

Australian/New Zealand Standard™

Wheelchairs

Part 2: Requirements and test methods for electrically powered wheelchairs (including mobility scooters)



AS/NZS 3695.2:2013

This Joint Australian/New Zealand Standard was prepared by Joint Technical Committee ME-067, Assistive Technology Products for Persons with Disabilities. It was approved on behalf of the Council of Standards Australia on 8 June 2013 and on behalf of the Council of Standards New Zealand on 14 June 2013. This Standard was published on 11 September 2013.

The following are represented on Committee ME-067:

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Association of Consultants in Access Australia
Australian Rehabilitation and Assistive Technology Association
Bus and Coach Association of New Zealand
Commercial Vehicle Industry Association of Australia
Consumers' Federation of Australia
Department of Family and Communities SA
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Australian/New Zealand Standard™

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Part 2: Requirements and test methods for electrically powered wheelchairs (including mobility scooters)

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PREFACE

This Standard was prepared by the joint Standards Australia/Standards New Zealand Committee ME-067, Mobility Appliances for People with Disabilities, to supersede, in part, AS/NZS 3695:1992, *Wheelchairs—Product requirements*.

The Standard is based on EN 12184:2009, *Electrically powered wheelchairs, scooters and their chargers—Requirements and test methods*.

The braking requirements of this Standard differ from the braking requirements of EN 12184 primarily when the wheelchair is in 'freewheel mode'. This Standard requires a warning label where no braking exists when a wheelchair is in freewheel mode while EN 12184 does not. The Committee is confident that international research will soon identify a method to retard a wheelchair at a set speed when it is in freewheel mode, which will be included in this Standard at the subsequent revision.

This is the first revision of this Australian Standard (originally issued in 1992) covering powered wheelchairs.

Where this Australian Standard does not apply to particular wheelchairs, contracting parties should consider if appropriate clauses of this Australian Standard may be applicable.

Manufacturers may also wish to consider if appropriate clauses of this Australian Standard may be used to assess the performance of their products against the relevant Essential Principles of the Medical Device legislation of the Australian Therapeutic Goods Act 1989.

In revising this Standard, the role and function of the Standard was expanded to align the AS 3695 series, where possible, with EN 12183:2008, *Manual wheelchairs—Requirements and test methods*, and specifically for this part of the series EN 12184:2009, *Electrically powered wheelchairs, scooters and their chargers—Requirements and test methods*. In addition, the Committee continues to embed developments from the ISO series of test methods for wheelchairs (ISO 7176 series, *Wheelchairs*) and seating (ISO 16840 series, *Wheelchair seating*).

This Standard is part of a series as follows:

AS

3695 Wheelchairs

3695.1 Part 1: Requirements and test methods for manual wheelchairs

3695.2 Part 2: Requirements and test methods for electrically powered wheelchairs
(this Standard)

Major changes to the previous edition are the following:

- (a) The Scope of this edition applies only to powered wheelchairs and scooters intended to carry one person.
- (b) An option to use a larger mass dummy, where the manufacturer specifies a larger user capacity than 100 kg, has been included (Clause 4.2).
- (c) The set-up configuration of the wheelchair for each test is as specified in ISO 7176-22 (Clause 4.3).
- (d) Clarity regarding order of testing is provided (Clause 4.4).
- (e) Powered wheelchairs may now be categorized into 3 classes: Class A for indoor, Class B for indoor/outdoor and Class C for outdoor (Clause 5) with each class having a different test requirements (Table 1).
- (f) The requirement for a risk analysis in accordance with AS/NZS 4810.1 and AS EN 12182 has been introduced (Clause 6).

