American National Standard

for Wheelchairs –
Volume 3:
Wheelchair Seating
RESNA American National Standard

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Foreword

This standard covers wheelchair seating devices with associated attachment hardware that are intended to provide postural support and/or tissue integrity management. 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 devices of a specific model and type. The performance a specific individual gets from his/her own wheelchair seating product will depend upon his/her own personal wheelchair set-up and may not represent the results obtained using the standardized RESNA test procedures.

RESNA WC Volume 3 consists of the following sections under the general title Wheelchairs:

**Volume 3: Wheelchair Seating**

- **Section 1:** Vocabulary, reference axis convention and measures for body posture and postural support surfaces
- **Section 2:** Determination of physical and mechanical characteristics of seat cushions intended to manage tissue integrity
- **Section 3:** Determination of static, impact and repetitive load strengths for postural support devices
- **Section 6:** Determination of the changes in properties following simulated extended use of seat cushions
- **Section 12:** Envelopment testing of seat cushions with dual semispherical indenter

The following ANSI/RESNA WC Volumes are also available:

- **Volume 1:** Requirements and Test Methods for Wheelchairs (including Scooters)
- **Volume 2:** Additional Requirements for Wheelchairs (including Scooters) with Electrical Systems
- **Volume 4:** Wheelchairs and Transportation

RESNA WC Volumes supersede ISO and EN documents by nature of their development by industry experts who focus directly on these particular devices and characteristics.

These standards had their inception in 1993 when the RESNA Standards Committee on Wheelchair and Related Seating began creating standards in the United States as a result of awareness of International Organization for Standardization (ISO) activities related to wheelchair seating. The standards were developed by the committee, which was composed of a variety of people including rehabilitation engineers, wheelchair seating manufacturers, governmental representatives, and wheelchair users and prescribers.

The standards are test procedures designed to produce objective information about wheelchairs seating products. 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 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 and seating.

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

RESNA Assistive Technology Standards Board  
1560 Wilson Blvd., Suite 850  
Arlington, VA 22209

This standard was approved by the RESNA Standards Committee on Wheelchair and Related Seating 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. Contributing members of the RESNA Standards Committee on Wheelchair and Related Seating consisted of the following members:

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Scope of Volume 3

Volume 3: Wheelchair Seating

Section 1 applies to seating intended to provide postural support within a wheelchair. It specifies:

a) a global coordinate system that permits the determination and recording of a person's posture while seated in a wheelchair;
b) the standard terms and definitions for use in describing both the posture and the anthropometrics of a person seated in a wheelchair;
c) the terms and definitions for describing the dimensions, location and orientation of seating support surfaces, which together comprise the body support system.

Section 1 does not specify any methods for use in measuring a person's seated posture, nor does it define terms for dynamic physiological movements (such as flexion or extension). Section 1 may be applicable to seating other than that intended for use within a wheelchair.

Section 2 specifies multiple test methods and disclosure requirements to assess performance of wheelchair seat cushions intended to maintain tissue integrity and prevent tissue trauma.

Section 3 specifies test methods for the determination of static, impact, and repetitive load strengths as well as disclosure requirements for postural support devices (PSD) with associated attachment hardware intended for use with wheelchairs. Section 3 does not test the transportability or the use of the PSD in a motor vehicle.

NOTE At the present time there are no minimum or maximum strength requirements specified in the test procedures for testing for PSDs. In the future, minimum or maximum loads for testing might be specified for testing on a pass/fail basis.

Section 6 specifies test methods that characterize the changes in physical and mechanical properties of seat cushions based on their age and use.

Section 12 specifies a method and apparatus for the measurement of performance of a wheelchair seat cushion intended to use immersion and envelopment to reduce local areas of pressure. The ability of the cushion to accommodate changes in indenter size and mass are measured to represent the changes in size and mass that can occur in the life of a user or between users.

This standard specifies requirements and test methods for determining wheelchair seating performance. It also specifies requirements for the disclosure of the test results. Some sections may be applicable to tissue integrity management devices used as other support systems, as well as to cushions used in situations other than a wheelchair.

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

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

Vocabulary, Reference Axis Convention and Measures for Body Segments, Posture and Postural Support Surfaces
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**B.4** Lower neck joint

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Section 1 Introduction

This section of RESNA WC-3 is based on ISO 16840-1. RESNA has created these amendments to eliminate redundancies and highlight discrepancies between the various parts of the ISO 16840 Wheelchair Seating Standards. These amendments apply to ISO 16840-1, dated March 15, 2006. At the time of publication of this standard, the March 15, 2006 edition of ISO 16840-1 was valid. All standards are subject to revision, and parties to agreements based on this section of RESNA WC Vol. 3 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 in the following amendments, 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.

The development of wheelchair seating as a sub-specialty of rehabilitation services has been occurring over the last several decades. This practice involves the selection and provision of wheelchair seating products that provide improved body support, movement control, and injury prevention for the wheelchair user. Inherent in this selection process is the measurement and communication of the anthropometrics and postural measures of the seated person, as well as the orientation, location, and linear measures of the person's seating support surfaces.

However, there has been tremendous variation in the use of the terminology and definitions related to the clinical measures of a seated individual. Standard definitions and terms are lacking for communicating critical postural information and support surface parameters in a way that is uniformly useful to service providers, researchers, manufacturers, wheelchair users and purchasers when selecting and providing wheelchair seating devices.

The purpose of this section of RESNA WC-3 is to specify standardized geometric terms and definitions for describing and quantifying a person’s anthropometric measures and seated posture, as well as the spatial orientation and dimensions of a person’s seating support surfaces. The body measurements also allow for the systematic monitoring of a person's seated posture change over time.
Section 1: Vocabulary, Reference Axis Convention and Measures for Body segments, Posture and Postural Support Surfaces

1. Scope

This section of RESNA WC-3 applies to seating intended to provide postural support within a wheelchair. It specifies:

a) a global coordinate system that permits the determination and recording of a person's posture while seated in a wheelchair;

b) the standard terms and definitions for use in describing both the posture and the anthropometrics of a person seated in a wheelchair;

c) the terms and definitions for describing the dimensions, location and orientation of seating support surfaces, which together comprise the body support system.

This section of RESNA WC-3 does not specify a method or instrument for measuring a person's seated posture, nor does it define terms for dynamic physiological movements (such as flexion or extension).

This section of RESNA WC-3 might be applicable to seating other than that intended to be used within a wheelchair.

2. Terms and definitions

For the purposes of this section of RESNA WC-3, the terms and definitions given in RESNA WC-1, Sec. 26 and the following apply:

2.1 absolute angle
angle which represents the orientation in space of a body segment or support surface reference plane relative to the gravitational axis system

NOTE See 5.2.

2.2 body centerline
vertical line falling on the midsagittal plane of the body, as viewed in the frontal plane

2.3 body segment line
line defined by two designated body landmarks, either palpated or calculated, used in determining angular positions of body segments

2.4 contact surface
surface of the seating support intended to be in contact with the seated person’s body