

American National Standard

for Wheelchairs –

Volume 1:

**Requirements and Test Methods for
Wheelchairs (including Scooters)**



RESNA

Rehabilitation Engineering and Assistive Technology Society of North America

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**Volume 1:
Requirements and Test Methods for Wheelchairs
(including Scooters)**

Secretariat

**Rehabilitation Engineering and Assistive
Technology Society of North America**

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Foreword

This standard covers manual and powered wheelchairs, including scooters, and personal mobility devices that may be supplied as accessories to wheelchairs and scooters. A wheelchair is generally tested as a complete system in a standard reference configuration that facilitates comparison of test results among different models. Accessory manufacturers often test their product on one wheelchair for which the accessory is recommended and determine those performance specifications that are affected by the addition of the accessory to the wheelchair.

In all cases, the information that is disclosed with regard to the testing should be considered with respect to the following note:

The results obtained are based on testing one or more wheelchairs of a specific model and type. The performance a specific individual gets from his/her own wheelchair will depend upon his/her own personal wheelchair set-up, driving skills and techniques and may not represent the results obtained using the standardized RESNA test procedures.

RESNA WC Volumes 1 and 2 consist of the following sections under the general title Wheelchairs:

Volume 1: Requirements and Test Methods for Wheelchairs (including Scooters)

- Section 1: **Determination of static stability**
- Section 5: **Determination of dimensions, mass and maneuvering space**
- Section 7: **Method of measurement of seating and wheel dimensions**
- Section 8: **Requirements and test methods for static, impact and fatigue strengths**
- Section 11: **Test dummies**
- Section 13: **Determination of coefficient of friction of test surfaces**
- Section 15: **Requirements for information disclosure, documentation and labeling**
- Section 16: **Resistance to ignition of upholstered parts – Requirements and test methods**
- Section 20: **Determination of the performance of stand-up type wheelchairs**
- Section 22: **Set-up procedures**
- Section 26: **Vocabulary**

Volume 2: Additional Requirements for Wheelchairs (including Scooters) with Electrical Systems

- Section 2: **Determination of dynamic stability of electrically powered wheelchairs**
- Section 3: **Determination of effectiveness of brakes**
- Section 4: **Energy consumption of electrically powered wheelchairs and scooters for determination of theoretical distance range**
- Section 6: **Determination of maximum speed, acceleration and deceleration of electrically powered wheelchairs**
- Section 9: **Climatic tests for electrically powered wheelchairs**

Section 10: **Determination of obstacle-climbing ability of electrically powered wheelchairs**

Section 14: **Power and control systems for electrically powered wheelchairs – Requirements and test methods**

Section 21: **Requirements and test methods for electromagnetic compatibility of electrically powered wheelchairs and motorized scooters**

The following sections are also on the work program:

Section 25: **Batteries and chargers for powered wheelchairs and motorized scooters – Requirements and test methods**

Section 28: **Requirements and test methods for stair-climbing devices**

The following RESNA WC Volumes are also under development:

Volume 3: Wheelchair Seating

Volume 4: Wheelchairs and Transportation

These standards had their inception in March of 1982 when the RESNA Standards Committee on Wheelchairs began creating standards in the United States as a result of awareness of International Organization for Standardization (ISO) activities related to wheelchairs. Eighteen standards were originally developed by the 26 member committee which was composed of a variety of people including rehabilitation engineers, wheelchair manufacturers, governmental representatives (Department of Veterans Affairs and Food and Drug Administration), and wheelchair users and prescribers. The committee completed the development of these standards in 1990. The committee grouped the standards into two volumes in 1998.

The standards are test procedures designed to produce objective information about wheelchairs. Some of the test methods establish minimum performance criteria for durability and safety reasons.

The American National Standards Institute (ANSI) originally sanctioned the ANSI/RESNA Standards on Wheelchairs in 1982. RESNA is now accredited as a standards organization and the Assistive Technology Standards Board (formerly Technical Standards Board) oversees the work of the RESNA standards committees. RESNA is an interdisciplinary organization that promotes assistive technology for people with disabilities. The committee has also worked concurrently with other countries as an ANSI member body to the International Organization for Standardization (ISO) to create international standards pertaining to wheelchairs.

