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2022-10

Wheelchair seating —

Part 3: Determination of static, impact, and repetitive load strengths for postural support devices

Sièges de fauteuils roulants —

Partie 3: Détermination de la résistance aux charges statiques, dynamiques et cycliques pour les dispositifs de maintien de la posture

Reference number
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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.

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).

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. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 173, *Assistive products* , Subcommittee SC 1, *Wheelchairs*.

This third edition cancels and replaces the second edition (ISO 16840-3:2014), which has been technically revised.

The main changes are as follows:

— the structure of the document has been updated;

— test results have been added;

— pass/fail requirements have been established.

A list of all parts in the ISO 16840 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.

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Introduction

Postural support devices (PSDs), constructed as additional components to wheelchair seating or as wheelchair seating in its own right, are widely available and used extensively by people with disabilities. The selection or prescription of the most appropriate PSD is intended to be, where appropriate, partially dependent on knowledge of the PSD's ability to withstand static, impact, and repetitive loads. This document specifies test methods and requirements for the strength of PSDs as manufactured, which are designed to identify likely points of failure by breaking, yielding, or loosening of components - it is not intended to predict the long-term useful life. The useful life of a device depends upon many variables of use, aging, and environment: the way in which it is installed, the frequency of use and forces to which it is subjected, abrasion points, vibration and fatigue, cleaning and periodic maintenance, and temperature, humidity and UV exposure.

The tests involve mounting the PSD to a rigid test fixture to simulate mounting on a wheelchair. Rigid test fixtures are used to provide a worst-case situation, by minimizing shock-absorption that can come, for example, from the damping effects of flex in the wheelchair frame, and also to make these tests repeatable by removing the variable of wheelchair type. Repetitive, static, and impact loads are then applied, as appropriate, according to the type of PSD, to determine if the minimum strength requirements are met.

When a series of strength/impact tests are performed on a PSD, the same sample PSD is used throughout and the tests conducted in series, from least stringent [lowest forces] to most stringent [highest forces]. In this manner, the PSD will be subjected to lower forces, which would typically be more frequently encountered in daily use, before being subjected to the higher forces that pose a greater risk of failure. If the sample PSD fails in a less stringent test, there is generally no reason to conduct more stringent tests until the PSD has been redesigned. Individual tests can be conducted using a unique sample PSD for each test, but this will not provide the same level of assurance about performance.

Some of the tests represented in this document are derived from ISO 7176-8. Many of the pass/fail criteria, test principles and test equipment are the same for this document as for ISO 7176-8.

Parts of this document are continuing to be developed so that future revisions can include the results of work in the following areas:

— further development of the test forces based on clinical data in order to determine actual impact, static, and repetitive forces that PSDs are subjected to;

— the collection of further data on the most common failures experienced in actual use of PSDs is ongoing.

— addressing any additional unaddressed PSD testing needs, including gaps as currently identified in Table 1.

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Wheelchair seating —

Part 3: Determination of static, impact, and repetitive load strengths for postural support devices

1 Scope

This document specifies requirements for static, impact, and repetitive load strengths for postural support devices (PSDs) with associated attachment hardware intended for use with an undefined wheelchair seating system. It specifies the test methods for determining whether the minimum performance requirements have been met to release a product into use. It also specifies requirements for disclosure of the test results. Not all tests apply to all PSDs.

This document includes sets of tests for these particular types of PSDs listed in Table 1:

Table 1 — Index of tests

PSD	Repetitive	Static	Impact
Seat cushion supporting structure	X		X
Back cushion supporting structure	X	X	X
Pelvic positioning	X	X	
Anterior trunk support	X	X	
Lateral support		X	
Medial knee support		X	
Head support	X	X	
Lower arm positioning devices	[a]	[a]	
Foot support		[b]	[b]

NOTE 1 Seat Cushion Supporting Structure is the system upon which the seat cushion is mounted.

NOTE 2 Back Cushion Supporting Structure is the system upon which the back support is mounted.

[a] Repetitive and static tests are under development for non-integrated, lower arm positioning devices. Arm support static test protocols are defined in ISO 7176-8 for supports which are integrated within the wheelchair.

[b] Static and impact foot support test protocols are defined in ISO 7176-8 for supports which are integrated within the wheelchair.

This document is also applicable to other seating systems.

The test methods can be used to verify the manufacturer's claims that a product meets the requirements of this document. This document does not apply to PSDs that are designed to fail under certain static, dynamic, or repetitive loads.

This document does not apply to the strength of PSDs under crash conditions in a motor vehicle.

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This document does not evaluate long-term useful life.

NOTE 1 ISO 16840-4 provides crash test methods and requirements for wheelchair seating systems when used as part of a wheelchair seat in a motor vehicle.

NOTE 2 For user masses greater or less than those specified in this document, appropriate extrapolation of test apparatus dimensions, mounting point separation, forces, etc. can be carried out, and the test parameters noted in the test report.

NOTE 3 Rigid surrogate test fixtures are utilized to provide a standardized test method, and consequently this document does not involve a test of a PSD on a particular wheelchair.