- (g) Pneumatic tyres are required to have a common inflation valve and be marked with the maximum inflation pressure (Clause 7.3).
- (h) A warning is required to state that 'There is no braking when this wheelchair is in freewheel mode' (Clause 10.4). The requirement for a separate parking brake that is effective in freewheel mode has been withdrawn.
- (i) Where used, batteries are required to be non-spillable (Clause 8.8).
- (j) Wheelchairs are required to be fitted with one or more emergency stop input devices (Clause 8.9).
- (k) Wheelchairs are required to have provision for fitting an anterior pelvic support (Clause 7.4).
- (l) Onboard and carry-on battery chargers are required to comply with environmental protection requirements IPX4 and class II test voltage requirements of AS/NZS 60335.1 and AS/NZS 60335.2.29 (Clause 8.5).
- (m) A test for the ability of the wheelchair to climb a specified maximum safe slope has been included (Clause 9.1.2).
- (n) The wheelchair is required to be able to negotiate various degrees of ground unevenness (Clause 9.1.3).
- (o) Parking brakes are required to have a fatigue test by operating the brake through 60 000 cycles (Clause 9.3.5).
- (p) Where the manufacturer specifies that the seat can be used in a motor vehicle, the wheelchair is required to comply with AS/NZS 3696.19 (Clause 9.4).
- (q) A more rigorous test for ignitability of upholstery is required. The test Standard for ignitability of upholstery has been changed from AS 3744.1 to AS/NZS ISO 7176.16 (Clause 9.7).
- (r) Informative appendices have been provided on recommendations for dimensions and manoeuvring space, design features, seating design, and lighting and reflectors.

The terms 'normative' and 'informative' have been used in this Standard to define the application of the appendix to which they apply. A 'normative' appendix is an integral part of a Standard, whereas an 'informative' appendix is only for information and guidance.

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STANDARDS AUSTRALIA/STANDARDS NEW ZEALAND

Australian/New Zealand Standard**Wheelchairs****Part 2: Requirements and test methods for electrically powered wheelchairs
(including mobility scooters)****1 SCOPE**

This 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 300 kg. It covers—

- (a) manual wheelchairs with add-on power kits used for propulsion; and
- (b) electrically powered wheelchairs (which include scooters).

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

This Standard does not apply (in total) to custom-made wheelchairs (fabricated to a prescription for a single user as defined by the Therapeutic Goods (Medical series) Regulations 2002). Where custom made wheelchairs are constructed—

- (i) on the basis of a standardized design;
- (ii) using structural members of common technical specification; or
- (iii) with primarily dimensional variations between occupants,

this Standard may be applied to the base design.

NOTE: Where the Standard is applied to the base design, the test sample will need be constructed to a specification that is representative of common prescriptions, in accordance with the base design, giving consideration to the set-up requirements specified in ISO 7176-22.

Specific elements of the Standard may be relevant to—

- (A) wheelchairs intended for special purposes, such as sports;
- (B) hand-rim-activated power-assisted wheelchairs; and
- (C) powered office chairs.

2 REFERENCED DOCUMENTS

The following documents are referenced in this Standard.

AS	
60529	Degrees of protection provided by enclosures (IP code) (IEC 60529:1989)
AS/NZS	
3200	Medical electrical equipment
3200.1.0	Part 1.0: General requirements for safety—Parent Standard
3696	Wheelchairs
3696.3	Part 3: Determination of effectiveness of brakes
3696.19	Part 19: Wheeled mobility devices for use as seats in motor vehicles (ISO 7176-19:2008, MOD)
4810	Medical devices—Risk management
4810.1	Part 1: Application of risk analysis

AS/NZS

- 60335 Household and similar electrical appliances
 60335.1 Part 1: Safety—General requirements (IEC 60335-1:2001, MOD)
 60335.2.29 Part 2.29: Safety—Particular requirements for battery chargers
 61000 Electromagnetic compatibility (EMC)
 61000.3.2 Part 3.2: Limits—Limits for harmonic current emissions [equipment input current (16 A per phase) (IEC 61000-3-2, Ed. 3.0 (2005) MOD]

AS/NZS ISO

- 7176 Wheelchairs
 7176.10 Part 10: Determination of obstacle-climbing ability of electrically powered wheelchairs
 7176.11 Part 11: Test dummies
 7176.14 Part 14: Power and control systems for electrically powered wheelchairs and scooters—Requirements and test methods
 7176.16 Part 16: Resistance to ignition of postural support devices
 7176.26 Part 26: Vocabulary

AS EN

- 12182 Technical aids for disabled persons—General requirements and test methods

IEC

- 60601 Medical electrical equipment
 60601.1 Part 1: General requirements for basic safety and essential performance
 62304 Medical device software—Software lifecycle processes

ISO

NOTE: Use of the Australian/New Zealand harmonized equivalent to these ISO Standards is acceptable.

