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Wheelchairs —

Part 5:
Determination of dimensions, mass and manœuvring space

Fauteuils roulants —

Partie 5: Détermination des dimensions, de la masse et de l'espace de manœuvre

[Revision of first edition (ISO 7176-5:1986)]

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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 7176-5 was prepared by Technical Committee ISO/TC 173, Assistive products for persons with disability, Subcommittee SC 1, *Wheelchairs*.

ISO 7176 consists of the following parts, under the general title Wheelchair

— 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 dimensions, mass and manoeuvring 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 19: *Wheeled mobility devices for use in motor vehicles*

— Part 21: *Requirements and test methods for electromagnetic compatibility of powered wheelchairs and motorised scooters*

— Part 22: *Set-up procedure for adjustable wheelchairs*

— 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 25: R*equirements and test methods for batteries and their chargers for powered wheelchairs and motorised scooters*

— Part 26: *Vocabulary*

A Technical Report, *ISO/TR 13570-1, Guidelines for the application of the ISO 7176 series on wheelchairs*, is also available giving a simplified explanation of these parts of ISO 7176.

Introduction

The purpose of this International Standard is to provide technical definitions together with appropriate test procedures for measuring important dimensions and masses of manual wheelchairs and electrically powered wheelchairs including scooters, which can be used to estimate the usability of a wheelchair.

A new approach is used for the pre-selection of the reference size from a wheelchair model with a range of various dimensions, by introducing reference dimensions of the intended user. This new approach ensures repeatable and comparable test results.

The information in the standard is intended for three main reader groups:

— prescribers and users of wheelchairs;

— architects and public authorities; and

— manufacturers, wheelchair providers, clinicians and test laboratories.

Features that are important to wheelchair users, such as the estimation of the space needed and general manoeuvrability, are contained in Clause 8, *Required measurements*. Values for the different features are disclosed in the wheelchair's specification sheet. The values can be used to determine, before purchase, the wheelchair's suitability in relation to specific requirements and needs.

Features that are of importance to architects and public authorities, such as use in narrow places are defined and appropriate methods for their determination, are included in Clause 9, *Architectural considerations*.

The technical features of a wheelchair that are of importance to manufacturers, wheelchair providers, clinicians and test laboratories such as items to be considered when manufacturing, setting up, adjusting, repairing or testing wheelchairs are included in Annex A, *Technical dimensions*.

Annex A, *Technical dimensions,* is informative and specifies test methods for supplementary dimensions which are critical to the quality and performance of the wheelchair (driving, steering, tracking etc.).

Informative Annex B, *Pivot width and reversing width*, contains theoretical details about pivot width and reversing width.

Informative Annex C, *Turning diameter*, contains theoretical details about turning diameter.

Informative Annex D, *Wheelchair longitudinal axis and wheelchair centre-point*, contains theoretical details about wheelchair longitudinal axis and wheelchair centre-point.

Informative Annex E, *Guidelines and Recommendations for Wheelchair Design and Performance,* contains technical details for better understanding and construction of specific wheelchair features.

Wheelchairs —

Part 5:
Determination of dimensions, mass and manœuvring space

1 Scope

This International standard specifies test methods for the determination of wheelchair dimensions and mass.

This International standard also specifies methods for the determination of outside dimensions when the wheelchair is occupied and the required manoeuvring space needed for wheelchair manoeuvres commonly carried out in daily life.

This International Standard also specifies requirements for the disclosure of the dimensions and masses.

This International standard contains five informative Annexes.

Annex A specifies methods for the determination of technical dimensions that can be important to the quality and performance of the wheelchair.

Annex B provides detailed information about pivot width and reversing width.

Annex C provides detailed information about the turning diameter.

Annex D provides details on determining the wheelchair longitudinal axis and wheelchair centre-point.

Annex E provides technical guidelines and interpretation for many of the measurements specified to facilitate improved understanding, design and construction of wheelchairs.

This International standard is applicable to manual wheelchairs and electrically powered wheelchairs (including scooters).

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 7176-7:1998*, Wheelchairs – Methods of measurement of seating and wheel dimensions.*

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

ISO 7176-13, Wheelchairs – Determination of coefficient of friction of test surfaces.

ISO 7176-15*, Wheelchairs - Requirements for information disclosure, documentation and labelling.*

ISO 7176-22:2000*, Wheelchairs – Set-up procedure.*

ISO DIS 7176-26:2004*, Wheelchairs – Vocabulary.*

ISO 9999:2002*, Technical aids for disabled persons – Classification.*

DIN 33402, *Body dimensions of people.*

NOTE When published, ISO 7176-26 will replace ISO 6440.

