

Nederlandse norm

# **NEN-EN 12184**

(en)

Electrically powered wheelchairs, scooters and  
their chargers - Requirements and test methods

Vervangt NEN-EN 12184:1999;  
NEN-EN 12184:2009 Ontw.

ICS 11.180.10; 29.200  
oktober 2009

Als Nederlandse norm is aanvaard:  
- EN 12184:2009,IDT

## Normcommissie 301071 "Rolstoelen"

---

Apart from exceptions provided by the law, nothing from this publication may be duplicated and/or published by means of photocopy, microfilm, storage in computer files or otherwise, which also applies to full or partial processing, without the written consent of the Netherlands Standardization Institute.

The Netherlands Standardization Institute shall, with the exclusion of any other beneficiary, collect payments owed by third parties for duplication and/or act in and out of law, where this authority is not transferred or falls by right to the Reproduction Rights Foundation.

---

Auteursrecht voorbehouden. Behoudens uitzondering door de wet gesteld mag zonder schriftelijke toestemming van het Nederlands Normalisatie-instituut niets uit deze uitgave worden verveelvoudigd en/of openbaar gemaakt door middel van fotokopie, microfilm, opslag in computerbestanden of anderszins, hetgeen ook van toepassing is op gehele of gedeeltelijke bewerking.

Het Nederlands Normalisatie-instituut is met uitsluiting van ieder ander gerechtigd de door derden verschuldigde vergoedingen voor verveelvoudiging te innen en/of daartoe in en buiten rechte op te treden, voor zover deze bevoegdheid niet is overgedragen c.q. rechtens toekomt aan de Stichting Reprorecht.

---

---

Although the utmost care has been taken with this publication, errors and omissions cannot be entirely excluded. The Netherlands Standardization Institute and/or the members of the committees therefore accept no liability, not even for direct or indirect damage, occurring due to or in relation with the application of publications issued by the Netherlands Standardization Institute.

---

Hoewel bij deze uitgave de uiterste zorg is nagestreefd, kunnen fouten en onvolledigheden niet geheel worden uitgesloten. Het Nederlands Normalisatie-instituut en/of de leden van de commissies aanvaarden derhalve geen enkele aansprakelijkheid, ook niet voor directe of indirecte schade, ontstaan door of verband houdend met toepassing van door het Nederlands Normalisatie-instituut gepubliceerde uitgaven.

## Nederlands voorwoord

Voor de in deze norm vermelde normatieve verwijzingen bestaan in Nederland de volgende equivalenten:

<u>vermelde norm</u>	<u>Nederlandse norm</u>	<u>titel</u>
EN 1021-1:2006	NEN-EN 1021-1:2006	Meubelen - Bepaling van de ontvlambaarheid van beklede meubelen - Deel 1: Smeulende sigaret als ontstekingsbron
EN 1021-2:2006	NEN-EN 1021-2:2006	Meubelen - Bepaling van de ontvlambaarheid van beklede meubelen - Deel 2: Equivalent van de lucifervlam als ontstekingsbron
EN 12182	NEN-EN 12182	Technische hulpmiddelen voor gehandicapten - Algemene eisen en beproevingsmethoden
EN 50272-3:2002	NEN-EN 50272-3:2002	Veiligheidseisen voor oplaadbare batterijen en batterij-installaties - Deel 3: Tractiebatterijen
EN 60335-1:2002	NEN-EN-IEC 60335-1:2002	Huishoudelijke en soortgelijke elektrische toestellen - Veiligheid - Deel 1: Algemene eisen
EN 60529:1991	NEN 10529:1992	Beschermingsgraden van omhulsels van elektrisch materieel (IP-codering)
EN 60601-1:2006	NEN-EN-IEC 60601-1:2006	Medische elektrische toestellen - Deel 1: Algemene eisen voor basisveiligheid en essentiële prestaties
EN 61000-3-2:2006	NEN-EN-IEC 61000-3-2:2006	Elektromagnetische compatibiliteit (EMC) - Deel 3-2: Limietwaarden - Limietwaarden voor de emissie van harmonische stromen (ingangsstroom van de toestellen $\leq 16$ A per fase)
EN ISO 14971:2009	NEN-EN-ISO 14971:2009	Medische hulpmiddelen - Toepassing van risicomanagement voor medische hulpmiddelen
ISO 7176-1:1999	NEN-ISO 7176-1:1999	Rolstoelen - Deel 1: Bepaling van de statische stabiliteit
ISO 7176-2:2001	NEN-ISO 7176-2:2001	Rolstoelen - Deel 2: Bepaling van de dynamische stabiliteit van elektrische rolstoelen
ISO 7176-3:2003	NEN-ISO 7176-3:2003	Rolstoelen - Deel 3: Bepaling van de doeltreffendheid van remmen
ISO 7176-4:2008	NEN-ISO 7176-4:2008	Rolstoelen - Deel 4: Energieverbruik van elektrische rolstoelen en scooters voor de bepaling van de theoretische maximumafstand
ISO 7176-6:2001	NEN-ISO 7176-6:2001	Rolstoelen - Deel 6: Bepaling van de maximumsnelheid, versnelling en vertraging van elektrische rolstoelen
ISO 7176-8:1998	-	-
ISO 7176-9:2001	NEN-ISO 7176-9:2001	Rolstoelen - Deel 9: Klimaatproeven voor elektrische rolstoelen
ISO 7176-10:2008	NEN-ISO 7176-10:2008	Rolstoelen - Deel 10: Bepaling van het vermogen van elektrische rolstoelen om obstakels te overwinnen
ISO 7176-11:1992	-	-
ISO 7176-13:1989	-	-
ISO 7176-14:1997	-	-
ISO 7176-14:2008	NEN-ISO 7176-14:2008	Rolstoelen - Deel 14: Vermogen- en besturingssystemen voor elektrische rolstoelen - Eisen en beproevingsmethoden
ISO 7176-15:1996	-	-
ISO 7176-19:2001	NEN-ISO 7176-19:2001	Rolstoelen - Deel 19: Mobiliteitsvoorzieningen op wielen voor gebruik in motorvoertuigen
ISO 7176-21:2003	NEN-ISO 7176-21:2003	Rolstoelen - Deel 21: Eisen en beproevingsmethoden voor elektromagnetische compatibiliteit van elektrisch aangedreven rolstoelen en gemotoriseerde scooters
ISO 7176-22:2000	NEN-ISO 7176-22:2000	Rolstoelen - Deel 22: Montageprocedures
ISO 7176-26:2007	NEN-ISO 7176-26:2007	Rolstoelen - Deel 26: Woordenlijst

ISO 10542-5:2004	NEN-ISO 10542-5:2004	Technische systemen en hulpmiddelen voor mensen met beperkingen of/en handicap - Rolstoelvastzetsystemen en veiligheidssystemen voor inzittenden - Deel 5: Systemen voor specifieke rolstoelen
------------------	----------------------	------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------

EUROPEAN STANDARD  
NORME EUROPÉENNE  
EUROPÄISCHE NORM

**EN 12184**

September 2009

ICS 11.180.10

Supersedes EN 12184:2006

English Version

**Electrically powered wheelchairs, scooters and their chargers -  
Requirements and test methods**

Fauteuils roulants électriques, scooters et leurs chargeurs -  
Exigences et méthodes d'essai

Elektrorollstühle und -mobile und zugehörige Ladegeräte -  
Anforderungen und Prüfverfahren

This European Standard was approved by CEN on 27 August 2009.

CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration. Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the CEN Management Centre or to any CEN member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the CEN Management Centre has the same status as the official versions.

CEN members are the national standards bodies of Austria, Belgium, Bulgaria, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland and United Kingdom.



EUROPEAN COMMITTEE FOR STANDARDIZATION  
COMITÉ EUROPÉEN DE NORMALISATION  
EUROPÄISCHES KOMITEE FÜR NORMUNG

**Management Centre: Avenue Marnix 17, B-1000 Brussels**

# Contents

Page

Foreword.....	5
Introduction .....	6
1 Scope .....	7
2 Normative references .....	7
3 Terms and definitions .....	9
4 Test apparatus .....	9
5 Type classes.....	10
6 General requirements.....	10
7 Design requirements .....	11
7.1 Foot supports, lower leg supports and arm supports .....	11
7.2 Pneumatic tyres .....	11
7.3 Fitting an anterior pelvic support.....	11
7.4 Wheelchairs for use as seats in motor vehicles.....	11
7.5 Braking systems .....	12
7.6 Freewheel device .....	12
7.7 Component mass.....	12
7.8 Battery enclosures and containers.....	12
7.9 Operations intended to be carried out by the occupant and/or assistant .....	13
7.10 Controls intended for operation by the occupant .....	13
7.11 Assistant control unit, push handles and handgrips.....	14
7.12 Charging connector.....	14
8 Performance requirements .....	14
8.1 General.....	14
8.2 Foot supports, lower leg support assemblies and arm supports .....	14
8.2.1 Requirements .....	14
8.2.2 Tests.....	15
8.3 Static, impact and fatigue strength.....	15
8.3.1 Requirements .....	15
8.3.2 Test.....	15
8.4 Braking system .....	16
8.4.1 General requirements.....	16
8.4.2 Tests.....	17
8.5 Operating forces .....	18
8.5.1 Requirements .....	18
8.5.2 Test.....	19
8.6 Assistant control unit, push handles and handgrips.....	19
8.6.1 Requirements .....	19
8.6.2 Test.....	20
8.7 Charging connector.....	20
8.7.1 Requirements .....	20
8.7.2 Test.....	20
8.8 Performance of driving characteristics .....	20
8.8.1 General.....	20
8.8.2 Ability to climb maximum safe slope .....	20
8.8.3 Ground unevenness .....	21
8.8.4 Maximum downhill speed .....	21
8.8.5 Dynamic stability .....	22

8.8.6	Obstacle climbing.....	22
8.8.7	Static stability .....	23
8.8.8	Maximum speed.....	23
8.8.9	Distance range .....	23
8.9	Surface temperature.....	23
8.10	Resistance to ignition .....	24
8.10.1	Upholstered composite parts.....	24
8.10.2	Foam materials .....	24
8.10.3	Other parts .....	24
8.11	Climatic test .....	24
8.12	Seating adjustments for tilt and recline systems .....	24
8.12.1	Requirements.....	24
8.12.2	Test method .....	24
9	Electrical requirements.....	25
9.1	General requirements .....	25
9.2	Requirement for controller on/off switch.....	25
9.3	Requirement for power indicator.....	25
9.4	Requirements for circuit protection .....	25
9.5	Requirements for battery chargers .....	25
9.6	Charge level indicator .....	26
10	Requirements for information supplied by the manufacturer .....	26
10.1	General .....	26
10.2	Pre-sale information.....	26
10.3	User information.....	27
10.4	Service information .....	28
10.5	Labels .....	28
11	Test report.....	28
12	Tables .....	30
13	Figures.....	32
Annex A	(informative) Recommendations for test dummies of mass greater than 100 kg.....	36
A.1	General .....	36
A.2	Construction .....	36
A.3	Accelerometer mounting .....	36
A.4	Design aims .....	37
Annex B	(informative) Recommendations for dimensions and manoeuvring space of electrically powered wheelchairs .....	45
B.1	Specific dimensions.....	45
B.1.1	Dimensions when ready for use .....	45
B.1.2	Push handle height .....	45
B.1.3	Ground clearance .....	45
B.2	Manoeuvring space .....	45
B.2.1	Turning diameter .....	45
B.2.2	Reversing width.....	45
B.3	Speed settings .....	45
Annex C	(informative) Recommended design features .....	47
C.1	Introduction.....	47
C.2	General recommendations .....	47
C.2.1	Anti-tip devices .....	47
C.2.2	Component mass .....	47
C.2.3	Fittings and tools.....	47
C.2.4	Tyres .....	47

**EN 12184:2009 (E)**

<b>C.2.5</b>	<b>Means to inflate tyres .....</b>	<b>47</b>
<b>C.2.6</b>	<b>Surface temperature .....</b>	<b>47</b>
<b>C.2.7</b>	<b>Occupant transfer into or out of the wheelchair .....</b>	<b>48</b>
<b>C.2.8</b>	<b>Resistance to contamination from urine incontinence .....</b>	<b>48</b>
<b>C.2.9</b>	<b>Indication for maximum safe slope.....</b>	<b>48</b>
<b>C.2.10</b>	<b>Mirrors.....</b>	<b>48</b>
<b>C.2.11</b>	<b>Head support.....</b>	<b>48</b>
<b>C.2.12</b>	<b>Accidental release of parking brakes and freewheel devices.....</b>	<b>48</b>
<b>C.3</b>	<b>Recommendations for performance characteristics .....</b>	<b>49</b>
<b>C.3.1</b>	<b>Indication of electrical faults .....</b>	<b>49</b>
<b>C.3.2</b>	<b>Batteries and their containers .....</b>	<b>49</b>
<b>C.3.3</b>	<b>Lighting.....</b>	<b>49</b>
<b>C.3.4</b>	<b>Control mechanism feedback.....</b>	<b>49</b>
<b>C.3.5</b>	<b>Freewheel alarm.....</b>	<b>49</b>
<b>C.3.6</b>	<b>Maximum speed .....</b>	<b>49</b>
<b>Annex D (informative)</b>	<b>Recommended seating design .....</b>	<b>50</b>
<b>Annex E (informative)</b>	<b>Manoeuvring forces .....</b>	<b>51</b>
<b>E.1</b>	<b>Recommendations.....</b>	<b>51</b>
<b>E.1.1</b>	<b>Push handle force.....</b>	<b>51</b>
<b>E.1.2</b>	<b>Handrim force.....</b>	<b>51</b>
<b>E.2</b>	<b>Manoeuvring test for handrim-activated power-assisted wheelchairs.....</b>	<b>51</b>
<b>Annex F (informative)</b>	<b>Technical changes from previous editions of EN 12184.....</b>	<b>52</b>
<b>F.1</b>	<b>Technical changes between the first (1999) and second (2006) editions .....</b>	<b>52</b>
<b>F.2</b>	<b>Technical changes from the second (2006) edition .....</b>	<b>53</b>
<b>Annex ZA (informative)</b>	<b>Relationship between this European Standard and the Essential Requirements of Council Directive 93/42/EEC of 14 June 1993 concerning medical devices.....</b>	<b>55</b>
<b>Bibliography</b>	<b>.....</b>	<b>59</b>



## Foreword

This document (EN 12184:2009) has been prepared by Technical Committee CEN/TC 293 "Assistive products for persons with disability", the secretariat of which is held by SIS.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest March 2010, and conflicting national standards shall be withdrawn at the latest by March 2010.

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

This document supersedes EN 12184:2006.

This document has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association, and supports essential requirements of Council Directive 93/42/EEC of 14 June 1993 concerning medical devices, as amended by Directive 2007/47/EC.

For relationship(s) with the applicable EU Directive(s), see informative Annex ZA, which is an integral part of this document.

Informative Annex F provides details of significant technical changes between this European Standard and the previous editions of 1999 and 2006.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Bulgaria, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland and the United Kingdom.

## Introduction

This is the third edition of this European Standard which was originally issued in 1999. The second edition was published in 2006 but was withdrawn in 2007.

