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Wheelchairs —

Part 30: Wheelchairs for changing occupant posture — Test methods and requirements

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Foreword

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

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*.

A list of all parts in the ISO 7176 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

Wheelchairs which can alter the occupant's position in relation to the ground, in one or multiple planes can be an important factor in the appropriate selection of a wheelchair for people with disability and/or aged persons. These wheelchairs and their adjustable body support system can allow the occupant to engage in their environment, or assist in altering pressure distribution and/or postural position.

These features include but are not limited to:

— recline (where the angle of a back support can be changed),

— tilt (where the angle of a seat surface can be changed),

— elevate (where the seat height changes in the vertical plane), and

— stand-up function (where the back support, seat surface, arm supports, lower leg and foot supports can be changed to support the occupant in a standing position).

Wheelchairs —

Part 30:
Wheelchairs for changing occupant posture — Test methods and requirements

1 Scope

This document specifies the test methods and requirements for determining the safety and performance of a manual and/or power wheelchair that incorporates technology to alter the posture of the wheelchair occupant, which are either electrically or manually operated by the occupant or assistant during normal wheelchair use. This can include recline, tilt, elevate and stand-up mechanisms or a combination of these. In order for a wheelchair to be able to recline, tilt, elevate and/or stand-up, the wheelchair requires additional mechanisms and mechanical structures to allow these features to operate. This document specifies the different functional and strength tests required to test these wheelchairs in critical configurations of their adjustable range.

This document does not cover wheelchairs where the only operator adjustable body support system (OABSS) is adjustable limb or head postural support devices alone (e.g. elevating leg supports).

This document does not include wheelchair and postural support device customization during initial or subsequent setup of a wheelchair for an individual occupant. It also does not reflect other factors that can influence wheelchair stability such as occupant movement, cushion thickness, and the addition of ancillary equipment (e.g. respiratory support items).

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 7176-1:2014, *Wheelchairs — Part 1: Determination of static stability*

ISO 7176-2:2017, *Wheelchairs — Part 2: Determination of dynamic stability of electrically powered wheelchairs*

ISO 7176-3:2012, *Wheelchairs — Part 3: Determination of effectiveness of brakes*

ISO 7176-4:2008, *Wheelchairs — Part 4: Energy consumption of electric wheelchairs and scooters for determination of theoretical distance range*

ISO 7176-5:2008, *Wheelchairs — Part 5: Determination of dimensions, mass and manoeuvring space*

ISO 7176-6:2001, *Wheelchairs — Part 6: Determination of maximum speed of electrically powered wheelchairs*

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

ISO 7176-9, *Wheelchairs — Part 9: Climatic tests for electric wheelchairs*

ISO 7176-10, *Wheelchairs — Part 10: Determination of obstacle-climbing ability of electrically powered wheelchairs*

ISO 7176-11, *Wheelchairs — Part 11: Test dummies*

ISO 7176-14, *Wheelchairs — Part 14: Power and control systems for electrically powered wheelchairs and scooters — Requirements and test methods*

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

ISO 7176-19, *Wheelchairs — Part 19: Wheeled mobility devices for use as seats in motor vehicles*

ISO 7176-21, *Wheelchairs — Part 21: Requirements and test methods for electromagnetic compatibility of electrically powered wheelchairs and scooters, and battery chargers*

ISO 7176-25, *Wheelchairs — Part 25: Batteries and chargers for powered wheelchairs*

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

ISO 16840-3:2014, *Wheelchair seating — Part 3: Determination of static, impact and repetitive load strengths for postural support devices*

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 terminological databases for use in standardization at the following addresses:

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

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

3.1
operator adjustable body support system
OABSS
postural support adjustable without tools and while occupied, that together change the posture of the wheelchair occupant

Note 1 to entry: These include recline, tilt, elevate and stand-up systems, but do not include adjustable limb or head postural support devices alone (e.g. elevating leg supports).

3.2
mechanism
system that provides the means for transitioning elements of the *OABSS* (3.1) from one position to another

Note 1 to entry: For some functions, a mechanism can be able to move multiple postural support devices (e.g. a stand-up wheelchair system that can move upper torso support and lower leg support of the wheelchair), while for some other functions a mechanism can be simple (e.g. a mechanical back support recline).

3.3
seated reference configuration
SRC
reference configuration of the body support system where no OABSS mechanisms are operated

Note 1 to entry: Position the test dummy in a posture close to the seated reference position as defined in ISO 16840-1.

Note 2 to entry: In this configuration, the body support systems most closely match the setup requirements of ISO 7176-22 for the wheelchair.

Note 3 to entry: If the body support system elevates, adjust its elevation to achieve a ground clearance of 50 mm beneath the foot supports after appropriate adjustment of leg supports.

