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Wheelchairs —

Part 3 :
Determination of efficiency of brakes

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Fauteuils roulants —

Partie 3 : Détermination de l'efficacité des freins [ISO 7176-3:1988](https://standards.iteh.ai/catalog/standards/sist/a392e0a5-4173-4c00-9002-91a01068a7f4/iso-7176-3-1988)

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Reference number
ISO 7176-3 : 1988 (E)

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.

Draft International Standards adopted by the technical committees are circulated to the member bodies for approval before their acceptance as International Standards by the ISO Council. They are approved in accordance with ISO procedures requiring at least 75 % approval by the member bodies voting.

International Standard ISO 7176-3 was prepared by Technical Committee ISO/TC 173, *Technical systems and aids for disabled or handicapped persons*.

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Users should note that all International Standards undergo revision from time to time and that any reference made herein to any other International Standard implies its latest edition, unless otherwise stated.

Wheelchairs —

Part 3 : Determination of efficiency of brakes

0 Introduction

ISO 7176 at present consists of the following parts :

- Part 1 : Determination of static stability.
- Part 2 : Determination of dynamic stability of electric wheelchairs.
- Part 3 : Determination of efficiency of brakes.
- Part 4 : Determination of energy consumption of electric wheelchairs.
- Part 5 : Determination of overall dimensions, mass and turning space.
- Part 6 : Determination of maximum speed, acceleration and retardation of electric wheelchairs.
- Part 7 : Determination of seating dimensions — Definitions and measuring methods.
- Part 8 : Static, impact and fatigue strength for manual wheelchairs.
- 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 controls.

1 Scope and field of application

This part of ISO 7176 specifies methods for determining the efficiency of the brakes of wheelchairs (manual, electric and any others).

2 References

- ISO 6440, *Wheelchairs — Nomenclature, terms and definitions.*
- ISO 7176-6, *Wheelchairs — Part 6 : Determination of maximum speed, acceleration and retardation of electric wheelchairs.*
- ISO 7176-11, *Wheelchairs — Part 11 : Test dummies.*¹⁾
- ISO 7176-13, *Wheelchairs — Part 13 : Determination of coefficient of friction of test surfaces.*¹⁾
- ISO 7930, *Wheelchairs — Type classification based on appearance characteristics.*

3 Definitions

For the purposes of this part of ISO 7176, the definitions given in ISO 6440 apply.

4 Principle

Performance of a number of brake tests which are intended to simulate conditions representing the normal use of a wheelchair. The tests are designed to determine the efficiency of brakes used on manual and electric wheelchairs.

5 Test plane

The tests shall be carried out on a flat and hard plane. For the parking brake tests (7.1), the slope of the test plane shall be adjustable. The surface of the test plane shall have a coefficient of friction as defined in ISO 7176-13.

6 Test wheelchair

Unless otherwise specified and wherever appropriate, the following conditions shall be fulfilled during testing.

¹⁾ At present at the stage of draft.

6.1 The wheelchair shall be fully equipped for normal use including armrests and leg supports with footrests, but excluding seat cushions.

6.2 If the wheelchair has pneumatic tyres, the air pressure in them shall be adjusted in accordance with the manufacturer's instructions. If a pressure range is specified, the highest recommended pressure shall be selected.

6.3 During the tests the wheelchair shall be loaded with a test dummy of appropriate size, constructed and positioned in accordance with ISO 7176-11, or with a person of the same mass. The dummy shall be secured to prevent movement from its position during the tests. If a human equivalent is used, motion of the body from the stated dummy position shall be minimized.

6.4 The body support system, if adjustable, shall be set to correspond to natural sitting posture, with the lowest part of the leg support/footrest 50 mm above the test plane and the seat corresponding to normal sitting height. Body support systems should be set such that the wheelchair is in the most stable configuration. The slope of the seat relative to the horizontal shall be as close as possible to 4°, sloping downwards to the rear. The slope of the backrest relative to the vertical shall be as close as possible to 10° of recline. The angle between the seat and the leg support shall be as close as possible to 90°.