- 68 ISO general purpose screw threads—Basic profile
 68-1 Part 1: Metric screw threads

ISO

- 7176 Wheelchairs
 7176-1 Part 1: Determination of static stability
 7176-2 Part 2: Determination of dynamic stability of electric wheelchairs
 7176-4 Part 4: Energy consumption of electric wheelchairs and scooters for determination of theoretical distance range
 7176-5 Part 5: Determination of dimensions, mass and manoeuvring space
 7176-6 Part 6: Determination of maximum speed, acceleration and deceleration of electric wheelchairs
 7176-7 Part 7: Measurement of seating and wheel dimensions
 7176-8 Part 8: Requirements and test methods for static, impact and fatigue strengths
 7176-9 Part 9: Climatic tests for electric wheelchairs
 7176-13 Part 13: Determination of coefficient of friction of test surfaces

ISO

- 7176-19 Part 19: Wheeled mobility devices for use as seats in motor vehicles
 7176-21 Part 21: Requirements and test methods for electromagnetic compatibility of electrically powered wheelchairs and scooters, and battery chargers
 7176-22 Part 22: Set-up procedures
 7176-25 Part 25: Batteries and chargers for powered wheelchairs

ISO

- 10542 Technical systems and aids for disabled or handicapped persons—Wheelchair tiedown and occupant-restraint systems
- 10542-1 Part 1: Requirements and test methods for all systems
- 10542-5 Part 5: Systems for specific wheelchairs

ANSI/RESNA

WC Vol. 1 Wheelchairs for use in motor vehicles

TGA Therapeutic Goods (Medical Devices) Regulations 2002

3 DEFINITIONS

For the purposes of this Standard the terms and definitions given in AS/NZS ISO 7176.26 [except for the definition of wheelchair, which is replaced by the one below (Clause 3.7)] applies, AS/NZS ISO 7176.14, AS EN 12182 and the ones below apply.

3.1 Audible warning device

A device for making a warning sound or noise e.g. horn.

3.2 Custom made wheelchair

A wheelchair that is—

- (a) specifically made in accordance with a request by a health professional specifying the design characteristics or construction of the medical device; and
- (b) intended to be used only in relation to a particular individual (i.e. a wheelchair fabricated to a prescription for a single user, as defined in the Therapeutic Goods Regulations 2002).

3.3 Freewheel device

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

3.4 Loaded wheelchair

Wheelchair loaded with a test dummy as specified in Clause 4.2 or loaded with a human test occupant (of equivalent mass).

3.5 Maximum safe slope

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

3.6 Non-spillable battery

Battery from which the electrolyte cannot escape, whatever its orientation.

3.7 Occupant

A person in the wheelchair, but not necessarily the person who operates it.

3.8 Operator

The occupant, or attendant, who propels and steers (manoeuvres) the wheelchair.

3.9 Wheelchair

A device to provide wheeled mobility with a seating support system for a person with impaired mobility.

NOTES:

- 1 An occupant with impaired mobility is a person not having the full capacity to walk unaided.
- 2 The definition includes scooters.

4 TEST APPARATUS, SET-UP AND ORDER OF TESTING

4.1 Test equipment

The following is required:

- (a) The test equipment, (including measuring and load application devices, surfaces and platforms, etc.) as specified.
- (b) 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 (see Clause 4.2).
- (c) Test block, capable of supporting the loaded wheelchair under each of its wheels, with equal length and width 200 mm $\pm$ 10 mm, thickness specified 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.
- (d) Horizontal test plane—A flat, rigid plane with a coefficient of friction as specified in ISO 7176-13, 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 1000 mm of extension in any direction and 25 mm apart per 6000 mm of extension in any direction.
- (e) Adjustable test plane—A flat, rigid plane having an adjustable slope, with coefficient of friction as specified in ISO 7176-13, of sufficient size to accommodate the wheelchair under test and such that the whole surface lies between two imaginary parallel planes 5 mm apart per 1000 mm of extension in any direction and 50 mm apart per 6000 mm of extension in any direction.
- (f) 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.
- (g) Means to measure force with an accuracy of $\pm$ 5% in increments of 1 N in the range of 0 N to 200 N.
- (h) Means to measure speed between 0 km/h and 20 km/h to an accuracy of $\pm$ 5%.
- (i) 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 greater.
- (j) Means to measure torque with an accuracy of $\pm$ 2% in the range of 0.5 Nm to 10 Nm.
- (k) Means to measure angles to an accuracy of $\pm$ 0.1°.
- (l) Means to move a brake lever smoothly for 60 000 cycles at a frequency of not more than 0.5 Hz.
- (m) Means to measure elapsed time in the range 0 to 30 s with an accuracy of $\pm$ 1 s.