Where this European Standard does not apply to particular wheelchairs, contracting parties should consider whether appropriate parts of this European Standard can be used. Manufacturers might also wish to consider whether appropriate parts of this European Standard can be used to assess the performance of their products against the Essential Requirements of the Council Directive concerning medical devices 93/42/EEC of 14 June 1993, as amended by Directive 2007/47/EC.

This European Standard contains requirements for ergonomic design related to the ease of wheelchair operation. They are intended to be applicable to at least 80 % of adult occupants and are based upon:

- the body size of occupants within the range 5th percentile adult female to 95th percentile adult male,
- the abilities and restrictions of a 65-year-old 50th percentile female, and
- the wheelchair being equipped with operating devices which are not custom-made for individual occupants.

## 1 Scope

This European Standard specifies requirements and test methods for electrically powered wheelchairs with a maximum speed not exceeding 15 km/h intended to carry one person of mass not greater than 100 kg, which includes:

- manual wheelchairs with add-on power kits used for propulsion,
- electrically powered wheelchairs, and
- electrically powered scooters with three or more wheels.

It also specifies requirements and test methods for battery chargers for wheelchairs and scooters.

This European Standard does not apply in total to:

- wheelchairs intended for special purposes, such as sports,
- custom-made wheelchairs,
- handrim activated power assisted wheelchairs and
- powered office chairs.

NOTE 1 The application of this standard is limited to wheelchairs with a maximum occupant mass of 100 kg because the maximum mass of dummy specified in ISO 7176-11:1992 is 100 kg. Annex A (informative) provides guidance for construction of dummies of mass 125 kg and 150 kg. At the time of publication, a new edition of ISO 7176-11 was under development, including test dummies with masses above 100 kg.

NOTE 2 Requirements for manually propelled wheelchairs are specified in EN 12183.

## 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.

EN 1021-1:2006, *Furniture — Assessment of the ignitability of upholstered furniture — Part 1: Ignition source smouldering cigarette*

EN 1021-2:2006, *Furniture — Assessment of the ignitability of upholstered furniture — Part 2: Ignition source match flame equivalent*

EN 12182, *Technical aids for disabled persons — General requirements and test methods*

EN 50272-3:2002, *Safety requirements for secondary batteries and battery installations — Part 3: Traction batteries*

EN 60335-1:2002, *Household and similar electrical appliances — Safety — Part 1: General requirements (IEC 60335-1:2001, modified)*

EN 60529:1991, *Degrees of protection provided by enclosures (IP code) (IEC 60529:1989)*

**EN 12184:2009 (E)**

EN 60601-1:2006, *Medical electrical equipment — Part 1: General requirements for basic safety and essential performance (IEC 60601- 1:2005)*

EN 61000-3-2:2006, *Electromagnetic compatibility (EMC) — Part 3-2: Limits — Limits for harmonic current emissions (equipment input current  $\leq 16$  A per phase) (IEC 61000-3-2:2005)*

EN ISO 14971:2009, *Medical devices — Application of risk management to medical devices (ISO 14971:2007, Corrected version 2007-10-01)*

ISO 7176-1:1999, *Wheelchairs — Part 1: Determination of static stability*

ISO 7176-2:2001, *Wheelchairs — Part 2: Determination of dynamic stability of electric wheelchairs*

ISO 7176-3:2003, *Wheelchairs — Part 3: Determination of effectiveness of brakes*

ISO 7176-4:2008, *Wheelchairs — Part 4: Energy consumption of electric wheelchairs and scooters for determination of theoretical distance range*

ISO 7176-6:2001, *Wheelchairs — Part 6: Determination of maximum speed, acceleration and deceleration of electric wheelchairs*

ISO 7176-8:1998, *Wheelchairs — Part 8: Requirements and test methods for static, impact and fatigue strengths*

ISO 7176-9:2001, *Wheelchairs — Part 9: Climatic test for electric wheelchairs*

ISO 7176-10:2008, *Wheelchairs — Part 10: Determination of obstacle-climbing ability of electrically powered wheelchairs*

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

ISO 7176-13:1989, *Wheelchairs — Part 13: Determination of coefficient of friction of test surfaces*

ISO 7176-14:1997, *Wheelchairs — Part 14: Power and control systems for electric wheelchairs — Requirements and test methods*

NOTE ISO 7176-14:1997 is used only for requirements and test methods for battery chargers.

ISO 7176-14:2008, *Wheelchairs — Part 14: Power and control systems for electrically powered wheelchairs and scooters — Requirements and test methods*

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

ISO 7176-19:2001, *Wheelchairs — Part 19: Wheeled mobility devices for use in motor vehicles*

ISO 7176-21:2003, *Wheelchairs — Part 21: Requirements and test methods for electromagnetic compatibility of electrically powered wheelchairs and motorized scooters*

ISO 7176-22:2000, *Wheelchairs — Part 22: Set-up procedures*

ISO 7176-26:2007, *Wheelchairs — Part 26: Vocabulary*

ISO 10542-5:2004, *Technical systems and aids for disabled or handicapped persons — Wheelchair tiedown and occupant-restraint systems — Part 5: Systems for specific wheelchairs*

### 3 Terms and definitions

For the purposes of this document the terms and definitions given in ISO 7176-26:2007 (with the exception of the definition of wheelchair which is replaced by 3.7 below), ISO 7176-14:2008, EN 12182 and the following apply.

#### 3.1

##### **audible warning device**

device for making a warning sound or noise

EXAMPLE A horn.

#### 3.2

##### **freewheel device**

means for disengaging the parking brake and/or the drive of a wheelchair to allow it to be manoeuvred manually

#### 3.3

##### **loaded wheelchair**

wheelchair loaded with a dummy as specified in 4.9 or loaded with a human test occupant

#### 3.4

##### **maximum safe slope**

maximum slope specified by the manufacturer on which the wheelchair meets all the requirements of dynamic stability, static stability, braking performance and slope climbing, traversing and descending

#### 3.5

##### **non-spillable battery**

battery from which the electrolyte can not escape whatever its orientation

#### 3.6

##### **spillable battery**

battery from which the electrolyte can escape in some orientations

#### 3.7

##### **wheelchair**

wheeled personal mobility device incorporating a seating support system for a disabled occupant that is propelled by one or more electric motors controlled by the occupant or by an assistant, and that has electronic control of speed and electronic or manual control of direction

NOTE 1 Definition is adapted from the definition given in the Global Medical Devices Nomenclature (GMDN).

NOTE 2 A disabled occupant is a disabled person or a person not having the full capacity to walk unaided.

NOTE 3 The definition includes scooters.

### 4 Test apparatus

**4.1 Adjustable test plane**, a flat, rigid plane having an adjustable slope, with a coefficient of friction as specified in ISO 7176-13:1989, of sufficient size to accommodate the wheelchair during the tests specified in 8.4 and 8.8, and such that the whole surface lies between two imaginary parallel planes 5 mm apart per 1 000 mm of extension in any direction and 25 mm apart per 6 000 mm of extension in any direction.

**4.2 Horizontal test plane**, a flat, rigid plane with a coefficient of friction as specified in ISO 7176-13:1989, of sufficient size to accommodate the wheelchair under test, and such that the whole surface lies between two imaginary horizontal planes 5 mm apart per 1 000 mm of extension in any direction and 25 mm apart per 6 000 mm of extension in any direction.

**EN 12184:2009 (E)**

**4.3 Means to apply a force** between 25 N and 200 N with an accuracy of  $\pm 5\%$  and with a rate of application less than 5 N/s.

**4.4 Means to measure force** with an accuracy of  $\pm 5\%$  in increments of 1 N in the range of 0 N to 200 N.

**4.5 Means to measure speed** between 0 km/h and 20 km/h to an accuracy of  $\pm 5\%$ .

**4.6 Means to measure distance** in the range of 0 m to 5 m with an accuracy of  $\pm 1$  mm or  $\pm 2\%$  whichever is the greater.

**4.7 Supplementary weights** to add to a human test occupant to achieve the maximum occupant mass specified by the manufacturer and to achieve a similar mass distribution to the dummy to be used as specified in 4.9.

**4.8 Test block**, capable of supporting the loaded wheelchair under each of its wheels, with length and width  $200\text{ mm} \pm 10\text{ mm}$ , thickness given in Table 1 'ground unevenness' and corner radii greater than 2,0 mm. For the two large surfaces, the whole of each surface shall lie between two imaginary horizontal planes 1 mm apart. The coefficient of friction shall be as specified in ISO 7176-13:1989.

**4.9 Test dummy**, of appropriate size, as specified in ISO 7176-11:1992.

NOTE Annex A gives guidance on construction of dummies with masses larger than those specified in ISO 7176-11:1992.

**4.10 Means to measure torque** with an accuracy of  $\pm 2\%$  in the range of 0,5 Nm to 10 Nm.

**4.11 Means to measure angles** to an accuracy of  $\pm 0,1^\circ$ .

**4.12 Means to move a brake lever** smoothly for 60 000 cycles at a frequency of not more than 0,5 Hz.

**4.13 Means to measure elapsed time** in the range 0 to 30 s with an accuracy of  $\pm 1$  s.

## 5 Type classes

Wheelchairs shall be classified in one or more of the following three classes, dependent upon their intended use:

- Class A - compact, manoeuvrable wheelchairs not necessarily capable of negotiating outdoor obstacles;
- Class B - wheelchairs sufficiently compact and manoeuvrable for some indoor environments and capable of negotiating some outdoor obstacles;
- Class C - wheelchairs, usually large in size, not necessarily intended for indoor use but capable of travelling over longer distances and negotiating outdoor obstacles.

NOTE Scooters are included within the classes above.

## 6 General requirements

The wheelchair shall conform to the requirements specified in EN 12182 for the following:

- intended performance and technical documentation;
- aids that can be dismantled;
- single-use fasteners;

- biocompatibility and toxicity;
- contaminants and residues;
- infection and microbiological contamination;
- overflow, spillage, leakage and ingress of liquids;
- safety of moving parts;
- prevention of traps for parts of human body;
- folding and adjusting mechanisms;
- surfaces, corners and edges;
- electronic programmable systems;
- clinical evaluation;
- ergonomics.

A risk analysis shall also be carried out in accordance with EN ISO 14971:2009.

## **7 Design requirements**

### **7.1 Foot supports, lower leg supports and arm supports**

The wheelchair shall be fitted with foot supports that have a means of positioning the occupant's feet at the required height, that prevent the occupant's feet from sliding backwards and that meet the performance requirements specified in 8.2.

Where fitted, lower leg supports and arm supports shall meet the performance requirements specified in 8.2.

### **7.2 Pneumatic tyres**

If the wheelchair is fitted with pneumatic tyres, they shall have the same type of valve connection on all tyres.

The tyres or the rims shall be marked with the maximum pressure in kPa or bar.

### **7.3 Fitting an anterior pelvic support**

The wheelchair shall have provision for an anterior pelvic support to be fitted. The manufacturer of the wheelchair shall have available as an option an anterior pelvic support which can be used with that provision.

### **7.4 Wheelchairs for use as seats in motor vehicles**

If the manufacturer specifies that the intended use of the wheelchair includes use by an adult as a seat in a motor vehicle, the wheelchair shall conform to the performance requirements of ISO 7176-19:2001.

If the manufacturer specifies that the intended use of the wheelchair includes use as a seat in a motor vehicle by a child of mass greater than 22 kg, the wheelchair shall conform to the performance requirements of ISO 7176-19:2001 with the exception of the horizontal excursion limits and the selection of the Anthropomorphic Test Device (ATD). The horizontal excursion limits specified in Table 1 of ISO 10542-5:2004 and the ATD selection specified in Table A.1 of ISO 10542-5:2004 shall apply.

**EN 12184:2009 (E)****7.5 Braking systems**

The wheelchair shall be fitted with a braking system that meets the performance requirements specified in 8.4.

If one or more brake levers are fitted to a wheelchair in the form used on bicycles and mopeds, the hand-grip width of such brake levers, measured 15 mm from the end of the brake lever, shall not be greater than 75 mm before a force is applied. See Figure 1.

**7.6 Freewheel device**

The wheelchair shall be fitted with a freewheel device that shall

- be accessible and operable by the occupant or an assistant or both in accordance with the manufacturer's intended use,
- be within the reach specified in Figure 2, if it is intended to be operated by the occupant,
- have operating forces for engaging and disengaging that do not exceed those stated in Table 1,
- be operable without detaching any parts,
- not depend on the battery power supplying the motor drive system,

NOTE 1 A battery independent from the motor drive battery may be used to supply energy to enable freewheel mode.

- have two defined positions including clear indication of freewheel mode and drive mode,

NOTE 2 An audible alarm activated when the freewheel device is in operation and deactivated when the drive and braking systems are fully operational would assist the occupant and/or assistant.

- prevent use of the wheelchair's drive system, if any part of the freewheel device is activated.

NOTE 3 These requirements apply in addition to those concerning non-powered mobility stated in ISO 7176-14:2008.

**7.7 Component mass**

If the wheelchair is intended to be dismantled for storage or transportation, any component that requires moving or handling that has a mass greater than 10 kg shall be provided with suitable handling devices (e.g. handles). The manufacturer shall provide information indicating the points where such components can be lifted and describing how they shall be handled during disassembly, lifting, carrying, and assembly to reduce risks to the person or persons moving or handling them.

**7.8 Battery enclosures and containers**

Battery enclosures and containers shall

- a) allow accessibility without the use of tools for inspection and service specified by the wheelchair manufacturer,
- b) provide protection so that it should not be possible for liquids dropping from above to enter into them and onto any cell or battery they contain,
- c) provide protection to stop any objects contacting the terminals of batteries and/or cells and the connections between them, to prevent a short circuit.

Battery enclosures shall be ventilated at the side near to the highest point by an opening or openings which have a total area not less than 100 mm<sup>2</sup> or as specified in 6.6.2 of EN 50272-3:2002 whichever is the greater.



NOTE The openings are intended to permit escape of gases.

Battery containers shall

- d) be used where spillable batteries are fitted to the wheelchair,
- e) be resistant to corrosion caused by battery gases and acid.

### **7.9 Operations intended to be carried out by the occupant and/or assistant**

Wheelchairs shall be designed to facilitate ease of operation by the occupant and/or assistant as specified in the manufacturer's instructions and meet the performance requirements of 8.2.1, 8.5, 8.6.1, 8.7.1, 8.9, 8.12.1, 9.2 and 9.3. In addition, brake levers shall meet the applicable requirements of 8.4.1.

Examples include:

- operation of adjustable seating,
- use of detachable components, including removable arm supports, lower leg supports etc., to facilitate safe transfers into and out of the wheelchair,
- use of folding mechanisms, including folding frames etc., to facilitate storage and transportation of unoccupied wheelchairs,
- carrying out maintenance, including use of tools etc.,
- use of manual steering controls,
- use of braking systems and freewheel devices,
- use of assistant controls,
- use of control devices.

### **7.10 Controls intended for operation by the occupant**

Controls intended to be operated by the occupant while seated shall be within the occupant reach as shown in Figure 2.