Suggestions for the improvement of this standard are welcome. They should be sent to the following address:

**RESNA Assistive Technology Standards Board
1700 North Moore Street, Suite 1540
Arlington, VA 22209**

This standard was approved by the RESNA Standards Committee on Wheelchairs and the RESNA Assistive Technology Standards Board for submittal to ANSI. Committee approval of the standard does not necessarily imply that all the committee members voted for its approval or the approval of

every test method or requirement in the standard. At the time the standard was developed, the RESNA Standards Committee on Wheelchairs consisted of the following members:

Organization Represented	Name of Representative
Beneficial Designs, Inc.....	Chair, Peter Axelson
Beneficial Designs, Inc.....	Secretariat, Denise Axelson
Beneficial Designs, Inc.....	Technical Standards Editor, Seanna Kringen
Ammer Consulting	William Ammer
Burke, Inc.....	DuWayne Kramer, Jerry Traylor
Convaid, Inc.....	Don Griggs, Sue Johnson
Dalhousie University-Nova Scotia Rehab Centre	R. Lee Kirby
DEKA Research and Development Corp.....	Phil Brown, Stewart Coulter, Kurt Heinzmann
East Penn Manufacturing Co., Inc.	Scott McCaskey, Mark Sherwood, Daniel Seidel
Golden Technologies.....	Fred Kiwak, Gene Kulon
Hoveround, Corp.....	Tony DiGiovanni
Human Engineering Research Laboratories.....	Samuel Connor, Jeremy Puhlman, Rory Cooper
Independence Technology, L.L.C.	James O'Donnell, Susan Eichler, William Farnella
Invacare, Corp.	Lee Sheffield, Kevin Hankins, Howard Loewenthal, David Mahilo
Laird Technologies.....	Gary Fenical
Lester Electrical	Jamie Jesse, Mark Bauer, Gary Bouc
Mcllwain Mobility Services	Chris Mcllwain
MET Laboratories, Inc.....	Rick Cooper, Leonard Frier
Minkel Consulting.....	Jean Minkel
MK Battery	Rick Spiegel, Dennis Sharpe
Mobility Designs, Children's Healthcare of Atlanta	Kay Koch
New York University – Occupational Therapy Dept.....	Anita Perr
Otto Bock HealthCare GmbH.....	Robert Clarke
Paralyzed Veterans of America	Thomas Stripling
PDG Product Design Group Inc.....	Matt Delorme
Permobil, Inc.	Tara Gentile, Mehdi Merhazi
Precision Calibration, Inc.	Michael Heckrotte
Pride Mobility Products, Corp.	Thomas Shappert, Harry Etheart
Radiometrics Midwest, Corp.	Dennis Rollinger
Sunrise Medical	Richard Runkles, Jim Christofferson, Steve Lindquist, Mark Greig, Paul Dickie
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Contents

Scope of Volume 1 and Volume 2	viii
Section 1 Determination of Static Stability	1.1
Section 5 Determination of Dimensions, Mass and Maneuvering Space.....	5.1
Section 7 Method of Measurement of Seating and Wheel Dimensions	7.1
Section 8 Requirements and Test Methods for Static, Impact and Fatigue Strengths.....	8.1
Section 11 Test Dummies	11.1
Section 13 Determination of Coefficient of Friction of Test Surfaces	13.1
Section 15 Requirements for Information Disclosure, Documentation and Labeling	15.1
Section 16 Resistance to Ignition of Upholstered Parts—Requirements and Test Methods....	16.1
Section 20 Determination of the Performance of Stand-Up Type Wheelchairs.....	20.1
Section 22 Set-Up Procedures	22.1
Section 26 Vocabulary	26.1

Scope of Volume 1 and 2

Volume 1: Requirements and Test Methods for Wheelchairs (including Scooters) of the RESNA wheelchair standard applies to (1) single passenger occupant and attendant propelled wheelchairs, (2) single passenger electrically powered wheelchairs including scooters, and (3) add-on power kits for single passenger occupant and attendant propelled wheelchairs, intended to provide indoor and outdoor mobility for people with disabilities.

Volume 2: Additional Requirements for Wheelchairs (including Scooters) with Electrical Systems of the RESNA Wheelchair Standard applies to (1) single passenger electrically powered wheelchairs including scooters and (2) add-on power kits for single passenger occupant and attendant propelled wheelchairs, intended to provide indoor and outdoor mobility for people with disabilities. Volume 2 also applies to electrically powered ancillary equipment of all wheelchairs and scooters that are included within the scope of Volume 1 and/or Volume 2.

Hereafter, the words "wheelchair" and "wheelchairs" shall refer to all wheelchairs including scooters and add-on power kits within the scope of this standard.

The RESNA wheelchair standard does not apply to: (1) wheelchairs intended for special purposes, such as sports, and one of a kind custom-made wheelchairs, (2) wheelchairs specially designed and fabricated for specific people with disabilities, or (3) powered office chairs.

NOTE 1 Changes such as different sizes or production upon receipt of an order do not qualify a wheelchair as "one of a kind".

NOTE 2 Appropriate sections of this standard may be applied to wheelchairs and wheelchair accessories outside this scope, to the extent that it is practical.

