guidelines of this document are intended to facilitate the introduction of lower tether anchorages in vehicles.

The specifications apply to completely installed LTAs by the vehicle manufacturer and to mounting points prepared for the installation of retrofit LTAs. To ensure sufficient strength of retrofit LTAs, the specifications given in Annex B shall be followed.

The installation requirements in 4.2 and the dimension requirements in 4.3 also apply to retrofit LTAs.

### 4.2 Positioning of lower tether anchorages

Lower tether anchorages, two or optionally a single one for use with each intended CRS position, shall be located within the zones shown in Figures 1 to 3, and according to the following specifications.

— For ISOFIX seating positions, a reference point for measurements is obtained by installing the ISO/R2 envelope (or physical fixture), in accordance with ISO 13216-3, in the vehicle seat. If adjustable, the seat shall be adjusted to its rearmost position.

— For non-ISOFIX seating positions, the reference point for measurements shall be obtained by installing the ISO/R2 envelope (or physical fixture) in the vehicle seat, using the envelope positioning procedure in Annex A. If adjustable, the seat shall be adjusted to its rearmost position.

— If two lower tether anchorages are chosen, they shall be positioned with a minimum distance of 280 mm for the respective CRS position.

  — The two anchorages do not need to be symmetrically positioned with respect to the centreline through the envelope/fixture. However,

    — anchorages shall not be positioned on the same side of the envelope/fixture centreline, and

    — the offset between the centreline of the installed anchorages and of the envelope/fixture should be no more than 200 mm measured perpendicularly from the centrelines.

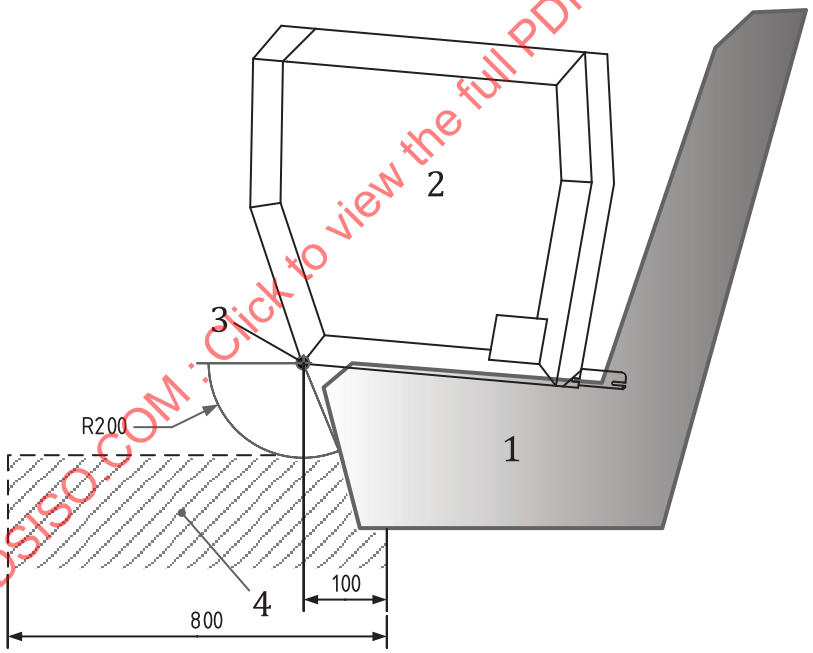
— If a single lower tether anchorage is chosen for the seating position, it shall be symmetrically positioned with respect to the centreline through the envelope/fixture within an offset of ±50 mm.

— Lower tether anchorages may be placed under the vehicle floor, for example in a storage compartment under a floor cover, if such a positioning can be regarded as acceptable from a usability perspective.

— The zone intended for a support leg in common solutions (zone indicated in Figure 3) shall not be used for lower tether anchorages.

— Rerouting of the lower tether strap path is allowed, although it should be ensured that it does not affect the function of the lower tethers or sensitive parts of the vehicle interior.