3.4
maximum adjustment configuration
MAC
configuration of the *OABSS* (3.1) that is the greatest change from the *SRC* (3.3), within the limits of normal human anatomical movement (toward full extension of all joints) and in this position adjusted to the greatest height of the occupant centre of mass

Note 1 to entry: For tilt, this would result in the maximum possible rearward rotation of the OABSS.

3.5
maximum driveable configuration
MDC
OABSS configuration closest to the *MAC* (3.4) which still allows the operator to effectively move the wheelchair in the horizontal plane to change location

Note 1 to entry: These configurations are described by the manufacturer and identified in the operator's manual.

Note 2 to entry: It does not include reduced speed settings that allow the operator to slightly adjust position relative to a fixed object (e.g. to approach a bench).

3.6
stabilizing device
equipment fitted to a wheelchair that can be deployed (by the operator or automatically) to increase the base of support (area within all points of ground contact) of the wheelchair to improve its static stability

4 Test methods

4.1 General principle

The testing of multiple configurations required by this document requires careful planning to optimize efficiency of tests. In some cases, tests in one configuration might automatically meet the requirements of another configuration. Some protocols aim to test the performance and properties of the OABSS and its effect on the wheelchair as a whole, while others focus on individual system requirements. A test facility's rationale for determining that a particular configuration meets the requirements of another configuration shall be reported in the test report. Test facilities shall indicate how they have achieved the intended outcome for each test setup in the OABSS configuration selected.

EXAMPLE Least stable – forward: by extending & raising the leg supports, putting the back support in minimal recline and maximum forward tilt, the combined centre of mass is as close to the front castors as possible.

4.2 Test preparation

Select a test dummy or a human occupant as specified in ISO 7176-11 of mass equal to the maximum occupant mass specified by the manufacturer for all cases except for static stability testing. Until ISO 7176-11 is revised to incorporate centres of mass advice for test dummies in the supine position, the "least stable" test of static stability (5.2 in this document) will usually occur with a test dummy of 100 kg mass or the maximum allowable mass and consequently both conditions shall be tested

The test dummy shall be held in place for testing with the knee/lower leg, the hip/upper torso and any other supports provided on the wheelchairs for changing occupant posture. If these supports are not adequate for supporting the test dummy, then straps with an elastic modulus of 2 N/mm to 5 N/mm of extension can be used in areas where needed.

A human test occupant may be used instead of a test dummy. The mass and mass distribution of the human occupant shall be within the tolerances specified in ISO 7176-11. This can be achieved by adding weights to the human occupant.

WARNING — Where a human test occupant is used, it is essential that appropriate precautions be taken to ensure the person's safety.

4.3 Determining the maximum drivable configuration

Fit the wheelchair with the test dummy or a human as specified in 4.2.

Determine the OABSS configuration closest to the MAC which still allows the wheelchair to move in the horizontal plane:

— and traverse up a step of 10 mm ± 2 mm, and

— for electrically powered wheelchairs, achieve a speed greater than 0,2 m/s.

ISO 7176-10 sets a nominal initial step height of 10 mm. If a different height is selected, this shall be reported in the test report against the description of the MDC. Where multiple configurations are possible, multiple MACs should be assessed using an iterative approach where necessary.

Movement that results through the operation of a freewheel mode is not considered as part of this configuration (i.e. gearboxes/motors shall remain engaged throughout the test).

If the operator's manual requires the operation of parking brakes prior to a particular OABSS adjustment, the wheelchair is not considered to be able to move in the horizontal plane for that adjustment.

Record the settings of the wheelchair in this configuration as the MDC.

4.4 Order of testing

Wheelchair testing shall be in any order of the ISO 7176 series, although most laboratories will choose to complete ISO 7176-8 as the final tests.

If the wheelchair meets multiple maximum configurations (full stand vs full recline), it shall be tested in the MAC or MDC of the multiple configurations which apply unless certain configuration combinations are not possible. Under circumstances where multiple maximum configurations are not possible to be used in combination or are not recommended by the manufacturer (and these recommendations are clearly indicated by sufficient labelling), then the wheelchair shall be tested in the maximum recommended inclination, raise or stand as specified by the manufacturer. Such test configurations shall be clearly documented in the test report.

Disconnecting interlocks is not required.

5 General requirements

5.1 Application

This clause applies to all wheelchairs for changing occupant posture.

5.2 Static stability

Test the wheelchair in accordance with ISO 7176-1 with the following changes:

a) Add the configurations from Table 1 of this document which lists extra configurations for static testing to ISO 7176-1, to Tables 1 to 3 of ISO 7176-1:2014.

b) Where the wheelchair deploys stabilizing devices in certain configurations:

   1) The "least stable" configuration is likely to occur prior to these devices contacting the ground.