6.5 On electric wheelchairs the batteries (accumulators) shall have at least 75 % of their rated nominal capacity at the start of the tests.

6.6 The wheelchair brakes shall be adjusted as recommended by the manufacturer. If a brake adjustment is not specified by the manufacturer, the chair shall be tested as supplied by the manufacturer.

7 Test procedures

7.1 Parking brake test

On electric wheelchairs, the power system shall be turned off.

7.1.1 With its brakes correctly adjusted and applied fully, position the wheelchair on the test plane such that, when the plane is inclined, the wheelchair is facing down the plane with its castors in the trailing position. Increase the angle of the plane relative to the horizontal until one of the following occurs :

- a) the wheelchair begins to roll down the plane (brake(s) failing to restrain the wheelchair);
- b) the wheelchair begins to slide down the plane (insufficient friction between the wheelchair tyres and the test plane);
- c) the wheelchair becomes unstable (one or more of its wheels lift off the test plane).

7.1.2 Repeat the test specified in 7.1.1 with the wheelchair positioned on the test plane such that, when the plane is inclined, the wheelchair is facing up the plane with its castors in the trailing position.

7.1.3 In each of these tests, note in the test report the maximum slope (to within $\pm 1^\circ$) achieved with the test plane, together with the fact that the test was terminated as a result of one of the following :

- a) brake failure (turning of wheels);
- b) loss of friction (skidding);
- c) instability (tipping).

Also note any other observations relevant to the test.

7.1.4 For braking systems operated by a lever, measure the force required to actuate and maintain the braking effect at the centre of the operating grip and normal to the lever.

7.2 Running brake tests

NOTE — These tests apply only to powered chairs. For testing chairs with automatic brakes only, see 7.2.3.

7.2.1 Conduct braking tests, with the wheelchair travelling at its maximum speed, under each of the following conditions :

- a) travelling forwards on a horizontal plane;
- b) travelling backwards on a horizontal plane;
- c) travelling forwards on a downhill plane with a slope of 5°.

During these tests, actuate the brake(s) to the maximum effect and maintain them in operation until the wheelchair is brought to a stop. Perform each test a minimum of three times.

Record the average braking distance and the maximum speed, together with other observations relevant to the test, such as tracking behaviour, stability, loss of friction and brake failure. The braking distance is defined as the distance travelled from the initiation of the control to the complete stop. The braking distance shall be measured within an accuracy of ± 100 mm.

It is not a requirement of this part of ISO 7176 to measure characteristics such as peak values of retardation, but this may be carried out at the tester's discretion as specified in ISO 7176-6.

7.2.2 Test the effect of raised temperature, induced by continuous use, on the braking systems of powered wheelchairs as follows.

Drive the wheelchair on a horizontal plane. Bring the wheelchair with maximum acceleration to full speed, then bring it to a full stop as quickly as possible. Repeat this procedure 10 times as quickly as possible. Immediately following this, carry out the braking test described in 7.2.1 a).

7.2.3 Determine the automatic braking distance as follows.

Drive the wheelchair at its maximum speed and then release the control mechanism under the following conditions :

- a) travelling forwards on a horizontal plane;
- b) travelling forwards on a downhill plane with a slope of 5°.

Perform each test a minimum of three times.

Record the average braking distance together with any other observation relevant to the test, such as tracking behaviour.

8 Test report

The test report shall contain the following information :

- a) a reference to this part of ISO 7176;
- b) the product type and type designation (see ISO 7930);
- c) the name and address of the manufacturer;
- d) a photograph of the wheelchair equipped as during the tests;
- e) the name and address of the test institution;
- f) the test results as specified in 7.1 and 7.2;
- g) the force, in newtons, required to operate the brakes during the tests;
- h) details of the test load used during the tests.

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