Dimensions in mm



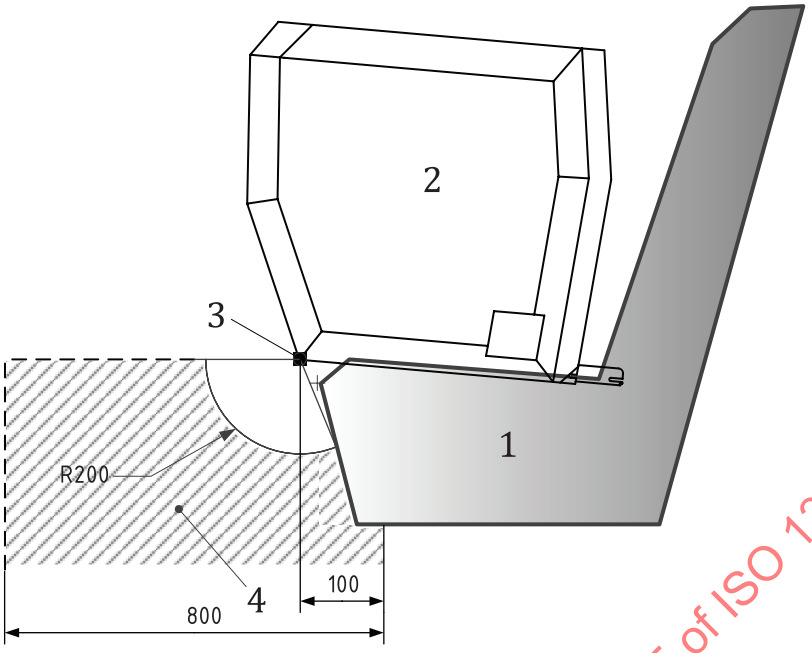



**Key**

1 vehicle seat illustration (rear row seating positions)
2 ISO/R2 envelope installed in related vehicle seating position
3 reference point on ISO/R2 envelope for LTA zone measurements
4 lower tether anchorage zone in side view, with upper limitation