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 898-7, *Mechanical properties of fasteners — Part 7: Torsional test and minimum torques for bolts and screws with nominal diameters 1 mm to 10 mm*

ISO 7176-8:2014, *Wheelchairs — Part 8: Requirements and test methods for static, impact and fatigue strengths*

ISO 7176-26, *Wheelchairs — Part 26: Vocabulary*

ISO 16840-2, *Wheelchair seating — Part 2: Determination of physical and mechanical characteristics of seat cushions intended to manage tissue integrity*

JIS K 7312, *Physical testing methods for molded products of thermosetting polyurethane elastomers*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 7176-26 and the following apply.

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

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

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

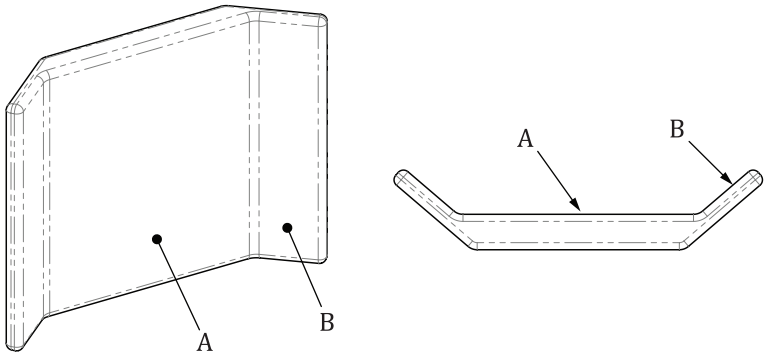
3.1
active support surface
postural support device that is power assisted to change its position or support surface shape

EXAMPLE An alternating pressure seat cushion or an electronically operated back support surface that reclines.

3.2
integrated lateral trunk support
lateral support that has a continuous structure with a back support

Note 1 to entry: See Figure 1.

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Key

A back support

B integrated lateral trunk support

Figure 1 — Example of a support viewed from above showing a cross-section of a back support with an integrated lateral trunk support

3.3
deformable support surface
support surface that conforms to the shape of the body part being supported

Note 1 to entry: The surface can possibly return to its original shape.

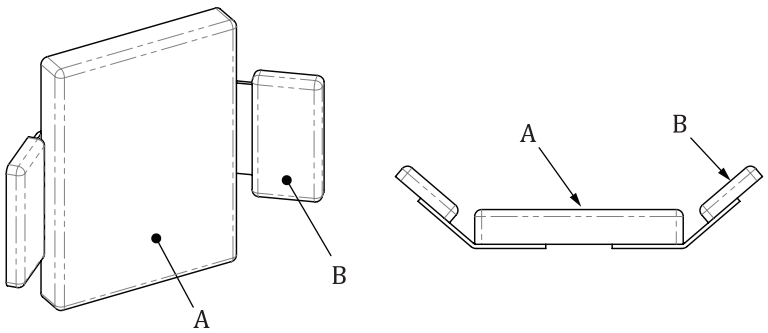
EXAMPLE Foam or fluid seat supports.

3.4
non-integrated
detachable, with or without the use of tools

Note 1 to entry: Items held in place by hook and loop fastenings are considered non-integrated.

3.5
non-integrated lateral support
lateral support that is mounted as a separate entity

Note 1 to entry: See Figure 2.



Key

A back support

B non-integrated lateral trunk support

Figure 2 — Example of a back support with a non-integrated lateral trunk support, viewed from above

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3.6
dynamic attachment hardware
hardware that, when a force is applied, allows a postural support device to move and return to its original position when the force is removed

EXAMPLE A PSD designed with a spring that allows movement.

3.7
mounting point
specified attachment location

3.8
passive support surface
postural support device that moves in response to the body part being supported and is not powered-assisted

Note 1 to entry: Passive support surfaces do not necessarily move back to a specific position.

EXAMPLE A mobile arm support is a passive support surface that allows movement with minimal resistance.

3.9
pivot axis
axis about which a device rotates

3.10
postural support device
PSD
structure, attached to a seat or chair, that has a surface that contacts the occupant's body and is used either to support, correct, or stabilize the occupant's posture

Note 1 to entry: For the purpose of this document, a PSD shall include its mounting components.

Note 2 to entry: Specific to wheelchair back supports and seat cushions, testing is intended to verify performance of the mounting components and the structural components.

3.11
slippage
shift in the relative position at an adjustment point of connected components of a postural support device

3.12
displacement
permanent change in the position of a surface or point relative to a fixed reference point, as a result of yielding, fracturing, or slippage

3.13
elastic deformation
temporary change in dimension or shape while under load

3.14
permanent deformation
retained change in dimension or shape after removal of a load

3.15
seat cushion supporting structure
SCSS
structural component(s) installed as part of a seating system to hold a seat cushion in place

3.16
back cushion supporting structure
BCSS
structural component(s) installed as part of a seating system to hold a back support in place

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