INTERNATIONAL STANDARD

ISO 16840-3

Third edition
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
ISO 16840-3:2022(E)

ISO copyright office
CP 401 • Ch. de Blandonnet 8
CH-1214 Vernier, Geneva
Phone: +41 22 749 01 11
Email: copyright@iso.org
Website: www.iso.org

Published in Switzerland

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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.

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.

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.

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

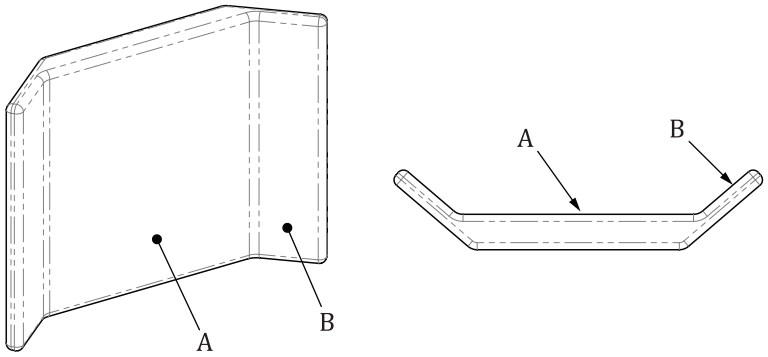
— IEC Electropedia: available at https://www.electropedia.org/

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.



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.

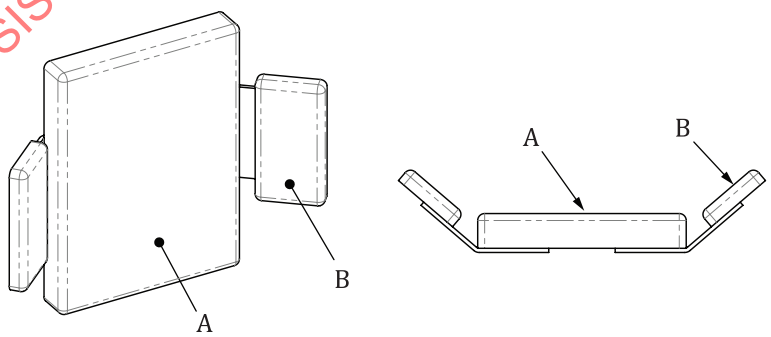
EXAMPLE Foam or fluid seat supports.

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

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

4 Principle

4.1 Overview

4.1.1 General

A postural support device is subjected to forces that represent repetitive loading, static loading, and impact loading typically expected during normal use of the device, as specified in each annex.

4.1.2 Repetitive load

A PSD subjected to repetitive loads shall be tested in accordance with the method given in Annex A.

4.1.3 Static load

A PSD subjected to static loads shall be tested in accordance with the method given in Annex B.

4.1.4 Impact load

A PSD subjected to impact loads shall be tested in accordance with the method given in Annex C.

4.2 PSD Sample

The same PSD sample shall be used for the complete set of tests, conducted in order from least stringent [lowest forces] to most stringent [highest forces]. Order of testing should be as progressing from repetitive loading to static loading, then impact loading. Testing shall be conducted either until a device is considered to have failed or until completion of all tests.

Individual tests can be conducted using a unique sample PSD for each test, but the results shall not be reported as evidence of conformance with this document.

5 Requirements

When tested in accordance with Annexes A, B and C, a PSD shall meet all the following requirements:

a) No PSD shall show evidence of fractures or visible cracks.

b) No belts, harnesses or other textiles, including those that are used as support structures, shall show evidence of tears or broken stitches.

NOTE Seat and back cushions themselves, which are not structural components, are not addressed in this document and are thus exempt from this requirement.

c) No nut, bolt, screw, locking pin, component or similar item shall loosen or detach.

d) No PSD shall show evidence of slippage at any adjustment point after forces have been removed, of more than 10 mm or 5° compared with its original set-up. If a set-up load is required, measurement shall be relative to the set-up loaded state.

e) No component or assembly of parts shall exhibit permanent deformation after forces have been removed, of more than 10 mm or 5°, compared with its original set-up. If a set-up load is required, measurement shall be relative to the set-up loaded state.

f) No PSD shall become permanently displaced more than 10 mm or 5° at the point of loading from the set-up loaded state, except in the case of pelvic positioning supports or anterior trunk supports:

1) pelvic positioning supports shall not demonstrate a vertical displacement of the loading pad of greater than 3 % of the loading pad width, when measured in the set-up loaded state after the test load has been applied and removed.

2) anterior trunk supports shall not demonstrate an angular displacement of the loading pad of greater than 5° in angle, when measured in the set-up loaded state after the test load has been applied and removed;

g) No electrical component shall disconnect or demonstrate damage that compromises the specified use.

h) No power-operated component (e.g. pneumatic, electrical, hydraulic) shall cease to be operational.

i) No parts that are designed to be removable, foldable, or adjustable shall cease to operate.

6 Test report requirements

6.1 The test report shall contain the following items:

6.2 Statement that the PSD and attachment hardware have been tested to this document, i.e. ISO 16840-3:2022.

6.3 Testing institution

a) Name;

b) Address;

c) Accreditations or certifications (if any);

d) Unique test report reference such as a report or contract number.

6.4 Dates

a) Date(s) of tests;

b) Date of report issue.

6.5 Manufacturer or entity requesting the testing

a) Name;

b) Address.

6.6 Product identification

a) Product name or model;

b) Serial number and/or batch number (if any).

Maximum user mass tested for the PSD where relevant.

6.7 Test apparatus used

Rigid test fixtures and/or adjacent parts used for each test.

6.8 Test equipment

Confirmation that prior to testing, equipment was calibrated or verified against measurement standards traceable to international or national measurement standards (where applicable);

Measurement equipment including, but not limited to, the following:

a) Linear measurement devices;

b) Angular measurement devices;

c) Force gauges.

6.9 Setup of the device

a) Description of setting, adjustments of PSDs used for each test;

b) Type or types of removable covering material, if any;

c) Repetitive load test, if applicable:

   i) force or torque applied.

d) Static load test, if applicable:

   i) maximum force or torque applied.

e) Impact load test, if applicable.

6.10 Test results

a) List of all the tests applied to the device in accordance with Table 1;

b) Statement of whether the same sample PSD was used for the series of tests, or if tests were conducted separately, using a unique sample PSD for each test;

c) Statement of whether the requirements of Clause 5 have been met

d) Repetitive load test results, if applicable:

   i) Number of cycles completed;

   ii) Statement of Pass/Fail according to the requirements of Clause 5. If any failure mode occurred, describe the failure mode and observations;

   iii) Comments on any additional observations.

e) Static load test results, if applicable:

   i) Maximum load applied;

   ii) Statement of Pass/Fail according to the requirements of Clause 5. If any failure mode occurred, describe the failure mode and observations;

   iii) Comments on any additional observations;

   iv) PSDs except for anterior pelvic and trunk supports, report:

      — maximum elastic deformation before one of the failure modes occurred;

      — permanent deformation that remains after the load has been returned to the set-up loaded state.

   v) Anterior pelvic supports, report:

      — maximum linear displacement resulting from elastic deformation while under load;

      — maximum angular displacement resulting from elastic deformation while under load.

vi) Rigid supports, report:

— offset distance (moment) to the point of force or torque application from the attachment point.

f) Impact load test results, if applicable.

g) Comments on any additional observations.

6.11 Photographs of test setups and the PSD and any attachment hardware before and after testing

Annex A
(normative)

Method for repetitive load testing of PSDs

A.1 Test principle

A.1.1 The PSD shall be attached to a rigid test fixture selected from Annex D in order to subject the device to forces representative of typical working conditions and minimize shock-absorption from the damping effects of flex in the system.