2) Stability for the relevant clause of ISO 7176-1 should be recorded in this "least stable" configuration, and again when the device is in the maximum adjustable configuration with stabilizing devices fully deployed.

3) If it is possible for the operator to switch off the deployment of or remove (without tools) stabilizing devices, each relevant test in ISO 7176-1 shall be repeated in the "least stable" configuration without deploying the stabilizing devices.

4) Replace Table 4 of ISO 7176-1:2014 with Table 2 of this document which lists static stability test results of OABSS.

Table 1 — Extra configurations for static testing according to ISO 7176-1

Adjustable wheelchair component	Least stable	Most stable
Body support system, supporting occupant in standing	Full standing setting[a]	Seated setting[b]
Whole body elevating postural support	Highest elevation	Lowest elevation
[a] Holding occupant in an upright standing position with hips and knees fully extended (if possible).		
[b] Supporting occupant in a typical seated posture – hips and knees flexed at approximately 90°.		

Table 2 — Static stability test results

Wheelchair tipping angle (degrees)				
Stability direction		Least stable	Most stable	Least stable – Without stabilizers[c]
Forward	Front wheels locked			
	Front wheels unlocked			
Rearward	Rear wheels locked			
	Rear wheels unlocked			
Lateral orientation[a]	Left			
	Right			
Anti-tip device tipping angle				
Stability direction		Least effective	Most effective	Does device prevent tipping over?
Anti-tip device[b]	Rearward			
	Forward			
Specify whether any active-stability system was operational during any test and annotate the above table accordingly.				
[a] With lockable wheels locked.				
[b] With the wheelchair in "least stable" configuration (see ISO 7176-1:2014, 11.2.2 and 11.2.3).				
[c] Only applicable where operator can prevent deployment of stabilizer(s).				

5.3 Dynamic stability of electrically powered wheelchairs

Test the power wheelchair in accordance with ISO 7176-2 with the following changes:

a) Add the configurations from Table 3 of this document which lists extra configurations for dynamic stability testing according to ISO 7176-2:2017, Tables 1 to 3, (rearward, forward and lateral stability).

Table 3 — Extra configurations for dynamic stability testing according to ISO 7176-2

Adjustable wheelchair component	Least stable
Body support system, supporting occupant in standing	Maximum drivable configuration (MDC)
Whole body elevating postural support	MDC; speed limiting systems can require iteration to determine the "least stable"
NOTE In general the "least stable" dynamic stability will be in the MDC due to the speed attainable, but in some cases, devices are less stable dynamically when operating in crawl mode and this can be verified through testing.	

b) Where the wheelchair deploys stabilizing devices in certain configurations:

1) The "least stable" configuration is likely to occur prior to these devices contacting the ground.

2) Stability for the relevant clause of ISO 7176-2 should be recorded in this "least stable" configuration, and again when the device is in the maximum drivable configuration with stabilizing devices fully deployed.

3) If it is possible for the operator to disable the deployment of stabilizing devices, each relevant test in ISO 7176-2 shall be repeated in the "least stable" configuration without deploying the stabilizing devices.

c) Where the wheelchair has multiple OABSS which can be tested together to create the "least stable" configuration, test together. If unable to be tested together, these shall be tested separately. All other "least stable" options listed in ISO 7176-2:2017, Tables 1 to 3 shall be tested together where possible.

EXAMPLE Tilt, recline or elevation positions cannot be achieved while the chair is in the full standing setting.

5.4 Efficiency of brakes

Test the wheelchair in accordance with ISO 7176-3 with the following addition:

For power wheelchairs, repeat ISO 7176-3:2012, 7.3 to 7.5 with OABSS in MDC.

5.5 Overall dimensions

Test the wheelchair in accordance with ISO 7176-5 with the following additions:

a) Measure the maximum overall height, width, and length with the wheelchair in the SRC, MAC and MDC.

b) Measure the dimensions specified in ISO 7176-5:2008, 9.3 in the MDC.

5.6 Strength tests

5.6.1 General

Test the wheelchair in accordance with ISO 7176-8:2014, Clauses 8, 9 and 10, with the following additions (in 5.6.2 and 5.6.3) if the MDC is different to the SRC:

5.6.2 Multi drum test

Apply the requirements of ISO 7176-8:2014 with the modification to 6.1 and 10.3.2 of ISO 7176-8:2014 below.

Replace paragraph 2 of ISO 7176-8:2014, 6.1 with:

“On a wheelchair with OABSS mechanisms, operate all mechanisms to move them off any locks or similar "docked" position (e.g. tilt the seat/back support system so that the mechanism bears the load of the seat system) but not more than 5° of angular movement or 1 0 mm of linear movement depending on the type of actuator/movement. If an electrically powered wheelchair does not drive in this position, reduce the adjustment until it does.”

