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# Technical systems and aids for disabled or handicapped persons — Wheelchair tiedown and occupant-restraint systems —

## Part 4: Clamp-type tiedown systems

*Assistances et aides techniques pour les personnes invalides ou handicapées — Systèmes d'attache du fauteuil roulant et de retenue de l'occupant —*

*Partie 4: Systèmes de fixation par crampon*

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## Foreword

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International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. 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 document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO 10542-4 was prepared by Technical Committee ISO/TC 173, *Assistive products for persons with disability*, Subcommittee SC 1, *Wheelchairs*.

ISO 10542 consists of the following parts, under the general title *Technical systems and aids for disabled or handicapped persons — Wheelchair tiedown and occupant-restraint systems*:

— *Part 1: Requirements and test methods for all systems*

— *Part 2: Four-point strap-type tiedown systems*

— *Part 3: Docking-type tiedown systems*

— *Part 4: Clamp-type tiedown systems*

— *Part 5: Systems for specific wheelchairs*

# Introduction

Providing effective crash protection for the wheelchair-seated occupant of a motor vehicle usually requires that equipment be installed to secure the wheelchair and restrain the occupant of the wheelchair. ISO 10542-1 gives general requirements for all wheelchair tiedown and occupant-restraint systems (WTORS). The provisions of ISO 10542-1 apply except as amended and supplemented by this part of ISO 10542 which gives particular requirements and test procedures for WTORS and their sub-assemblies and components that use a mechanical clamp-type system to secure the wheelchair in a vehicle.

# Technical systems and aids for disabled or handicapped persons — Wheelchair tiedown and occupant-restraint systems —

## Part 4:
## Clamp-type tiedown systems

## 1 Scope

This part of ISO 10542 specifies test methods and requirements for design and performance, instructions to installers and users, and product marking and labelling of wheelchair tiedown and occupant-restraint systems (WTORS).

It is applicable only to WTORS that use clamp-type tiedown to secure wheelchairs when used as a forward facing seat by an adult passenger or driver of a motor vehicle.

This part of ISO 10542 is applicable primarily to complete WTORS, but a portion of this part of ISO 10542 can also be applied to components and sub-assemblies sold separately and for replacement parts.

This part of ISO 10542 is applicable to WTORS intended for use with all types of manual and powered wheelchairs, including scooters with three or more wheels.

## 2 Normative references

The following referenced documents are indispensable for the application 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 10542-1:2001, *Technical systems and aids for disabled or handicapped persons — Wheelchair tiedown and occupant-restraint systems — Part 1: Requirements and test methods for all systems*

## 3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

**3.1**

**clamp-type tiedown**

method of wheelchair tiedown or securement that uses only mechanical linkages and/or grips requiring manual positioning and tensioning of the end fittings to the wheelchair

**3.2**

**wheelchair securement adaptor**

hardware that is attached temporarily or permanently to the wheelchair frame to accommodate wheelchair securement by a wheelchair tiedown

## 4 Design requirements

The design requirements of ISO 10542-1 apply, together with the additional requirement that clamp-type wheelchair tiedowns be designed such that securing and releasing the tiedown according to the manufacturer's instructions shall not require operating forces in excess of

— 60 N for hand-operated devices,

— 100 N for foot-operated devices,

— 2,25 N·m torque for screw-operated clamp-type tiedowns

in order to meet the dynamic performance requirements of 6.1 in ISO 10542-1:2001, as tested in accordance with Annex A.

NOTE Design recommendations are presented in Annex B of this document.

## 5 Information, identification and instruction requirements

### 5.1 Identification and labelling

The requirements of 5.1.1 in ISO 10542-1:2001 with the exception of 5.1.1 c) apply, with the addition that the clamp-type tiedown and replacement parts shall be permanently and legibly marked showing that the wheelchair tiedown conforms to this part of ISO 10542 (i.e. ISO 10542-4).

### 5.2 Instructions for installers

The requirements of 5.2 in ISO 10542-1:2001 with the exception of 5.2.2 c) apply, with the addition of statements that

a) the wheelchair tiedown conforms to this part of ISO 10542 (i.e. ISO 10542-4),

b) identify any limitations in the use,

c) identify the circumstances in which a wheelchair tiedown adaptor is needed,

d) specify the wheelchair securement adaptor to be used with the system, and specify the procedure for installation and removal if used.

### 5.3 User and maintenance instructions

The requirements of 5.3 in ISO 10542-1:2001 with the exception of 5.3.2 a) apply, with the addition of statements that

a) the wheelchair tiedown conforms with this part of ISO 10542 (i.e. ISO 10542-4),

b) specify the schedule for routine maintenance,

c) identify when a wheelchair securement adaptor(s) should be used,

d) specify the procedure for installation and removal of wheelchair securement adaptors, if used,

e) specify the procedures to attach and tension the clamp recommended by the manufacturer of the clamp(s),

f) the wheelchair can be adversely affected if the instructions of the wheelchair tiedown manufacturer are not followed,

g) identify any limitations in use.