NOTE The test forces specified in this document are intended to simulate typical conditions of use with reasonable safety factors to meet the general expectations for performance of the devices described. Actual conditions of use vary according to the weight and strength of the wheelchair occupant, the configuration of the seating system and wheelchair, and external factors such as temperature and acceleration.

Persons using this document to inform the selection of a PSD should exercise judgement when the conditions of use are extreme.

A.1.2 If a combination of PSDs is provided for testing as a unit from a manufacturer, set up the complete system of the PSDs. Each PSD of this system shall be tested as specified in the relevant clause of this document.

A.1.3 These tests apply to the PSDs designated in Table 1.

A.1.4 The PSD shall not be retightened or its position shall not be readjusted during load testing.

A.2 Test apparatus

A.2.1 **A rigid test fixture**, appropriate to PSD location selected from Annex D.

A.2.2 **A device**, for applying a repetitive load to the PSD that

a) applies the applied force or torque to an accuracy of ±3 %,

b) applies the force or torque at a rate not greater than 100 N/s or 50 newton-metres/s,

c) completely releases the force or torque,

d) reapplies the force or torque until the specified number of cycles is achieved, and

e) avoids a frequency of loading that is the resonant frequency of any active support surface.

A.2.3 **A device**, for measuring the displacement of the loading pad or PSD.

A.3 Test preparation

A.3.1 The environment within which tests are to be conducted shall be maintained at 23 °C ± 2 °C, with relative humidity of 50 % ± 5 % as defined in ISO 554[1].

A.3.2 The test PSD shall be placed in the test environment for at least 12 h before testing.

Select the appropriate loading pad from Annex E.

A.4 Test procedure

A.4.1 Secure the PSD to the rigid test fixture specified in Annex D, according to the PSD manufacturer's instructions for attachment to a wheelchair.

A.4.2 If a PSD is provided with its attachment hardware as a system from a manufacturer, set up the PSD and attachment hardware together as a unit. PSDs that are designed to be attached with hardware, but are supplied without the attachment hardware, shall be attached using surrogate attachment hardware.

A.4.3 If a combination of PSDs is provided for testing as a unit from a manufacturer, set up the complete system of the PSDs. Each PSD of this system shall be tested as specified in a relevant clause of this document.

NOTE Various fasteners, e.g. hook and loop, can be used to assist in maintaining the position of PSDs for testing, providing they do not interfere with the test procedure. The loading pad can be connected to an inertial arrestor to prevent injury if the PSD breaks under test loads.

A.4.4 Adjust all PSDs, including passive support surfaces and active support surfaces to a configuration that minimizes their ability to withstand repeated loads but which remain within the limits of adjustment specified by the manufacturer.

NOTE An example of the worst-case situation for some PSDs is a load application that results in a maximum moment arm. For example, with the PSD at full extension, position and angle, and with full lateral offset.

A.4.5 Tighten all fastenings as specified in the manufacturer's instructions. If not specified, tighten to 80 % of the breaking torque as specified in ISO 898-7.

The input hand force required on PSDs that are designed to have frequent adjustments by hand and are supplied with knobs or handles are listed in Table A.1 as reference for hand forces. Knobs and handles used should fix the PSD in position with the forces/torque indicated.

Table A.1 — Hand forces for knobs, hand levers and cranks

Type	Diameter/Length	Torque/Force
Knobs (torque)	38 mm to 76 mm	2,3 Nm
Hand levers	50 mm	66 N
Cranks	90 mm to 500 mm	89 N one hand

A.4.6 Apply a repetitive test load to each of the PSDs according to the relevant procedures in this annex.

A.4.7 Record the following:

a) the maximum displacement permitted by the movement of dynamic attachment hardware or deformable support surfaces or passive support surfaces;

b) the force or torque to displace or move components that are designed to move; such components include dynamic attachment hardware or deformable support surfaces or passive support surfaces;

c) maximum force or torque applied;

d) if a performance limit occurs, the force or torque at which it occurs and the type of failure;

e) the offset distance (moment) from the attachment point to the point of load application;

f) the rigid test fixture used for each test;

g) the loading pad used for each test;

h) cycles completed.

A.5 Seat cushion supporting structure (SCSS)

A.5.1 General

Seat cushion supporting structure is a structural component, installed as part of a seating system. If the seating system includes an integrated cushion, it shall be included in the test.

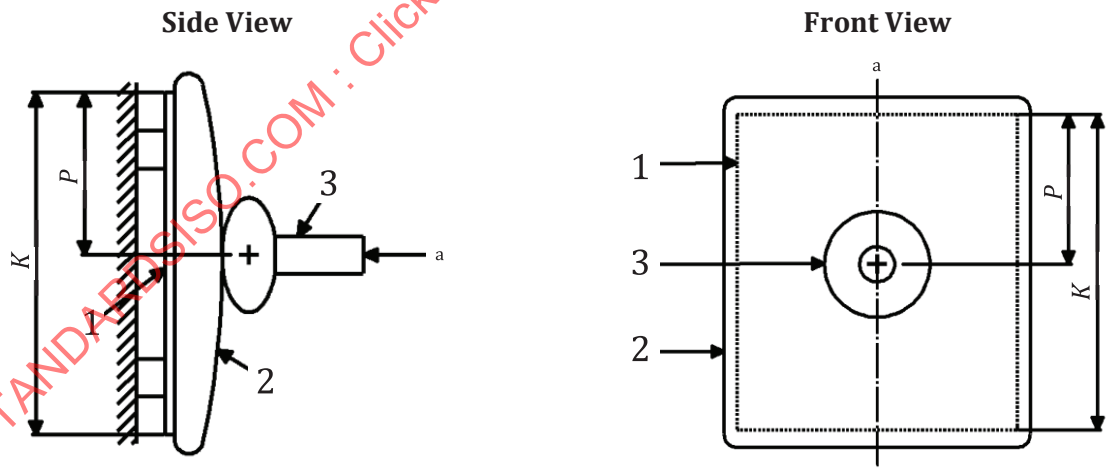
NOTE Pass/fail requirements for the cushion itself are not covered by this document.

A.5.2 Test without a seat cushion, unless the seat cushion is integrated within the SCSS, in which case, test the system.

A.5.3 Mount the seat on a rigid test fixture as specified in Annex D. When the seat is typically mounted to a tubular structure, the fixture in Clause D.2 shall be used. When the seat is mounted to a flat plate, fixture Clause D.3 shall be used.

A.5.4 Select the loading pad as specified in Annex E.

A.5.5 Set up the means to apply a repetitive load such that the loading pad is perpendicular ±5° to the surface of the base of the adjustable rigid test frame described in Figure D.1, to which the seat cushion supporting structure is mounted, and in the centre line, ±10 mm (Figure A.1).



Key

1 the BCSS/SCSS structural (rigid) element
2 back support or seat cushion upholstery
3 loading pad
K length of BCSS/SCSS
P distance from top of BCSS/SCSS to point of impact
a Center line.

Figure A.1 — Set up of apparatus for repetitive or static load tests on BCSS or SCSS

A.5.6 Set the repetitive test load within 10 % of L, calculated using Formula (A.1):

$$L = 0{,}75 \times m \times 1{,}5 \times 9{,}8 \quad \text{(A.1)}$$

where

L is the numerical value of the repetitive test load, expressed in newtons (N);

m is the numerical value of the maximum user mass recommended by the manufacturer expressed in kilograms;

9,8 is the gravitational constant in m/s^2.