Replace ISO 7176-8:2014, 10.3.2 with:

“Run the machine until the “reference drum” has completed 200 000 revolutions.

If the wheelchair drives not only in SRC but also in other modes with seat elevation, standing, recline or tilt the wheelchair shall be drum tested for 10 % of the time that it drives in each of those configurations that it drives in at full speed. The drum testing shall be conducted at 1 m/s if the wheelchair goes into reduced speed mode setting for seat elevation, standing, recline or tilt shall be drum tested at a reduced speed testing. The drum test speed shall be reduced by reducing 1 m/s by the same percentage of speed reduction. The normal testing shall be performed first.

If the speed of the machine coincides with a resonant frequency of the wheelchair, adjust the speed within the permitted tolerance to avoid resonance.

For manual wheelchairs in SRC, the drum testing also shall be conducted at 1 m/s. Only for manual wheelchairs run in OABSS configuration at reduced speed. Only a 30 % reduction in speed should occur.

If the manufacturer claims that the wheelchair exceeds the minimum requirement, extend the test until the claimed number of cycles has been completed.”

NOTE A 30 % reduction in speed will reduce the energy of the impacts from the slats by 50 %.

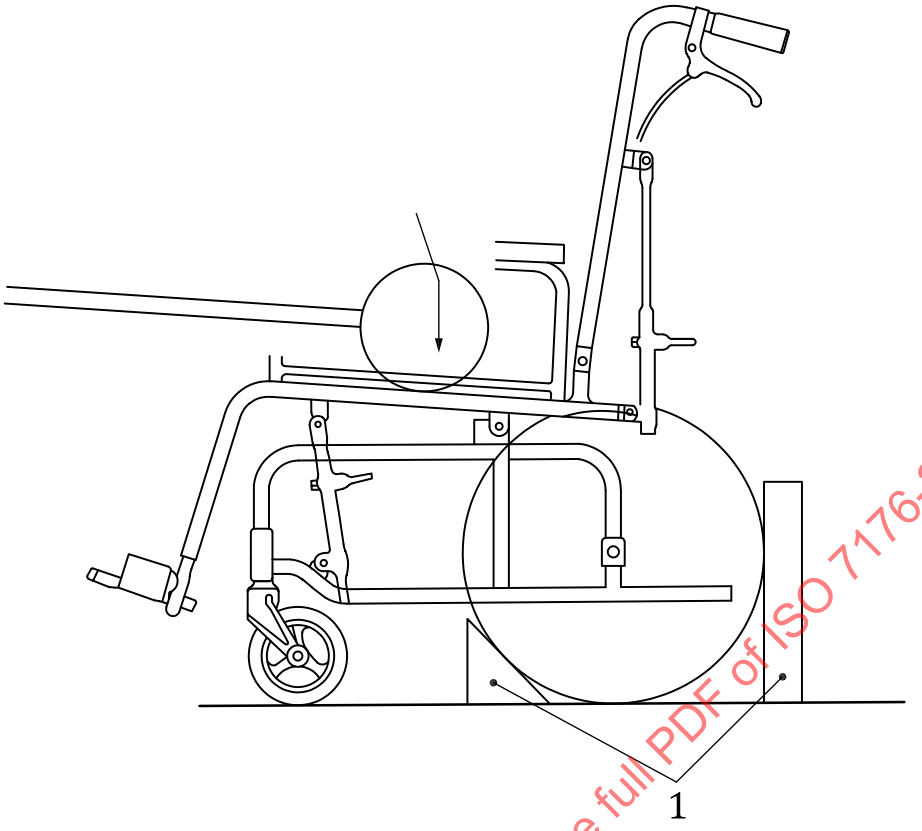
For example, a wheelchair that has reduced speed settings for tilt, recline, seat elevation and standing mode shall be run 10 % in each of these modes which will be 40 % of the cycles, and if the wheelchair has full speed with some tilt and some recline and some elevation, it shall be tested in each of these modes 10 % and thereby totalling another 30 %. So, the remaining number of cycle in full speed mode for SRC would be 30 %.

5.6.3 Seat impact strength - Test method

a) If the seat inclination is adjustable, that inclination shall be set at 5° ± 2°. Otherwise set in the SRC.

b) The impact is applied to a point 75 mm ± 25 mm posterior to the front edge of the seat surface.

c) The impact pendulum shall be as specified in ISO 7176-8:2014, 5.5 and be applied to the surface of the seat perpendicularly.



Key

1 stopper

Figure 1 — Impact strength test for seat

The test method shall be as follows.

a) Set the test unit on a flat surface. The castor wheels shall not be fixed but the drive wheels shall be fixed so that the impact load can be applied perpendicularly to the seat surface as shown in Figure 1.

b) Raise the pendulum to 180 mm height from the seat surface to be impacted and release it freely to hit the seat.

c) Repeat this 10 times.

