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Wheelchairs —

Part 21: Requirements and test methods for electromagnetic compatibility of electrically powered wheelchairs and scooters, and battery chargers

Fauteuils roulants —
Partie 21: Exigences et méthodes d'essai pour la compatibilité des fauteuils roulants électriques et scooters motorisés

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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 7176-21 was prepared by Technical Committee ISO/TC 173, *Assistive products for persons with disability*, Subcommittee SC 1, *Wheelchairs*.

This second edition cancels and replaces the first edition (ISO 7176-21:2003), 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 effectiveness of brakes*

— *Part 4: Energy consumption of electric wheelchairs and scooters for determination of theoretical distance range*

— *Part 5: Determination of dimensions, mass and manoeuvring 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 electrically powered wheelchairs*

— *Part 11: Test dummies*

— *Part 13: Determination of coefficient of friction of test surfaces*

— *Part 14: Power and control systems for electrically powered wheelchairs and scooters — 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 as seats in motor vehicles*

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

— *Part 22: Set-up procedures*

— *Part 23: Requirements and test methods for attendant-operated stair-climbing devices*

— *Part 24: Requirements and test methods for user-operated stair-climbing devices*

— *Part 26: Vocabulary*

A Technical Report (ISO/TR 13570-1, *Wheelchairs — Part 1: Guidelines for the application of the ISO 7176 series on wheelchairs*) is also available, giving information on how to use the ISO 7176 standards when selecting a wheelchair and helping readers to understand the purpose for, and content of, the International Standards on wheelchairs.

Introduction

Electrically powered wheelchairs and their battery chargers are meant to operate without introducing significant electromagnetic disturbances into the environment and without significant degradation of operational performance in the presence of electromagnetic disturbances expected in normal use. Wheelchairs are often used near roads and therefore should be immune to radio frequency fields from both static and mobile communications equipment, as well as from other sources of electromagnetic disturbance. Injury could occur in the event of unintentional movement or change in direction of movement of a wheelchair.

This part of ISO 7176 specifies requirements and test methods for wheelchairs and their battery chargers to minimize the risks associated with their exposure to reasonably foreseeable electromagnetic interference and electrostatic discharge and with their production of electromagnetic fields that could impair the operation of other devices or equipment in their usual environment.

The upper frequency limit and test level for radiated r.f. immunity requirements are selected according to the environment in which the wheelchair is used and the related risk. Hence the requirements for a wheelchair while it is driving are consistent with its use as a medical device, but the requirements for charging are consistent with use of the wheelchair and charger as domestic electrical equipment.

Wheelchairs —

Part 21: Requirements and test methods for electromagnetic compatibility of electrically powered wheelchairs and scooters, and battery chargers

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

1 Scope

This part of ISO 7176 specifies requirements and test methods for electromagnetic emissions and for electromagnetic immunity of electrically powered wheelchairs and scooters with a maximum speed of not more than 15 km/h intended for indoor and/or outdoor use by people with disabilities. It is also applicable to manual wheelchairs with an add-on power kit. It is not applicable to vehicles designed to carry more than one person.

This part of ISO 7176 also specifies requirements and test methods for the electromagnetic compatibility of battery chargers intended for use with electrically powered wheelchairs and scooters.

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

NOTE The term “wheelchair” is used in this part of ISO 7176 to cover electrically powered wheelchairs, scooters and manual wheelchairs with an add-on power kit.

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

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

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

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

IEC 61000-3-2, *Electromagnetic compatibility (EMC) — Part 3-2: Limits — Limits for harmonic current emissions (equipment input current ⩽ 16 A per phase)*

IEC 61000-3-3, *Electromagnetic compatibility (EMC) — Part 3-3: Limits — Limitation of voltage changes, voltage fluctuations and flicker in public low-voltage supply systems, for equipment with rated current ⩽ 16 A per phase and not subject to conditional connection*

IEC 61000-4-2, *Electromagnetic compatibility (EMC) — Part 4-2: Testing and measurement techniques — Electrostatic discharge immunity test*

IEC 61000-4-3, *Electromagnetic compatibility (EMC) — Part 4-3: Testing and measurement techniques — Radiated, radio-frequency, electromagnetic field immunity test*

IEC 61000-4-4, *Electromagnetic compatibility (EMC) — Part 4-4: Testing and measurement techniques — Electrical fast transient/burst immunity test*

IEC 61000-4-5, *Electromagnetic compatibility (EMC) — Part 4-5: Testing and measurement techniques — Surge immunity test*

IEC 61000-4-6, *Electromagnetic compatibility (EMC) — Part 4-6: Testing and measurement techniques — Immunity to conducted disturbances, induced by radio-frequency fields*

IEC 61000-4-8, *Electromagnetic compatibility (EMC) — Part 4-8: Testing and measurement techniques — Power frequency magnetic field immunity test*

IEC 61000-4-11, *Electromagnetic compatibility (EMC) — Part 4-11: Testing and measurement techniques — Voltage dips, short interruptions and voltage variations immunity tests*

CISPR 11, *Industrial, scientific and medical (ISM) radio-frequency equipment — Electromagnetic disturbance characteristics — Limits and methods of measurement*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

3.1
drive wheel
wheel, or one of a set of wheels, that propels the wheelchair

3.2
front vertical plane
plane normal to the forward direction of travel and tangential to the front edge of the furthest forward wheel

See Figure 1.