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 7176-26, ISO 7176-7, ISO 7176-22 and the following apply.

NOTE 1 When published, ISO 7176-26 will replace ISO 6440.

3.1
camber
position of a fixed wheel where its bottom and top do not have the same distance from a vertical plane through the wheelchair longitudinal axis

NOTE 1 Measurement is in accordance with A.4 (see Figure 1).

NOTE 2 Camber is positive if the bottom of the wheel is closer to a vertical plane through the wheelchair longitudinal axis than the top, zero is vertical, and negative if the top of the wheel is closer to a vertical plane through the wheelchair longitudinal axis than the bottom. Camber is expressed in degrees for each single fixed wheel.

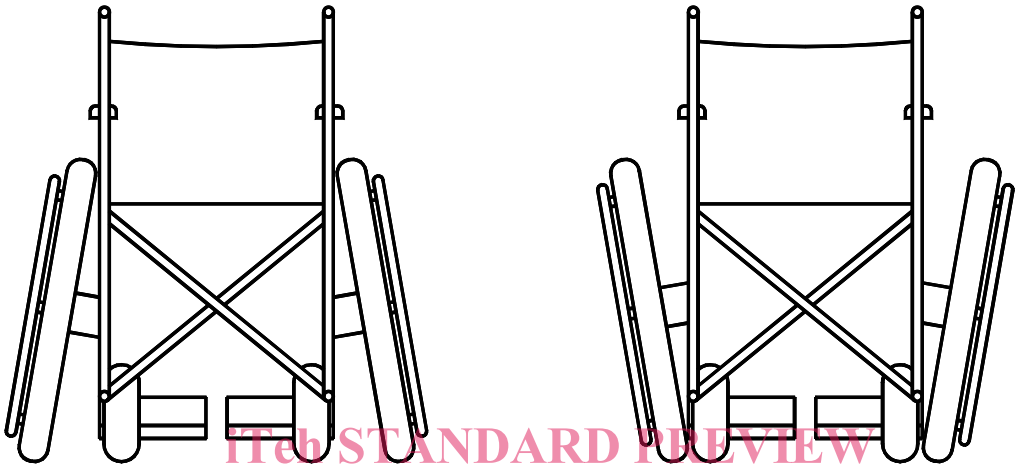
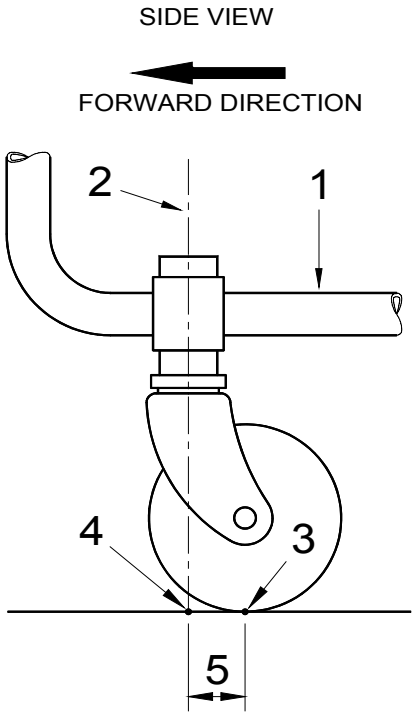


Figure 1 - Camber (exaggerated)

3.2
castor trail
fore-aft distance between the ground contact point of a castor wheel and that point where the castor stem axis intersects with the ground

NOTE 1 Measurement is in accordance with A.13 (see Figure 2).

NOTE 2 By definition, the castor trail is always positive.



Key:

1 part of wheelchair frame
2 castor stem axis
3 ground contact point of castor wheel
4 point where the castor stem axis intersects with the ground
5 castor trail

Figure 2 - Castor trail

3.3
castor wheel misalignment

lateral distance between the ground contact point of the castor wheel and that point where the castor stem axis intersects with the ground.

NOTE 1 Measurement is in accordance with A.14 (see Figure 3).

NOTE 2 Castor wheel misalignment is positive if the ground contact point of the castor wheel is closer to a vertical plane through the wheelchair longitudinal axis than the point of intersection of the castor stem axis with the ground, zero is the desired neutral position, and negative if the point of intersection of the castor stem axis with the ground is closer to a vertical plane through the wheelchair longitudinal axis than the ground contact point of the castor wheel.