5.7 Wheelchairs for use as a seat in a motor vehicle

If the manufacturer specifies that the intended use of the wheelchair includes use as a seat in a motor vehicle by a person of mass equal to or greater than 22 kg, the wheelchair shall conform to the performance requirements of ISO 7176-19.

OABSS wheelchairs should be tested in the manufacturer's specified position for transport.

Conformity with ISO 7176-19 can be demonstrated by type testing a model variant within the same make.

NOTE It is recognized that single sample testing does not mean that every variation of a given wheelchair model will exhibit exactly the same performance behaviour in crash situations. However, it is also recognized that it is not feasible for manufacturers to independently test every variation of a given wheelchair model.

As such, the expectation is that wheelchair manufacturers will test a suitably representative test sample (or test samples). Where manufacturers make any subsequent claims of conformity they ensure that the test sample is adequately representative of the model variation for which conformity is claimed.

This will be determined by critical assessment of design data, with consideration of design factors and options that alter the structural performance of the chair. Where representative assumptions are made, manufacturers ensure adequate safety factors are incorporated into critical design elements.

In addition, where requested, manufacturers make details of the test sample configuration, options and setup available to suppliers and/or purchasers.

5.8 Climatic tests for wheelchairs for changing occupant postures

Test the wheelchair in accordance with ISO 7176-9 for electric-powered OABSS.

5.9 Back support strength

Test the back support in accordance with ISO 16840-3:2014, 9.4 with the following changes:

a) Test the back support in the SRC within the wheelchair frame, position a rigid stop against the rear wheels of wheelchairs with tilt and/or recline and attach a restraint to a forward part of the frame to prevent the wheelchair from tipping backwards beyond the balance point.

b) Test to 1 000 cycles.

5.10 Requirements for the operation force of levers

This test shall be applied where any OABSS is operated with a lever (or levers). The test method shall be carried out as specified in ISO 7176-3:2012, Annex A. All levers and controls for use by the operator shall meet the following requirements.

Where postural support devices are intended to be changed by an operator while the seating support system is occupied, the controls to achieve that change shall not

a) require any component to be detached,

b) require the use of tools, and

c) require the use of force normal to the movement exceeding:

   — 60 N for combined hand and arm operation;

   — 13,5 N for operation by one hand;

   — 5 N for operation by one finger;

   — 100 N for operation by pushing with a foot;

   — 60 N for operation by pulling with a foot.

If it is not obvious how to operate the control, the operation should be shown in the user manual and/or marking on the wheelchair.

NOTE The operating forces specified in this clause are derived from ISO 9355-3 where maximum recommended force for a normal adult is given, considering the direction of force applied.

6 Specific requirements for electrically powered wheelchairs and scooters.

6.1 Electrical, power and other controls and mechanisms

The wheelchair shall meet the requirements of ISO 7176-14, ISO 7176-21 and ISO 7176-25.

6.2 Theoretical range/postural cycles of electrically powered wheelchairs and scooters due to the energy consumption of the OABSS

Test the wheelchair in accordance with ISO 7176-4 with the addition of either 6.2.1 or 6.2.2, depending on the battery type of the powered wheelchair:

6.2.1 For OABSS's which share a power source with the wheelchair's drive system — Modified theoretical range

a) At the completion of ISO 7176-4:2008, 7.2, repeat the wheelchair preparation as specified in ISO 7176-4:2008, Clause 6.

b) Actuate each powered postural adjustment in turn, from locked and seated position (SRC) to MAC. Then reverse each of the actuators in turn to return the OABSS to the original position. This represents a complete posture change cycle.

c) Repeat b) 20 times (20 complete cycles).

d) Record the total electrical energy consumed by the wheelchair, expressed in watt-hours.

NOTE The total amp-hour reading for the 20 complete cycles (P) typically represents the amp-hours consumed during one day of normal use of the mechanisms to change posture.

e) Obtain the results according to the procedure of ISO 7176-4 as recorded on the test report (calculated range of the wheelchair (km) and the battery capacity (watt-hours) at the 5 h rate.

f) Calculate the reduction of range using the following formula:

$$R_r = R_c \, E_a / E_{BAT}$$

where

R_r is the reduction of range of the OABSS wheelchair resulting from one day of normal use expressed in kilometres;

E_a is the total electrical energy consumed from one day of normal use of the OABSS actuators expressed in watt-hours;

R_c is the theoretical continuous driving range, expressed in kilometres;

E_{BAT} is the nominal energy capacity of the wheelchair's battery set, expressed in watt hours according to ISO 7176-4.

g) Record results.