3.3
rear vertical plane
plane normal to the forward direction of travel and tangential to the back edge of the rearmost wheel

See Figure 1.

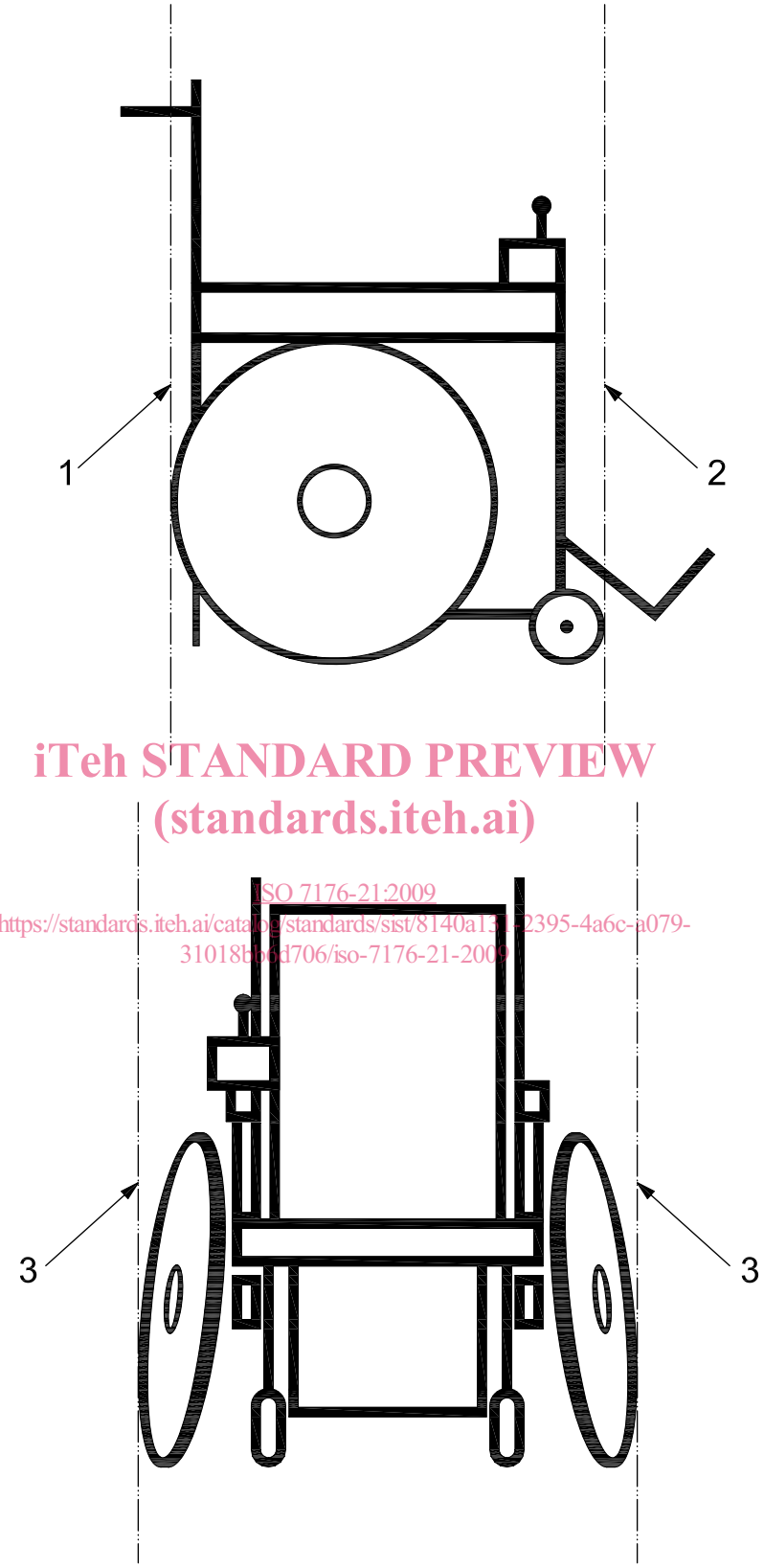
3.4
side vertical plane
plane parallel to the forward direction of travel and tangential to the outer edge of the outermost wheel on the side of the wheelchair

See Figure 1.