**Figure 1 — Lower tether anchorage zone for rear seat row(s), side view**

Dimensions in mm

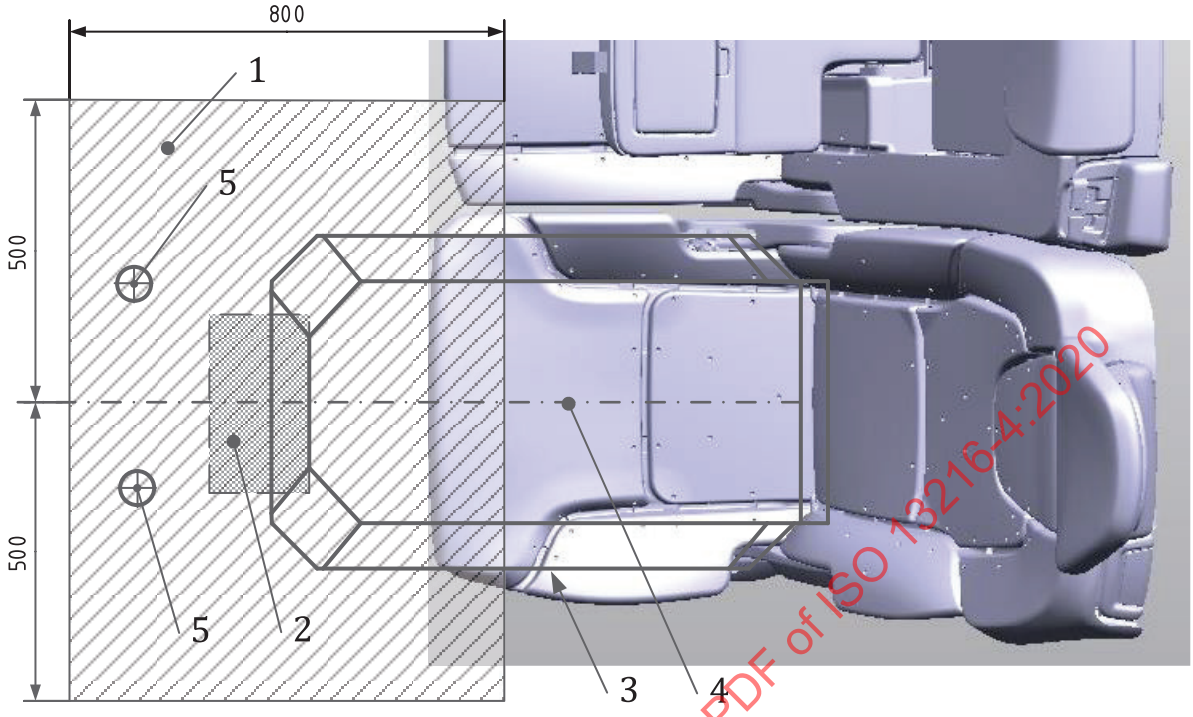



**Key**

1 vehicle seat illustration (front seating position)
2 ISO/R2 envelope installed in related vehicle seating position
3 reference point on ISO/R2 envelope for LTA zone measurements
4 lower tether anchorage zone in side view, with upper limitation

**Figure 2 — Lower tether anchorage zone for front passenger seat, side view**

Dimensions in mm




**Key**

1 lower tether anchorage zone, top view
2 support leg zone (to be avoided)
3 ISO/R2 envelope installed in related vehicle seating position
4 centreline of ISO/R2 and ISOFIX anchorage positions (contour only shown)
5 lower tether anchorage, example positions

NOTE The rearmost surface of the zone is positioned 100 mm rear of a vertical plane through the reference point on the ISO/R2 envelope. See Figures 1 and 2.

**Figure 3 — Lower tether anchorage zone for rear and front passenger seating positions, top view**

### 4.3 Lower tether anchorage design

The lower tether anchorage shall have an opening (square, circular, or semi-circular) and clearance space to allow attachment with a standard top tether connector, in accordance with ISO 13216-2:2004, Figure 8.

For anchorages designed to be used for two adjacent CRS positions, the opening and clearance space shall allow for simultaneous attachment with two standard top tether connectors.

LTA shall be designed to avoid inadvertent injuries to passengers, for example designed to minimise sharp edges and protrusions.

## 5 Lower tether anchorage strength requirements and testing

### 5.1 Strength test method

The strength test considers a maximum loading from a CRS including child having a total mass of up to 40 kg.

In case the lower tether anchorages are part of, or attached to, a part of the vehicle with an already type-approved strength (e.g. according to UN R.14[3], UN R.145[5], UN R.17[4], FMVSS 207[6], CMVSS 207[7], ADR 3[8], or other applicable standards), the strength requirements according to this document are considered fulfilled.

During the strength test, all relevant interior components (e.g. seat in front of CRS position) shall be mounted. If not otherwise recommended by the vehicle manufacturer, adjustable seats should be positioned as follows:

— longitudinally, to the closest position of mid-position between the rearmost position and the foremost position;

— vertically, to the closest position of the mid position of its height adjustment.

Apply a force of 2 500 N to each lower tether anchorage, by means of a representative lower tether strap 38 mm ± 3 mm wide that is fitted at one end with suitable hardware for applying the force and at the other end with a bracket for the attachment to the lower tether anchorage.

For anchorages designed to be used for two adjacent CRS positions, or in case of a single LTA, the force shall be 5 000 N.

The force:

— shall be applied in a direction determined by the FDRP (force direction reference point), with a tolerance of ±20 mm in all directions given in Figure 4, noting that the FDRP lateral position coincides with the centreline of the ISO/R2 envelope,