The following controls, if fitted, are included:

- on/off switch or key,
- speed regulator,
- speed pre-setting,
- running brake,
- parking brake,
- audible warning device,
- direction indicator,
- direction switch,

**EN 12184:2009 (E)**

- control device,
- manual steering controls,
- lighting controls,
- seating adjustments,
- detachable components, including removable arm supports, lower leg supports etc., to facilitate safe transfers into and out of the wheelchair,
- steering controls,
- freewheel device.

**7.11 Assistant control unit, push handles and handgrips**

When fitted, an assistant control unit, push handles and handgrips shall meet the performance requirements specified in 8.6.

**7.12 Charging connector**

The wheelchair shall be fitted with a charging connector that meets the performance requirements specified in 8.7.

**8 Performance requirements****8.1 General**

Unless otherwise specified in this clause, the wheelchair shall be prepared as specified in ISO 7176-22:2000 for each test.

**8.2 Foot supports, lower leg support assemblies and arm supports****8.2.1 Requirements**

Any swing away, movable or removable foot support, lower leg support assembly or arm support fitted on the wheelchair shall

- a) incorporate a means to locate it securely in any intended operating position,
- b) be adjustable in increments not exceeding 25 mm,
- c) be accessible and operable by the occupant or an assistant or both in accordance with the manufacturer's intended usage and within the reach space shown in Figure 2, and
- d) be operable without the use of tools.

When tested as specified in 8.2.2.2, separate foot supports shall have a gap between them that

- does not exceed 35 mm if the wheelchair is intended to be occupied by an adult,
- does not exceed 25 mm if the wheelchair is intended to be occupied by a child, or
- that is fitted with a means to prevent the occupant's feet from sliding into the gap.

## 8.2.2 Tests

### 8.2.2.1 Test for general performance

- Fit foot supports, lower leg support assemblies and arm supports in the operating position(s) specified in the manufacturer's instructions.
- Adjust the foot supports, lower leg support assemblies and arm supports as specified in the manufacturer's instructions.
- Record whether the foot supports, lower leg support assemblies and arm supports met the requirements.

### 8.2.2.2 Test for foot support gap

- Simultaneously apply a force  $F \pm 5$  N to the centroid of each foot support, normal to the plane of the unloaded foot support. In cases where the foot support has no identifiable plane, apply the force within 5° of vertical. The force  $F$  is calculated from the following equation:

$$F = 0,125 \times m \times g$$

where

$F$  is the force applied to each foot support, expressed in newtons;

$m$  is the maximum occupant mass specified by the manufacturer, expressed in kilograms;

$g$  is the acceleration due to gravity, 9,81 m/s<sup>2</sup>.

- Apply the force for 5 s to 10 s.
- While the force is being applied measure the shortest distance between the foot supports.
- Record whether the foot supports met the requirements.

## 8.3 Static, impact and fatigue strength

### 8.3.1 Requirements

The wheelchair shall conform to the requirements of ISO 7176-8:1998 with the exception that wheelchairs of Class A are not required to be tested as specified in 10.5 (drop test) of ISO 7176-8:1998.

Arm supports and back supports shall conform to the static loading requirements of ISO 7176-8:1998 in all intended operating positions with the exception of the upward force on a push handle which shall be 880 N.

NOTE The upward force is a correction of the value for upward force on push handles stated in Table 8 of ISO 7176-8:1998.

### 8.3.2 Test

Test the wheelchair in accordance with ISO 7176-8:1998.

**EN 12184:2009 (E)****8.4 Braking system****8.4.1 General requirements**

a) The braking system shall

- be accessible and operable by the occupant or an assistant or both in accordance with the manufacturer's intended use;
- be within the reach specified in Figure 2, if it is intended to be operated by the occupant;
- have operating forces for engaging and disengaging that do not exceed those stated in Table 1 when tested in accordance with 8.4.2.1;

NOTE 1 The brake lever type shown in Figure 1 has a combined hand and arm operation.

- include a running brake, which operates independently of tyre wear and tyre inflation pressure and when tested according to 8.4.2.2 does not exceed the maximum stopping distance specified in Table 2 (e.g. manual brake control or control device);
- include a running brake which, when operated with the wheelchair in freewheel mode, shall bring the wheelchair to a stop;

NOTE 2 The maximum stopping distances of Table 2 do not apply when the wheelchair is in the freewheel mode.

- include an automatic brake, which operates independently of tyre wear and tyre inflation pressure and is operated by releasing the control device to achieve a zero speed command (e.g. spring loaded disc brake);
- include a parking brake which operates independently of tyre wear and tyre inflation pressure (e.g. drum brake in wheels, spring loaded disc) that shall
  - 1) be operable when there is no power from the battery supplying the drive system,
  - 2) be operable when the wheelchair is in freewheel mode,
  - 3) meet the parking brake effectiveness requirement in Table 1 when tested according to 8.4.2.3 and, after testing as specified in b), when tested according to 8.4.2.6,
  - 4) have provision for adjustment and/or replacement as specified by the manufacturer, if the parking brake is subject to wear,
  - 5) not have parts that protrude above the level of the unoccupied seat when the brake is engaged, if the wheelchair is fitted with arm supports that can be moved or removed to enable transfer when tested according to 8.4.2.4,
  - 6) be operated either by hand or foot, and not exceed the brake lever operating forces specified in Table 1 when tested in accordance to 8.4.2.1,
  - 7) not allow the loaded wheelchair to slide nor for its wheels to rotate when tested as specified in ISO 7176-3:2003 on the maximum safe slope established by Table 1 or on the maximum safe slope specified by the manufacturer if greater, when facing
    - up the slope and
    - down the slope.

- b) No brake mechanism shall have moved from the pre-set position, no component or assembly of parts shall exhibit deformation, free play or loss of adjustment that adversely affects the function of the wheelchair when:

- the wheelchair has been tested as specified in ISO 7176-8:1998 and
- the parking brake has been operated for 60 000 cycles as specified in 8.4.2.5.

NOTE 4 Braking functions may be combined in one device (e.g. the spring loaded disc brake could combine automatic brake and parking brake).

NOTE 5 The wheelchair might be subject to national requirements for brakes.

## 8.4.2 Tests

### 8.4.2.1 Test for determination of brake lever operating forces

- a) Adjust the brakes as specified by the manufacturer.
- b) Select the part of the lever through which the force is to be applied as shown in Figure 3.
  - 1) If the lever is fitted with a generally spherical knob, apply the force through the centre of the knob.
  - 2) If the lever is tapered, apply the force through the point where the largest cross section intersects the centre line of the lever.
  - 3) If the lever is parallel or any shape other than those above, apply the force through a point on the centre line of the lever 15 mm below the top.
  - 4) If the form of the lever is such that the lever is gripped by the whole hand apply the force through the centre line of the lever 15 mm from the end.
  - 5) If the brake is operated by pushing or pulling a bar or pad, apply the force to the centroid of the bar or pad.
- c) Apply the brakes while measuring the force with the device specified in 4.4 aligned in the direction of travel of the point of application of the force in order to measure the maximum application force required.
- d) Release the brakes while measuring the force with the device specified in 4.4 aligned in the direction of travel of the point of application of the force in order to measure the maximum releasing force required.
- e) Perform c) and d) three times in total and record the measurements.
- f) Calculate and record the arithmetic mean value of the forces measured.
- g) Determine whether or not the requirements for operating forces stated in Table 1 have been met.

### 8.4.2.2 Test for the determination of the effectiveness of running brakes

Perform the tests for normal, reverse command and emergency operation specified in 7.3, 7.4 and 7.5 of ISO 7176-3:2003 using a loaded wheelchair, on the horizontal and on the steepest slope specified in ISO 7176-3:2003 less than or equal to the maximum safe slope. The wheelchair fails the requirement if the maximum stopping distance specified in Table 2 of this European Standard is exceeded, either on the horizontal or on the test slope, or if the deceleration value specified in Table 2 is exceeded.

**EN 12184:2009 (E)****8.4.2.3 Test for determination of effectiveness of parking brakes**

- a) Adjust the parking brake in accordance with the manufacturer's instructions without exceeding the operating force requirements stated in Table 1.
- b) Test the loaded wheelchair facing uphill as specified in ISO 7176-3:2003, with the test plane inclined to the horizontal at the applicable angle stated in Table 1 for the type class of the wheelchair, or at the maximum slope specified by the manufacturer if it is greater.
- c) Repeat b) with the wheelchair facing downhill.
- d) Determine whether the parking brake hold the loaded wheelchair stationary on the slope.

**8.4.2.4 Test for protrusion of parts of the parking brakes**

To test for protrusion of parts of the parking brake above the level of the unoccupied seat perform the following.

- a) Engage the parking brake.
- b) Move or remove the arm support to enable transfer.
- c) Check whether any part of the parking brake protrudes above the level of the seat.

**8.4.2.5 Test for fatigue strength of manually operated parking brakes**

- a) Adjust the parking brake in accordance with the manufacturer's instructions without exceeding the operating force requirements stated in Table 1.
- b) Carry out the test with the parking brake mounted on the wheelchair.
- c) Move the lever of the brake smoothly from the non-braking position to the braking position for 60 000 cycles at a frequency not greater than 0,5 Hz (4.12). If the wheelchair is fitted with two identical brakes (left and right), test only one of the brakes. Carry out maintenance during testing only as specified in the manufacturer's instructions.
- d) Inspect the brake mechanism to determine whether it has moved from the pre-set position, or whether any component or assembly of parts shows visible signs of cracks, breakages, gross deformations, free play or loss of adjustment that adversely affects the function of the wheelchair.

**8.4.2.6 Test for the determination of effectiveness of parking brakes after fatigue strength testing**

- a) Adjust the parking brakes in accordance with the manufacturer's instructions without exceeding the operating force requirements stated in Table 1.
- b) Repeat the test specified in 8.4.2.3.

**8.5 Operating forces****8.5.1 Requirements**

All controls shall have operating forces for engaging and releasing that do not exceed those stated in Table 1 when tested in accordance with 8.5.2. Brake operating levers shall be tested in accordance with 8.4.2.1.

In addition, to achieve the intended function of the system or device being operated, turning knobs operated by one hand shall have

- the numerical value of the torque, expressed in Nm, for knobs greater than or equal to 25 mm in diameter shall not be greater than 0,05 times the numerical value of the diameter of the knob, expressed in mm, where the force is transmitted by friction and
- the numerical value of the torque, expressed in Nm, for knobs less than 25 mm diameter shall not be greater than 0,025 times the numerical value of the diameter of knob, expressed in mm.

### 8.5.2 Test

- a) Position a means to apply force or torque as applicable:
  - 1) where the operation is performed by pushing or pulling, position the means to apply force parallel to the direction of operation and in the middle of the knob or button;
  - 2) in the case of a lever, position the means to apply force at a distance of 15 mm from the end of the operating lever;
  - 3) for a turning knob, use a suitable means (e.g. a force gauge) to position the means to measure torque concentrically on the knob.
- b) Gradually increase the force or torque until the intended function of the system or device as specified by the manufacturer's instructions is achieved.
- c) Measure and record the maximum operating force.
- d) Perform b) to c) three times in total.
- e) Calculate and record the arithmetic mean of the three recorded measurements.

## 8.6 Assistant control unit, push handles and handgrips

### 8.6.1 Requirements

When an assistant control unit is fitted, the unit shall be positioned behind the wheelchair's back support, between 900 mm and 1 200 mm from the floor to the centre of the operating means for the control device (e.g. joystick handle).

When an assistant control unit is fitted, a means to support the assistant's hand or hands used to operate the control device while the wheelchair is being driven shall be fitted.

When push handles are fitted, no part of the wheelchair shall lie within a space to the rear of the wheelchair bounded by the following:

- a plane at 85° to the horizontal, that touches the rearmost points of the push handles as shown in Figure 4;
- two planes not less than 350 mm apart equidistant from a vertical plane parallel to the forward direction of travel that bisects the wheelchair;
- the horizontal test plane.

When the wheelchair is fitted with steering and/or manoeuvring handgrips for assistant use, the handgrips shall be at least 75 mm in length and between 20 mm and 50 mm in diameter.

When manoeuvring handgrips are fitted with controls that are intended to be used by being gripped by one hand, the handgrip width needed to grip them shall be no greater than 75 mm (see Figure 1).

**EN 12184:2009 (E)****8.6.2 Test**

- a) Place the wheelchair on the horizontal test plane.
- b) Note the position of the assistant control device and measure the height of its operating means above the test plane.
- c) Project the planes specified in 8.6.1 and determine whether any part of the wheelchair lies within the enclosed space.
- d) Measure the dimensions of the steering and/or manoeuvring handgrips.
- e) Where applicable, measure the grip width of the controls fitted to the manoeuvring handgrips that are intended to be used by being gripped by one hand.
- f) Inspect the wheelchair for means to support the assistant's hand or hands used to operate the control device while the wheelchair is being driven.
- g) Record whether the wheelchair meets the requirements.

**8.7 Charging connector****8.7.1 Requirements**

The charging connector shall be accessible and operable by the occupant and assistant within the region specified in Figure 2 when operated as specified in the manufacturer's instructions.

NOTE The shape and position of the charging connector are important factors contributing to the ease and safety of operation.

**8.7.2 Test**

- a) Connect the charging connector to recharge the battery as specified in the manufacturer's instructions.
- b) Record whether the charging connector meets the requirement.

**8.8 Performance of driving characteristics****8.8.1 General**

The loaded wheelchair shall meet the driving performance requirements specified in Table 1 and Table 2 for the type class of the wheelchair as specified in Clause 5.

**8.8.2 Ability to climb maximum safe slope****8.8.2.1 Requirements**

The wheelchair shall be capable of climbing at a speed not less than 2 km/h:

- the applicable maximum safe slope specified in Table 1, or
- the maximum safe slope specified by the manufacturer, whichever is greater.

The wheelchair passes the test specified in 8.8.2.2 if it achieves or exceeds a speed of 2 km/h after travelling 5 m up the specified maximum safe slope without any visible lifting of any uphill wheel(s).

NOTE Uphill wheel lifting does not apply to wheelchairs with six or more wheels.



### 8.8.2.2 Test

- a) Select and fit a test dummy as specified in ISO 7176-22:2000, or use a human test occupant.

If a human occupant is used, make provision to use an occupant of the same mass  $\pm 1$  kg as the dummy specified above. Supplementary weights as specified in 4.7 may be used.

**CAUTION — This testing is potentially hazardous to a human test occupant and test personnel. Appropriate safety precautions should be taken to avoid injury.**

NOTE During the tests care should be taken to minimize any body movement of the occupant, whether intentional or unintentional, which could affect the stability of the wheelchair.

- b) Adjust the gradient of the adjustable test plane specified in 4.1 to the applicable slope specified in Table 1 for the type class of the wheelchair or the maximum safe slope specified by the manufacturer whichever is the greater.
- c) Starting on the adjustable test plane drive the loaded wheelchair up the adjustable test plane using the maximum speed command.
- d) Measure and record the speed of the wheelchair to an accuracy of  $\pm 10$  % when it has travelled  $5\text{ m} \pm 10\text{ cm}$  up the slope.

### 8.8.3 Ground unevenness

#### 8.8.3.1 Principle

A wheelchair shall be able to drive on uneven terrain without stopping even if one wheel is at a higher level than the others.

#### 8.8.3.2 Requirement

The wheelchair shall be capable of driving when any of its wheels is raised to a height specified in Table 1 for ground unevenness.