## 6 Performance requirements

The performance requirements of 6.1 in ISO 10542-1:2001 apply.

The performance requirements of 6.2 in ISO 10542-1:2001 apply, when testing in accordance with Annex A of this part of ISO 10542.

## 7 Test report

The requirements of Clause 7 in ISO 10542-1:2001 with the exception of 7.4 apply, with the addition of the following:

a) a statement whether the device is hand- or foot-operated;

b) a statement as to whether or not the WTORS met the applicable requirements of Clauses 4, 5 and 6;

c) the operation force used to secure and release the clamp-type wheelchair tiedown as specified in Annex A.

# Annex A
(normative)

# Frontal impact test

## A.1 Principle

Annex A of ISO 10542-1:2001 applies, with the addition that the maximum operating force used to secure the clamp-type wheelchair tiedown is defined in order to reduce variability in results obtained from testing within and between laboratories.

NOTE The procedures for measurement of operating force included in this annex are based on the measurement procedures defined in EN 12184[1].

## A.2 Test sample

The test sample requirements of Annex A of ISO 10542-1:2001 apply.

## A.3 Test apparatus

In addition to the test apparatus specified in Annex A of ISO 10542-1:2001, a means to measure the operation force used to secure and release the clamp-type wheelchair tiedown with an accuracy of ± 5 N is required.

## A.4 Test preparation and procedure

The test preparation requirements and procedures as specified in Annex A of ISO 10542-1:2001 apply, with the following modifications and additions.

a) Add to A.4.5: Install, if needed, wheelchair securement adaptors on the SWC.

b) Delete the contents of A.4.8 and replace by the following.

   1) Secure and release the SWC with the clamp-type tiedown system according to the manufacturer's instructions.

   2) Measure the forces for securing and releasing the wheelchair tiedown as specified in A.5.

   3) Secure the SWC with the clamp-type tiedown system according to the manufacturer's instructions.

   4) Ensure that the forces to secure and release the clamp-type tiedown do not exceed the requirements of Clause 4 of this part of ISO 10542.

## A.5 Procedures for measurement of operating force

### A.5.1 Lever-operated clamps

The following procedure shall be followed.

a) Select the part of the lever through which the force is to be applied, as follows.

   1) If the lever is fitted with a generally spherical knob, apply the force through the centre of the knob.

   2) If the lever is tapered, apply the force through the point where the largest cross-section intersects the centreline of the lever.

   3) If the lever is parallel or any shape other than those above, apply the force through a point on the centreline of the lever 15 mm below the top.

4) If the form of the lever is such that the lever is gripped by the whole hand or is foot-operated, apply the force through the centreline of the lever 15 mm from the end.

5) If the lever is hand-operated by pushing or pulling a bar or pad, apply the force to the centroid of the bar or pad.

b) Operate the WTORS by applying the means to measure the force until the wheelchair is secured in accordance with the manufacturer's instructions.

c) Record the maximum force applied for securing.

d) Operate the WTORS by applying the means to measure the force until the wheelchair is released in accordance with the manufacturer's instructions.

e) Record the maximum force applied for releasing.

f) Repeat b) to e) three times in total, and calculate the average values for securing and releasing.

g) Record the average values for securing and releasing.

### A.5.2 Screw-operated clamps

The following procedure shall be followed.

a) Apply force by using a torque meter positioned concentrically on the operating nut of the clamp-type tiedown system, increasing to the maximum operating force as slowly as possible.

NOTE The torque meter may require the addition of an appropriate device to fit the shape of the operating nut.

b) Record maximum operating torque to tie down the wheelchair and to release it.

c) Perform a) to b) three times in total.

d) Calculate the average values for securing and releasing.

e) Record the average values for securing and releasing.

# Annex B
(informative)

# Design guidelines

## B.1 Introduction

This annex contains design recommendations and guidelines for manufacturers.

## B.2 Design guidelines

The clamp-type tiedown system should

a) not become partially or totally disengaged due to the effect of vehicle movements,
b) operate easily,
c) operate safely without injury to fingers or feet of the operators,
d) not damage the wheelchair if properly used,
e) not disengage from the wheelchair frame if it becomes loose during usage in transit,
f) be unaffected by wheelchair tyre pressure,
g) have a jaw opening of at least 30 mm if the tiedown system is intended to engage with the tubular frame,
h) not have protruding parts that can cause injury.

# Bibliography

[1] EN 12184, *Electrically powered wheelchairs, scooters and their chargers — Requirements and test methods*

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