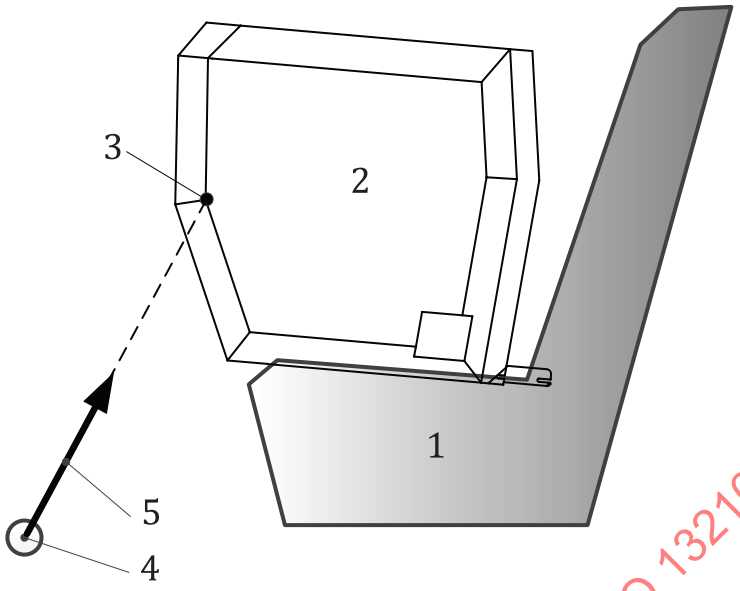
— shall be attained within 30 s, and

— shall be maintained for a minimum of 0,2 s.

NOTE The test method is designed to be as realistic as possible. Any strap re-routing influenced by the vehicle interior, for example by the seat in front of the ISO/R2 envelope, is also considered in the strength test.






**Key**

1 vehicle seat illustration
2 ISO/R2 envelope installed in related vehicle seating position
3 FDRP (force direction reference point)
4 example of actual LTA position in vehicle
5 test force direction

NOTE The FDRP lateral position coincides with the centreline of the ISO/R2 envelope.

**Figure 4 — FDRP, Force Direction Reference Point, and test force direction**

### 5.2 Strength requirements

When testing in accordance with 5.1, excursion is not limited, and permanent deformation of the lower tether anchorage with respect to the vehicle is acceptable provided that the anchorage does not break or separate from the vehicle.

## 6 Instructions and marking

The location of the lower tether anchorages and/or LTA mounting points, as well as their intended use, shall be described in the vehicle owner's manual.

Marking[1] of the LTA shall be placed close to the LTA and shall indicate the intended use as described in the vehicle owner's manual.



1) A standardised marking is not included in this edition of this document.

# Annex A
(normative)

# ISO/R2 positioning procedure for non-ISOFIX seat position

In case of a non-ISOFIX vehicle seat position the following procedure should be applied.

1) Place a cotton cloth on the vehicle seatback and cushion.

2) Remove the ISOFIX attachments from the child restraint fixture (CRF) or retract them to a position fully inside the backseat line.

3) Place the CRF on the vehicle seat.

4) Ensure that the CRF is located with its centreline on the apparent centreline of the seating position, ±25 mm, with its centreline parallel with the centreline of the vehicle.

5) Push rearwards on the centre of the front of the CRF with a force of 100 N ± 10 N, applied parallel to the lower surface, and remove the force.

6) Push vertically downwards on the centre of the upper surface of the CRF with a force of 100 N ± 10 N and remove the force.

NOTE The above installation procedure is in line with the UN R16 procedure and is also used in ISO 13216-3 for positioning a booster seat without ISOFIX support.

# Annex B
(normative)

# Requirements and testing of retrofit lower tether anchorages

## B.1 General requirements on retrofit lower tether anchorages

For the installation of retrofit LTAs, the positioning requirements in 4.2 apply. The dimension requirements in 4.3 apply.

Retrofit LTAs may require strength testing outside a specified vehicle model. For this purpose, the strength test method and strength requirements in B.2 applies.