#### 8.8.3.3 Test

- a) Place the loaded wheelchair on the horizontal test plane.
- b) Place the test block specified in 4.8 under one wheel, such that one of its largest faces is flat on the test plane with the centre of the block beneath the point of contact with the wheel.
- c) Attempt to drive the loaded wheelchair slowly off the test block.
- d) Record the result of the test.
- e) Repeat for the remaining wheels, one at a time.
- f) The test is passed if the wheelchair is able to drive slowly off the test block for each wheel.

### 8.8.4 Maximum downhill speed

#### 8.8.4.1 Requirement

The wheelchair shall not exceed 125 % of its maximum speed on the horizontal, when driving down a gradient equivalent to its maximum safe slope.

**EN 12184:2009 (E)****8.8.4.2 Test**

- a) Drive the loaded wheelchair at maximum speed down a gradient equivalent to its maximum safe slope and measure the speed with a device as specified in 4.5.
- b) Record the measured speed and record whether the wheelchair meets the requirement.

**8.8.5 Dynamic stability****8.8.5.1 Requirements**

The dynamic response score of the wheelchair shall be 2 or 3 as specified in Table A.1 of ISO 7176-2:2001 when tested on the slopes specified in Table 1 of this European Standard for the type class of the wheelchair and at the maximum safe slope specified by the manufacturer.

NOTE Uphill wheel lifting does not apply to wheelchairs with six or more wheels.

**8.8.5.2 Test**

- a) Test the loaded wheelchair to the clauses of ISO 7176-2:2001 listed below to determine the dynamic stability of the loaded wheelchair on the test plane inclined at the angle to the horizontal stated in Table 1 for the type class of the wheelchair.
  - For rearwards dynamic stability:
    - 8.1 Wheelchair preparation;
    - 8.2 Starting forwards;
    - 8.3 Stopping after travelling forwards;
    - 8.4 Braking when travelling backwards;
  - For forward dynamic stability:
    - 9.1 Wheelchair preparation;
    - 9.2 Braking when travelling forwards;
  - For dynamic stability in lateral directions:
    - 10.1 Wheelchair preparation;
    - 10.2 Turning on a slope.
- b) If the maximum safe slope specified by the manufacturer is greater than the values in Table 1, repeat a) with the test plane set at the maximum safe slope specified by the manufacturer.

**8.8.6 Obstacle climbing****8.8.6.1 Requirements**

The wheelchair shall be capable of climbing and descending obstacles of the height specified in Table 1 for the type class of the wheelchair without any part of the wheelchair other than wheels or a kerb climbing device contacting the obstacle or the test plane.

#### **8.8.6.2 Test**

Test the wheelchair as specified in ISO 7176-10:2008 for climbing and descending a test obstacle of the height specified in Table 1 for the type class of the wheelchair.

If the manufacturer specifies a procedure for climbing steps, kerbs or obstacles, test as specified in ISO 7176-10:2008 using only the manufacturer's recommended technique. If the manufacturer specifies a run-up distance greater than that specified in ISO 7176-10:2008, limit the run-up distance to the maximum specified in that document.

If the manufacturer of the wheelchair does not specify a procedure for climbing steps, kerbs or obstacles, test as specified in ISO 7176-10:2008 using the methods specified in that document.

#### **8.8.7 Static stability**

##### **8.8.7.1 Requirements**

The wheelchair shall meet or exceed the minimum requirements for static stability specified in Table 1 for the type class of the wheelchair.

##### **8.8.7.2 Test**

Test the loaded wheelchair as specified in ISO 7176-1:1999 to determine whether the static stability meets or exceeds the angles in Table 1 for the type class of the wheelchair.

#### **8.8.8 Maximum speed**

##### **8.8.8.1 Requirements**

The maximum speed of the wheelchair when travelling forwards and travelling in reverse on the horizontal shall not exceed the maximum speed requirements specified in Table 1 for the type class of the wheelchair.

##### **8.8.8.2 Test**

Test the loaded wheelchair as specified in ISO 7176-6:2001 for the maximum forward speed and maximum reverse speed on a horizontal surface.

Record the results and determine whether the requirement has been met.

#### **8.8.9 Distance range**

##### **8.8.9.1 Requirements**

The theoretical continuous driving distance range for the wheelchair shall not be less than the requirement specified in Table 1 for the type class of the wheelchair.

##### **8.8.9.2 Test**

Test the loaded wheelchair as specified in ISO 7176-4:2008.

Record the results and determine whether the requirement has been met.

#### **8.9 Surface temperature**

Surfaces of the wheelchair that can come into direct contact with the occupant's skin and/or assistant's skin during normal use and that are within the envelope illustrated in Figure 2 shall not exceed 41 °C when tested

**EN 12184:2009 (E)**

as specified in EN 12182. If an ambient temperature is not specified, test at an ambient temperature of  $20\text{ °C} \pm 2\text{ °C}$ .

**8.10 Resistance to ignition****8.10.1 Upholstered composite parts**

For upholstered parts which are composites of cover and filling, with or without a support base or interliner, the complete composite shall be tested by the methods specified in EN 1021-1:2006 and EN 1021-2:2006. Progressive smouldering ignition and flaming ignition as defined in these European Standards shall not occur.

**8.10.2 Foam materials**

For foam materials which form all or part of a seat, back support, postural support, arm support or lower leg support and which consist of foam material with or without an integral skin, the material of each part shall be tested with the source applied centrally to the material face that contacts the occupant by the methods specified in EN 1021-1:2006 and EN 1021-2:2006. Progressive smouldering ignition and flaming ignition as defined in these European Standards shall not occur.

**8.10.3 Other parts**

For sling seats, sling backs, belts, restraint harnesses, foot supports and clothing guards, the material of each item shall be tested with the source applied centrally to the material face that contacts the occupant by the methods specified in EN 1021-1:2006 and EN 1021-2:2006. Progressive smouldering ignition and flaming ignition as defined in these European Standards shall not occur.

NOTE It is not necessary to test components that are inherently resistant to ignition; e.g. steel frame tube.

**8.11 Climatic test**

The wheelchair shall conform to the requirements of ISO 7176-9:2001. The spray water test in clause 14.2.4 of EN 60529:1991 shall also be carried out.

**8.12 Seating adjustments for tilt and recline systems****8.12.1 Requirements**

If the manufacturer specifies that the seating can be adjusted by an assistant or the occupant or both while the occupant is seated, the assistant and/or the occupant shall not have to lift a mass (e.g. the combined mass of the occupant and the seating) which presents a moving and handling safety hazard to the assistant and/or the occupant.

Controls for seating adjustments intended to be operated by the occupant shall be accessible to the occupant from all seating positions.

NOTE The shaded region of Figure 2 shows the maximum reach space for the occupant in relation to the position of the back support reference plane and the seat reference plane (see ISO 7176-7:1998).

**8.12.2 Test method**

- a) Adjust the seating as specified in the manufacturer's instructions.
- b) Record whether the wheelchair meets the requirements.

## 9 Electrical requirements

### 9.1 General requirements

The wheelchair shall conform to the requirements of ISO 7176-14:2008 and ISO 7176-21:2003.

In addition, wheelchairs that include an on-board battery charger shall conform to the applicable electrical requirements of EN 60601-1:2006 and EN 61000-3-2:2006 for electromagnetic compatibility.

### 9.2 Requirement for controller on/off switch

Provision shall be made for the occupant and/or assistant to switch the wheelchair on and off.

Switches intended to be operated by the occupant shall be within the reach space shown in Figure 2. Switches intended to be operated by an assistant shall be attached to the assistant control unit positioned as specified in 8.6.1.

If the wheelchair is switched off while driving on the horizontal, it shall come to a stop within the maximum stopping distances specified in Table 2.

### 9.3 Requirement for power indicator

The wheelchair shall be fitted with a device to indicate to the occupant and/or assistant that power is switched on. The colour of this indication shall conform to EN 60601-1:2006.

### 9.4 Requirements for circuit protection

Circuits connected to batteries on the wheelchair shall be protected against excessive current.

NOTE Fuses, automatic and manually re-settable circuit breakers are examples of means of protection.

The driving, braking and steering functions shall not be affected by the operation of the means of protection of any other circuit.

Lights, direction indicators and hazard warning flasher functions shall not be affected by the operation of the means of protection of any other circuit.

### 9.5 Requirements for battery chargers

Battery chargers for wheelchairs shall conform to the requirements of ISO 7176-14:1997 that apply to battery chargers, together with the following provisions:

- a) battery chargers shall indicate when charging is in progress and when charging is complete;
- b) battery chargers shall have the capability of charging batteries discharged to 70 % of their nominal voltage;
- c) battery chargers shall operate without the need for intervention or supervision apart from connecting and turning on at the start of charging and turning off and disconnecting at the end of charging;
- d) carry-on and on-board battery chargers shall meet the environmental protection requirements of IPX4 when tested in accordance with EN 60529:1991 and meet the Class II Test Voltage requirements of EN 60335-1:2002 concluding the test.

**EN 12184:2009 (E)****9.6 Charge level indicator**

The wheelchair shall be equipped with a charge level indicator.

**10 Requirements for information supplied by the manufacturer****10.1 General**

Each wheelchair shall be provided with documentation and labelling that conform to the requirements in EN 12182 and ISO 7176-15:1996.

In addition, the manufacturer shall provide the documentation in three separate sections: pre-sale, user and service information as specified in 10.2, 10.3 and 10.4. These may be provided as separate printed documents or in other forms of media to meet the needs of individual occupants or their assistants.

**10.2 Pre-sale information**

In addition to the requirements of 10.1, pre-sale information shall include the following:

- a) information on how to obtain the user information in a format appropriate for use by visually impaired people;
- b) description of the intended occupant of the wheelchair (as a minimum this will include occupant mass plus any specific requirements for functional capability, visual ability and cognisance to operate the wheelchair safely in its intended environment);
- c) description of the intended use and the intended environment;
- d) type class of the wheelchair: Class A, Class B or Class C;
- e) overall dimensions (width, length and height) of the wheelchair, expressed in millimetres, and its mass, expressed in kilograms, when it is ready for use and, if applicable, when it is folded or dismantled;
- f) reversing width, expressed in millimetres;
- g) maximum safe slope, expressed in degrees;
- h) maximum height of kerb which the wheelchair can descend safely, expressed in millimetres;
- i) information concerning whether the removal of parts or accessories intended by the manufacturer to be removed without the use of tools will have adverse or beneficial effects on the wheelchair;
- j) standard options that are available for the wheelchair;
- k) type of tyres that can be used on the wheelchair;
- l) if a programmable controller is fitted, information on the method of programming, who should carry out the programming and the effects it can have on driving performance;
- m) operator control adjustments;
- n) theoretical continuous driving distance range, expressed in kilometres, that the wheelchair can travel under its own power on the horizontal when tested in accordance with ISO 7176-4:2008, with the addition of a note explaining that the distance will be reduced if the wheelchair is used frequently on slopes, rough ground or to climb kerbs etc.;

NOTE This additional requirement may be reduced to some degree if an accurate charge level indicator is fitted.

- o) whether and how the wheelchair can be folded or dismantled to assist in storage or transport;
- p) if the wheelchair can be dismantled or has any removable parts, the mass of the heaviest part, expressed in kilograms;
- q) instructions regarding transport of the wheelchair when it is unoccupied (e.g. in a car or aeroplane);
- r) information on whether or not the wheelchair is intended to be used as a seat in a motor vehicle;
- s) if the manufacturer specifies that the wheelchair is intended for use as a seat in a motor vehicle, the method of attaching wheelchair tiedown and occupant restraints, and recommendations about suitable tiedown and restraint systems.

### 10.3 User information

User information shall be provided by the manufacturer with each wheelchair. Further copies shall also be available for any subsequent user of the wheelchair. User information shall contain all pre-sale information and the following:

- a) the unique identification number of the wheelchair and information on the location of the unique identification number on the wheelchair;
- b) the intended operator (occupant, assistant or both);
- c) any adjustment or settings required before the wheelchair can be used and warnings of how adjustments or settings affect stability;
- d) where applicable, information on any adjustments that can be made and who is competent to carry out these adjustments;
- e) instructions on operation of all controls, including brakes;
- f) instructions on how to engage and disengage the drive system;
- g) the wheelchair manufacturer's recommended tyre pressure(s), expressed in kilopascals (kPa) or bar;
- h) instructions for dealing with tyre punctures, where pneumatic tyres are fitted;
- i) the battery type and nominal voltage;
- j) instructions for battery maintenance;
- k) instructions for operating the battery charger, including warnings regarding any potential safety hazards (e.g. a possibility of gas accumulating in the charging area);
- l) instructions on dismantling and re-assembly of the wheelchair or any removable parts;
- m) the masses of parts of the wheelchair that are expected to be handled during dismantling, reassembly, or carrying, expressed in kilograms;
- n) the positions of points where the component parts can be gripped for safe moving and handling and/or a method for handling during dismantling, assembly or carrying;
- o) a warning that surface temperatures can increase when exposed to external sources of heat (e.g. sunlight);

**EN 12184:2009 (E)**

- p) a warning that the wheelchair might disturb the operation of devices in its environment that emit electromagnetic fields (e.g. alarm systems of shops, automatic doors etc.);
- q) a warning that the driving performance of the wheelchair can be influenced by electromagnetic fields (e.g. those emitted by portable telephones, electricity generators or high power sources);
- r) a warning if driving characteristics can be adjusted outside the limits specified in Table 1 and Table 2;
- s) a warning for trapping hazards (e.g. pinch points);
- t) the level of resistance to ignition of materials and assemblies;
- u) information on the recycling of used batteries and other parts of the wheelchair;
- v) a warning if the adjustments of seating or wheel positions can be set outside safe limits;
- w) the expected service life of the wheelchair.

**10.4 Service information**

The service information shall contain all the pre-sale information, user information and instructions necessary for the maintenance, adjustment and repair of the wheelchair and for the replacement of parts.

**10.5 Labels**

In addition to the requirements of 10.1, the manufacturer shall apply permanent labels for the following:

- a) devices for disengagement of the drive system, showing engaged and disengaged positions, including a warning that the drive system should be re-engaged before an occupant is left unattended or attempts to operate the wheelchair;
- b) for wheelchairs where the intended use includes use as a seat in a motor vehicle, the position of attachment points for wheelchair tie-down and occupant restraint systems (WTORS);
- c) the year of production for the product;
- d) for battery chargers that are not on-board chargers, information and connection details specified in Clause 9 of ISO 7176-14:1997;
- e) for wheelchairs not intended to be used as a seat in a motor vehicle, a warning label that it is not intended to be used as a seat in a motor vehicle;
- f) for Class A wheelchairs for use indoors only a warning that it should only be used indoors.

**11 Test report**

The test report shall contain the following information:

- a) unique report number;
- b) name and address of the testing institution;
- c) date of issue of the test report;
- d) reference to this edition of this European Standard, i.e. EN 12184:2009;



- e) name and address of the manufacturer of the wheelchair;
- f) description of the sample including the manufacturer's or vendor's trade mark, model or type, serial number and any variations or accessories fitted;
- g) manufacturer, type and model of controller and motors and the type and capacity of the batteries fitted to the wheelchair during the tests;
- h) source of the sample;
- i) details of the set-up of the wheelchair as specified in ISO 7176-22:2000, including details of how it is equipped and adjustments;
- j) ambient temperature at which each test was carried out;
- k) size of the dummy used or, if a human test occupant is used, the mass of the occupant and weights;
- l) where the controller is programmable, the settings used while testing;
- m) photograph of the sample equipped as during the test;
- n) results of the tests;
- o) statement of whether or not the tested sample met all of the applicable requirements of this European Standard and a list of all the failed requirements.

