

Development and Application of Wheelchair Standards: *Everything most people want to know in 30 minutes or less!*

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This presentation is intended to provide general information regarding the contents of the voluntary industry standards for wheelchair products. These standards are currently organized into 24 interrelated documents that are harmonized world-wide under the auspices of the international Standards Organization (ISO). They cover both manual and powered wheelchairs, including scooters. All ISO standards are reviewed every five years and revisions made as deemed necessary.

Those seeking more specific information are urged to obtain the current versions of the specific standards. Most national standards are adoptions of the ISO standard.

Overview

- Voluntary standards, manual and powered W/Cs.
- USA/Canada/ISO* collaboration
- ANSI/RESNA** standards-US
- Work began, 1979---now 23 parts in total.
- Type: mainly information/performance disclosure--some pass/fail.
- Test methods to verify performance/safety.
- Required info. disclosure in presale literature.

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* International Organization for Standardization - <http://www.iso.ch/>
**ANSI: American National Standards Institute - <http://www.ansi.org/>
RESNA: Rehabilitation Engineering and Assistive Technology Society of North America <http://www.resna.org/>

Why Bother?

- Standards ensure minimum levels of performance.
- Allows accurate comparison between products.
- Stimulates quality improvement.
- Reduces manufacturer's liability exposure.
- Gives engineers something to do!

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Part 01: Determination of Static Stability *

- Test information specifies:
 - Tipping angle* in degrees on a slope while facing:
 - forward
 - rearward, including anti-tip device
 - sideways

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*Test information from this standard allows comparison of how stable or "tippy" one wheelchair will be compared to another when standing still on a ramp.

Part 02: Determination of Dynamic Stability (Powered Chairs)*

- Test Information Specifies:
 - a) rearward and forward stability-traveling forwards and backwards
 - starting on the level
 - starting on 3°, 6° and 10° ramps
 - stopping on 3°, 6° and 10° ramps
 - stability while travelling up a step transition

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*This test information allows the comparison of stability or “tippiness” of powered W/cs when moving over a variety of typical terrains at its maximum speed.

Part 02: Determination of Dynamic Stability (Powered Chairs)

- Test Information Specifies:
 - b) forward stability-
 - travelling from sloped to level surface
 - hitting an upward step transition
 - hitting a downward step transition



Part 02: Determination of Dynamic Stability (Powered Chairs)

- Test Information Specifies:
 - c) lateral stability -
 - turning on a downhill slope
 - turning in a circle on level
 - turning suddenly on level
 - one side travelling down step transition



Part 03: Determination of Effectiveness of Brakes*

- Test Information specifies:
 - a) Parking Brake - must hold W/C on 8° slope
 - b) Running Brake - minimum stopping distance on level under 3 conditions:
 - Normal operation
 - Max. braking-reversed control
 - Emergency braking -power off
 - c) Parking Brake fatigue-60,000 cycles

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* Part 3 test information not only allows comparison of the brake performance of both manual and powered wheelchairs, but also indicates whether the W/c meets the minimum requirement of holding on an 8° sloped surface.

Part 04: Determination of Energy Consumption (Powered Chairs)*

- Test Information Specifies:
 - maximum speed of W/C
 - theoretical range in km

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Part 4 test information tells the purchaser how fast the W/c will travel and approximately how far it will travel with a fully charged battery.

Part 05: Determination of Overall Dimensions, Weight, and Turning Space

- Test Information Specifies:
 - overall length, width of W/c
 - min. folded length, width, height, volume*
 - total mass of W/c and removable parts**
 - minimum turning radius or turnaround space***

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* minimum folded dimensions can be important information for a person planning on collapsing a W/c for stowage in a vehicle.

** total weight of the the W/c and its removable parts is also important information if lifting of the W/c is a requirement.

***turning radius information is a good indicator of the maneuverability of the W/c in tight spaces.

Part 06: Determination of Max. Speed, Acceleration and Retardation (Powered Chairs)

- Test Information Specifies:
 - max. speed forward/reverse
 - On level surface
 - max. speed forward
 - Up and down 3° and 6° ramps
 - max. acceleration/retardation*

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Part 4 indicates how quickly the W/c starts and stops under various typical test conditions

Part 07: Determination of Seating and Wheel Dimensions*

- Test Information Specifies:
 - seat plane angle
 - max. seat width, depth
 - seat height from floor
 - backrest angle, plus
 - 12 other seat and wheel location dimensions*
(if applicable, adjustment ranges are given)

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Part 7 is provides critical measurement information on the W/c seat dimensions and distances to reach the wheels. It is this information that allows the comparison and selection of a W/c seat size to best meet the needs of the persons

Part 08: Static, Impact and Fatigue Strength

a) Static tests-how strong?

- Test information: pass/fail
 - known static loads are applied to:
 - armrests, footrests, tipping levers, hand grips and push handles

b) Impact tests-how strong?

- Test information: -pass/fail
 - known impact loads are applied to:
 - backrest, handrim, castors, footrests, armrests, front structure

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Part 8 test information basically allows a comparison of strength and durability of wheelchairs and confirmation that they have met the minimum requirements

Part 08: Static, Impact and Fatigue Strength

c) Fatigue tests-how durable?

– Test information (based on min.
requirements-pass/fail):

- a) 200,000 cycles on double drum tester without failure, and
- b) 6,666 curb drops (50mm) without failure



Part 09: Climatic Tests (Powered Chairs)*

- Test Information: pass/fail
 - a) effects of rain on controls
 - b) effects of temperature on controls
 - cold-13°F (-25°C)
 - hot- 122°F (50°C)

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*Part 9 test information informs the purchaser of a powered W/c that the control system will perform safely even if subjected to rain or extremes of heat and cold.