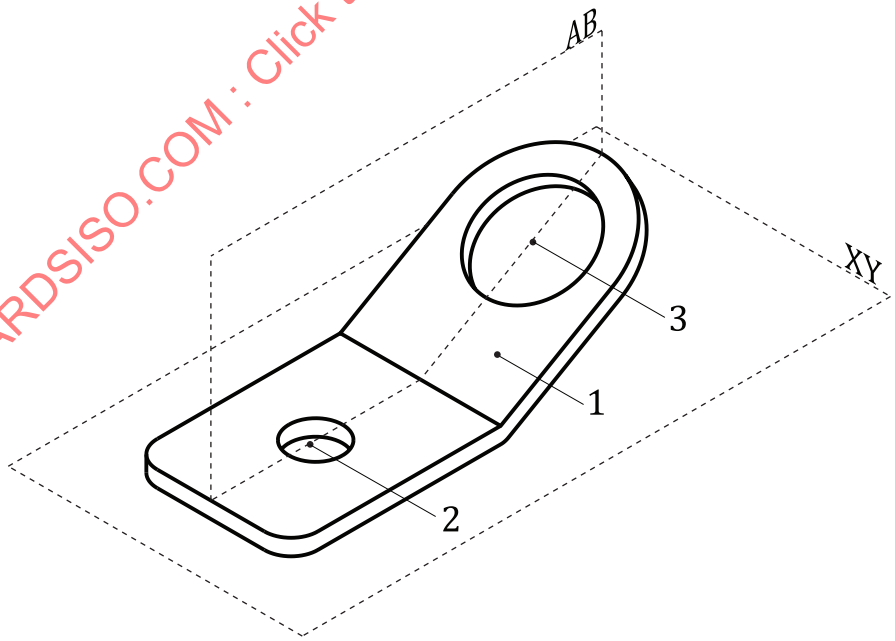
## B.2 Strength test method

### B.2.1 Installation method

According to the retrofit LTA manufacturer instructions, fasten the retrofit LTA to a rigid structure, not necessarily a vehicle body, by a bolt of minimum dimension M8, tightened with sufficient torque to avoid any rotation around the bolt axis during the entire strength test. If necessary, a washer of maximum diameter Ø24 mm may be used between the retrofit LTA and the bolt head.

The retrofit LTA shall be installed in such way that a plane AB is running through the centrum of the retrofit LTA two anchorage points and perpendicular to the rigid surface XY the retrofit LTA is fastened to. See Figure B.1.






**Key**

1 retrofit LTA, example design
2 anchorage point A, used for installing the retrofit LTA
3 anchorage point B, used when applying force

**Figure B.1 — Definition of installation planes for retrofit LTA**

### B.2.2 Force application

Apply a force of 2 500 N to the retrofit LTA, by means of a representative lower tether strap 38 mm ± 3 mm wide that is fitted at one end with suitable hardware for applying the force and at the other end with a bracket for the attachment to the retrofit LTA.

For retrofit LTAs with a design that allow for simultaneous attachment with two standard top tether connectors a force of 5 000 N shall be applied.

The force:

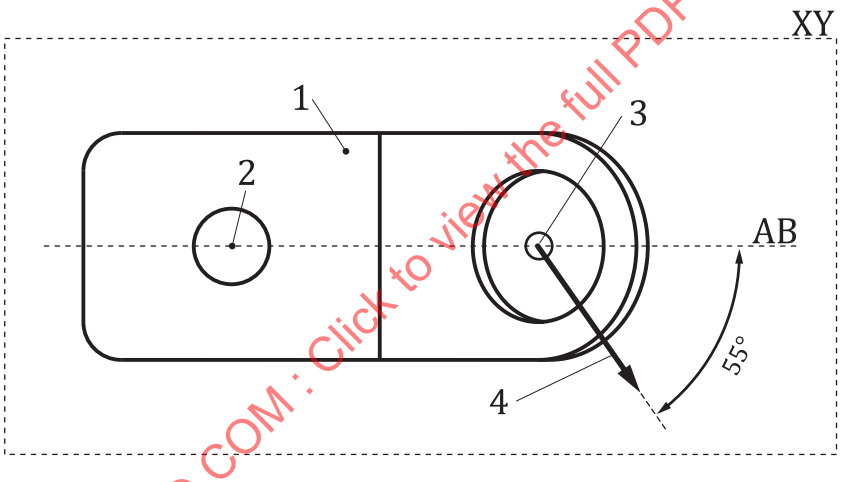
— shall be attained within 30 s, and

— shall be maintained for a minimum of 0,2 s.

After the force is initially applied, no rotation around the attachment bolt axis is allowed.