A.5.7 Apply the repetitive test load for 17 500 cycles or until prior failure.

NOTE This test is derived from an assumption of a user loading a seat four times per hour over a 12 h day, 365 days a year, with load assumed to be 75 % of the user mass, with a load safety factor of 1,5. This does not imply a one-year useful life.

A.5.8 If any failure to meet requirements in Clause 5 occurs, record the number of cycles and the type of failure.

A.6 Back cushion supporting structure (BCSS)

A.6.1 Test without a back cushion, unless the back cushion is integrated to the BCSS, in which case, test the system.

NOTE Pass/fail requirements for the cushion itself are not covered by this document.

A.6.2 Mount the BCSS on a rigid test fixture as specified in Annex D.

For BCSSs with length equal or less than 410 mm, the point of impact application shall be located at the centre line, 30 mm ± 10 mm below the top of the back support structural (rigid) surface as shown as P in Figure A.1. For back supports with height of more than 410 mm, calculate the distance P in mm using Formula (A.2):

$$P = K - 380 \quad \text{(A.2)}$$

where K is the length of the back support structural (rigid) surface in mm.

A.6.3 Select the appropriate loading pad as specified in Annex E.

A.6.4 Set up the means to apply a repetitive load such that the loading pad is perpendicular ±5° to the surface of the base of the adjustable rigid test frame described in Figure D.1, to which the back support supporting structure is mounted, and in the centre line, ±10 mm (see Figure A.1).

A.6.5 Set the repetitive test load at L ±10 %, calculated using Formula (A.3):

$$L = 0{,}35 \times m \times 1{,}5 \times 9{,}8 \quad \text{(A.3)}$$

where

L is the numerical value of the repetitive test load, expressed in newtons (N);

m is the numerical value of the maximum user mass recommended by the manufacturer expressed in kilograms;

9,8 is the gravitational constant in m/s^2.

A.6.6 Apply the repetitive test load for 17 500 cycles or until prior failure

NOTE This test is derived from an assumption of a user loading a seat four times per hour over a 12 h day, 365 days a year, with load on the back support assumed to be 35 % of the user mass with a safety factor of 1,5. This does not imply a one-year useful life.

A.6.7 If any failure to meet requirements in Clause 5 occurs, record the number of cycles and the type of failure.

A.7 Anterior pelvic positioning support

A.7.1 Throughout this clause, the anterior pelvic support is referred to as support; the applicable pelvic loading pad is referred to as the loading pad.

Select the appropriate test parameters corresponding to the user mass shown in Table A.2 and pelvic loading pad from Table E.1, based on the maximum specified user mass. If the maximum specified user mass is >10 kg more than a user mass in Table A.2 (i.e. 25 kg, 50 kg, etc.), select the next greater user mass for testing.

A.7.2 Set up each support and the associated testing equipment as specified in Annex D and Annex E

A.7.3 Set up the means to apply a repetitive load, such that the loading pad is perpendicular, within ±5°, to the support and in the centre line, within ±10 mm, of the support (see Figure B.3).

A.7.4 Pre-load the support by applying a set-up load to the loading pad as given in Table A.2.

A.7.5 Measure and record the position of the loading pad or devise a means to use this position as a zero reference to measure from A.7.9.

A.7.6 Set the repetitive test load to the maximum load as given in Table A.2.

A.7.7 Apply the repetitive test load using the PSD loading pads specified in Annex E for 1 000 cycles.

A.7.8 If any performance limit as specified in Clause 5 occurs during the 1 000 cycles, record the type of performance limit experienced and the number of cycles.

A.7.9 Relax all force to eliminate tension in the support for 30 min ± 10 min to allow the support materials to recover from any temporary elongation.

A.7.10 Apply the set-up load specified in Table A.2 and measure the position of the loading pad. Any difference between this position and the original position is the displacement resulting from permanent deformation of the support. Record the displacement.

A.7.11 If any failure to meet requirements in Clause 5 occurs, record the number of cycles and the type of failure.

Table A.2 — Anterior pelvic positioning support mounting point separation and repetitive load parameters

Parameter	User mass					
	25 kg	50 kg	75 kg	100 kg	150 kg	Tolerance
Mounting point separation (mm)	280	360	430	480	580	±30 mm
Set-up load (N)	50	50	50	50	50	±3 %
Maximum load (N)[a]	125	250	375	500	750	±3 %
Maximum allowable displacement of loading pad (mm)[b]	6	8	10	11	13	±0,5 mm
[a] Maximum Load = 0,5 x user mass.						
[b] Maximum allowable displacement of loading pad is based on a 3 % of the width (w) of the loading pad.						

A.8 Anterior trunk support

A.8.1 Throughout this clause, an anterior trunk support is referred to as support. The applicable variable torso loading pad is referred to as the loading pad.

Select the appropriate test parameters corresponding to the user mass shown in Table A.3 and torso loading pad from Table E.2, based on the maximum specified user mass. If the specified user mass is >10 kg more than a user mass in Table A.3 (i.e. 25 kg, 50 kg, etc.), select the next greater user mass for testing.

A.8.2 Set up each support and the associated testing equipment as specified in Annex E.

A.8.3 Set up the means to apply a repetitive torque, such that the loading pad is located relative to the pivot axis according to Table A.3 (see Figure D.4).

A.8.4 Pre-load the support by applying a set-up torque per Table A.3 to the pivoting test frame.

A.8.5 Record the angular position of the loading pad.

A.8.6 Set the repetitive load to the maximum torque as given in Table A.3.

A.8.7 Apply the repetitive test torque as specified in Table A.3 for 1 000 cycles.

A.8.8 If any failure to meet requirements in Clause 5 occurs, record the number of cycles and the type of failure.

A.8.9 Relax all torque to eliminate tension in the support for 30 min ± 10 min to allow the support materials to recover from any temporary elongation.

A.8.10 Apply the set-up torque specified in Table A.3 and measure the angular position of the loading pad. Any difference between this angle and the original angle is the displacement resulting from permanent deformation of the support. Record the displacement angle.

Table A.3 — Anterior trunk support repetitive load parameters

Parameter	User mass				
	25 kg	50 kg	75 kg	100 kg	Tolerance
Set-up torque (Nm) [a]	18	27	30	33	±3 %
Maximum torque (Nm) [b]	31	92	157	230	±3 %
[a] Set-up torque = 50 x *D* where *D* (m) = Shoulder to pivot axis *d* (mm) / 1 000 (mm/m). [b] Maximum torque = *F* x *D* where *F* (N) = 0,35 × user mass (kg) × 9,8 (m/s ^{2}); where *D* (m) = Shoulder to pivot axis *d* (mm) / 1 000 (mm/m).					

A.9 Head support system

A.9.1 The term head support applies to all items that contact the head, including one or more functions of support, rest, and/or restraint.

A.9.2 Mount the head support on a rigid test fixture as specified in Annex D and adjust it to the position with the centre of the head support contact surface located 250 mm (tolerance ±10 mm) above the rigid test fixture or the head support mounting hardware (if applicable).

NOTE An example of the test set-up is given in Figure B.4.

If the position is not available or possible, adjust the position as close as possible to that specified above.

A.9.3 Select the convex hemispherical loading pad specified in Annex E.

A.9.4 Calculate the force using Formula (A.4):

$$F = 0{,}083 \times m \times 1{,}5 \times 9{,}8 \quad \text{(A.4)}$$

(up to a limit of 168 N, or any greater repetitive test force specified by the head support manufacturer)

where

F is the numerical value of the repetitive test load, expressed in newtons (N);

m is the numerical value of the maximum user mass recommended by the manufacturer, expressed in kilograms (kg);

9,8 is the gravitational constant in m/s^2.