## 12 Tables

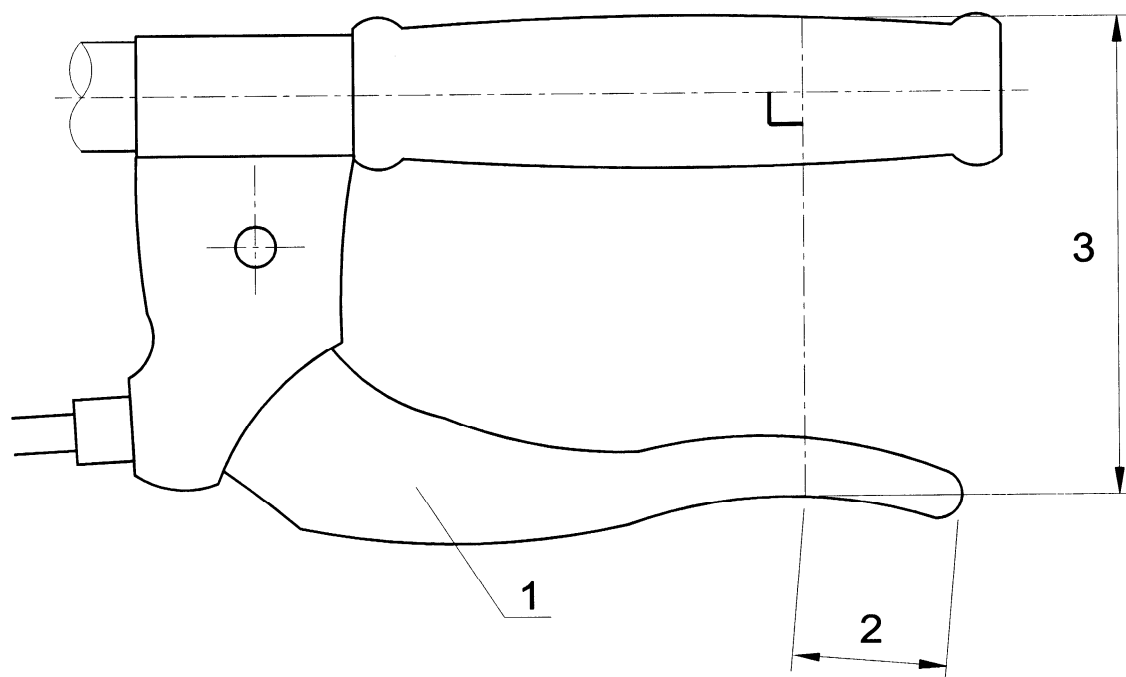
Table 1 — Requirements and tests for driving characteristics of type classes

Driving characteristics	Test	Requirement		
		Class A	Class B	Class C
Maximum safe slope	8.8.2.2	minimum 3°	minimum 6°	minimum 10°
Dynamic stability	8.8.5.2			
- starting forwards uphill		3° minimum slope	6° minimum slope	10° minimum slope
- stopping forwards uphill		3° minimum slope	6° minimum slope	10° minimum slope
- stopping forwards downhill		3° minimum slope	6° minimum slope	10° minimum slope
- stopping backwards downhill		3° minimum slope	6° minimum slope	10° minimum slope
- turning on a slope		No tipping beyond balance point shall occur	No tipping beyond balance point shall occur	No tipping beyond balance point shall occur
Static stability	8.8.7.2			
- all directions		6° minimum slope <b>or</b> the maximum safe slope claimed by the manufacturer if greater	9° minimum slope <b>or</b> the maximum safe slope claimed by the manufacturer if greater	15° minimum slope <b>or</b> the maximum safe slope claimed by the manufacturer if greater
Maximum operating forces				
Brake levers	8.4.2.1			
Freewheel lever and controls	8.5.2			
- single finger operation		5 N	5 N	5 N
- one hand operation		13,5 N	13,5 N	13,5 N
- combined hand and arm operation		60 N	60 N	60 N
- foot operation, pushing operation		100 N	100 N	100 N
- foot operation, pulling operation		60 N	60 N	60 N
Parking brake effectiveness	8.4.2.3 and 8.4.2.6	6° <b>or</b> the maximum safe slope claimed by the manufacturer if greater	9° <b>or</b> the maximum safe slope claimed by the manufacturer if greater	15° <b>or</b> the maximum safe slope claimed by the manufacturer if greater
Maximum speed	8.8.8			
- forwards horizontal		15 km/h	15 km/h	15 km/h
- reverse horizontal		70 % of maximum forward speed of the wheelchair <b>or</b> 5 km/h whichever is lower	70 % of maximum forward speed of the wheelchair <b>or</b> 5 km/h whichever is lower	70 % of maximum forward speed of the wheelchair <b>or</b> 5 km/h whichever is lower
Obstacle climbing and descending ability	8.8.6.2			
- minimum obstacle height		15 mm	50 mm	100 mm
Minimum theoretical continuous driving distance range	8.8.9.2	15 km	25 km	35 km
Ground unevenness	8.8.3.3	10 mm	30 mm	50 mm

**Table 2 — Requirements and tests for driving characteristics on the horizontal for all type classes**

Driving characteristics and requirements			Test
Maximum value of deceleration Peak lasting more than 0,03 s = 4 m/s <sup>2</sup>			8.4.2.2
Maximum stopping distance			8.4.2.2
Speed (km/h)	Horizontal (m)	On slope (m)	
4,0	0,6	1,2	
5,0	0,8	1,6	
6,0	1,0	2,0	
7,0	1,2	2,4	
8,0	1,5	3,0	
9,0	1,8	3,6	
10,0	2,1	4,2	
11,0	2,5	5,0	
12,0	2,9	5,8	
13,0	3,4	6,0	
14,0	3,9	6,0	
15,0	4,5	6,0	

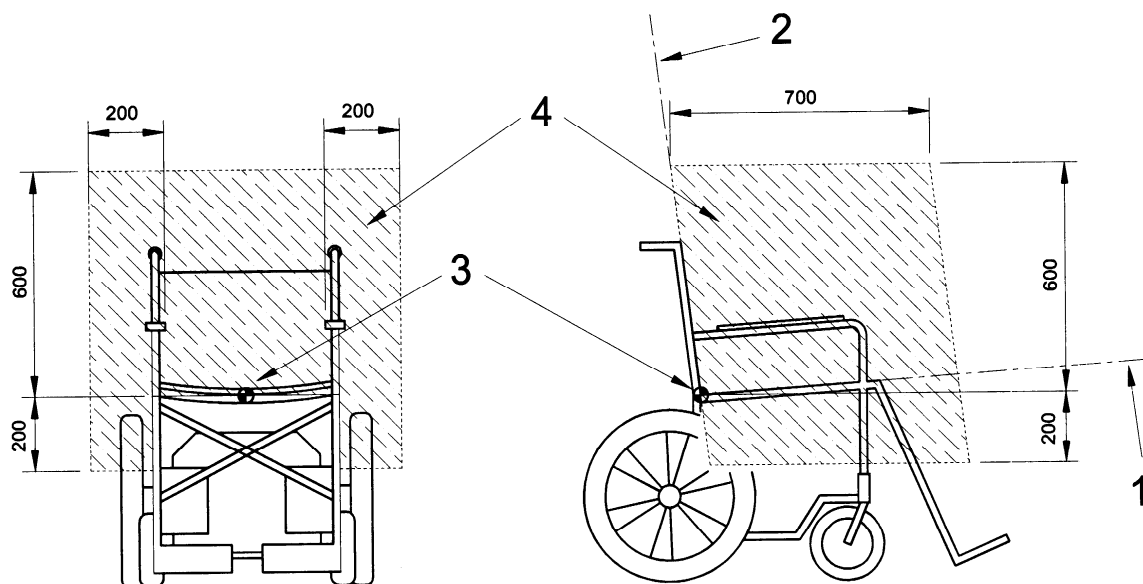
## 13 Figures

**Key**

- 1 lever gripped by the fingers of one hand
- 2 15 mm
- 3 handgrip width

**Figure 1 — Handgrip width**

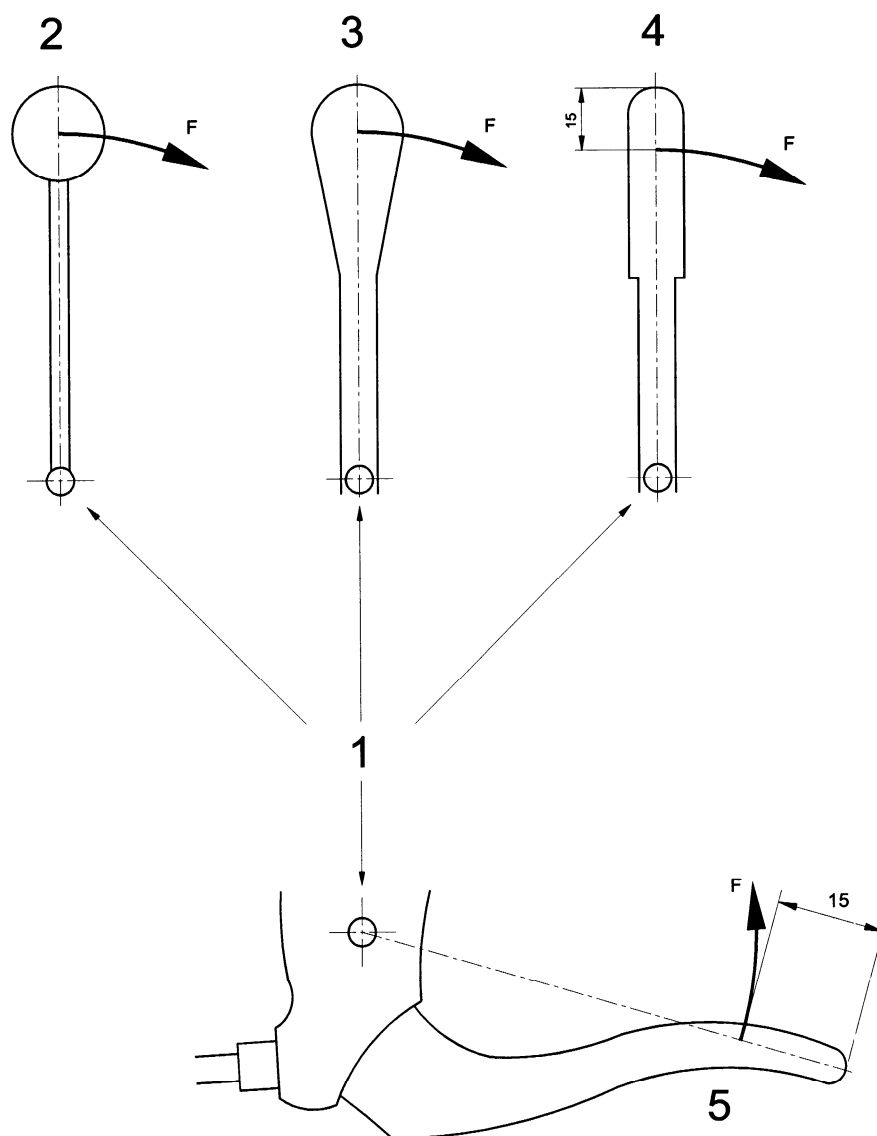
Dimensions in millimetres

**Key**

- 1 seat reference plane
- 2 back support reference plane
- 3 seat reference point
- 4 occupant reach for electrically powered wheelchair

**Figure 2 — Occupant reach for electrically powered wheelchair**

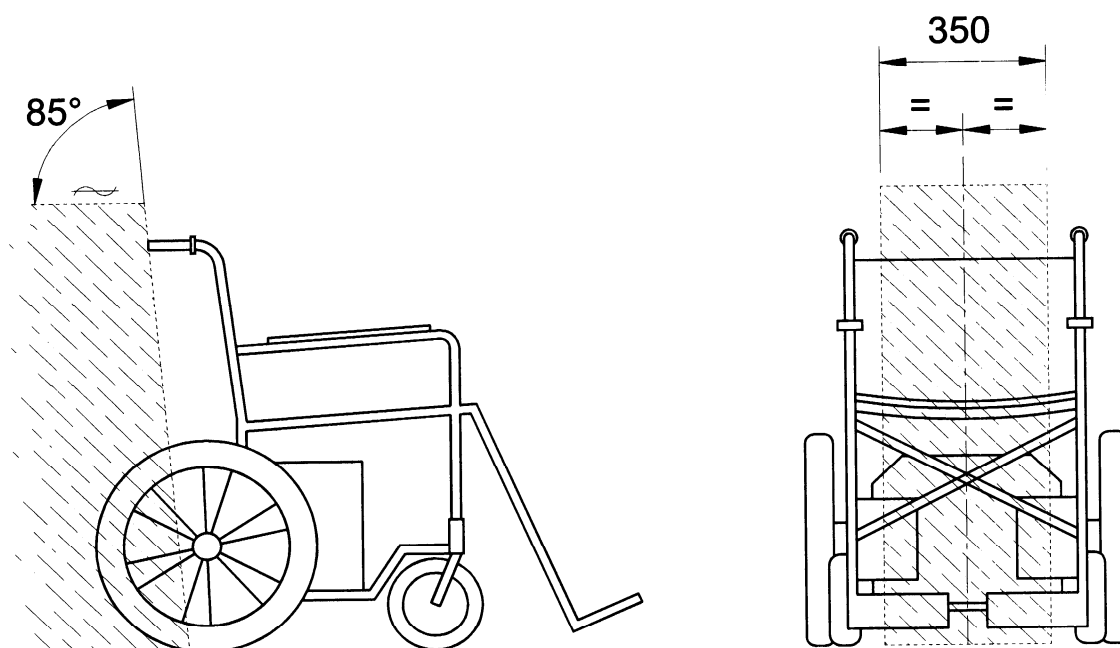
Dimensions in millimetres

**Key**

- 1 fulcrum
- 2 generally spherical knob
- 3 tapered lever
- 4 parallel lever
- 5 bicycle-style lever
- F path of the point of application of the operating force

**Figure 3 — Application of forces to levers**

Dimensions in millimetres

**Figure 4 — Space for assistant movement**

## **Annex A**

### **(informative)**

## **Recommendations for test dummies of mass greater than 100 kg**

### **A.1 General**

The scope of this European Standard is limited to wheelchairs intended for a maximum user mass not greater than 100 kg. This annex describes a method for modifying the 100 kg test dummy specified in ISO 7176-11:1992 to produce test dummies with nominal masses of 125 kg and 150 kg. Parties wishing to test the performance of wheelchairs intended for user masses greater than 100 kg are encouraged to use these dummies where they are applicable.

This annex can also be used to develop designs for test dummies of different masses between 100 kg and 150 kg.