4.2 Test dummy

The test dummy shall be as specified in AS/NZS ISO 7176.11 for mass equal to the maximum occupant mass specified by the manufacturer, with a tolerance of 0 kg to +5kg.

4.3 Set-up

The wheelchair shall be prepared in accordance with ISO 7176-22, for each test.

4.4 Order of testing

The tests shall be performed on a single test sample, in any order.

5 TYPE CLASSES

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

- (a) *Class A* Compact, manoeuvrable wheelchairs not necessarily capable of negotiating outdoor obstacles.
- (b) *Class B* Wheelchairs sufficiently compact and manoeuvrable, yet of sufficient strength and capable of negotiating a range of indoor and outdoor environments.
- (c) *Class C* Wheelchairs, usually large in size, not necessarily intended for indoor use but capable of travelling over longer distances and negotiating outdoor obstacles.

NOTES:

- 1 Class A chairs are typically used within, but not limited to, institutional settings.
- 2 Scooters are included in the classes above.

6 GENERAL REQUIREMENTS

6.1 Risk analysis

In addition to technical requirements of this Standard, manufacturers shall identify hazards and estimate risks associated with the wheelchair in accordance with AS/NZS 4810.1.

NOTE: The results of this analysis may be used to determine whether further risk management is required in line with AS EN 12182.

6.2 Specific design and hazard management requirements

The wheelchair shall conform to the requirements specified in AS EN 12182 for the following, with any reference to EN 1441 replaced with an equivalent reference to AS/NZS 4810.1:

- (a) Intended performance and technical documentation.
- (b) Aids that can be dismantled.
- (c) Single-use fasteners.
- (d) Biocompatibility and toxicity.
- (e) Contaminants and residues.
- (f) Infection and microbiological contamination.
- (g) Overflow, spillage, leakage and ingress of liquids.
- (h) Safety of moving parts.
- (i) Prevention of traps for parts of human body.
- (j) Folding and adjusting mechanisms.
- (k) Surfaces, corners and edges.
- (l) Clinical evaluation*.
- (m) Ergonomics.

6.3 Measurement of overall dimensions, mass and turning parameters

Record the following properties of the wheelchair, as measured by the test specified in ISO 7176-5, or as specified in Appendix B:

- (a) Height range of push handles if fitted, which shall be adjustable within a height range of 900 mm to 1200 mm.
- (b) Ground clearance of the occupied wheelchair.

* The requirement for clinical evaluation will apply when the current edition of AS EN 12182 (2002) is revised.

- (c) Dimensions as specified in Table B1, Appendix B.
- (d) Mass (in kilograms) of the wheelchair when ready for use, and of its heaviest component when dismantled.

7 DESIGN AND CONSTRUCTION REQUIREMENTS

7.1 Foot supports, lower leg supports and arm supports

The following requirements apply:

- (a) The wheelchair shall be fitted with foot supports and/or lower leg supports that have a means of positioning the occupant's feet at the required height and prevent the occupant's feet from sliding backwards.
NOTE: A provision to prevent rearward sliding of the feet/lower legs may include a posterior lower leg support.
- (b) Any fitted foot supports and lower leg supports shall be adjustable (with tools if required) in increments not exceeding 25 mm.
- (c) Any swing-away, movable or removable foot support, lower leg support assembly or arm support fitted on the wheelchair shall—
 - (i) incorporate a means to locate it securely in any intended operating position;
 - (ii) 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 Figures A1 and A2, Appendix A;
 - (iii) in the case of a swingaway arm support, incorporate a means suitable for loading in any operating position; and
 - (iv) be moveable to facilitate transfer without the use of tools.
- (d) Foot supports shall meet the performance requirements specified in Clause 10.7.

NOTE: For recommendations on the design of features of a wheelchair, see Appendix C.