NOTE 1 This test is derived from an assumption of a user loading a head support four times per hour over a 12 h day, 365 days a year, with load assumed to be 8,3 % of the user mass, with a load safety factor of 1,5. This does not imply a one-year useful life.

NOTE 2 According to the study results in Table A.2.3, 'Relative weight and length of body segments for adult men and women' from Reference [3], the average percentage of body weight for head and neck is 7,1 % for men and 9,4 % for women.

NOTE 3 Head supports designed for use by occupants with high spasticity will experience much higher forces than specified in this clause, and manufacturers can select an appropriately greater repetitive test force.

A.9.5 Set up a means for applying the repetitive test force *F*, so that its line of action is perpendicular to the head support surface and its point of application is at the centre (tolerance ±10 mm) of the head support surface as shown in Figure B.4. A constant load shall be monitored and maintained throughout the test.

A.9.6 Apply the repetitive test load for 17 500 cycles. The applied load shall not deviate more than 10 % from *F*.

A.9.7 If any failure to meet requirements in Clause 5 occurs, record the number of cycles and the type of failure.

NOTE If another PSD (e.g. a back support) is designed to accommodate head support mounting hardware, it is important to test the head support attachment point of this PSD using the same principle describe above. A rigid test fixture can be used for testing when head supports can be used with numerous back supports.

Annex B
(normative)

Method for static load testing of PSDs

B.1 Test principle

B.1.1 The PSD shall be attached to a rigid test fixture selected from Annex D in order to subject the device to forces representative of typical working conditions and minimize shock-absorption from the damping effects of flex in the system.

NOTE The test forces specified in this document are intended to simulate typical conditions of use with reasonable safety factors to meet the general expectations for performance of the devices described. Actual conditions of use vary according to the weight and strength of the wheelchair occupant, the configuration of the seating system and wheelchair, and external factors such as temperature and acceleration.

Persons using this document to inform the selection of a PSD should exercise judgement when the conditions of use are extreme.

B.1.2 If a combination of PSDs is provided for testing as a unit from a manufacturer, set up the complete system of the PSDs. Each PSD of this system shall be tested as specified in the relevant clause of this document.

B.1.3 These tests apply to the PSDs designated in the Scope.

B.1.4 The PSD shall not be retightened or its position readjusted during load testing.

B.2 Test apparatus

B.2.1 **A rigid test fixture**, appropriate to PSD location selected from Annex D.

B.2.1 **A device**, for applying forces to a PSD that

a) measures the applied force to an accuracy of ±3 %,

b) applies the force at a rate no greater than 100 N/s, and

d) maintains the applied force for a duration no less than 5 s.

B.2.1 **A device**, for measuring the displacement of the loading pad or PSD.

B.3 Test item preparation

B.3.1 The environment within which tests are to be conducted shall be maintained at 23 °C ± 2 °C, with relative humidity of 50 % ± 5 % as defined in ISO 554[1].

B.3.2 The test PSD shall be placed in the test environment for at least 12 h before testing.

B.4 Test procedure

B.4.1 Secure the PSD to the rigid test fixture selected from Annex D, according to the PSD manufacturer's instructions for attachment to a wheelchair.

B.4.2 If a PSD is provided with its attachment hardware as a system from a manufacturer, set up the PSD and attachment hardware together as a unit.

NOTE Various fasteners, e.g. hook and loop, can be used to assist in maintaining the position of PSDs for testing, providing they do not interfere with the test procedure. The loading pad can be connected to an inertial arrestor to prevent injury if the PSD breaks under test loads.

B.4.3 Adjust all PSDs, including passive support surfaces and active support surfaces, to a configuration that minimizes their ability to withstand static loads, but which remains within the limits of adjustment specified by the manufacturer.

NOTE An example of the worst-case situation for some PSDs can be a position that would cause a situation of maximum moment arm. For example, with the PSD at full extension, position and angle, and with full lateral offset.

B.4.4 Tighten all fastenings as specified in the manufacturer's instructions. If not specified, tighten to 80 % of the breaking torque as specified in ISO 898-7

B.4.5 The input hand force required on PSDs that are designed to have frequent adjustments by hand and are supplied with knobs or handles are listed in Table A.1 as reference for hand forces. Knobs and handles used should fix the PSD in position with the forces/torque indicated.

B.4.6 Select the most appropriate loading pad from Annex E.

B.4.7 Apply a test load to each of the PSDs according to the relevant procedures in this annex.

B.5 Static load application

B.5.1 Align the loading pad selected from Annex E to apply the test force or torque at the centre of a support surface within ±10 mm. If using a pivoting torso loading pad align the loading pad relative to the pivot axis per Table E.2.

B.5.2 For pelvic supports, align the loading pad to apply the force perpendicular, within ±10°, to the support surface.

NOTE The angle of the force might need to be adjusted to accommodate displacement of the PSD under load.

B.5.3 Measure and record the position of the loading pad under the set-up load.

B.5.4 Apply a force or torque using the static loading device for a duration no less than 5 s.

B.5.5 Measure the position of the loading pad under the maximum load.

B.5.6 Relax all force to eliminate tension in the support for 30 min ± 10 min to allow the support materials to recover from any temporary elongation.

B.5.7 Reapply the set-up force and measure the position of the loading pad.

B.5.8 Record the following during testing:

a) the maximum displacement permitted by the movement of any dynamic attachment hardware or deformable support surfaces or passive support surfaces;

b) the force or torque to displace or move components that are designed to move. Such components include dynamic attachment hardware or deformable support surfaces or passive support surfaces;

c) the maximum force/torque applied;

d) If any failure to meet requirements in Clause 5 occurs, record the force/torque and the type of failure;

e) the offset distance from the attachment point to the point of load application;

f) the rigid test fixture used for each test;

g) the loading pad used for each test.

B.5.9 Remove the force or torque.

B.6 Lateral and medial support surface test methods

B.6.1 General

The following tests apply to, but are not limited to, the following lateral and medial support devices:

— lateral trunk supports;

— lateral pelvic supports;

— lateral upper leg supports;

— lateral knee supports;

— lateral lower leg supports;

— lateral head support;

— medial knee supports.

B.6.2 Lateral supports: outward lateral forces

B.6.2.1 Identify if the lateral support is integrated or non-integrated as specified.

B.6.2.2 Select the convex loading pad from Clause E.5.

B.6.2.3 Calculate the force using Formula (B.1):

$$F = 0{,}25 \times m \times 1{,}5 \times 9{,}8 \quad \text{(B.1)}$$

where

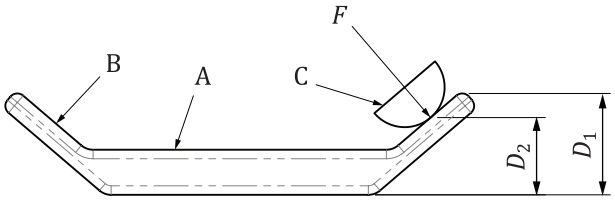
F is the numerical value of the test load, expressed in newtons (N);

m is the numerical value of the maximum user mass recommended by the manufacturer expressed in kilograms;

9,8 is the gravitational constant in m/s^2.

NOTE This represents a load on the lateral supports is assumed to be 25 % of the user mass, with a safety factor of 1,5.

B.6.2.4 For integrated lateral trunk supports, apply the test force, F, at a point (D_2) which is 75 % ± 5 % of the total depth (D_1) of the support, measured from the plane of the rigid back structure as shown in Figure B.1.