6.2.2 For OABSS's which have a separate power source dedicated to the OABSS — Theoretical cycle capacity

a) Complete the 6.2.1 a) and b).

b) Record the total electrical energy consumed by the OABSS mechanism, expressed in watt-hours.

c) Calculate the number of posture change cycles on a full battery charge using the following formula:

$$S = E_{BAT} / E_{cycle}$$

where

S is the number of complete posture change cycles per full battery charge;

E_{cycle} is the total electrical energy consumed for a complete cycle of the mechanism for changing occupant posture expressed in watt-hours.

6.3 Test methods of maximum speed of electrically powered wheelchairs

Test the wheelchair in accordance with ISO 7176-6 with the following additions:

a) Repeat Clause 6 for any applicable operator adjustable body support systems (OABSS) in maximum drivable configuration (MDC) as specified by the manufacturer.

b) Replace Table 1 of ISO 7176-6:2001 with Table 4 of this document which lists extra configurations for maximum speed of electrically powered wheelchairs according to ISO 7176-6.

Table 4 — Extra configurations for maximum speed of electrically powered wheelchairs according to ISO 7176-6

		SRC	MDC_1	MDC_2
Maximum speed (v_{mm}) m/s	Forwards, horizontal			
	Rearwards, horizontal			
MDC_1, MDC_2 represent two different possible MDCs for multiple posture control extremes. If there are more than two MDC, add extra columns and label accordingly.				

6.4 Obstacle climbing — Determination of obstacle climbing ability of electrically powered wheelchairs

Test the wheelchair in accordance with ISO 7176-10 with the following additions:

a) Repeat the test for the relevant MDC for climbing and descending a test obstacle to determine the maximum obstacle height achieved.

b) Disclose the achieved height in millimetres.

7 Specific requirements for wheelchairs with either an electrically or manually operated body support system for occupant not exceeding 150 kg - Back support applied wheelchair tip fatigue strength

7.1 General

Occupied wheelchairs can often be tipped backward by assistants when manoeuvring them. The tipping action can put considerable stress on the back support and related components. It is important that a wheelchair that can be tipped in this way is able to withstand repeated tipping without damage.

7.2 Requirement

This requirement applies only to wheelchairs where the maximum occupant mass is not greater than 150 kg and where the intended use includes tipping the occupied wheelchair backward about the rear wheel axles by use of the push handles.

After the wheelchair has been subjected to the test specified in 7.1.3, no part of the back support shall have moved from the pre-set position and the wheelchair shall meet the requirements of ISO 7176-8:2014, 4.1.

7.3 Test method

a) Set the wheelchair to the SRC.

b) If the position of the rear wheels' axle is adjustable, set the axles to the most rearward and most upward position with respect to the frame in accordance with the manufacturer's instructions for use. If the position of the front wheels is adjustable, set them to the most forward position in accordance with the manufacturer's instructions.

c) The height adjustment of the front casters shall be in accordance to the rear wheel position to result in a seat angle of 4°, or as close as possible to 4°.

d) If the position of the backrest and/or push handles is adjustable, set them to the maximum height in accordance with the manufacturer's instructions.

e) Ensure that the rear wheels are free to rotate, for example by disengaging parking brakes.

f) Restrain the rear wheels using an appropriate means so that the wheelchair can be tipped about the axles of the rear wheels without the wheels moving.

g) Attach the means to tip the wheelchair to the push handles so that it will apply forces horizontally in the opposite direction to the forward direction of travel (see Figure 2), and that the resultant force vector bisects the wheelchair between the push handles. The means of attachment shall not apply any lateral forces to the push handles.

h) Secure the dummy in the wheelchair using appropriate means so that it will remain in position as the wheelchair is tipped and returned to the upright position.

i) Using the means to tip the wheelchair, smoothly tip the loaded wheelchair backwards to the angle where the front wheels are lifted to a height of 50 mm +0/–10 mm above the test surface. Then smoothly return the loaded wheelchair to the upright position. Ensure the push handles are not pushed forward when the wheelchair is upright.

j) Repeat i) for 20 000 cycles at a rate of 10 +2/–0 cycles per minute.

k) Readjustment is permitted no more than 4 times during test.

l) Inspect the wheelchair and determine whether it has met the requirement.