7.2 Component mass

If the wheelchair is intended to be dismantled for storage or transportation, any component with a mass greater than 10 kg that requires moving or handling 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 are to be handled during disassembly, lifting, carrying, and assembly to reduce risks to the person or persons moving or handling them.

7.3 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 kilopascals or bar.

7.4 Anterior pelvic support

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

NOTES:

- 1 It is recommended that power wheelchairs be supplied and fitted with an anterior pelvic support upon delivery to an occupant.
- 2 The term 'support' is used in relation to occupant posture, and the term 'restraint' is used in relation to safety in motor vehicle impacts. In Australia and New Zealand, the anterior pelvic support is commonly known as a wheelchair seat or lap belt.

7.5 Braking systems

7.5.1 General requirements

The wheelchair braking system shall comply with the following:

- (a) A running brake that operates independently of tyre wear and tyre inflation pressure shall be included, and when tested in accordance with ISO 7176-2, it shall not exceed the maximum stopping distance specified in Table 2.

NOTE: An example of the above is a motor-controlled or variable friction-based manual braking system.

- (b) An automatic brake that operates independently of tyre wear and tyre inflation pressure by releasing the control device to achieve a zero speed command shall be included.

NOTE: An example of the above is a spring-loaded disc brake that locks the motor/gearbox and thus wheel (unless in freewheel mode) but may depend on electric power for operation.

- (c) A parking brake that operates independently of tyre wear and tyre inflation pressure shall be included. The parking brake shall—

- (i) be accessible and operable by the occupant or the attendant or both, as specified in Appendix A, in accordance with the manufacturer's intended use;
- (ii) have maximum operating forces for engaging and disengaging as specified in AS/NZS 3696.3 when tested using methods specified in AS/NZS 3696.3;
- (iii) be operable when there is no power from the battery supplying the drive system;
- (iv) meet the parking brake effectiveness requirement of AS/NZS 3696.3;
- (v) have provision for adjustment and/or replacement as specified by the manufacturer if the parking brake is subject to wear;
- (vi) be operated either by hand or foot and not exceed the brake lever operating forces specified in AS/NZS 3696.3 when tested in accordance with Clause 9.4.1;

NOTE: Wheelchairs operated by the occupant using a circular hand rim attached to the wheels are considered to have a provision to stop the wheelchair so the occupant can slow down. The requirement for operating forces for engaging and disengaging as specified in AS/NZS 3696.3 is not applicable for this type of braking system. Wheelchairs intended to be controlled by an attendant may require a running brake to allow the attendant to slow or stop the wheelchair.

- (vii) not allow the loaded wheelchair to slide nor for its wheels to rotate when tested as specified in AS/NZS 3696.3 on the maximum safe slope established by Table 1 or, if it is greater, the maximum safe slope specified by the manufacturer, when facing—

(A) up the slope; and

(B) down the slope; and

NOTE: Examples of the above are a solenoid or 'sprag' that locks the motor/gearbox system in the power-off condition, a drum brake in the wheels, or spring-loaded disc.

- (viii) for engaged brakes, when used with removable or movable arm supports, have no parts that protrude above the level of the unoccupied seat (to enable occupant transfers).

NOTE: Where a hand- or foot-operated parking brake that operates on the tyre is fitted, it should meet the requirements of Clause 7.5.1(c) but is not required to meet the tyre wear and inflation requirements of that clause without adjustment (by tools if necessary).

7.5.2 Reliability of performance

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

- (a) the wheelchair has been tested in accordance with ISO 7176-8; and
- (b) the parking brake has been operated for 60 000 cycles as specified in AS/NZS 3696.3.