### **A.2 Construction**

Each dummy is constructed from the 100 kg test dummy, with the following modifications:

- mass is added to the front of the trunk section, the top of the upper leg section and the front of the lower leg section;
- a wider back plate is fitted;
- a larger thigh plate is fitted.

**NOTE** The 125 kg and 150 kg test dummies use the same size of back plate, but different sizes of thigh plate.

General views of the 125 kg dummy and the 150 kg dummy are provided in Figure A.1 and Figure A.2 respectively. The additional masses are steel blocks with dimensions as specified in Table A.1. The number of blocks used for each test dummy is specified in Table A.2. The positions for attachment of the blocks are specified in Figure A.6, Figure A.7 and Figure A.8.

The back plate and thigh plates are constructed and attached to the applicable dummy as specified in ISO 7176-11:1992. Figure A.3 and Figure A.4 specify the dimensions for the thigh plates of the 125 kg dummy and the 150 kg dummy respectively. The dimensions of the back plate are shown in Figure A.5.

The added mass should be equally disposed about the plane of symmetry of the dummy to ensure the centre of mass is not displaced to the right or left.

Attachment hardware (e.g. fasteners) should be of sufficient strength to retain the steel blocks when the dummy is in use, but should not exceed the mass limits specified in Table A.2.

### **A.3 Accelerometer mounting**

The recommended position for an accelerometer is the centre of the forward face of the 6 kg steel block added to the trunk section (see Figure A.9).



**Table A.1 — Steel blocks for additional masses**

Nominal mass kg	Dimensions mm
1,5	$(240 \pm 5) \times (80 \pm 3) \times (10 \begin{smallmatrix} 0 \\ -1 \end{smallmatrix})$
3,0 <sup>a</sup>	$(240 \pm 5) \times (80 \pm 3) \times (20 \begin{smallmatrix} 0 \\ -2 \end{smallmatrix})$
4,5	$(180 \pm 5) \times (80 \pm 3) \times (40 \begin{smallmatrix} 0 \\ -4 \end{smallmatrix})$
6,0 <sup>a</sup>	$(240 \pm 5) \times (80 \pm 3) \times (40 \begin{smallmatrix} 0 \\ -4 \end{smallmatrix})$
8,5	$(340 \pm 5) \times (80 \pm 3) \times (40 \begin{smallmatrix} 0 \\ -4 \end{smallmatrix})$
<sup>a</sup> These blocks have the same dimensions as those specified in ISO 7176-11:1992.	

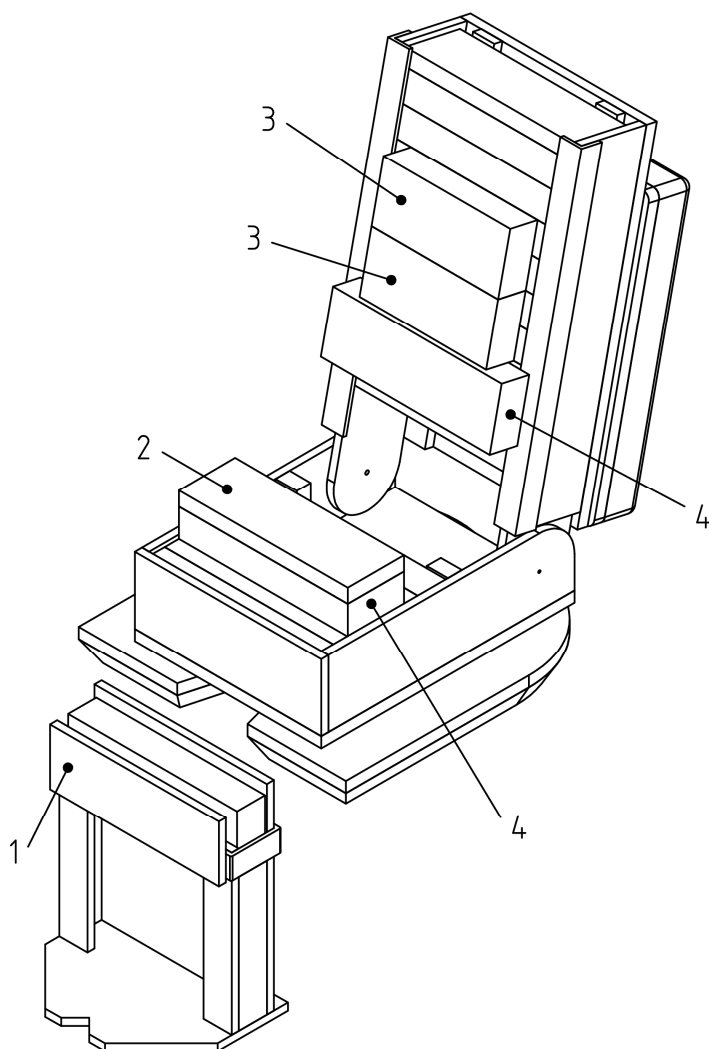
#### A.4 Design aims

The intention for the design of the two dummies is:

- to extend the range of mass of the ISO 7176-11:1992 test dummies in 25 kg increments;
- to keep the centre of mass of the combined trunk/upper leg section of the dummy approximately at the same point;
- to preserve the ratio of the masses of the trunk, upper leg and lower leg sections;
- to avoid restriction of the range of rotation of the pivot joint between the trunk and upper leg sections by the masses added to them.

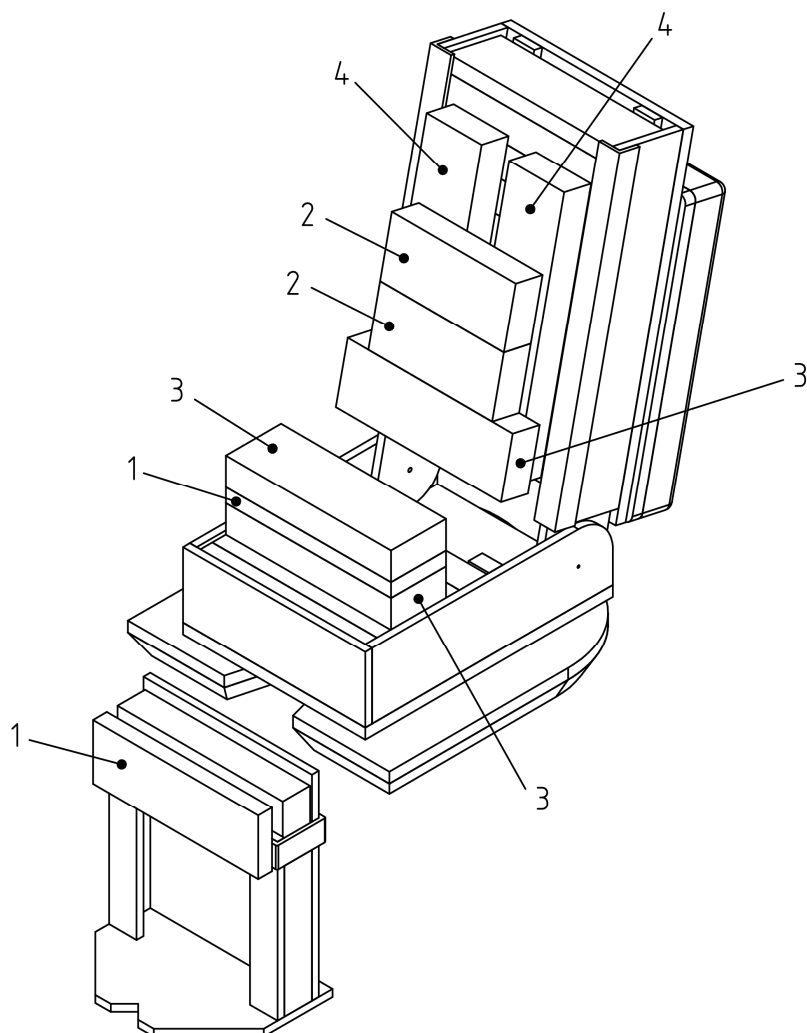
Table A.2 — Dummy component masses

Component	Mass	
	kg	
	150 kg dummy	125 kg dummy
<b>Trunk</b>		
100 kg dummy trunk	61 ± 3	61 ± 3
Additional masses	$2 \times 8,5 = 17$ $1 \times 6 = 6$ $2 \times 4,5 = 9$	$1 \times 6 = 6$ $2 \times 4,5 = 9$
Additional construction	< 0,5	< 0,5
Subtotal	93 ± 3	76 ± 3
<b>Upper legs</b>		
100 kg dummy upper legs	31 ± 3	31 ± 3
Additional masses	$2 \times 6 = 12$ $1 \times 3 = 3$	$1 \times 6 = 6$ $1 \times 3 = 3$
Additional construction	≤ 1,0	≤ 1,0
Subtotal	47 ± 3	41 ± 3
<b>Lower legs</b>		
100 kg dummy lower legs	7 ± 1	7 ± 1
Additional masses	$1 \times 3 = 3$	$1 \times 1,5 = 1,5$
Additional construction	< 0,5	< 0,5
Subtotal	10 ± 1	9 ± 1
<b>Total</b>	150 $\begin{smallmatrix} +5 \\ -2 \end{smallmatrix}$	125 $\begin{smallmatrix} +5 \\ -2 \end{smallmatrix}$

**Key**

- 1 1,5 kg steel block
- 2 3,0 kg steel block
- 3 4,5 kg steel block
- 4 6,0 kg steel block

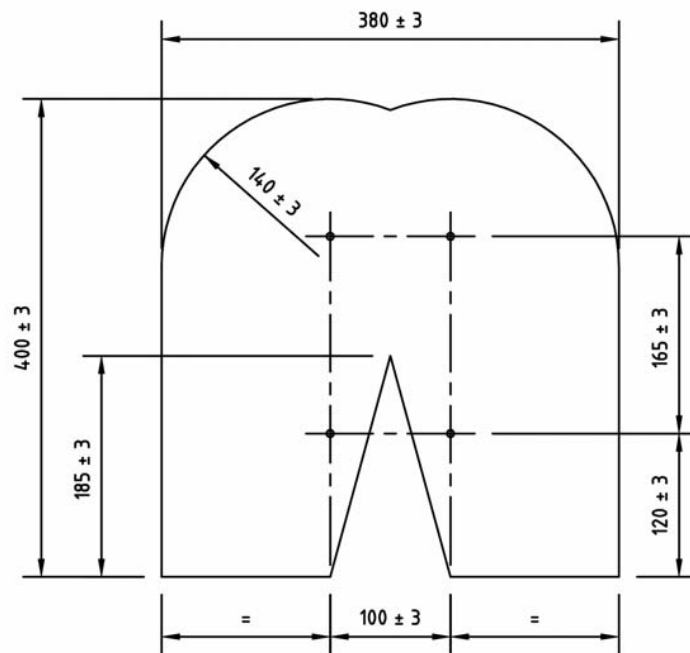
**Figure A.1 — 125 kg dummy**

**Key**

- 1 3,0 kg steel block
- 2 4,5 kg steel block
- 3 6,0 kg steel block
- 4 8,5 kg steel block

**Figure A.2 — 150 kg dummy**

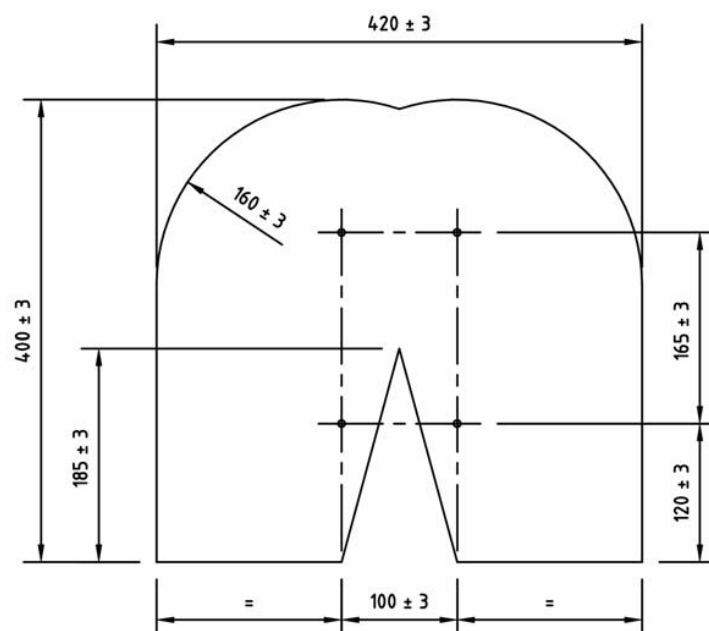
Dimensions in millimetres



NOTE Holes for screws to attach thigh plate to lower leg section shown in four positions.

**Figure A.3 — Thigh plate for 125 kg dummy**

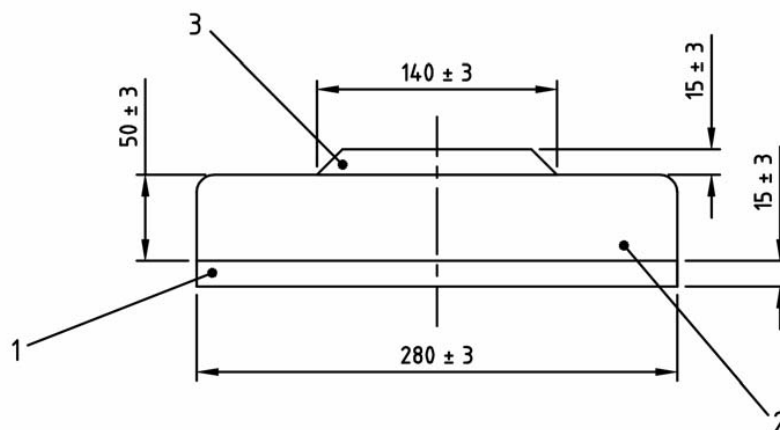
Dimensions in millimetres



NOTE Holes for screws to attach thigh plate to lower leg section shown in four positions.

**Figure A.4 — Thigh plate for 150 kg dummy**

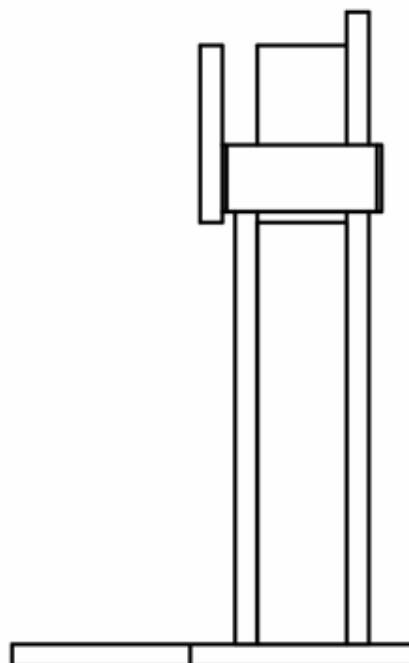
Dimensions in millimetres

**Key**

- 1 Plywood
- 2 Open-cell rigid foam
- 3 Closed-cell foam

NOTE ISO 7176-11:1992 specifies other details of the back plate size and construction.