Any retrofit LTA shall fulfil the strength requirements for both load cases A and B described below. A retrofit LTA which has not previously been under load shall be used for each load case.

For load case A, the force shall be applied in a direction of 55° ± 5° against plane AB, measured in a plane parallel to the rigid surface XY, and a direction of 45° ± 5° against the rigid surface XY, measured in plane AB. See Figures B.2 and B.3.




**Key**

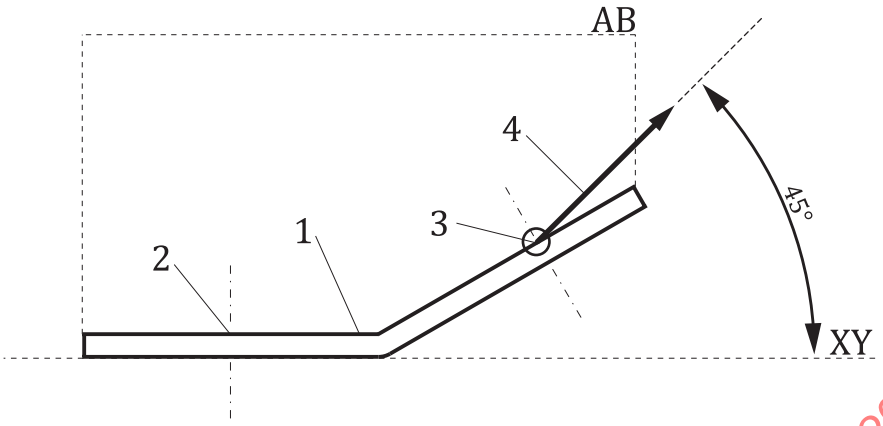
1 retrofit LTA, example design

2 anchorage point A, used for installing the retrofit LTA

3 anchorage point B, used when applying force

4 test force direction

**Figure B.2 — Load case A, view in plane XY**

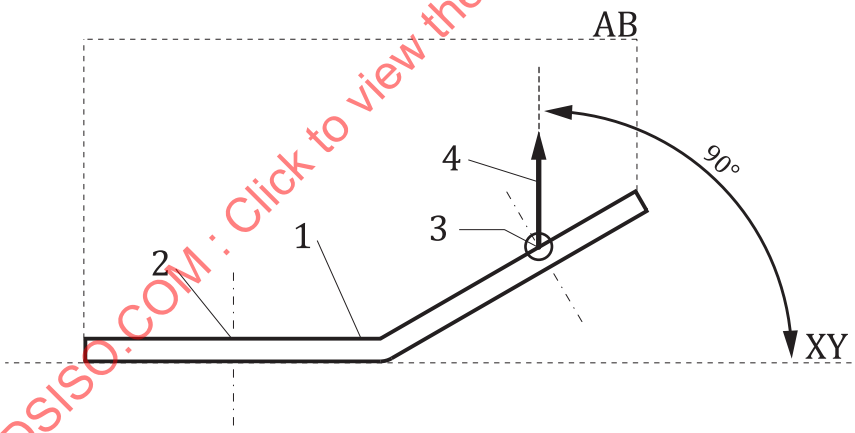



**Key**

1 retrofit LTA, example design
2 anchorage point A, used for installing the retrofit LTA
3 anchorage point B, used when applying force
4 test force direction

**Figure B.3 — Load case A, view in plane AB**

For load case B, the force shall be applied in a direction perpendicular (90 ± 5°) to the rigid surface XY. See Figure B.4.




**Key**

1 retrofit LTA, example design
2 anchorage point A, used for installing the retrofit LTA
3 anchorage point B, used when applying force
4 test force direction

**Figure B.4 — Load case B, view in plane AB**

## B.3 Strength requirements

When testing in accordance to B.2.2, excursion is not limited, and permanent deformation of the retrofit LTA with respect to the rigid structure it is attached to is acceptable provided that the anchorage does not break or separate from the rigid structure.

NOTE The strength requirements are the same as in 5.2.

# Annex C
(informative)

# Example LTA installations

Figures C.1 to C.4 below illustrate some examples of LTA installations.