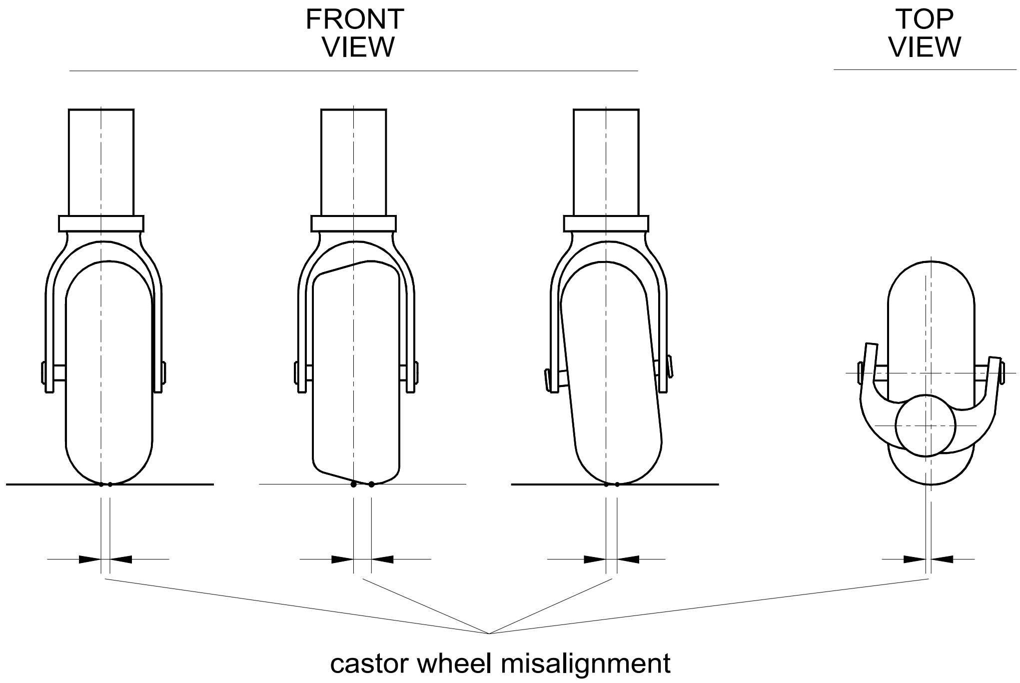


Figure 3 - Castor wheel misalignment (exaggerated)

3.4
fixed wheel
wheel that cannot change its angular orientation relative to the wheelchair

EXAMPLE drive wheel, manoeuvring wheel or guide wheel

3.5
front wheel track
distance between the ground contact points of the front wheels

NOTE Measurement is in accordance with A.6 (see Figure 4).