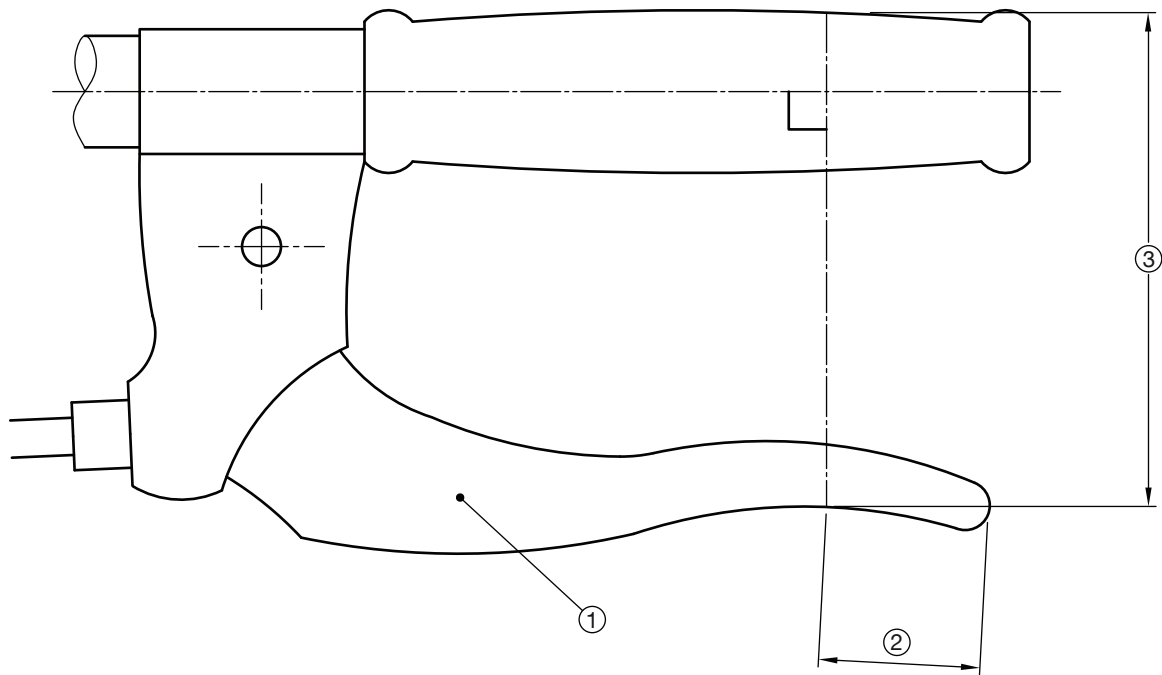
NOTES:

- 1 Braking functions may be combined in one device (e.g. the spring-loaded disc brake may combine automatic brake and parking brake).
- 2 The wheelchair may be subject to transport authority requirements for brakes.

7.6 Means for operating brakes

- (a) Brakes shall—
 - (i) be accessible and operable by the occupant or an assistant or both, as specified in Appendix A, in accordance with the manufacturer's intended use;
 - (ii) be within the reach specified in Figure A1, Appendix A, if they are intended to be operated by the occupant; and
 - (iii) have operating forces for engaging and disengaging that do not exceed those stated in AS/NZS 3696.3 when tested in accordance with AS/NZS 3696.3;
- (b) If one or more brake levers are fitted to a wheelchair in the form used on bicycles and mopeds—
 - (i) the handgrip width of such brake levers, measured 15 mm from the end of the brake lever, shall be not greater than 80 mm before a force is applied (as shown in Figure 1); and
 - (ii) the force applied to each lever to stop the loaded wheelchair and hold it stationary on the maximum safe slope shall not exceed 60 N;
- (c) Means for releasing parking brakes shall be protected against activation caused by accidental contact.

NOTE: An example of the above is the use of two separate mechanical actions or electrical interlocks to operate or release.



LEGEND:

- 1 = Lever gripped by the finger of one hand
- 2 = 15 mm
- 3 = Handgrip width

FIGURE 1 HANDGRIP WIDTH

7.7 Freewheel device

7.7.1 General requirements

The wheelchair shall be fitted with a freewheel device that shall—

- (a) be accessible and operable by the occupant or an attendant, or both, in accordance with the manufacturer's intended use;
- (b) be within the reach specified in Figure A1, Appendix A, if it is intended to be operated by the occupant;
- (c) have operating forces for engaging and disengaging that do not exceed those stated in AS/NZS 3696.3;
- (d) be operable without detaching any parts;
- (e) not depend on the battery power supplying the motor drive system;
NOTE: A battery independent from the motor drive battery may be used to supply energy to enable freewheel mode.
- (f) have two defined positions including clear indication of freewheel mode and drive mode; and
NOTE: 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 attendant.
- (g) prevent use of the wheelchair's drive system, if any part of the freewheel device is activated.

These requirements apply in addition to those applying to non-powered mobility stated in AS/NZS ISO 7176.14.