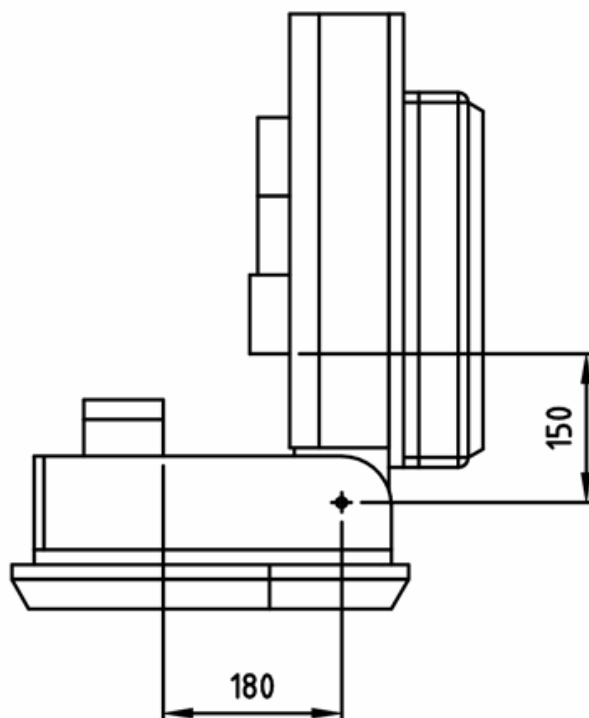
**Figure A.5 — Back plate for 125 kg and 150 kg dummies**



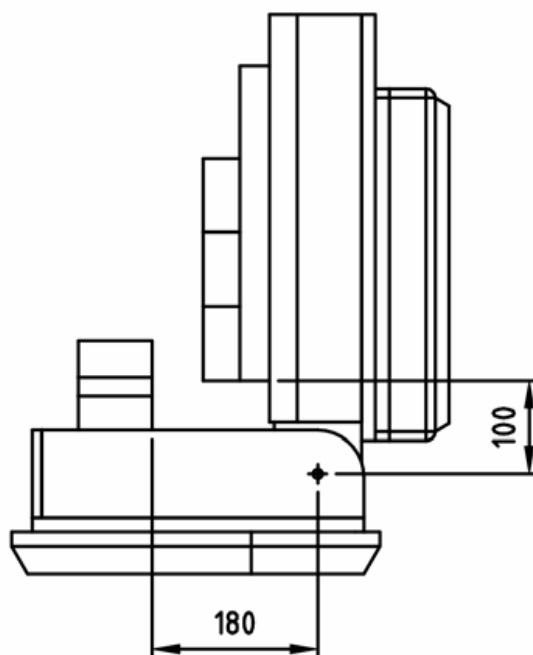
NOTE The additional mass fitted to the 125 kg dummy is shown as an example.

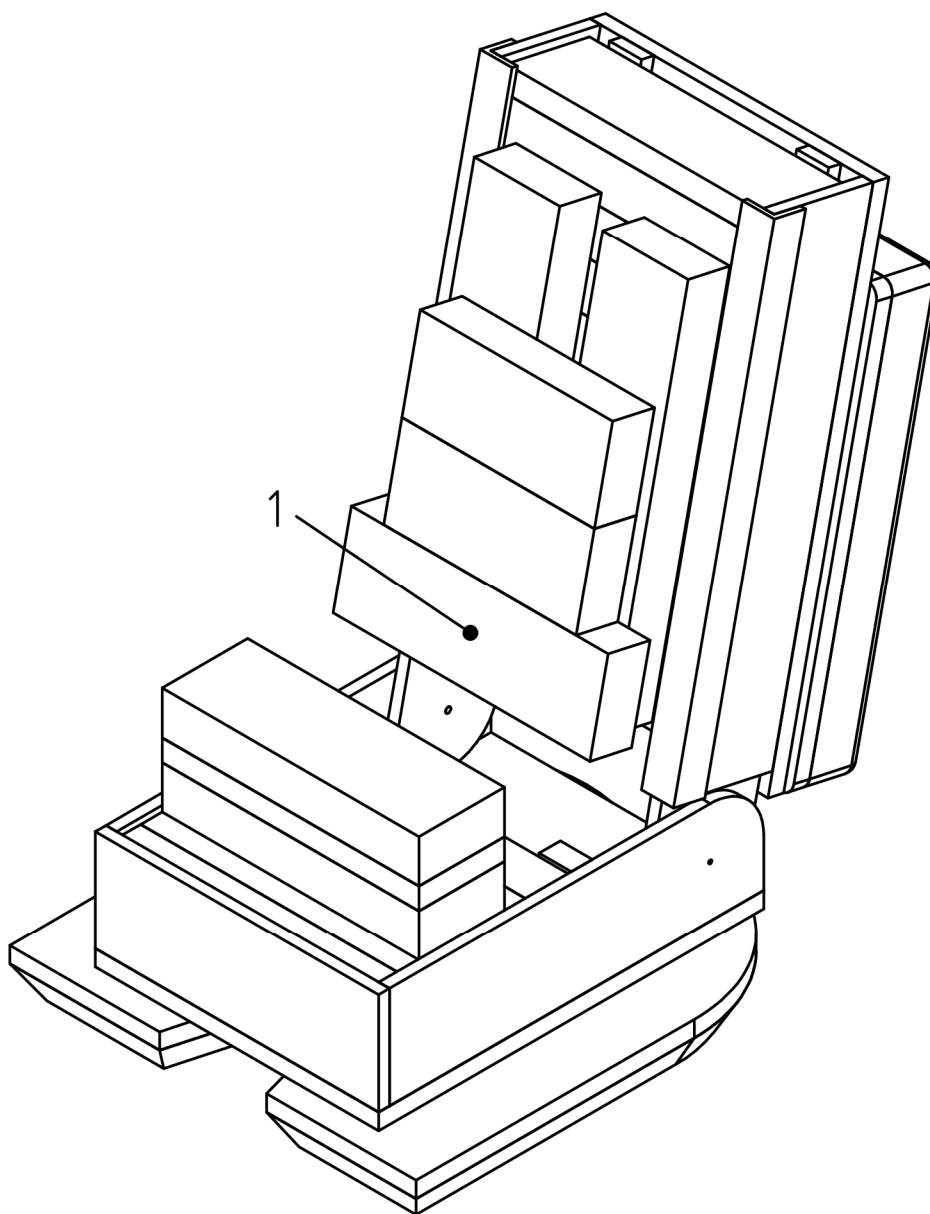
**Figure A.6 — Lateral view of leg section with additional mass attached**

Dimensions in millimetres

**Figure A.7 — Lateral view of trunk and upper leg sections of 125 kg dummy**

Dimensions in millimetres

**Figure A.8 — Lateral view of trunk and upper leg sections of 150 kg dummy**

**Key**

1 recommended accelerometer mounting position

NOTE The 150 kg dummy is shown as an example.

**Figure A.9 — Accelerometer mounting**



## **Annex B**

### **(informative)**

## **Recommendations for dimensions and manoeuvring space of electrically powered wheelchairs**

### **B.1 Specific dimensions**

#### **B.1.1 Dimensions when ready for use**

The overall width and full overall length should not be greater than the applicable values specified in Table B.1 for the type class of the wheelchair.

#### **B.1.2 Push handle height**

The height of push handles, if fitted, should be between 900 mm and 1 200 mm.

#### **B.1.3 Ground clearance**

The ground clearance, when measured in accordance with the method specified in ISO 7176-5:2008, should not be less than the value specified in Table B.1. This recommendation does not apply to wheelchairs designed for special purposes that are incompatible with the recommendation, e.g. stand-up wheelchairs and wheelchairs with a seat that lowers to ground level.

### **B.2 Manoeuvring space**

#### **B.2.1 Turning diameter**

The turning diameter, as measured by the test specified in ISO 7176-5:2008, should not be greater than the value specified in Table B.1 for the type class of the wheelchair.

#### **B.2.2 Reversing width**

The reversing width, as measured by the test specified in ISO 7176-5:2008, should not be greater than the value specified in Table B.1 for the type class of the wheelchair.

### **B.3 Speed settings**

The pre-set value of the maximum speed should be limited to a maximum of 15 km/h.

If a maximum speed regulator is present, the highest values capable of being set by the operator should not exceed 15 km/h.

It should not be possible to change other settings of the wheelchair without the aid of a tool, key entry combination or similar means of restricting access. If the means of restricting access is other than a tool, it should not consist of operations that are performed in normal use of the wheelchair.

**Table B.1 — Dimensions and manoeuvring space of electrically powered wheelchairs**

<b>Dimensions</b>	<b>Class A</b> mm	<b>Class B</b> mm	<b>Class C</b> mm
Full overall length - maximum	1 200	1 400	no recommendation
Overall width - maximum	700	700	800
Turning diameter - maximum	2 000	2 800	no recommendation
Reversing width - maximum	1 300	1 800	no recommendation
Ground clearance - minimum	30	60	80

## **Annex C** (informative)

### **Recommended design features**

#### **C.1 Introduction**

Since wheelchairs serve many different users who have many different requirements and demands, it is not possible to make the recommendations contained in this Annex mandatory for every wheelchair. Manufacturers should follow the recommendations as far as possible and applicable, depending on the intended use of the wheelchair.

#### **C.2 General recommendations**

##### **C.2.1 Anti-tip devices**

If the wheelchair is fitted with anti-tip devices, they should not move from their pre-set positions or lose their function when preventing a loaded wheelchair from tipping.

Anti-tip devices should be positioned so they will not cause the wheelchair to exceed the applicable full overall length limit specified in Table B.1, and they should not interfere with mounting or dismounting kerbs when in a non-working position.

Anti-tip devices should be labelled with a warning that the occupant should be informed when an anti-tip device is fitted or removed.

##### **C.2.2 Component mass**

If any parts can be removed from the wheelchair, or if the wheelchair can be dismantled, the maximum mass of any component should not exceed 10 kg.

##### **C.2.3 Fittings and tools**

All screws, fasteners and similar fittings should be of metric size as specified in ISO 68-1:1998. A minimum of tools should be required for their operation and maintenance.

##### **C.2.4 Tyres**

The wheelchair should be fitted with tyres that do not mark indoor floors.

##### **C.2.5 Means to inflate tyres**

An appropriate means to inflate the tyres should be supplied with the wheelchair if it is fitted with pneumatic tyres.

##### **C.2.6 Surface temperature**

The thermal properties of materials that come into direct contact with the occupant, e.g. control units or upholstered parts, should be considered when selecting these materials to avoid excessive surface temperatures when they are exposed to external sources of heat (e.g. sunlight).

**C.2.7 Occupant transfer into or out of the wheelchair**

When the manufacturer specifies that a sideways transfer can be made, lower leg supports should be removable and their mountings should not protrude more than 50 mm in front of the seat and/or protrude more than 20 mm above the unoccupied seat when the lower leg supports are removed.

When the manufacturer specifies that the occupant can make a sideways step to a standing position in front of the wheelchair, lower leg supports should be removable.

When lower leg supports are not removable, foot supports should be movable or removable so that the occupant has room to rise from a seated position in the wheelchair to a standing position. The underside of a movable foot support should not present any sharp edges or protrusions that can contact the occupant's lower legs or feet when the foot supports are raised.

**C.2.8 Resistance to contamination from urine incontinence**

Contamination resistance and methods for cleaning and decontamination should be considered when selecting materials that can come in contact with urine (e.g. upholstered parts) in order to avoid the occurrence of unhygienic conditions, odours and degradation of materials.

**C.2.9 Indication for maximum safe slope**

The wheelchair should have the provision for including a device which indicates or provides an alarm to the operator when 80 % of the maximum safe slope is reached.

This indicator should operate when facing up a slope, down a slope and also across a slope.

**C.2.10 Mirrors**

The wheelchair should have the capability of mounting a rear view mirror or mirrors when required by the occupant.

**NOTE** This is essential where the occupant cannot rotate their upper body or neck to see behind them when seated in the wheelchair.

**C.2.11 Head support**

If the use of the wheelchair allows the seat or the back support to be reclined to an angle of more than 25° to the vertical, the wheelchair should have a head support or provision to attach a head support.

The manufacturer of a wheelchair that has such provision should have a head support available as an option.

The "head support height above seat" dimension (see ISO 7176-7:1998, dimension 10) of the wheelchair should cover the range 680 mm to 844 mm in order to be appropriate for the body size of various occupants.

If a wheelchair is available with a head support, and the seat or the back support can be reclined to an angle of more than 25° to the vertical, the operator's manual should contain an instruction to use the head support when the seat or the back support is reclined.

**C.2.12 Accidental release of parking brakes and freewheel devices**

Means for releasing parking brakes should be designed so that they are guarded against release caused by accidental contact. Freewheel devices should be designed so that they are guarded against disengagement caused by accidental contact.

**EXAMPLE** The use of two separate mechanical actions or electrical interlocks to operate or release.

### **C.3 Recommendations for performance characteristics**

#### **C.3.1 Indication of electrical faults**

The wheelchair should be equipped with a means for indicating fault(s) in its electrical system.

#### **C.3.2 Batteries and their containers**

Batteries and battery containers should be resistant to mechanical damage (e.g. cracking).

Batteries should be removable from wheelchairs with powered seat lifts, with the seat at any position of its travel, if there is no manual operation of the seat when the power is off.

Batteries used for driving the wheelchair should be of the traction or semi-traction type.

Batteries for wheelchairs which might be used indoors (Class A and Class B) should be non-spillable.

NOTE Non-spillable batteries might be more acceptable in aircrafts and road vehicles than batteries containing free liquid electrolytes.

#### **C.3.3 Lighting**

The wheelchair might be subject to national requirements for lights and reflectors.

If there are no national requirements, the manufacturer should make an effort to conform to applicable automotive Directives of the European Union (76/756/EEC, 97/28/EEC).

The manufacturer should also consider the applicable requirements of Directive 2006/42/EC of the European Parliament and of the Council of 17 May 2006 on machinery.

#### **C.3.4 Control mechanism feedback**

The operator should receive feedback from a function's control mechanisms (e.g. light or sound etc.) to verify that the function is actually operating.

#### **C.3.5 Freewheel alarm**

When the freewheel device is operated an audible warning should be emitted until the freewheel device is deactivated and the drive and braking system is fully operational.

#### **C.3.6 Maximum speed**

Operation of functions which can adversely affect the stability and safety of a wheelchair (e.g. elevating seats, lower leg supports and reclining back supports) should automatically reduce the maximum speed of the wheelchair.

## Annex D (informative)

### Recommended seating design

- a) Care should be taken to minimise the likelihood of seating producing pressure ulcers.
- b) Foot supports should allow small adjustments of the foot support to seat distance over a sufficient range to suit an individual occupant and to allow a good pressure distribution under the occupant's upper legs.
- c) The seat angle, measured as specified in ISO 7176-7:1998, should be between + 4° and + 14°.
- d) The angle between the back support plane and the seat plane should be between 90° and 100° when not adjustable. If the angle is adjustable, the range of adjustment should be at least 15°.
- e) Combined seat and back support units which can be tilted should have a range of at least 20° of adjustment and be capable of operation by the occupant or assistant when the occupant is seated in the wheelchair.

NOTE 1 The occupant and assistant will require mechanical advantage within the mechanism so that he or she does not have to lift the full mass of the occupant whilst adjusting the tilt.