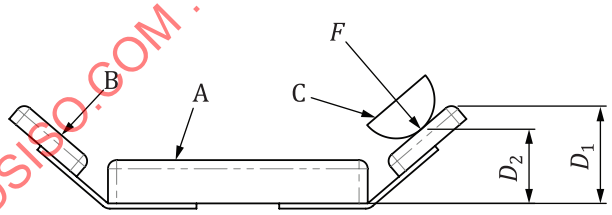
Key

A back support
B integrated lateral trunk support
C hemispherical convex loading pad
D_1 lateral trunk support depth
D_2 location of force application
F force

Figure B.1 — Example of force application to an integrated lateral trunk support on a back support

B.6.2.5 For non-integrated lateral supports, apply the test force, F, at a point (D_2) which is 75 % ± 5 % of the total depth (D_1) of the support including any mounting hardware, measured from the plane of the rigid back structure, typically the attachment or pivot point as shown in Figure B.2. If adjustable, the lateral support shall be adjusted to its most extended position.

B.6.2.6 If any failure to meet requirements in Clause 5 occurs, record the force and the type of failure.



Key

A back support
B non-integrated lateral trunk support
C hemispherical convex loading pad
D_1 lateral trunk support depth
D_2 location of force application
F force

Figure B.2 — Example of force application to a non-integrated lateral trunk support

B.6.3 Medial knee supports: inward forces

B.6.3.1 Select the hemispherical convex loading pad from Clause E.7.

B.6.3.2 Calculate the force using Formula (B.2):

$$F = 0{,}25 \times m \times 1{,}5 \times 9{,}8 \quad \text{(B.2)}$$

where

F is the numerical value of the test load, expressed in newtons (N);

m is the numerical value of the maximum user mass recommended by the manufacturer, expressed in kilograms.

9,8 is the gravitational constant in m/s^2.

NOTE This represents a load on the lateral supports is assumed to be 25 % of the user mass, with a safety factor of 1,5.

B.6.3.3 For medial knee supports, apply the test force in the inward direction as specified in Clause B.5 to the centre of the support surface ±10 mm for a duration no less than 5 s.

NOTE This load simulates the inward forces on a medial knee support in the horizontal plane.

B.6.3.4 If any failure to meet requirements in Clause 5 occurs, record the force and the type of failure.

B.6.4 Pelvic and trunk supports: anterior forces

B.6.4.1 Pelvic support

B.6.4.1.1 Select the appropriate test parameters corresponding to the user mass shown in Table B.1 and pelvic loading pad from Table E.1, based on the maximum specified user mass. If the specified user mass is >10 kg more than a user mass in Table B.1 (i.e. 25 kg, 50 kg, etc.), select the next greater user mass for testing.

B.6.4.1.2 Select the appropriate pelvic loading pad as specified in Annex E. For supports that use straps, attach the straps to an adjustable rigid test frame or surrogate support surface as specified in Annex D.

B.6.4.1.3 The mounting point separation on the adjustable rigid test frame shall be as specified in Table B.1.

NOTE An example of the test set-up is given in Figure B.3.

B.6.4.1.4 Set up a means for applying the test force, so that the line of force application is perpendicular to the adjustable rigid test frame representing the seat. The line of force application shall also be at the mid-point of the loading pad.

B.6.4.1.5 Apply the set-up load as specified in Table B.1.

B.6.4.1.6 Measure and record the position of the loading pad or devise a means to use this position as a zero reference.

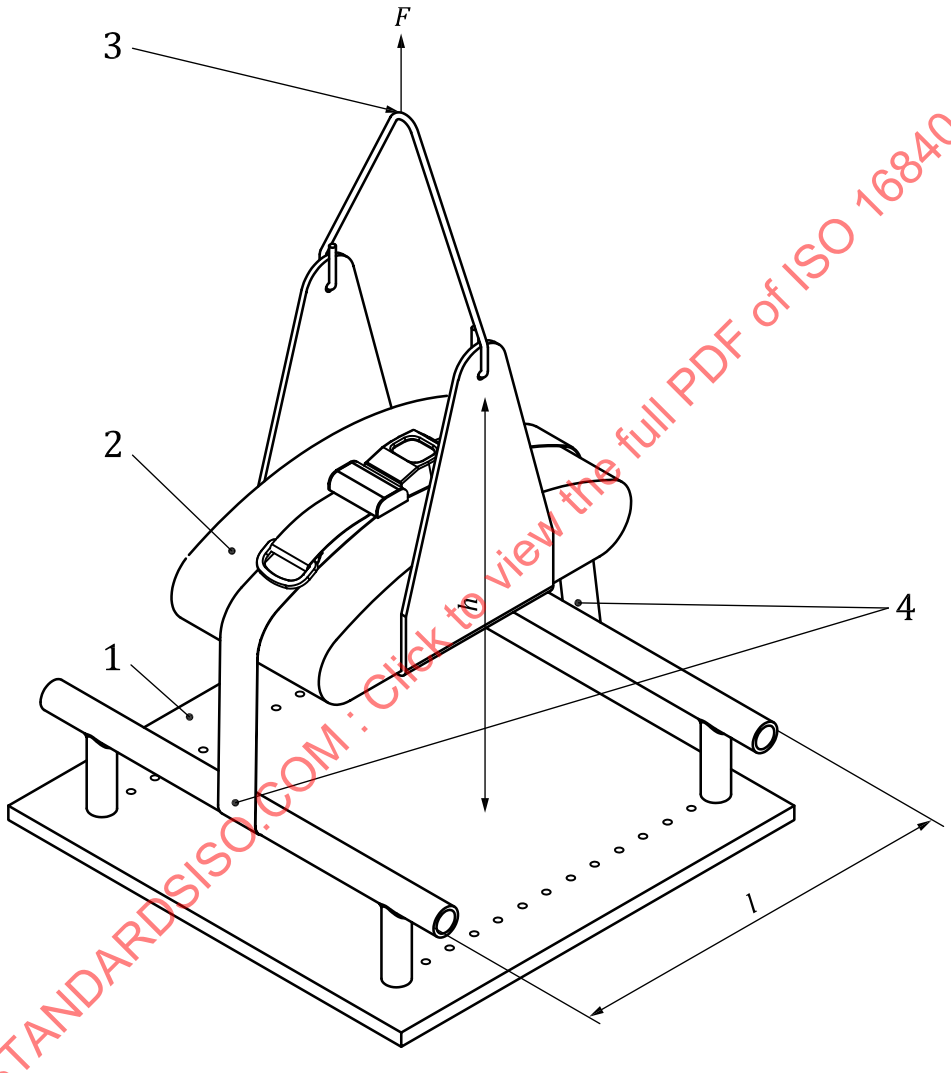
B.6.4.1.7 Apply the test force away from the test frame surface, against the anterior pelvic support as to the maximum force specified in Table B.1.

B.6.4.1.8 If any failure to meet requirements in Clause 5 occurs, record the force and the type of failure. If no failure has occurred, record the maximum displacement of the loading pad permitted

by the support. Any difference between this position and the set-up load position is the displacement resulting from elastic deformation of the support (and, less significantly, compression of the loading pad).

B.6.4.1.9 Relax all force to eliminate tension in the support for 30 min ± 10 min to allow the support materials to recover from any temporary elongation.

B.6.4.1.10 Apply the set-up force again as specified in Table B.1 and measure the position of the loading pad. Any difference between this position and the original position is the displacement resulting from permanent deformation of the support. Record the displacement permitted by the support.