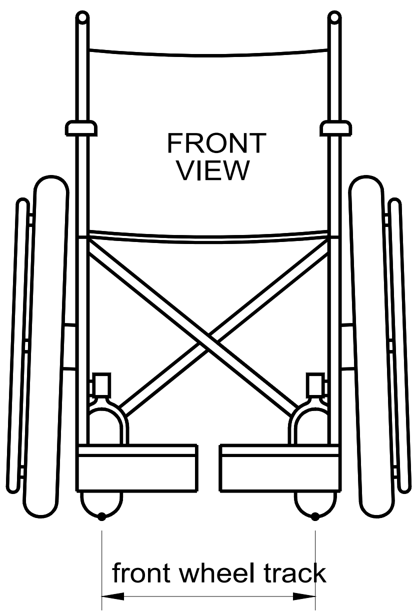
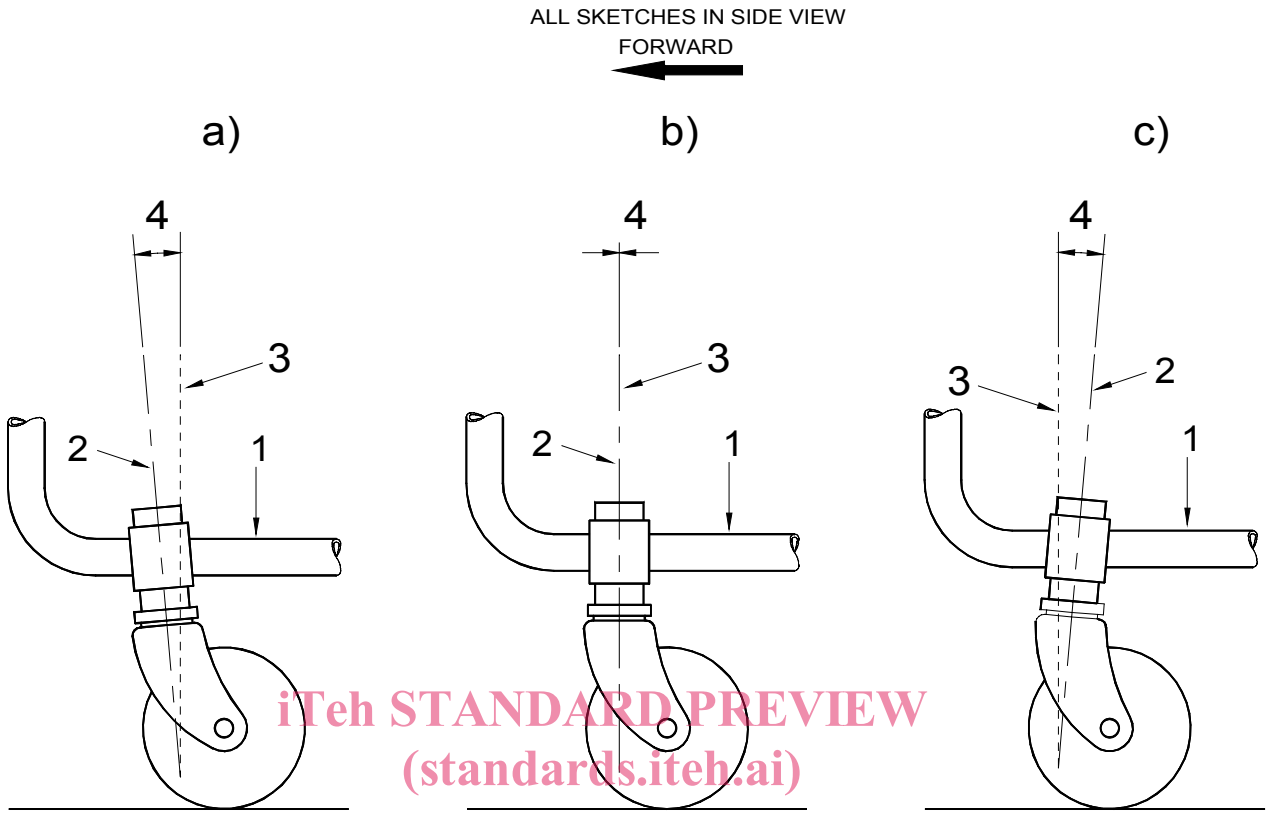


Figure 4 - Front wheel track (example)

3.6
frontal rake
angle between the castor stem and the vertical in the fore-aft direction

NOTE 1 Measurement is in accordance with A.11 (see Figure 5).

NOTE 2 The frontal rake is a misalignment angle. It is positive if the top of the castor stem is in front of its bottom (see Figure 5 a), zero is the desired vertical position (see Figure 5 b), and negative if the bottom of the castor stem is in front of its top (see Figure 5 c). The frontal rake is expressed in degrees for each single castor wheel.



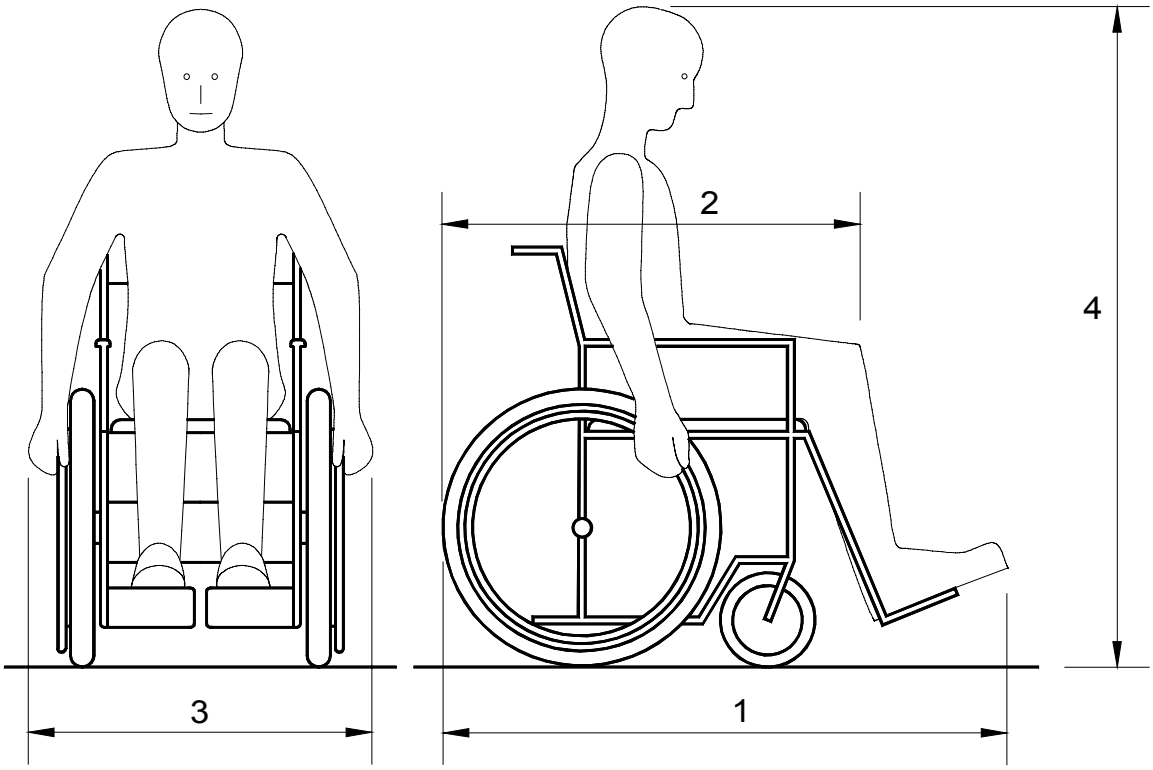
Key:

