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

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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*.

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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).

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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 ISO 7176-30:2018
OABSS https://standards.iteh.ai/catalog/standards/sist/f0b8d7c6-6bec-4336-a4b7-4c472922bba/iso-7176-30-2018
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

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4 Test methods

4.1 General principle

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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

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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.

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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).