Key

1 adjustable rigid test frame
2 pelvic loading pad
3 midpoint of the loading pad
4 mounting points
F test force
l mounting point separation
h measurement of position of loading pad

Figure B.3 — Example of test set-up for static load testing of the anterior pelvic support

Measure position of the loading pad from a fixed point on the test frame to the hanging hole in the loading pad cradle (*h* in Figure B.3) to eliminate measurement errors that can result from tilting of the cradle.

Table B.1 — Pelvic positioning support mounting point separation and static load parameters

Parameter	User mass					
	25 kg	50 kg	75 kg	100 kg	150 kg	Tolerance
Mounting point separation (mm)	280	360	430	480	580	±30 mm
Set-up load (N)	50	50	50	50	50	±3 %
Maximum load (N)[a]	250	500	750	1 000	1 500	±3 %
Maximum allowable displacement of loading pad (mm) [b]	6	8	10	11	13	±0,5 %

[a] Maximum load = 9,8 × User mass.

[b] Maximum allowable displacement of loading pad is based on 3 % of the width (*w*) of the loading pad.

B.6.4.2 Trunk support

B.6.4.2.1 Select the appropriate test parameters corresponding to the user mass shown in Table B.2 and torso loading pad from Table E.2, based on the maximum specified user mass. If the specified user mass is >10 kg more than a user mass in Table B.2 (i.e. 25 kg, 50 kg, etc.), select the next greater user mass for testing. For supports that use straps, attach the straps to an adjustable rigid test frame or surrogate support surface as specified in Annex D. Attach the loading pad to the pivoting test frame. Install the support to the test frame or surrogate support surface according to the manufacturer's instructions

B.6.4.2.2 Devise a means of applying torque to the pivoting test frame (see Annex E). Locate the torso loading pad in relationship to the pivot axis per Table E.2 (see Annex E for an example set-up).

B.6.4.2.3 Apply the set-up torque as specified in Table B.2.

B.6.4.2.4 Measure and record the angular position of the loading pad.

B.6.4.2.5 Apply the test torque away from the test frame surface, against the anterior trunk support demonstrated in Annex D to the maximum torque specified in Table B.2 for a duration no less than 5 s.

B.6.4.2.6 If any failure to meet requirements in Clause 5 occurs, record the number of cycles and the type of failure. If no failure has occurred, record the maximum angular displacement of the loading pad permitted by the support. Any difference between this position and the set-up load position found in (reference) is the displacement resulting from elastic deformation of the support.

B.6.4.2.7 Relax all torque to eliminate tension in the support for 30 min ± 10 min to allow the support materials to recover from any temporary elongation.

B.6.4.2.8 Apply the set-up torque again as specified in Table B.2 and measure the angular position of the loading pad. Any difference between this angle and the original angle is the displacement resulting from permanent deformation of the support. Record the displacement angle permitted by the support.

Table B.2 — Anterior trunk support static load parameters

Parameter	User mass				
	25 kg	50 kg	75 kg	100 kg	Tolerance
Set-up torque[a] (Nm)	18	27	30	33	±3 %
Maximum torque[b] (Nm)	63	187	315	462	±3 %
[a] Set-up Torque = 50 x *D* where *D* (m) = Shoulder to Pivot Axis *d* (mm)/1 000 (mm/m). [b] Maximum Torque = *F* x *D* where *F* (N) = 0,7 x User mass (kg) × 9,8 (m/s ^{2}); where *D* (m) = Shoulder to Pivot Axis *d* (mm)/1 000 (mm/m).					

B.6.5 Head support: posterior forces

B.6.5.1 Mount the head support on a rigid test fixture as specified in Annex D and adjust it to the position with the centre of the head support surface located 250 mm (tolerance ±10 mm) above the rigid test fixture or the head support mounting hardware (if applicable).

NOTE An example of the test set-up is given in Figure B.4.

If the position is not available or possible, adjust the position as close as possible to that specified above.

B.6.5.2 Select the convex hemispherical loading pad specified in Clause E.7

B.6.5.3 Calculate the test force using Formula (B.3) with the safety factor equal to 2:

$$F_H = 0{,}166 \times m \times 2 \times 9{,}8 \quad \text{(B.3)}$$

(up to a limit of 225 N or any greater test force specified by the head support manufacturer)

where

F_H is the numerical value of the test load, expressed in newtons (N);

m is the numerical value of the maximum user mass specified by the manufacturer, expressed in kilograms (kg);

9,8 is the gravitational constant in m/s^2.

NOTE 1 According to the study results in Table A.2.3, 'Relative weight and length of body segments for adult men and women' from Reference [3], the average percentage of body weight for head and neck is 7,1 % for men and 9,4 % for women. The average was doubled for this static load application.

NOTE 2 The safety factor of 2 is higher for this test because of the greater occupant tone that can be exerted on a head support.

B.6.5.4 Set up a means for applying the test force F_H, so that its line of action is perpendicular to the head support surface and its point of application is at the centre (tolerance ±10 mm) of the head support surface as shown in Figure B.4.

B.6.5.5 The applied test load shall not deviate more than ±3 % of F_H.

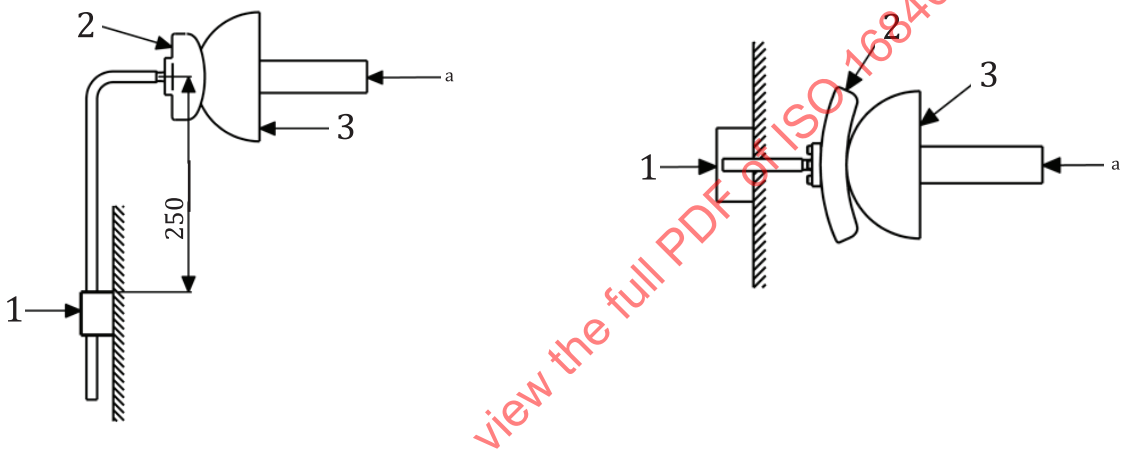
B.6.5.6 If any failure to meet requirements in Clause 5 occurs, record the force and the type of failure.

B.6.5.7 Repeat B.6.5.4 to B.6.5.6 with setting up a means for applying the test force F_H perpendicular to the head support surface at points 35 mm ± 5 mm horizontally in turn right and left of the centre of the head support surface.

B.6.5.8 Any lateral head supports shall be tested as specified in B.6.1 using the test force amount in accordance with Formula (B.3).

B.6.5.9 If any failure to meet requirements in Clause 5 occurs, record the force and the type of failure.

Dimensions in millimetres



a) Side View **b) Top View**

Key

1 rigid test fixture and attachment hardware (if applicable)
2 head support pad
3 convex hemispherical loading pad
a Load.