Part 10: Determination of of Obstacle Climbing Ability (Powered Chairs)*

- Test information specifies:
 - max. obstacle W/C can climb when approached at 90°, when:
 - a) traveling forward or backward with no run-up
 - b) traveling forward or backward with a 0.5 m run-up

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*Part 10 test information allows comparison to the obstacle climbing ability of a powered wheelchair. This can be important information if obstacles, say, higher than 1 inch (25mm), will be encountered in the planned use of the W/c.

Part 11: Test Dummies*

- Specifies four sizes of anthropometrically designed test weights:
 - large adult-220 lbs./100kg
 - adult-165 lbs./75kg
 - small adult-110 lbs./50kg
 - child-55 lbs./25kg

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*Part 11 provides information for use by manufacturers or testing labs, regarding the construction details of the four different-sized test dummies used in many of the tests.

Part 12: Tracking Characteristics

- Deleted from series



Part 13: Coefficient of Friction of Test Surfaces*

- Purpose: Provides a standard method to confirm that the test surface has a coefficient of friction between 0.75 and 1.0

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*Part 13 ensures that the tests are conducted on test surfaces with the same friction characteristics.

Part 14: Testing of Power and Control Systems (Powered Chairs)*

- Test information: -pass/fail
 - Specifies:
 - results of 17 tests related to the safety of the electrical power and control systems

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* Part 14 is a large number of test procedures (17) that are designed to verify the safety of the power system (controls and battery) of powered wheelchairs.

Part 15: Guidelines for Information Disclosure*

- General requirements: specifies-
 - a) what information must be disclosed in presale literature
 - b) what must be permanently labeled on the W/C
 - c) required provision of user, warranty and repair information

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*Part 15 is important from the perspective that it specifies the test information that must be either disclosed in the marketing literature, user's information manual, or permanently labeled on the W/c.

Part 16: Flammability Characteristics

- Information: -pass/fail
 - resistance to ignition of seat materials (cigarette test)

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Part 16 confirms that the wheelchair upholstery meets minimum flammability safety tests.

Part 17: Serial Interface for Electric Wheelchairs Controllers*

- specifies:
 - electronic interface for connecting a motor controller to a joystick and other accessories (ECUs, computers, AAC devices),
 - software communication protocols
 - Status- removed from ISO series- 1999

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*Part 17 was intended to establish an electronic standard for the method by which

W/c controls would communicate with other electronic equipment in the users environment, such as computers, communication devices or environment control devices. Unfortunately, it did not proceed quickly enough through the required stages of development and was terminated by ISO.

Part 18: Stair Climbing Devices*

- Specifies:
 - requirements and test methods for stair climbing devices (Wheelchairs [W/Cs] and wheelchair carriers),
 - ergonomic considerations for user and attendants, and
 - labeling and other information disclosure requirements
 - Status-ISO-DIS voting stage, no US version

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*Part 18 is more important for European companies, where stair climbing devices, especially attendant operated, are in common use.

Part 19: Wheeled Mobility Devices for Use in Motor Vehicles*

- Specifies:
 - design requirements and performance test methods for W/Cs intended to be used as seats in motor vehicles,
 - presale information disclosure and permanent labeling requirements, and
 - required user information.
 - Status-- voting stages
 - ANSI/RESNA-WC-19, final Fall 99
 - ISO-final Fall 2000

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* In addition to the the requirements of all the other parts, Part 19 specifies what additional requirements must be met if the W/c is to be marketed as suitable for use as a seat in a motor vehicle.

Part 20: Determination of Performance of Stand-up Wheelchairs

- Specifies:
 - modifications to dummy test series to allow for standing
 - displacement between user and W/C - during transition from sitting to standing
 - Status: final voting stage (ISO)



Part 21: Requirements and Test Methods for Electromagnetic Compatibility*

- Specifies:
 - requirements and test methods for electromagnetic emissions,
 - electromagnetic immunity to external emissions,
- applies to: W/Cs and scooters with a max. speed of 15km/h.

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* Part 21 confirms that the controls of W/c are immune to electromagnetic interference emissions to a specified level that may result from such external sources as; cell phones, emergency vehicle radios, etc. Interference from such sources has caused wheelchair users to lose control of their powered wheelchairs.

Part 22: Set up Procedure*

- specifies how W/Cs must be set-up prior to any tests
- particularly important for W/Cs with adjustable components
- Under active development

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* Part 22 is information that is used by test labs to make sure that each wheelchair is configured or set up the same way prior to the commencement of the tests.

Part 93: Wheelchair Maximum Overall Dimensions*

- provides max. recommended overall W/C dimensions
- guidelines for W/C designers and others to ensure environmental access

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* Intended to provide important information on maximum overall dimensions of wheelchairs for use by those professions responsible for the design of environments in which wheelchairs are expected to successfully function.

Additional Information

- References

- A Guide to Wheelchair Selection-how to use the ANSI/RESNA wheelchair standards to buy a wheelchair

Axelson, Minkel and Chesney,
Paralyzed Veterans of America, 1994

- WWW version of Guide:
(http://www.wheelchairnet.org/ProdServ/Docs/WCN_PVA_guide.html)
- Full Standards Set-RESNA (<http://www.resna.org>)

