
Wheelchairs —

Part 3:

Determination of effectiveness of brakes

Fauteuils roulants —

Partie 3: Détermination de l'efficacité des freins

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ISO copyright office
Case postale 56 • CH-1211 Geneva 20
Tel. + 41 22 749 01 11
Fax + 41 22 749 09 47
E-mail copyright@iso.org
Web www.iso.org

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO 7176-3 was prepared by Technical Committee ISO/TC 173, *Technical systems and aids for disabled or handicapped persons*, Subcommittee SC 1, *Wheelchairs*.

This second edition cancels and replaces the first edition (ISO 7176-3:1988), which has been technically revised.

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

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

- *Part 15: Requirements for information disclosure, documentation and labelling*
- *Part 16: Resistance to ignition of upholstered parts — Requirements and test methods*
- *Part 19: Wheeled mobility devices for use in motor vehicles*
- *Part 22: Set-up procedures*
- *Part 23: Requirements and test methods for attendant-operated stair-climbing devices*

The following parts are also on the programme of work:

- *Part 20: Determination of the performance of stand-up type wheelchairs*
- *Part 21: Requirements and test methods for electromagnetic compatibility of electrically powered wheelchairs and motorized scooters*
- *Part 24: Requirements and test methods for user-operated stair-climbing devices*

A Technical Report (ISO/TR 13570:2001, *Guidelines for the application of the ISO 7176 series on wheelchairs*) is also available giving a simplified explanation of these parts of ISO 7176.

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Wheelchairs —

Part 3: Determination of effectiveness of brakes

1 Scope

This part of ISO 7176 specifies test methods for the measurement of the effectiveness of brakes of manual wheelchairs and electrically powered wheelchairs, including scooters, intended to carry one person, with a maximum speed not exceeding 15 km/h. It also specifies disclosure requirements for the manufacturer.

2 Normative references

The following referenced documents are indispensable for the application 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 6440, *Wheelchairs — Nomenclature, terms and definitions*

ISO 7176-6, *Wheelchairs — Part 6: Determination of maximum speed, acceleration and deceleration of electric wheelchairs* <https://standards.iteh.ai/catalog/standards/sist/4aaab84-b920-47de-bcab-b46249e58fed/iso-7176-3-2003>

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

ISO 7176-13, *Wheelchairs — Part 13: Determination of coefficient of friction of test surfaces*

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

ISO 7176-22, *Wheelchairs — Part 22: Set-up procedures*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 6440 and the following apply.

3.1

running brake

means to stop or to slow the wheelchair

3.2

control device

means by which the user directs an electrically powered wheelchair to move at the desired speed and/or in the desired direction of travel

3.3

parking brake

means to keep the wheelchair stationary

3.4 tipping
movement of the wheelchair occurring when the force under its uphill wheels becomes zero whilst negotiating a test slope or when the force under all trailing wheels becomes zero whilst travelling on the horizontal test surface

3.5 sliding
movement of the wheelchair across the test surface without rotation of its braked wheels

4 Principle

A number of wheelchair braking operations are carried out and the resulting responses of the wheelchair are measured and observed.

5 Apparatus

5.1 Rigid, flat, horizontal test plane with a coefficient of friction as specified in ISO 7176-13, of sufficient size to conduct the tests and within a test environment at $20\text{ °C} \pm 10\text{ °C}$.

NOTE 1 An area of approximately 10 m by 3 m is normally of sufficient size.

NOTE 2 The floor of a typical large building used for manufacturing or indoor leisure with, for example, a wooden, concrete, or asphalt floor is acceptable.

5.2 Adjustable test plane, a rigid, flat test plane within a test environment at $20\text{ °C} \pm 10\text{ °C}$, and which:

- a) is large enough to accommodate the test wheelchair;
- b) has a surface which lies between two imaginary parallel planes 5 mm apart throughout the test and which has a coefficient of friction as specified in ISO 7176-13;
- c) has a slope which can be adjusted from the horizontal about a single axis:
 - 1) if the slope of the test plane is increased in a continuous fashion, the rate of increase in the slope should not exceed $1^\circ/\text{s}$ as the angle of wheelchair instability is approached;
 - 2) if the slope of the test plane is increased in a stepwise fashion, the movement between steps should be sufficiently smooth that it does not affect the test results.

NOTE A range of angles from horizontal to 25° is usually adequate for most wheelchairs.

5.3 Rigid, flat, inclined test ramp within a test environment at $20\text{ °C} \pm 10\text{ °C}$, with a coefficient of friction as specified in ISO 7176-13 and with inclinations of $3^\circ \pm 0,5^\circ$, $6^\circ \pm 0,5^\circ$ and $10^\circ \pm 0,5^\circ$ relative to the horizontal.

NOTE 1 This may be either three separate fixed ramps or a single ramp with adjustable inclination.

NOTE 2 An area of approximately 10 m by 3 m is normally of sufficient size for each ramp, but testing of larger wheelchairs may require larger ramps.

5.4 Test dummy, as specified in ISO 7176-11, or a human test driver.

NOTE 1 If a dummy is used, remote control devices may be used to operate the wheelchair controls.

NOTE 2 If a human driver is used, care should be taken during the test to minimize any movement of the driver's position or posture within the chair as this may affect the results.

5.5 Supplementary weights to add to the human test driver to give the mass distribution equivalent to the relevant dummy.

5.6 Braking distance measurement equipment to measure the braking distance of a wheelchair with an accuracy of ± 50 mm.

5.7 Inclinometer to measure the angle of the slope of the test plane with respect to the horizontal to an accuracy of $\pm 0,2^\circ$.

5.8 Force measurement equipment to measure force with an accuracy of 5 % over a range of 10 N to 250 N.

5.9 Repetitive brake operating system to operate the parking brakes from the brake-off position to the brake-on position and return to the brake-off position 60 000 times at a frequency not exceeding 0,5 Hz such that the means does not apply forces in excess of 1,5 times the force required to operate the brakes.

6 Preparation of the test wheelchair

Prepare the test wheelchair as follows before commencing the sequence of tests.

- a) Set up the wheelchair with the test dummy as specified in ISO 7176-22 and add restraints to minimize movement. If a human test driver is used, set up the wheelchair as specified in ISO 7176-2 and with the driver in a position similar to that specified for the test dummy.
- b) For wheelchairs with adjustable brakes, adjust the brakes as specified by the manufacturer in the user manual or, if the manufacturer gives no specification for adjustment, adjust the brakes to give a maximum operating force as specified in Table 1, measured using the method specified in Annex A.

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Table 1 — Maximum operating force

Means of operation	Operating force N
hand	60 ± 5
foot, push	100 ± 10
foot, pull	60 ± 5
finger	$13,5 \pm 2$

The operating forces may not be achievable for some designs of brake. In such cases, the brakes shall be adjusted to give the value as near as practicable to these values.

If the operating force exceeds the value specified in Table 1, the operating force shall be disclosed as specified in Clause 10.

7 Brake performance

WARNING — These tests are potentially hazardous to test personnel. Precautions should be taken.

7.1 General

Perform the tests specified in 7.2 to 7.5. The tests in Clause 7 may be performed in any sequence, but shall be carried out before the tests specified in Clause 8.