
Wheelchairs —

Part 19:

**Wheeled mobility devices for use in motor
vehicles**

Fauteuils roulants —

*Partie 19: Dispositifs de mobilité montés sur roues et destinés à être
utilisés dans des véhicules à moteur*

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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 7176 may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

International Standard ISO 7176-19 was prepared by Technical Committee ISO/TC 173, *Technical systems and aids for disabled or handicapped persons*, Subcommittee SC 1, *Wheelchairs*.

ISO 7176 consists of the following parts, under the general title *Wheelchairs*:

- *Part 1: Determination of static stability*
- *Part 2: Determination of dynamic stability of electric wheelchairs*
- *Part 3: Determination of effectiveness of brakes*
- *Part 4: Energy consumption of electric wheelchairs and scooters for determination of theoretical distance range*
- *Part 5: Determination of overall dimensions, mass and turning space*
- *Part 6: Determination of maximum speed, acceleration and deceleration of electric wheelchairs*
- *Part 7: Measurement of seating and wheel dimensions*
- *Part 8: Requirements and test methods for static, impact and fatigue strengths*
- *Part 9: Climatic tests for electric wheelchairs*
- *Part 10: Determination of obstacle-climbing ability of electric wheelchairs*
- *Part 11: Test dummies*
- *Part 13: Determination of coefficient of friction of test surfaces*
- *Part 14: Power and control systems for electric wheelchairs — Requirements and test methods*
- *Part 15: Requirements for information disclosure, documentation and labelling*
- *Part 16: Resistance to ignition of upholstered parts — Requirements and test methods*
- *Part 22: Set-up procedures*

The following parts are also on the work programme:

- *Part 19: Wheeled mobility devices for use in motor vehicles*
- *Part 21: Electromagnetic compatibility of electrically powered wheelchairs and motorized scooters — Requirements and test methods*
- *Part 23: Requirements and test methods for attendant-operated stair-climbing devices*
- *Part 24: User-operated stair-climbing devices — Requirements and test methods*
- *Part 25: Requirements and test methods for batteries and their chargers for powered wheelchairs and motorized scooters*

Annexes A to C form a normative part of this part of ISO 7176. Annexes D and E are for information only.

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Introduction

Transportation safety research has verified that the design of the vehicle seat, as well as the occupant restraints and occupant compartment in motor vehicles, can play a vital role in reducing the severity of injury during a collision. People with disabilities must often remain in their wheelchairs whilst travelling in motor vehicles as drivers or passengers. Since most wheelchairs were not designed with this purpose in mind, the majority of wheelchair users have a lower level of travel safety when seated in their wheelchairs in a moving motor vehicle. Also, if wheelchairs can be adequately secured in vehicles, the safety of other passengers is enhanced in the case of a vehicle collision.

This part of ISO 7176 sets out the design, performance requirements and associated test methods for wheelchairs that are intended for use as a seat in a motor vehicle. The ISO 10542 series for wheelchair tiedown and occupant restraint systems provides performance requirements and test methods for the equipment necessary to secure a wheelchair and provide restraint for the wheelchair occupant.

The dynamic test requirements specified in this part of ISO 7176 are representative of conditions that occur in a 48 km/h frontal vehicle impact with a wheelchair forward facing. Dynamic performance of rearward facing wheelchairs in a frontal impact, and of occupied wheelchairs in rear, side or rollover crashes, may be addressed in future international standards. Wheelchair impact testing using surrogate wheelchair tiedowns that are representative of different types of commercial tiedowns may also be addressed in future international standards (see annex E).

This part of ISO 7176 was developed with the recognition that a wheelchair may be secured by various types of wheelchair tiedown systems which use different numbers and types of wheelchair securement points and different types of anchorages. Effective wheelchair securement in the real world requires compatibility of the wheelchair securement available in transportation vehicles and the method of securement provided on the wheelchair. When this part of ISO 7176 was developed, there was a large variety of securement systems in use throughout the world. Of these, the four-point strap-type tiedown was considered to be the most widely used generic securement method. The requirements of this part of ISO 7176 are also based on well-documented motor vehicle crash statistics, which clearly indicate that more than fifty per cent of all serious injuries occur in a frontal crash.

For these reasons, this part of ISO 7176 requires that a wheelchair provides for effective securement in a frontal impact using the four-point strap-type securement system. Thus, a wheelchair shall provide four securement points, as a minimum, and be dynamically tested when secured by these points, using a four-point strap-type tiedown system. In addition, this part of ISO 7176 allows for the provision and testing of other methods of securement, such as clamping or docking systems.

Whilst the four-point strap-type tiedown system has proven to be applicable for a wide range of wheelchairs, it is a tiedown method that cannot be implemented independently by the wheelchair occupant, and therefore requires involvement by a second person. Accordingly, it is desirable to progress towards a securement method that can be implemented independently by the wheelchair-seated passenger. Work has commenced within ISO/TC 173 SC 1 to specify the requirements for a universal interface device (UID) that will facilitate the independent securement of wheelchairs by docking-type securement devices.

This part of ISO 7176 has also been developed with the recognition that use of a pelvic belt alone as an occupant restraint does not provide the wheelchair occupant with the same level of crash protection in a frontal impact as does the use of both a pelvic and an upper torso restraint. Therefore, the provisions and test methods of this part of ISO 7176 are based on the use of both pelvic and upper torso belt-type restraints.

This part of ISO 7176 should be viewed in the totality of daily wheelchair use and the range of standards to which all wheelchairs are expected to comply. The primary objective of wheelchairs is to serve as effective mobility devices and, in that respect, they shall first comply with the applicable requirements as set out in the other parts of the ISO 7176 series. Transportation is, in fact, only one of many daily activities that introduce unique circumstances and requirements that wheelchairs and wheelchair occupants may experience. Wheelchair products complying with this part of ISO 7176 will have additional features that provide increased levels of occupant security and safety whilst their occupants are riding in a motor vehicle. However, a wheelchair's failure to comply with the provisions of this part of ISO 7176 should not be used to limit access to, and availability of, motor vehicle transportation for wheelchair users.

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Wheelchairs —

Part 19: Wheeled mobility devices for use in motor vehicles

1 Scope

This part of ISO 7176 specifies wheelchair design and performance requirements and associated test methods, as well as requirements for wheelchair labelling, presale literature disclosure, user instructions and user warnings. These requirements are applicable to wheelchairs that are designed to be secured by any type of wheelchair tiedown in accordance with ISO 10542-1 and any other applicable parts of the ISO 10542 series.

This part of ISO 7176 applies to all manual and powered wheelchairs, including scooters, which, in addition to their intended function as mobility devices, are also intended for use as forward-facing seating by adult occupants of motor vehicles. It also applies to wheelchairs with add-on components designed to meet one or more of the requirements of this part of ISO 7176.

2 Normative references

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The following normative documents contain provisions which, through reference in this text, constitute provisions of this part of ISO 7176. 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 7176 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 3795, *Road vehicles, and tractors and machinery for agriculture and forestry — Determination of burning behaviour of interior materials*

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

ISO 7176-15, *Wheelchairs — Part 15: Requirements for information disclosure, documentation and labelling*

ISO 10542-1, *Technical systems and aids for disabled or handicapped persons — Wheelchair tiedown and occupant-restraint systems — Part 1: Requirements and test methods for all systems*

ISO 10542-2, *Technical systems and aids for disabled or handicapped persons — Wheelchair tiedown and occupant-restraint systems — Part 2: Four-point strap-type tiedown systems*

FMVSS 20949 CFR part 571.209; Seat Belt Assemblies; Oct. 1, 1992

ECE R 16, *Uniform provisions concerning the approval of safety belts and restraint systems for adult occupants of power-driven vehicles*, revision 3, amendment 2, 16 August 1993

3 Terms, definitions and abbreviations

For the purposes of this part of ISO 7176, the following terms, definitions and abbreviations apply.

3.1

add-on components

hardware that is attached to the wheelchair frame subsequent to sale by the wheelchair manufacturer, in a manner that requires the use of tools for removal, in order to enhance the design and/or performance of the wheelchair

3.2

adult

person having a mass greater than 36 kg

3.3

anchor point

point (area) on a vehicle interior component, floor, wall, wheelchair or wheelchair tiedown, to which an anchorage is attached

3.4

anchorage

assembly of components and fittings by which loads are transferred directly from the wheelchair tiedown to the vehicle, or from the occupant restraint to the vehicle, wheelchair, wheelchair tiedown, or vehicle interior component

3.5

anthropomorphic test device¹⁾

ATD

articulated physical analogue of a midsize male used to represent a wheelchair occupant in a test

3.6

belt

length of webbing material used as part of an occupant restraint or postural support

3.7

clamp-type tiedown

method of wheelchair securement or tiedown that uses mechanical linkages and/or grips that require manual positioning of the end-fittings on the wheelchair

NOTE Tightening of the tiedown on the wheelchair may be either by manual effort or by an external power source that is operated by an electrical switch.

3.8

docking-type tiedown

method of wheelchair securement by which portions of the wheelchair, or add-on components fastened to the wheelchair, align and mate with anchorages fastened to the vehicle upon movement of the wheelchair into position in the vehicle

NOTE 1 Lockdown of the wheelchair may occur automatically during wheelchair engagement, or may require manual intervention through operation of a mechanical lever or electrical switch.

NOTE 2 Release of the wheelchair may require operation of a mechanical lever or an electrical switch.

3.9

excursion

horizontal movement of an ATD or wheelchair target relative to its initial position on an impact sled during a test

1) Hybrid II and Hybrid III ATDS can be purchased from: First Technology Safety Systems, Inc., Plymouth, Michigan, USA and Vector Research, Inc., Milan, Ohio, USA.

3.10**forward-facing**

orientation in which the wheelchair-seated occupant faces the front of the vehicle with the wheelchair reference plane within ten degrees of the longitudinal axis of the vehicle

3.11**four-point tiedown**

wheelchair tiedown system that attaches to the wheelchair frame at four separate securement points and also attaches to the vehicle at four separate anchor points

3.12**four-point strap-type tiedown**

four-point tiedown that uses four strap assemblies to secure the wheelchair in the vehicle

3.13*g*

abbreviation for acceleration due to gravity measured at sea level: one *g* is equal to 9,8 ms⁻²

NOTE The term is used to specify the levels of accelerations and/or decelerations in simulation impact testing.

3.14**H-point**

point located on the left and right sides of the pelvic region of an anthropomorphic test device (ATD) that represents the approximate locations of the human hip joint centres in the side views, as specified by the ATD manufacturer

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3.15**head restraint**

device intended to limit rearward displacement of the wheelchair occupant's head

3.16**impact simulator**

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device for accelerating, decelerating, or a combination of decelerating and accelerating, a section of a vehicle or simulated vehicle structures, including instrumentation for measuring data required by this part of ISO 7176

3.17**impact sled**

part of an impact simulator on which components can be mounted for impact testing

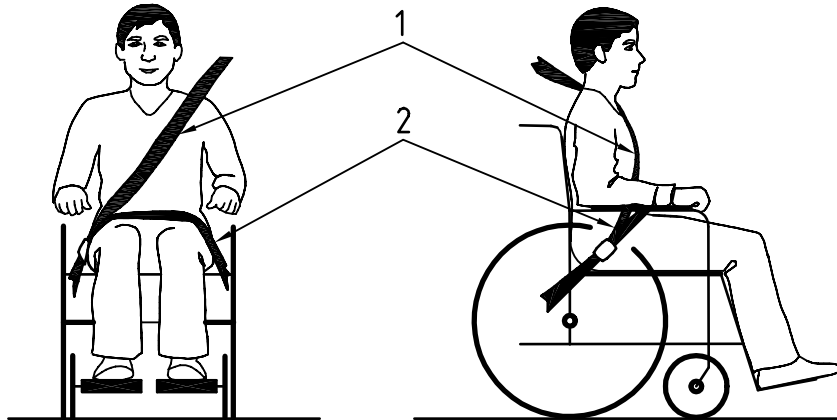
3.18**occupant restraint**

system or device intended to restrain a motor-vehicle occupant during an impact in order to prevent ejection, and prevent or minimize contact with the vehicle interior components and other occupants

3.19**pelvic restraint****pelvic belt****lap belt****lap restraint****lower torso restraint**

belt restraint assembly intended to limit movement of the pelvis

NOTE See Figure 1.