- f) The seat depth for wheelchairs intended for adults should be between 305 mm and 565 mm, when measured as specified in ISO 7176-7:1998.
- g) The effective seat width for wheelchairs intended for adults should be between 320 mm and 610 mm, when measured as specified in ISO 7176-7:1998.
- h) The seat height should be between 370 mm and 580 mm, when measured as specified in ISO 7176-7:1998, with at least 30 mm of free space between the bottom of the foot support(s) and the floor for wheelchairs for indoor use or wheelchairs with a tilt system, and with at least 50 mm of free space between the bottom of the foot support(s) and the floor for wheelchairs for outdoor use.
- i) The arm support height for wheelchairs intended for adults should be between 155 mm and 325 mm, when measured as specified in ISO 7176-7:1998.
- j) The back support height for wheelchairs intended for adults should be between 300 mm and 740 mm, when measured as specified in ISO 7176-7:1998.

NOTE 2 The recommendation for back support height of 740 mm is for specific wheelchair types such as geriatric and comfort chairs. With this height the back support can support the head of the occupant.

## **Annex E** (informative)

### **Manoeuvring forces**

#### **E.1 Recommendations**

##### **E.1.1 Push handle force**

The force on push handles necessary for turning the wheelchair should be no more than 70 N.

The force on push handles necessary for reversing the direction of turn should be no more than 70 N.

##### **E.1.2 Handrim force**

The force on handrims necessary for turning the wheelchair should be no more than 45 N.

The force on handrims necessary for reversing the direction of turn should be no more than 60 N.

#### **E.2 Manoeuvring test for handrim-activated power-assisted wheelchairs**

The manoeuvrability of a handrim-activated power-assisted wheelchair when in freewheel mode is determined in two ways:

- by determining the force required to reverse the direction of turn of the wheelchair inside its turning diameter (causing rotation of the castor wheels to approximately the opposite direction of travel);
- by determining the force required to reverse the direction of travel of the wheelchair from a stationary position (likewise causing rotation of the castor wheels to approximately the opposite direction of travel).

## Annex F (informative)

### Technical changes from previous editions of EN 12184

#### F.1 Technical changes between the first (1999) and second (2006) editions

In preparing the second edition, the content of the first edition was revised to incorporate numerous technical and editorial changes. All potential changes suggested by member bodies and working group members were considered by the working group. Where consensus could be achieved the changes were incorporated into the second edition. Where consensus could not be achieved, or the technical changes suggested were not of sufficient maturity to include in the second edition, the subject area was recommended to be put forward for a future revision. Some of these points were included in informative Annexes A, B, C and D (which correspond to Annexes B, C, D and E respectively in the third edition).

One major change from the first edition was the separation of design and performance requirements into two clauses. In some areas changes to the technical requirements of the previous edition were not incorporated, however others did incorporate updated technical content either in the design or the performance requirements or in both. This led to considerable changes in the format from the previous edition.

The list below includes the significant technical changes between the first and second editions, but it does not include all changes. Clause number references apply to the second edition.

- The scope of the second edition did not limit the applicability of the standard to wheelchairs with a maximum user mass of 100 kg, and the second edition specified a method of augmenting the 100 kg ISO test dummy to test wheelchairs with larger maximum user mass.
- The scope of the second edition included electrically powered scooters with three or more wheels. Those scooters were also included within the type classes specified in Clause 5 and throughout the content of the second edition.
- The normative references included appropriate new or revised standards that had been issued by CEN, ISO and IEC since the first edition was published. The normative references were dated to ensure that any subsequent revisions of the normative reference standards could be considered for their potential effect on the content of this European Standard. Future issues of revised normative references might not apply in total without further revision being made to this European Standard.
- The test apparatus was revised and updated to incorporate brake lever test equipment.
- Design requirements in the second edition were extracted from the performance requirements clause in the first edition. Design and performance requirements were clearly separated between Clauses 7 and 8 in the second edition.
- Design requirements in the second edition incorporated new or updated specific requirements for wheelchairs for use in motor vehicles (7.4), braking systems (7.5), freewheel device (7.6), component mass (7.7), battery enclosure (7.8), operations intended to be carried out by the occupant and/or assistant (7.10), control operation when seated (7.11), assistant control (7.12) and charging connector (7.13).
- Performance requirements in the second edition incorporated new or updated specific requirements for foot, leg, and arm supports (8.2), static, impact and fatigue strength (8.3), braking systems (8.4), operating force (8.7), assistant control (8.8), charging connector (8.9), joystick and control device (8.10), driving characteristics (8.11), surface temperature (8.12), noise (8.13) and resistance to ignition (8.14).



- Electrical requirements in the second edition incorporated new or updated specific requirements for electromagnetic compatibility (9.1), controller on/off switch (9.2) and on-board chargers (9.6).
- The requirement for information to be supplied by the manufacturer (Clause 10) was considerably updated in the second edition following input from users, member countries and working group members.
- A new requirement for a test report was added in Clause 11 of the second edition.
- Revised and updated tables were placed into Clause 12 of the second edition.
- Revised and new figures referenced within the second edition were placed into Clause 13.
- The content of Annex ZA of the second edition was compiled taking into account the new and updated content.

## F.2 Technical changes from the second (2006) edition

Following publication of the second edition, errors were discovered in the equations for augmenting the 100 kg ISO test dummy. These errors could have affected the evaluation of the stability of wheelchairs intended for users of mass greater than 100 kg, and hence have been potentially hazardous. This matter was raised officially, and in early 2007 CEN/BT circulated a resolution for the withdrawal of the second edition, together with EN 12183:2006, the related standard for manual wheelchairs, that contained the same errors.

After considering alternatives, the committee has decided that the most suitable corrective action is to limit the scope of the standard to a maximum user mass of 100 kg, and to provide information on the construction of 125 kg and 150 kg test dummies to assist those wishing to evaluate the performance of wheelchairs with a larger user mass.

New editions of several normative reference documents have been published since the second edition was prepared. These have been included in an appropriate manner, which has led to the removal or modification of some requirements and test methods where they are duplicated in the referenced documents. Generally these have not resulted in any technical changes unless noted below.

In the same intervening period, Council Directive 93/42/EEC was amended by Directive 2007/47/EC. Changes to the Essential Requirements have been addressed, as have the implications of the link to Directive 2006/42/EC on machinery.

The list below includes the significant technical changes between the second and third editions, but it does not include all changes.

- The scope is limited to a maximum user mass of 100 kg. References to maximum user mass that exceeds that limit has been removed from the normative content throughout the document.
- All normative references are dated and refer to the latest editions at the time of publication, apart from the reference to EN 12182, which is undated, and the reference to ISO 7176-19:2001.
- The reference to ISO 7176-14:2008 implies a number of technical changes.
- The reference to ISO 7176-14:1997 has been retained for requirements and test methods related to battery chargers, since they do not appear in ISO 7176-14:2008.
- Some additional references have been made to provisions in EN 12182 as required by the amendments to the Directive concerning medical devices.
- The maximum stopping distances for use on slopes is specified, and the test method clarified.

**EN 12184:2009 (E)**

- The requirement for dynamic stability has been clarified.
- Ambiguous requirements for uncontrolled movement of seating have been removed, since this is already covered by requirements in EN 12182 relating to adjustable parts.
- The reference to ISO 7176-8 has been corrected.
- Annex ZA has been updated to reflect the new content and changes to the Essential Requirements.

In addition, many minor editorial changes have been made. In particular, definitions which appear in ISO 7176-26:2007 have been removed, and this document has been revised to use its applicable terms.

## Annex ZA (informative)

### Relationship between this European Standard and the Essential Requirements of Council Directive 93/42/EEC of 14 June 1993 concerning medical devices

This European Standard has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association to provide a means of conforming to Essential Requirements of the New Approach Directive 93/42/EEC of 14 June 1993 concerning medical devices, as amended by Directive 2007/47/EC.

Once this standard is cited in the Official Journal of the European Union under that Directive and has been implemented as a national standard in at least one Member State, compliance with the clauses of this standard given in Table ZA.1 confers, within the limits of the scope of this standard, a presumption of conformity with the corresponding Essential Requirements of that Directive and associated EFTA regulations.

**Table ZA.1 — Correspondence between this European Standard and EU Directives**

Clauses/subclauses of this European Standard	Corresponding Directive 93/42/EEC Annex 1 Essentials Requirements	Comments
All	1	<p>Each device needs to be considered against its intended user and its intended usage to establish the potential hazards and risks.</p> <p>EN ISO 14971 is generally applicable.</p> <p>EN 12182 is a general reference document.</p> <p>The ISO 7176 series is used as basic reference in particular concerning tests. However some results are comparative and require further interpretation to show how the intended performance has been achieved and how specific risks have been reduced or removed.</p> <p>Annexes B, C, D and E give guidance concerning other aspects of design, performance etc.</p>
5, 6, 7, 8, 9, 10	2	<p>Each device needs to be considered against its intended user and its intended usage to establish the potential hazards and risks and to consider whether the solutions are appropriate.</p> <p>EN ISO 14971 is generally applicable.</p> <p>The minimum requirements for information, labelling, warnings etc. are in Clause 10.</p>
5, 6, 7, 8, 9	3	<p>Each device needs to be considered against its intended user and its intended use.</p> <p>EN ISO 14971 is generally applicable.</p> <p>The ISO 7176 series is used as basic reference in particular concerning tests. However some results are comparative and require further interpretation to show how the intended performance has been achieved and how specific risks have been reduced or removed.</p>

Table ZA.1 (continued)

Clauses/subclauses of this European Standard	Corresponding Directive 93/42/EEC Annex 1 Essentials Requirements	Comments
5, 6, 8, 9, 10	4	The tests are based on stresses that can occur during the lifetime of the device under general conditions of use. Test results might require further interpretation to fully cover the intended user and the intended usage of an individual device.  The lifetime of the device is included in Clause 10.
6, 7, 8, 9, 10	5	Packaging and storage is included in Clause 10.
6, 8, 10	6	Each device needs to be considered against its intended user and its intended usage to establish the potential hazards and risks and to consider whether the solutions are appropriate.  EN ISO 14971 is generally applicable.  EN 12182 is referenced for clinical investigation.
6, 7, 8.10, 9.1	7.1	Toxicity and biocompatibility is covered by reference to EN 12182.  Flammability is covered by 8.10 and by reference to ISO 7176-14.
6, 7, 10	7.2	Contaminants and residues are covered by reference to EN 12182.  Storage is referred to in the information to be supplied by manufacturers in Clause 10.
	7.3	Manufacturers should be aware that in some circumstances their products might be exposed to unusual risks and provide appropriate advice, information etc.  EXAMPLES body fluids, outdoor environment etc.
	7.4	This European Standard contains no applicable requirements.
6, 7.8, 9	7.5	Overflow, spillage, leakage, ingress of liquids is covered by reference to EN 12182.  Leakage from battery containers is covered in 7.8 and ISO 7176-14.
6, 7.8, 8.11, 9.1	7.6	Ingress of liquids is covered by reference to EN 12182.  Electrical enclosures are covered in 7.8, 8.11 and ISO 7176-14.
6, 7.7, 10	8.1	Biocompatibility, toxicity, contaminants, residues, infection are covered by reference to EN 12182.  Handling is included in 7.7 and cleaning is included in Clause 10.
	8.2	Manufacturers should consider whether any materials used, e.g. in seating or postural supports, are covered by this requirement.
	8.3, 8.4, 8.5, 8.6, 8.7	This European Standard has no applicable requirements.

Table ZA.1 (continued)

Clauses/subclauses of this European Standard	Corresponding Directive 93/42/EEC Annex 1 Essentials Requirements	Comments
7, 8, 9, 10	9.1	Manufacturers should consider that in some circumstances their products might be used in combination with other equipment and provide appropriate advice, information etc.  EXAMPLES wheelchairs occupied when in vehicles, battery chargers, environmental controls, communication aids, supportive seating or other assistive technology.  Use in combination with other devices is partially addressed by ISO 7176-14.
6, 7, 8, 9	9.2	Requirements not covered are: Volume/pressure ratio Ageing of material Accuracy of measuring and control mechanisms
7.8, 8.10, 9.1	9.3	Fire retardancy is covered in 8.10 and by reference to ISO 7176-14. The risk of fire or explosion in single fault condition is partially covered by reference to ISO 7176-14.
9.6	10	Accuracy of measuring devices in the control system is covered by ISO 7176-14.
	11	This European Standard has no applicable requirements.
7, 9	12.1	Power and control systems design for repeatability, reliability and performance are not fully covered.  Reduction of risks in single fault condition for control systems is covered in ISO 7176-14. Other single faults are not fully covered.
6	12.1a	Partially covered by reference to EN 12182.
9.1, 9.3, 9.6	12.2	Covered by requirements for charge level indicator and by reference to ISO 7176-14.
	12.3, 12.4	This European Standard has no applicable requirements.
9.1	12.5	Covered by reference to ISO 7176-21.
7, 8, 9	12.6	Electrical risks to an occupant or an assistant from the wheelchair, control system or charger are not specifically mentioned within this standard however if all the clauses of this European Standard are met there will be some reduction of risk.  Each device needs to be considered against its intended user and its intended usage to establish the potential hazards and risks and consider whether the solutions are appropriate.
6, 7, 8	12.7.1	Moving parts, traps, adjusting mechanisms, surfaces, corners, edges are covered by reference to EN 12182 and ISO 7176-14 (pinch points)  Static and dynamic stability are covered but the results of the tests require interpretation by the manufacturer to ensure that they are meaningful in the protection of the occupant in normal use of the wheelchair and to provide the maximum safe slope required in Clause 10.
	12.7.2	Vibration is not covered.

Table ZA.1 (concluded)

Clauses/subclauses of this European Standard	Corresponding Directive 93/42/EEC Annex 1 Essentials Requirements	Comments
9.1	12.7.3	Noise is covered by ISO 7176-14.
7, 8, 9	12.7.4	Gas, hydraulic and pneumatic connectors and terminals are not covered, nor are electrical connectors to supply mains.
8.9	12.7.5	Partially covered by 8.9.
	12.8.1	This European Standard has no applicable requirements.
	12.8.2	This European Standard has no applicable requirements.
9, 10	12.9	Covered by reference to ISO 7176-14.
10	13.1	Covered by Clause 10.
	13.2	This European Standard has no applicable requirements.
10.5	13.3	Partially covered by 10.5.
10	13.4	Covered by Clause 10.
	13.5	This European Standard has no applicable requirements.
10	13.6	Partially covered by Clause 10.

The essential health and safety requirements of Directive 2006/42/EC of the European Parliament and of the Council of 17 May 2006 on machinery that are more specific than the essential requirements set out in Annex I of Directive 93/42/EEC as amended by Directive 2007/47/EC are generally covered by the reference to EN 12182 and the provisions of this standard. Lighting is partially covered by C.3.3.

**WARNING — Other requirements and other EU Directives might be applicable to the product(s) falling within the scope of this standard.**

## Bibliography

- [1] ISO 68-1:1998, *ISO general purpose screw threads — Basic profile — Part 1: Metric screw threads*
- [2] ISO 7176-5:2008, *Wheelchairs — Part 5: Determination of dimensions, mass and manoeuvring space*
- [3] ISO 7176-7:1998, *Wheelchairs — Part 7: Measurement of seating and wheel dimensions*