a) positive frontal rake
b) no frontal rake
c) negative frontal rake
1 part of wheelchair frame
2 axis of castor stem
3 vertical
4 frontal rake

Figure 5 - Frontal rake (exaggerated)

3.7
full occupied length
distance between the most forward and most rearward point of an occupied wheelchair that has leg supports and foot supports, including a simulated user

NOTE Measurement is in accordance with 9.2 (see Figure 6).



Key:

1 full occupied length
2 reduced occupied length
3 occupied width
4 occupied height

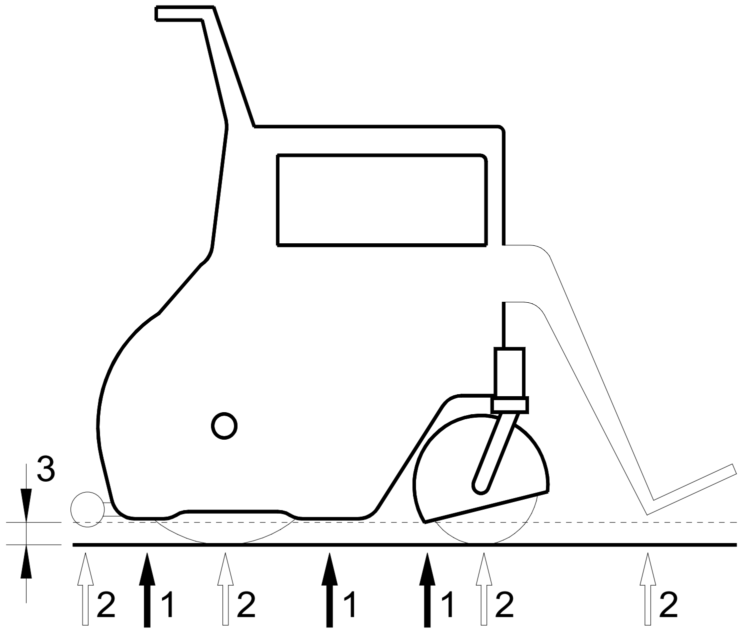
Figure 6 - Dimensions of the wheelchair when occupied

3.8
full overall length
distance between the most forward and most rearward point of the wheelchair when assembled and ready for use with any leg supports and foot supports fitted.

NOTE Measurement is in accordance with 8.2.

3.9
ground clearance
vertical distance between the ground and the lowermost point of the occupied wheelchair that is not a wheel, leg support, foot support or anti-tipping device

NOTE Measurement is in accordance with 8.11 (see Figure 7)



Key:

1 typical critical points
2 wheels, leg/foot supports and anti-tipping devices are not considered
3 ground clearance

Figure 7 - Ground clearance (example)

3.10
ground contact point
midpoint of the area where the wheel contacts the ground (see Figure 8)

NOTE One means of identifying the ground contact point is to place four feeler gauges of equal thickness and with at least one straight edge on the test plane. (Example for a feeler gauge is a piece of tin or other rigid material, 0,5 mm ± 0,2 mm thick). Push two of them from the front and rear under the wheels with their straight edges horizontally and perpendicular to the wheelchair longitudinal axis and push the other two of them from the both sides under the wheels with their straight edges parallel to the wheelchair longitudinal axis. Push all feeler gauges until they contact the wheel. The ground contact point is located in the middle of the rectangle created by the straight edges of the four feeler gauges.