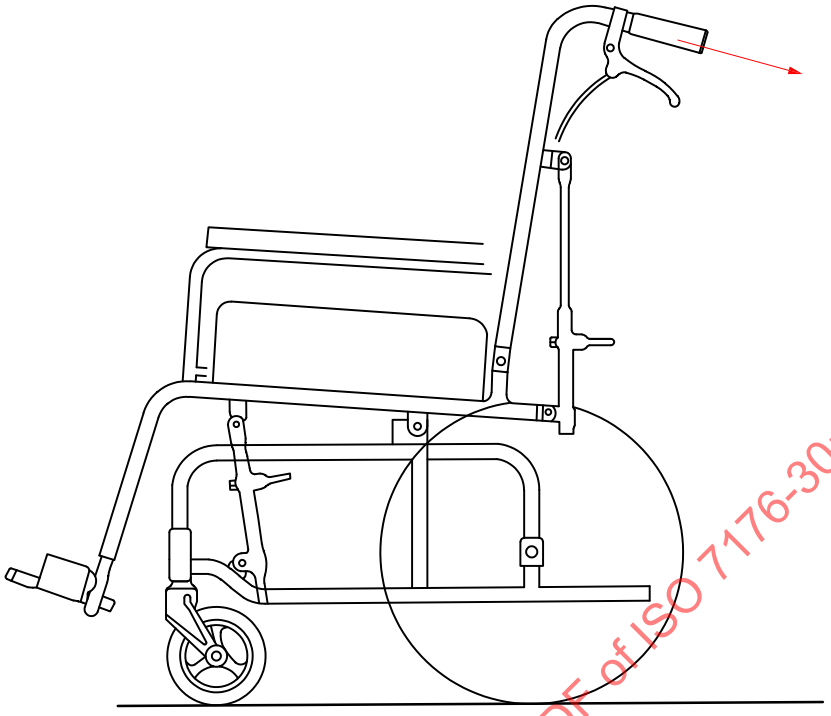


Figure 2 — Repeat test of raising the casters

8 Back-support adjustment force test (unlocked) for reclining type wheelchair

This test shall be applied on wheelchairs with manual adjustment of the back support.

The purpose of this test is to measure the force needed to change the recline of the back support from fully reclined to minimal recline. Tests have indicated that the maximum force to the operator occurs at the maximal recline upon release of mechanical locks. This information will inform the assistant of the necessary force required to change the back support recline with an occupant of maximum rated size.

a) The wheelchair brakes shall be applied, and the test dummy shall be fitted.

b) Fit a means to apply a force equally to the handgrips of the back-support (Figure 3).

c) Any mechanical locks for reclining shall be released so that the back-support can move up and down freely.

d) Measure the vertical force at the push handles required to prevent the back support from further reclining. Use a measuring instrument such as a push-pull gauge. The force shall be measured vertically, at the maximum reclining angle, holding the load 10 seconds after locks are released.

e) Report the force recorded in the test report.

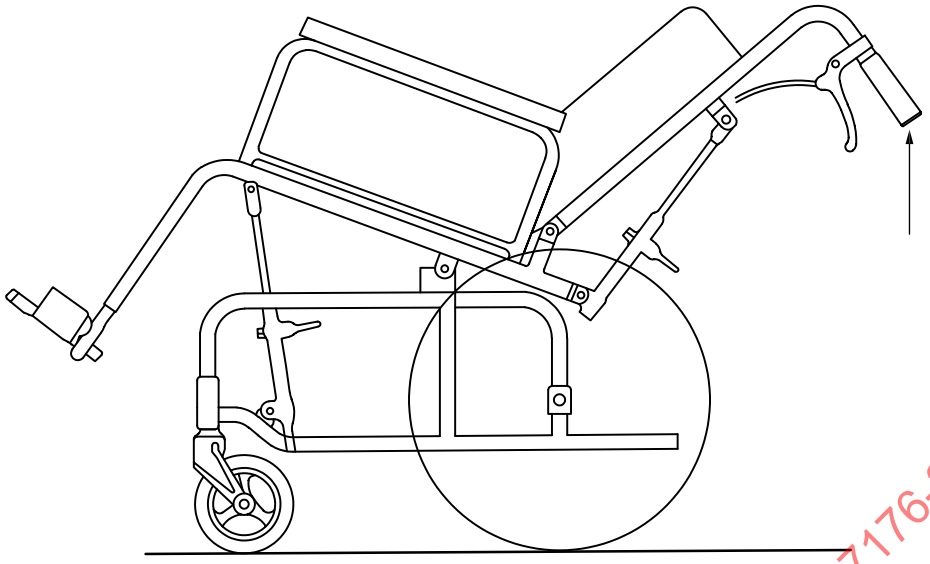


Figure 3 — Measurement of back support adjustment force

9 Specific requirements for wheelchairs with stand-up mechanisms

9.1 Strength test for wheelchairs that incorporate a stand-up mechanism with lower leg support

9.1.1 General

The strength test of the lower leg support ascertains if the support has sufficient strength, with safety margins, to prevent the occupant from falling in any position from standard to stand-up. It shall not be possible to unintentionally disengage the support mechanisms.