Figure B.4 — Example of posterior force application to head support

B.6.6 Back support: posterior force

B.6.6.1 Utilize the apparatus and method of application as specified in Clause A.6 for a single load.

B.6.6.2 Calculate the force using Formula (B.4):

$$F = 0{,}7\ m \times 1{,}5 \times 9{,}8 \qquad \text{(B.4)}$$

where

F is the numerical value of the test load, expressed in newtons (N);

m is the numerical value of the maximum user mass recommended by the manufacturer, expressed in kilograms;

9,8 is the gravitational constant in m/s^2.

NOTE This represents a load assumed to be 70 % of the user mass, which is twice the load applied in repetitive testing, with a safety factor of 1,5.

B.6.6.3 If any failure to meet requirements in Clause 5 occurs, record the force and the type of failure.

Annex C
(normative)

Method for impact testing of PSDs

C.1 Test principle

C.1.1 The PSD shall be attached to a rigid test fixture selected from Annex D in order to subject the device to forces representative of typical working conditions and minimize shock-absorption from the damping effects of flex in the system.

NOTE The test forces specified in this document are intended to simulate typical conditions of use with reasonable safety factors to meet the general expectations for performance of the devices described. Actual conditions of use vary according to the weight and strength of the wheelchair occupant, the configuration of the seating system and wheelchair, and external factors such as temperature and acceleration.

Persons using this document to inform the selection of a PSD should exercise judgement when the conditions of use are extreme.

C.1.2 If a combination of PSDs is provided for testing as a unit from a manufacturer, set up the complete system of the PSDs. Each PSD of this system shall be tested as specified in a relevant clause of this document.

C.1.3 These tests apply to the PSDs designated in the Scope.

C.1.4 The PSD shall not be retightened or its position readjusted during load testing.

C.2 Test apparatus

C.2.1 **A rigid test fixture**, appropriate to PSD location selected from Annex D.

C.2.2 **A device**, for applying an impact load to the PSD as specified below.

C.2.3 **Seat and back support impact loading device**, for applying an impact load to the PSD, consisting of

a) an impact pendulum as specified in ISO 7176-8:2014, 5.5, and

b) a means to measure the angle of the longitudinal axis of the pendulum prior to being dropped to an accuracy of ±2°.

C.2.4 **A device**, for measuring the displacement of the PSD.

C.3 Test item preparation

C.3.1 The environment within which tests are to be conducted shall be maintained at 23 °C ± 2 °C, with relative humidity of 50 % ± 5 % as defined in ISO 554[1].

C.3.2 The test PSD shall be placed in the test environment for at least 12 h before testing.

C.4 Impact test procedure

C.4.1 Secure the PSD to the rigid test fixture selected from Annex D, according to the PSD manufacturer's instructions for attachment to a wheelchair.

C.4.2 If a PSD is provided with its attachment hardware as a system from a manufacturer set up the PSD and attachment hardware together as a unit.

NOTE Various fasteners, e.g. hook and loop, can be used to assist in maintaining the position of PSDs for testing, providing they do not interfere with the test procedure. The loading pad can be connected to an inertial arrestor to prevent injury if the PSD breaks under test loads.

C.4.3 Adjust all PSDs, including passive support surfaces and active support surfaces, to a configuration which minimizes their ability to withstand impact loads, but which remain within the limits of adjustment specified by the manufacturer

NOTE An example of the worst-case situation for some PSDs is a position that would cause a situation of maximum moment arm. For example, with the PSD at full extension, position and angle, and with full lateral offset.

C.4.4 Tighten all fastenings as specified in the manufacturer's instructions. If not specified, tighten to 80 % of the breaking torque as specified in ISO 898-7.

C.4.5 The input hand force required on PSDs that are designed to have frequent adjustments by hand and are supplied with knobs or handles should refer to Table A.1 as reference for hand forces.

C.4.6 If any failure to meet requirements in Clause 5 occurs, record the type of failure.

C.5 Back cushion supporting structure (BCSS) resistance: posterior impact

C.5.1 Impactor

Seat and back support impact loading device as specified in C.2.2.

C.5.2 Test procedure

C.5.2.1 The pendulum shall be in the vertical position ±1° when the ball strikes the back support structural (rigid) surface.

C.5.2.2 Adjust the pendulum so that the impact load is normal to the back support structural surface.

a) Test without a back support cushion, unless the back support cushion is integrated in the BCSS, in which case, test the system.

b) For BCSS with adjustable height mounting hardware, the tests shall be performed with the mounting hardware in its lowest position on the back support, as a worst-case condition.

c) For BCSS with length equal or less than 410 mm, the point of impact application shall be located at the centre line, 30 mm ± 10 mm below the top of the BCSS structural (rigid) surface as shown as *P* in Figure C.1. For BCSS with height of more than 410 mm, calculate the distance *P* in mm using Formula (C.1):

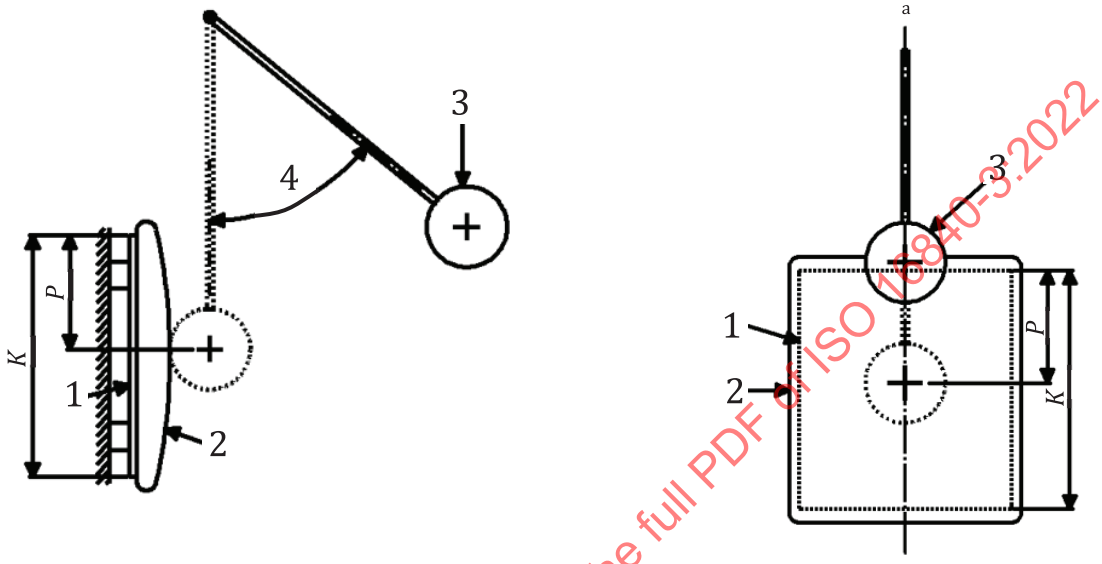
$$P = K - 380 \quad \text{(C.1)}$$

where *K* is the height of the BCSS structural (rigid) surface in mm.

C.5.2.3 Raise the pendulum by 30° ± 2° from touching the BCSS and then release it to strike the BCSS as shown in Figure C.1.

C.5.2.4 Repeat the test with the pendulum positioned to strike the BCSS at points located 0,3 times the BCSS maximum width from each side of its centre line.

C.5.2.5 If any failure to meet requirements in Clause 5 occurs, record the type of failure.



a) Side View **b) Front View**

Key

1 the BCSS/SCSS structural (rigid) element
2 back support or seat cushion upholstery
3 impact test pendulum
4 angle of lift of pendulum (see C.5.2.3; C.6.2.2)
K length of BCSS/SCSS
P distance from top of BCSS/SCSS to point of impact
a Center line.

Figure C.1 — Impact test alignment and set-up

C.6 Seat cushion supporting structure (SCSS) resistance: impact

C.6.1 Position the adjustable rigid test frame such that the SCSS is vertical ±1°. Set up the means to apply an impact load such that the impact occurs when the rod is parallel to the base, applying a perpendicular load ±5° to the surface of the seat described in Figure C.1, to which the seat cushion supporting structure is mounted, and in the centre line, ±10 mm.

C.6.2 Adjust the pendulum so that the impact load is normal to the seat cushion support structural surface.

a) Test without a seat cushion, unless the seat cushion is integrated in the SCSS, in which case, test the system.

b) For SCSS, the point of impact application shall be located at the centre of the seat cushion (see Figure C.1).

C.6.2.1 Adjust the pendulum so that the impact load is applied to the centre of the SCSS.

C.6.2.2 Lift the pendulum to 90° ± 1° and release to strike the seat as shown in Figure C.1.

C.6.2.3 If any failure to meet requirements in Clause 5 occurs, record the type of failure.

Annex D
(normative)

Mounting fixtures for the testing of postural support devices

D.1 Test principles

Static mounting fixtures are employed to enable repetitive, static and impact loading of postural support devices in isolation from a wheelchair. The mounting fixtures therefore simulate 'worst case' conditions for componentry of the postural support device by removing less rigid parts of the wheelchair that would tend to absorb energy and dampen loads on the PSD

The mounting fixtures can be used for all three types of loading scenarios.

D.2 Adjustable rigid test frame

The adjustable rigid test frame is used to simulate a wheelchair frame, typically used to attach the sling seat or sling back.

The frame allows a range of angle adjustment of PSD attachment hardware.

NOTE The testing of one-piece shells with a combination of two rigid frames can be used.

The outside dimensions between the adjustable rigid components of the test frame should be adjustable from 280 mm ± 30 mm to 580 mm ± 30 mm. An example of an adjustable rigid test frame and mounting rig is shown in Figure D.1.

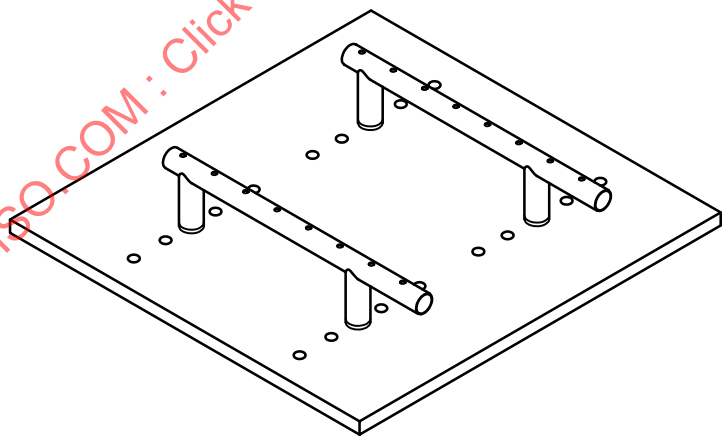
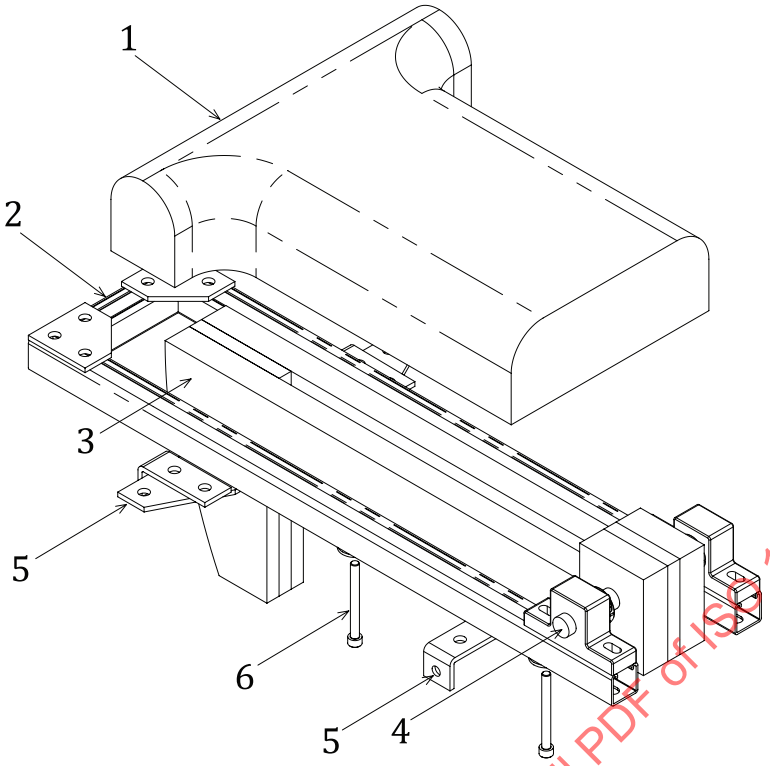


Figure D.1 — Example of adjustable rigid test frame, with mounting bars attached parallel to a base

D.3 Pivoting test frame

The pivoting test frame is used to apply a torque to a loading pad in order to simulate forward leaning of a seated user of a postural support device. Table D.1 contains the calculated forces to achieve the required test torque for each user mass: Figure D.4 provides an illustration of the parameters described in Table D.1.

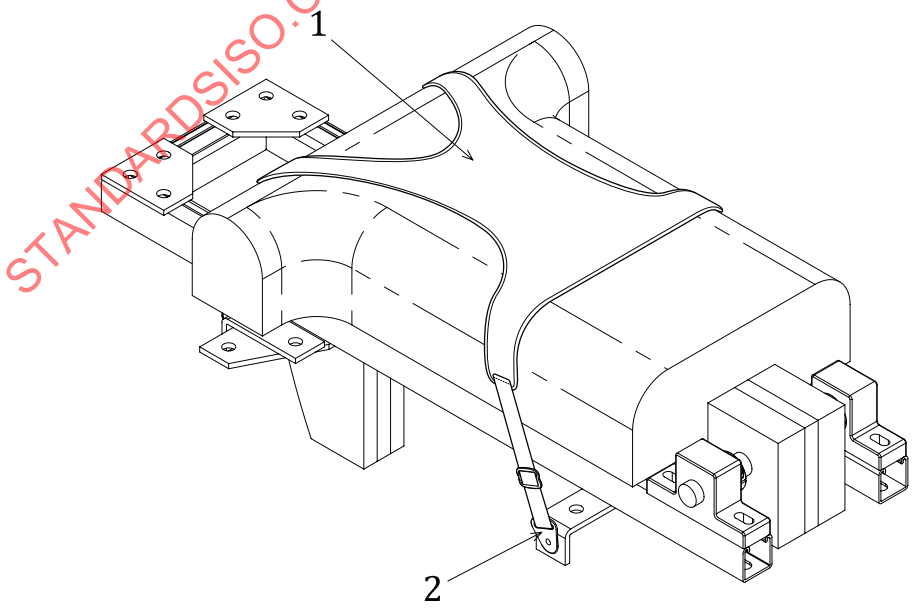
NOTE Examples of a pivoting test frame are shown in Figures D.2 and D.3.



Key

1 torso loading pad
2 fixed test frame
3 pivoting arm
4 pivot axis (axle)
5 adjustable mounting points
6 torso loading pad attachment screws

Figure D.2 — Pivoting Test Frame and Torso Loading Pad



a) Isometric view