Key

- 1 Diagonal shoulder belt
- 2 Pelvic belt

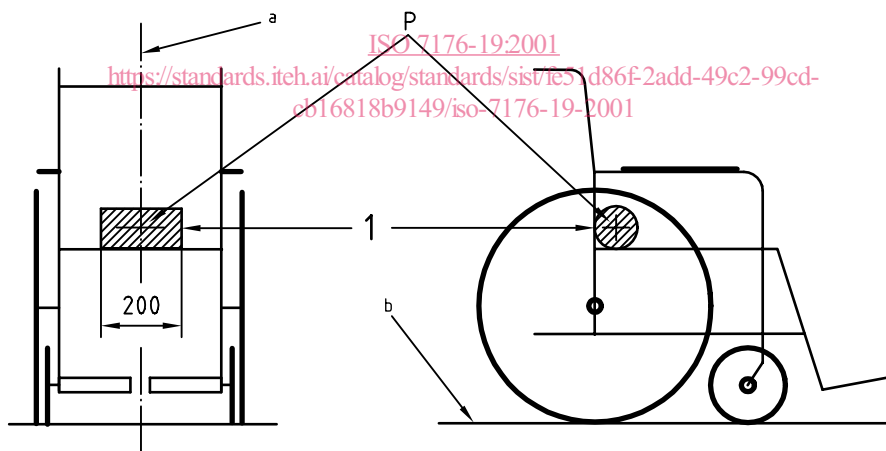
NOTE Use of a pelvic belt alone is not recommended in transport.

Figure 1 — Pelvic and upper torso belt

**3.20
point P**

reference point that lies at the cross-sectional centre of a 100 mm diameter, 200 mm long, lightweight (max. 0,5 kg) cylinder positioned with the longitudinal axis perpendicular to the wheelchair reference plane, such that the curved surface of the cylinder contacts with the backrest and the upper surface of the seat

NOTE See Figure 2.



Key

- 1 Cylinder, diameter 100 mm
- a Wheelchair reference plane
- b Wheelchair ground plane

Figure 2 — Wheelchair reference point P and wheelchair reference plane

**3.21
postural support
postural belt**

component or belt used to support a person in a desired seated position, but not intended to provide occupant-restraint in a vehicle impact

3.22**power(ed)**

systems which are operated by means of an energy source other than manual effort

3.23**securement points**

points on the wheelchair to which wheelchair tiedowns connect

3.24**strap**

length of webbing material used in a wheelchair tiedown

3.25**surrogate tiedown**

wheelchair securement system used during wheelchair testing to simulate commercial tiedown systems

NOTE Guidelines are provided in annex E.

3.26**tilt-in-space**

type of wheelchair seat design that allows the complete seat structure to rotate in the wheelchair reference plane relative to and about an axis located on the wheelchair base

3.27**upper torso restraint****shoulder belt****diagonal belt****diagonal restraint****torso harness**

portion of the occupant restraint intended to limit movement of the chest and head by application of restraint forces to the shoulders and chest

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3.28**wheelchair footprint**

space outlined on the horizontal wheelchair ground plane by projecting vertically down from the outermost edges of the structural members that comprise the mobile base and seat of the wheelchair

3.29**wheelchair ground plane**

plane representing the surface on which the wheelchair rests

NOTE See Figure 2.

3.30**wheelchair reference plane**

vertical plane in longitudinal centreline of the wheelchair

NOTE See Figure 2.

3.31**wheelchair tiedown****wheelchair securement**

device or system designed to secure a forward-facing wheelchair in place in a motor vehicle

NOTE The vehicle-anchored tiedown component may be installed using either permanent fasteners or by using a mechanical coupling that allows for position adjustment for different wheelchairs.

3.32**wheelchair tiedown and occupant-restraint system****WTORS**

complete restraint system for wheelchair-seated occupants comprised of equipment for wheelchair tiedown and a belt-type occupant restraint