In summary, Volume 1 specifies tests and methods of measurement applicable to all wheelchairs (manual and electric), while Volume 2 specifies additional tests and methods of measurement applicable to electrically powered wheelchairs and to the electrical systems of all wheelchairs. Thus, both volumes are required for testing powered wheelchairs. However, only Volume 1 is required for testing manual wheelchairs.

This standard specifies requirements and test methods for determining wheelchair performance. It also specifies requirements for the disclosure of the test results.

These test methods may be used to verify manufacturers' claims that a product exceeds the minimum requirements of this standard.

Standardized means of preparing and adjusting wheelchairs are provided to enable the test results to be used for the comparison of performance.

WARNING: This RESNA Standard calls for the use of procedures that may be injurious to the testing technician if adequate precautions are not taken.

Section 1

Determination of Static Stability

Contents

Section 1 Introduction	3
1 Scope	4
2 Normative references	4
3 Terms and definitions.....	4
4 Principle	5
5 Apparatus	5
6 Selecting the test wheelchair.....	6
7 Adjusting the wheelchair.....	6
8 Placing the test dummy in the wheelchair.....	7
9 Test for static stability in the forward direction	7
10 Test for static stability in the rearward direction	13
11 Test for static stability with anti-tip devices.....	19
12 Test for static stability in the lateral orientation of least stability	24
13 Test report	29
14 Disclosure of results.....	30
Annex A (informative) Methods of preventing wheels from sliding on the test plane	32
Annex B (informative) Explanation of figures	
Bibliography	33

Section 1 Introduction

This section of RESNA WC-1 is based on ISO 7176-1:1999. RESNA amended ISO 7176-1:1999 to eliminate redundancies and highlight discrepancies between the various sections of the ISO 7176 wheelchair standards, and to include editorial and technical revisions.

At the time of publication of this section, ISO 7176-1:1999 was valid. All standards are subject to revision, and parties to agreements based on this section of RESNA WC-1 are encouraged to investigate the possibility of applying the most recent edition of the ISO standard. Members of ISO maintain registers of currently valid International Standards. More recent versions of this ISO document may have resolved some of the highlighted discrepancies. If ISO resolves these discrepancies in a different manner than described herein, the RESNA amendments shall supersede the ISO revision.

In this section, strikethrough text indicates text that has been deleted from the ISO standard, and underlined blue text indicates text that has been added to the ISO standard.

It is important to know the static-stability characteristics of a wheelchair for prescription and adjustment purposes. Some users need large reserves of stability to ensure their safety while others prefer finely balanced wheelchairs which have better maneuverability. **Wheelchair users and prescribers should take into consideration that static stability is only one factor affecting dynamic stability, others being the position of the wheelchair user in the wheelchair, the skill of the wheelchair user, the manner in which the wheelchair is propelled, and the environment in which the wheelchair is operated.**

This section of RESNA WC-1 specifies tests in which static stability is measured with wheel locks (parking brakes) applied, as is the case if the wheelchair is standing on a slope. Tests are also made with the wheels unlocked, simulating the situation where the wheelchair is standing on a slope with the wheels against obstacles, the situation on a level surface with the wheels unlocked and the wheelchair user reaching for an object, or instability while rolling. These tests also give information about the ease with which a wheelchair can be tipped about its rear wheels as can happen when negotiating curbs or balancing on the rear wheels.

Tests are also made that determine the tipping angle of the wheelchair when it is supported by an anti-tip device.

Section 1: Determination of Static Stability

1 Scope

This section of RESNA WC-1 specifies the test methods for determining the static ~~tipping~~ stability of wheelchairs, including scooters. This section of RESNA WC-1 is applicable to wheelchairs ~~and vehicles~~ that are ~~included in the 12.21 series~~ described in ISO 9999 and are intended to provide indoor and outdoor mobility for people with disabilities ~~whose mass does not exceed the maximum mass of the test dummy given in ISO 7176-11.~~

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 9999, Technical aids for disabled persons – Classification

[RESNA WC-1:2009, Section 7: Method of measurement of seating and wheel dimensions](#)

[RESNA WC-1:2009, Section 11: Test dummies](#)

[RESNA WC-1:2009, Section 15: Requirements for information disclosure, documentation and labeling](#)

[RESNA WC-1:2009, Section 22: Set-up procedures](#)

[RESNA WC-1:2009, Section 26: Vocabulary](#)

3 Terms and definitions

For the purposes of this section of RESNA WC-1, the terms and definitions given in RESNA WC-1 Sec. 26 and the following apply:

3.1 lockable wheels

wheels equipped with parking brakes, or wheels whose rolling motion is locked by the means of propulsion (e.g., by hands, levers, motors)

3.2 tipping angle

angle of the test plane from the horizontal at which the forces become zero under all uphill wheels

NOTE 1 A number of methods are available with which to determine when the forces become zero under the uphill wheels. These include, but are not limited to, the following: the ability to pull pieces of paper from