**Figure C.1 — Rear seating LTA position example (on seat rails)**

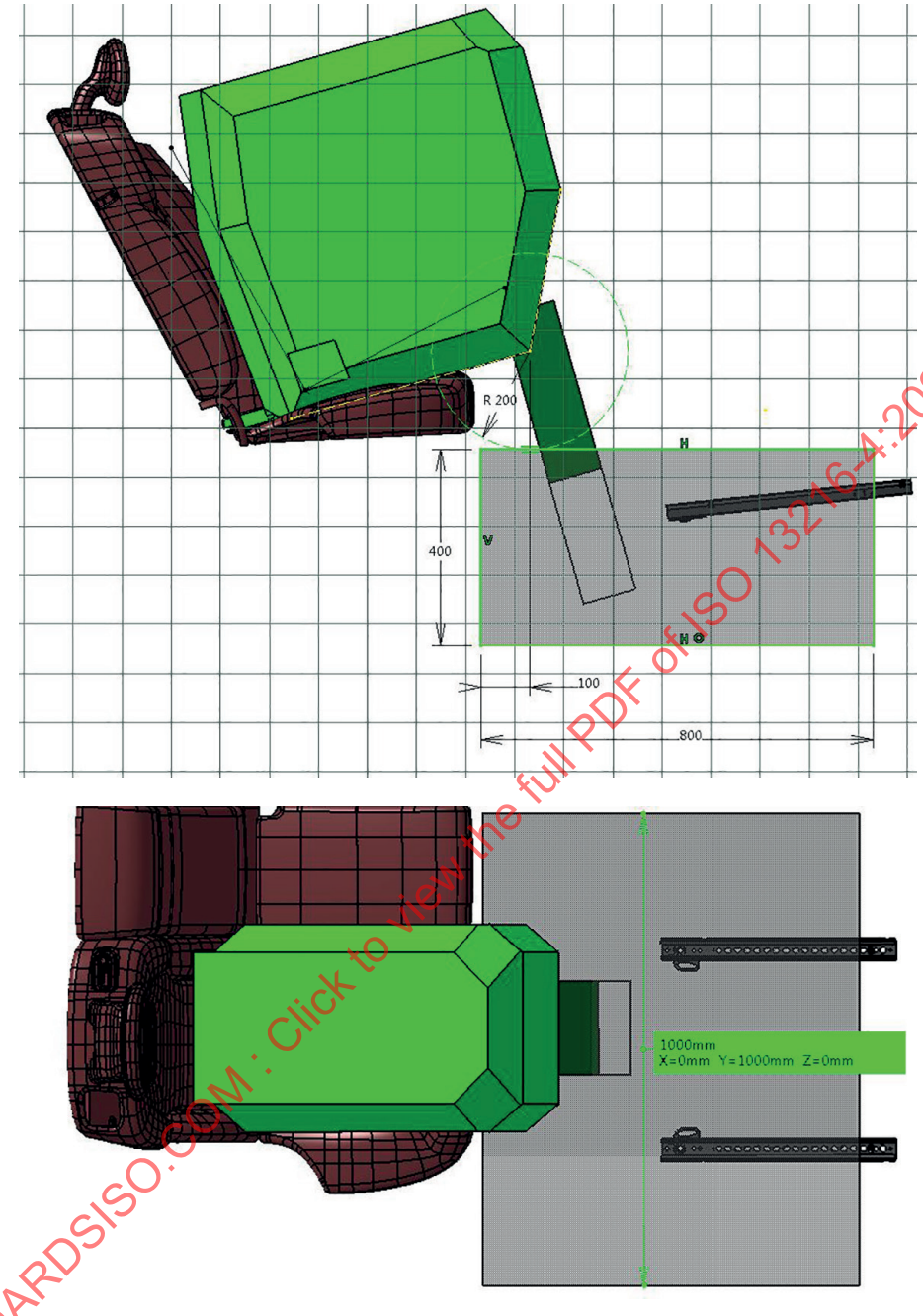



**Figure C.2 — Rear seating LTA position example, with dimensions**