The user manual shall contain a requirement about the placement of the lower leg support within certain distance from the knee to prevent the occupant from being injured.

If the wheelchair is not properly designed or adjusted for the wheelchair occupant, injuries to the occupant could occur during transition from sitting to standing. To prevent the injuries, it is highly recommended to follow the recommendations in Annex A.

9.1.2 Test methods

a) Apply a horizontal force F_h, as shown in Figure 4, to the lower leg support, using a 50 mm wide strap to apply the load. If there are separate lower leg supports, apply the force F_h evenly to the supports. The force shall be:

$$F_h = mg$$

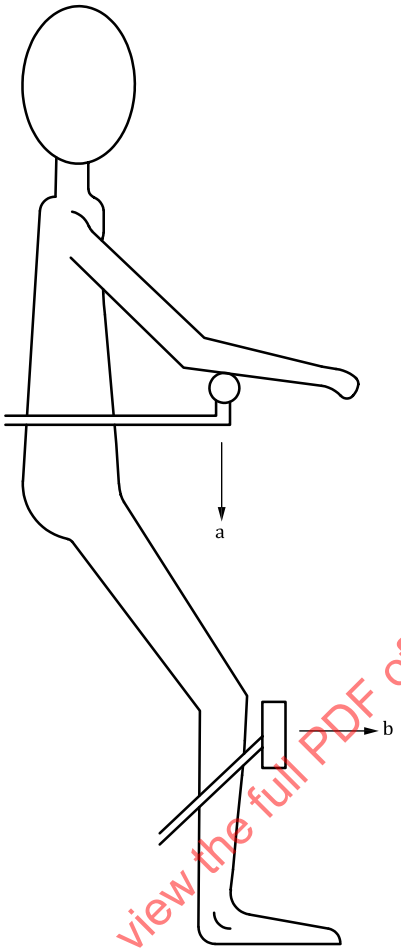
where

F_h is the force in newtons;

m is the maximum allowable mass of the wheelchair occupant that is recommended by the manufacturer in kg;

g is the Earth's gravitational constant (9,81 m/s^2).

b) Inspect the wheelchair and record if the lower leg support is deformed or broken.



a Vertical force to arm support.

b Horizontal force to knee support.

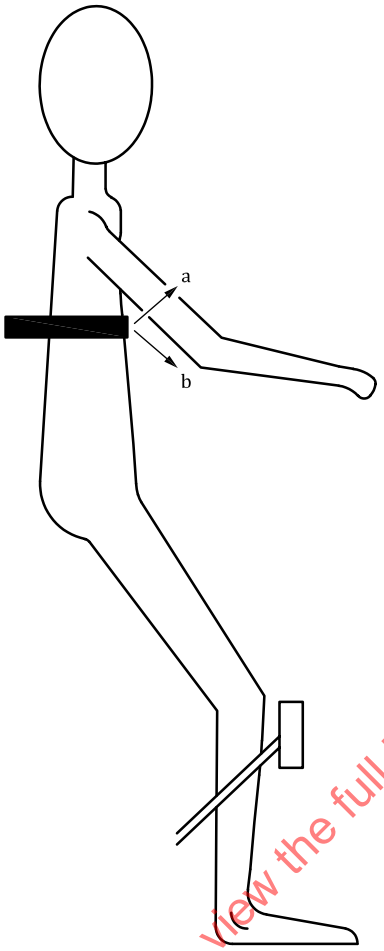
Figure 4 — Force application to knee support and arm supports

9.2 Strength test for the wheelchairs for changing occupant posture which has stand-up mechanism with hip/upper torso support

9.2.1 General

The strength test of the hip/upper torso support ascertains if the support has sufficient strength, with safety margins, to prevent the occupant from falling in any position from seated to standing. It shall not be possible to unintentionally disengage the support mechanisms.

The user manual shall contain a requirement about the placement of the hip/upper torso support to prevent the occupant from being injured.



a Obliquely upward force to hip/upper torso support.

b Obliquely downward force to hip/upper torso support.

Figure 5 — Force application to anterior torso/pelvic supports

9.2.2 Test methods

a) Apply a vertical force F_V, as shown in Figure 4, to the hip/upper torso support, using a 50 mm wide strap to apply the load. The force shall be:

$$F_V = 0{,}70 \cdot mg$$

where

F_V is the force in N;

m is the maximum allowable mass of the wheelchair occupant that is recommended by the manufacturer in kg;

g is the Earth's gravitational constant (9,81 m/s^2).

b) Inspect the wheelchair and record if the hip/upper torso support is deformed or broken.

c) Apply a force F_A, as shown in Figure 5, to the hip/upper torso support, using a 50 mm wide strap to apply the load, at a 45° angle to the horizontal plane. The force shall be: