
Wheelchairs —

Part 8:

Requirements and test methods for static,
impact and fatigue strengths

Fauteuils roulants —

*Partie 8: Prescriptions et méthodes d'essai pour la résistance statique, la
résistance aux chocs et la résistance à la fatigue*



Contents

1 Scope	1
2 Normative references	1
3 Definitions	2
4 Requirements	2
4.1 Strength requirements	2
4.2 Disclosure requirements	3
5 Test apparatus	3
6 Preparation of test wheelchair	9
6.1 Equipping the wheelchair	9
6.2 Inflation of pneumatic tyres	10
6.3 Adjustments	10
6.4 Test dummies	11
6.5 Records	12
7 Sequence of tests	12
8 Test methods for static strength	12
8.1 Principle	12
8.2 Wheelchair preparation	12
8.3 Selection of loading pad	13
8.4 Armrests: resistance to downward forces — Test method	13
8.5 Footrests: resistance to downward forces — Test method	14
8.6 Tipping levers — Test method	16
8.7 Handgrips — Test method	18
8.8 Armrests: resistance to upward forces — Test method	20

© ISO 1998

All rights reserved. Unless otherwise specified, no part of this publication may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying and microfilm, without permission in writing from the publisher.

International Organization for Standardization
Case postale 56 • CH-1211 Genève 20 • Switzerland
Internet iso@iso.ch

Printed in Switzerland

8.9 Footrests: resistance to upward forces— Test method	22
8.10 Push handles: resistance to upward load — Test method.....	24
8.11 Records	24
9 Test methods for impact strength	26
9.1 Principle.....	26
9.2 Wheelchair preparation.....	26
9.3 Backrest: resistance to impact — Test method	26
9.4 Handrim: resistance to impact — Test method	27
9.5 Castors: resistance to impact — Test method	28
9.6 Footrests: resistance to impact — Test method	30
9.7 Front structure: resistance to impact — Test method.....	31
9.8 Records	32
10 Fatigue tests — Test method	34
10.1 Principle.....	34
10.2 Preparation of test wheelchair for fatigue tests.....	34
10.3 Restraints of test dummy.....	34
10.4 Two-drum test.....	36
10.5 Drop test	37
10.6 Records	38
11 Evaluation of test results	38
12 Test report	38
Annex A (informative) Principles applied to derive static test loads	40
Annex B (informative) Design considerations	48
Annex C (informative) Derivation of pendulum swing angle for castor and footrest impact tests	49
Annex D (informative) Derivation of pendulum centre of percussion	52
Annex E (informative) Tracking characteristics of wheelchairs	54

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 voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

International Standard ISO 7176-8 was prepared by Technical Committee ISO/TC 173, *Technical Systems and Aids for Disabled or Handicapped Persons*, Subcommittee SC 1, *Wheelchairs*.

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 efficiency of brakes*
- Part 4: *Determination of energy consumption of electric wheelchairs and scooters*
- Part 5: *Determination of overall dimensions, mass and turning space*
- Part 6: *Determination of maximum speed, acceleration and retardation of electric wheelchairs*
- Part 7: *Method of 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 the 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: *Requirements and test methods for resistance to ignition of upholstered parts*
- Part 17: *Serial interface for electric wheelchair controllers*
- Part 18: *Stair traversing devices*
- Part 19: *Wheeled mobility devices for use in motor vehicles*
- Part 20: *Determination of the performance of stand-up type wheelchairs*
- Part 21: *Requirements and test methods for electromagnetic compatibility of powered wheelchairs and motorized scooters.*
- Part 22: *Set up procedure for adjustable wheelchairs.*

Parts 17 to 22 are included in the work programme, but at early stages.

NOTE A technical report will also be made available giving a simplified explanation of these parts of ISO 7176.

Introduction

This part of ISO 7176 calls for the use of procedures that may be injurious to health if adequate precautions are not taken. It refers only to technical suitability and does not absolve the manufacturer or test house from legal obligations relating to health and safety at any stage.

Many wheelchairs have adjustable components and/or alternative parts. Where there is an obligation to ensure that all variations conform to this part of ISO 7176, it is for those commissioning the tests to decide which configurations should be tested.

However, there is also a need to be able to make comparisons between different products; a reference configuration that gives a basis for such comparisons is specified.