3.5
off-board battery charger
free-standing, self-contained battery charger separate from the wheelchair

3.6
carry-on battery charger
off-board battery charger intended for transportation on the wheelchair

3.7
on-board battery charger
battery charger that is built into the wheelchair and cannot be removed without the use of tools



Key

1 rear vertical plane
2 front vertical plane
3 side vertical plane

Figure 1 — Reference planes

4 Classification of electrically powered wheelchairs

Electrically powered wheelchairs are classified as follows:

— category A: wheelchairs with electronic differential steering and electronic brake control;

— category B: wheelchairs with electronic speed control, electronic servo steering and electronic brake control;

— category C: wheelchairs with electronic speed control, manual steering and electronic brake control;

— category D: wheelchairs with electronic differential steering and manual brake control;

— category E: wheelchairs with electronic speed control, electronic servo steering and manual brake control;

— category F: wheelchairs with electronic speed control, manual steering and manual brake control;

— category G: wheelchairs with a simple on-off motor, manual steering and manual brake control.

NOTE A wheelchair can fall into more than one category.

5 Requirements

5.1 General

All wheelchairs shall meet the requirements of 5.2.

Wheelchairs with an on-board battery charger shall also meet the requirements of 5.3.

Off-board and carry-on battery chargers shall meet the requirements of 5.4.

NOTE An observation period of 2 s is specified in many of the requirements of 5.2, 5.3 and 5.4. This is not intended to imply that it is acceptable for the wheelchair or charger under test to fail after the observation period has elapsed. An indefinite observation period is impractical and it is assumed that if the wheelchair or charger does fail during a test, it will fail within 2 s of a test event.

5.2 Wheelchair drives

5.2.1 Radiated emissions

When tested in accordance with 9.2.1, the wheelchair shall meet the radiated emissions limits specified in CISPR 11 for group 1, class B equipment.

5.2.2 Electrostatic discharge immunity

Prior to and at the conclusion of testing in accordance with 10.1.1.1 and 10.1.1.2, the wheelchair shall meet the functional requirement specified in ISO 7176-9 (see also Clause 8).

When the wheelchair is tested in accordance with 10.1.1.1, using test levels of ± 2 kV, ± 4 kV and ± 6 kV for contact discharges and test levels of ± 2 kV, ± 4 kV and ± 8 kV for air discharges, and when the wheelchair is tested in accordance with 10.1.1.2 using a test level of ± 8 kV:

a) the drive system of the wheelchair shall meet the requirements of 5.2.5 during each discharge and for 2 s following each discharge or set of discharges if a programmable ESD generator is used;

b) electrically powered devices that are not used for driving (such as servo-assisted leg supports and seating systems with stand-up functions) shall not move during each discharge and for 2 s following each discharge or set of discharges if a programmable ESD generator is used.

5.2.3 Radiated r.f. field immunity

Prior to and at the conclusion of testing in accordance with 10.2.1, the wheelchair shall meet the functional requirement specified in ISO 7176-9 (see also Clause 8).

When the wheelchair is tested in accordance with 10.2.1, using a test level of 20 V/m, from 26 MHz to 2,5 GHz:

a) the drive system of the wheelchair shall meet the requirements of 5.2.5 in the presence of the applied radio frequency (r.f.) field;

b) electrically-powered devices that are not used for driving (such as servo-assisted leg supports and seating systems with stand-up functions) shall not move in the presence of the applied r.f. field.

5.2.4 Power frequency magnetic field immunity

Prior to and at the conclusion of testing in accordance with 10.6, the wheelchair shall meet the functional requirement specified in ISO 7176-9 (see also Clause 8).

When the wheelchair is tested in accordance with 10.6, using test level 4 specified in IEC 61000-4-8, at 50 Hz and 60 Hz:

a) the drive system of the wheelchair shall meet the requirements of 5.2.5 in the presence of the applied field;

b) electrically-powered devices that are not used for driving (such as servo-assisted leg supports and seating systems with stand-up functions) shall not move in the presence of the applied field.

NOTE Other magnetic field immunity requirements are under consideration.

5.2.5 Stability of speed and direction

5.2.5.1 Speed

For category A, B, C, D, E and F wheelchairs (wheelchairs with electronic speed control), the average wheel speed change, ΔS_{avg}, calculated as specified in Clause 11, shall not exceed ± 20 %.

NOTE A positive value indicates a speed increase, while a negative value indicates a speed decrease.

For category G wheelchairs (wheelchairs without electronic speed control), the speed requirement does not apply.

5.2.5.2 Steering

For category A and D wheelchairs (wheelchairs with electronic differential steering), the differential wheel speed change, ΔS_{diff}, calculated as specified in Clause 11, shall not exceed ± 25 %.

NOTE A positive value corresponds to a right turn, while a negative value corresponds to a left turn.

For category B and E wheelchairs (wheelchairs with electronic servo steering), the maximum permissible change in steering servo position or steered wheel angle is that corresponding to a turning radius of 4 m, as specified in ISO 7176-5.

For category C, F and G wheelchairs (wheelchairs with manual steering), the steering requirement does not apply.