It is anticipated that all parts of this International Standard will continue to be developed and future revisions may include the results of ongoing work in the following areas:

- the fatigue testing of electrically powered wheelchairs, and in particular, the speed and size of obstacle of the two-drum test machine;
- requirements for wheelchairs where the mass of the user exceeds 100 kg;
- development of the design recommendations in annex B to normative requirements;
- development of more precisely defined failure criteria, and, in particular, a tracking test to determine if any test damage is acceptable (see annex E);
- consideration whether the fatigue test requirements should be revised for manual wheelchairs intended for 'active users' and fitted with very small castors;
- a more precisely defined set up procedure for the reference configuration of adjustable wheelchairs as given in ISO 7176-22, which is under preparation;
- further development of the test dummies to improve the way in which they load the backs of test wheelchairs, and in particular to improve their suitability for use with wheelchairs with low backrests.

This document is a preview generated by EVS

Wheelchairs —

Part 8:

Requirements and test methods for static, impact and fatigue strengths

1 Scope

This part of ISO 7176 specifies requirements for static, impact and fatigue strength of wheelchairs including scooters intended for users whose mass does not exceed 100 kg. It specifies the test methods for determining whether the requirements have been met. It also specifies requirements for disclosure of the test results.

The test methods may also be used to verify manufacturers' claims that a product exceeds the minimum requirements of this part of ISO 7176.

A reference configuration is specified for adjustable wheelchairs and scooters to enable test results to be used for the comparison of performance.

It applies to occupant- and attendant-propelled manual wheelchairs and electrically powered wheelchairs intended to provide indoor and outdoor mobility for people with disabilities. For electrically powered wheelchairs, it applies to those with a maximum speed of not more than 15 km/h where not more than two wheels are driven and which have three or more wheels located on two parallel, transverse axes.

NOTE 1 This part of ISO 7176 does not apply to wheelchairs where the wheels lie on more than two axes (e.g. in 'diamond' configuration).

NOTE 2 Clauses of this part of ISO 7176 may be used as a basis for developing requirements and test methods for wheelchairs not covered by this part of ISO 7176.

The application of this part of ISO 7176 is limited to wheelchairs with a maximum occupant mass of 100 kg because this is the maximum mass of test dummy available in ISO 7176-11. Further work is needed to investigate the effects of the lifestyle of people with larger body masses.

NOTE 3 For the purposes of this part of ISO 7176, "wheelchair(s)" is used as an abbreviation for manual wheelchair(s) or electrically powered wheelchair(s), including scooter(s), to which the requirements and test methods are applied.

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this part of ISO 7176. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this part of ISO 7176 are encouraged to investigate the possibility of applying the most recent editions of the standards listed below. Members of IEC and ISO maintain registers of currently valid International Standards.

ISO 845: 1988, *Cellular plastics and rubbers — Determination of apparent (bulk) density*.

ISO 2439: 1997, *Flexible cellular polymeric materials — Determination of hardness (indentation technique)*.

ISO 6440:1985, *Wheelchairs — Nomenclature, terms and definitions*.

ISO 7176-6: 1988, *Wheelchairs — Part 6: Determination of maximum speed acceleration and retardation of electric wheelchairs*.

ISO 7176-7:—¹⁾, *Wheelchairs — Part 7: Method of measurement of seating and wheel dimensions*.

ISO 7176-11: 1992, *Wheelchairs — Part 11: Test dummies*.

ISO 7176-15: 1996, *Wheelchairs — Part 15: Requirements for information disclosure, documentation and labelling*.

3 Definitions

For the purposes of this part of ISO 7176, the definitions given in ISO 6440, ISO 7176-11 and ISO 7176-7 and the following definitions apply.

- 3.1 maximum user mass:** Maximum mass of user specified by the wheelchair manufacturer.
- 3.2 specification sheets:** Manufacturer's pre-sale literature that gives wheelchair performance information.
- 3.3 footpiece(s):** Component(s) used to replace the lower leg portion of the standard test dummies.
- 3.4 negative camber:** Situation when the wheels are inclined towards each other so that the tops of the wheels are closer to each other than the bottoms.
- 3.5 test dummy back:** Rear face of the body portion of the test dummy (see reference plane in figure 4).

4 Requirements

4.1 Strength requirements

When tested in accordance with clauses 8, 9 and 10, a single wheelchair shall meet all the following requirements at the conclusion of all the tests.

- a) No component shall be fractured or have visible cracks.

NOTE — Cracks in surface finishes, such as paint, that do not extend into the structural material do not constitute a failure.

- b) No nut, bolt, screw, locking-pin, adjustable component or similar item shall have become detached after having been tightened, adjusted or refitted once. However, in addition, footrests may be adjusted after each of the two footrest impact tests (see 9.6).
- c) No electrical connector shall be displaced or disconnected.
- d) All parts intended to be removable, folding or adjustable shall operate as described by the manufacturer.
- e) All power-operated systems shall operate as described by the manufacturer.
- f) Handgrips shall not be displaced.
- g) Any multiposition or adjustable component shall not be displaced from the preset position, except as permitted in 4.1b).

¹⁾ To be published.