Future Developments

Wheelchair Standards: An Overview

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A series of wheelchair standards are currently in the final phase of approval by the American National Standards Institute (ANSI). These standards have been under development for several years, working closely with the International Standards Organization (ISO) so that the ANSI standards will be essentially the same as those in the other participating countries.

The development of standards has been a long and tedious process involving participation from many disciplines and interests. The ANSI Technical Advisory Group (TAG), organized by RESNA, operates under a grant from the Veterans Administration, with a secretariat at RESNA.

The main purpose of these standards is to provide the user and prescriber with the knowledge and assurance that a product measures up in durability and performance. The standards are of value to the manufacturer on an international basis because it enhances their position in foreign markets and restricts the sale of imports that do not meet these standards. The standards define test procedures that are useful to the Veterans Administration and other national purchasing agencies in establishing acceptance criteria for domestic or imported products.

The ANSI TAG has a diverse membership consisting of users, manufacturers, engineers, testing authorities, therapists and distributors. As each of these professionals may have differing requirements, considerable discussion and testing is required in order to reach a decision. It is then followed by the drafting and redrafting of documents particularly within the ISO since language also plays a part in arriving at understandable and unequivocal statements. Throughout the entire process, there is one paramount concern and that is that the standards do not restrict innovation by specifying a particular material or construction. The standards are therefore Performance Standards that establish means by which durability and performance may be measured. In some cases levels of acceptance may be recommended, in others only the disclosure of the results is required.

ISO standards must undergo a rigorous procedure which includes a majority vote from all participating and observer countries that are involved. At the national level, the ANSI/RESNA TAG is developing standards that will be adopted as U.S. standards once they have been subjected to public comment and have been approved by ANSI's Standards Review Board. The standards, once they come into effect, are voluntary standards, not law. ANSI is strictly a private, non-government, institute. It is in the interest of manufacturers to adhere to the standards so that they may be so labeled. Any wheelchair that does not carry the ANSI label will be at a real disadvantage in the market place.

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Currently there are 17 standards under consideration. Four of these are general in nature covering terms and definitions, overall dimensions, test dummy specifications and the procedure for measuring the coefficient of friction of test surfaces. The dummy is a simple design used to load the wheelchair in a manner equivalent to typical users. Four dummies are used with overall weights of 25, 50, 75 and 100 Kg representing children, small adults, average adults and large adults, respectively. The results of tests that include the use of dummies must always include the weight of the dummy(s) used.

One other general test concerns burning; hazards associated with cigarettes and matches igniting upholstery. The test procedures are adapted directly from those already in use for furniture.

The nature and status of selected standards are as follows:

Nomenclature, Terms, and Definitions (Final)

This national standard defines the basic elements of wheelchairs (manual, electric, and others) and gives terms and definitions for these elements in an illustrated glossary. It also illustrates the dimensions commonly used to describe wheelchair physical characteristics.

1) Static Stability (Final)

This applies to manual and powered wheelchairs and refers to the tipping angle of the wheelchair with and without locked brakes when loaded with the appropriate dummy. The tipping in the forward, rearward and lateral directions is determined plus any other direction that may be more critical. The standard will not include acceptance levels, but requires the disclosure of the test results so that the consumer or prescriber may make an informed choice.

The mean value of the test results of other wheelchairs in the same category will be included in the disclosure. Since some wheelchairs have adjustable wheel or seat positions, the maximum and minimum values are recorded.

2) Dynamic Stability of Electric Wheelchairs (Final)

This standard is concerned with the stability of an electric wheelchair when turning at full speed.

3) Efficiency of Brakes (Final)

This test is concerned with the ability of wheel locks to hold the wheelchair and dummy on a slope. The stopping distance from maximum speed both on the level and on a 5-degree slope is measured on powered wheelchairs. It also applies to wheelchairs with mechanical brakes that are sometimes used on European wheelchairs.

4) Energy Consumption of Electric Wheelchairs (Final)

In this test, the energy consumption is recorded over a standard course that includes turns and slopes. From the test results, the theoretical range can be calculated for indoor and outdoor conditions based on the nominal capacity of the battery(s).

5) Overall Dimensions, Mass and Turning Space (Final)

The overall dimensions are self explanatory and include the folded position with and without demountable parts such as footrests. The turning space includes the smallest turning radius and the narrowest corridor in which the wheelchair can reverse direction with a single backing operation.

6) Maximum Speed and Acceleration of Electric Wheelchairs (Final)

The maximum speed is determined on a level surface loaded with the appropriate dummy or a person of the same weight. The maximum acceleration requires the use of the dummy to ensure consistency. The acceleration is measured by an accelerometer mounted on the dummy and filtered to eliminate all frequencies higher than 30 Hz. The results indicate the wheelchair performance but are also concerned with the comfort and stability of the user under maximum acceleration.

7) Seating Dimensions (Under Development)

This proposed standard is still under development. It is based on loading the wheelchair with a specified loader gauge to form the upholstery into the shape it would assume in normal use. From this position, 26 measurements are recorded on the dimensions of the seat, backrest, footrests and armrests. For ergonomic reasons, the position of the seat with respect to the handrim or other propulsion device is included. The loader gauge, based on a design used in the

European furniture industry, will be available in child and adult sizes.

8) Static Impact and Fatigue Strength (Under Development)

This is one of the few instances where minimum levels of performance are recommended. The actual test values are based on dummy size, and the test results must state which dummy was used, indicating the weight of the person for whom the wheelchair is suitable.

The static test consists of applying a load to various parts of the wheelchair.

The impact testing has several parts. For testing casters, footrests and other parts subject to impact against curbs and potholes, the wheelchair is loaded with the appropriate dummy and crashed into the obstacle at a pre-determined speed. The seat and backrest are tested by dropping a soccerball fitted with 25 kg of lead shot on specific areas and in specific directions. The wheel and axle assemblies are tested by dropping the wheelchair loaded with the appropriate dummy from a prescribed height so as to land on each wheel separately. The test simulates the stresses incurred when rolling off a curb. The handrims are tested with a weighted pendulum which simulates the accidental striking of the handrims on a door frame.

The fatigue test is conducted using a two-drum test machine. The wheelchair is positioned on the test machine so that the front and rear wheels will run on the drums.

The wheelchair loaded with the appropriate dummy is secured by the axles while the drums are rotated at a speed corresponding to about 1 meter per second. Fastened to each drum are slats, one-half × 1 and one-half inches. The number of cycles satisfactorily completed is then disclosed.

The order of testing is specified and one wheelchair must be used for all tests. The disclosed values include the static forces applied, the velocity or dropheight of the impact and the number of fatigue cycles completed without structural failure.

9) Climatic Tests for Electric Wheelchairs (Final)

There are two parts for this test. One involves the use of a water spray, simulating heavy rain, to determine any safety hazards or performance deficiencies under these conditions. The second part tests the wheelchair's performance after exposure to hot and cold conditions. The temperature range for operating conditions is from −20 degrees C to +50 degrees C and for storage at temperatures from −40 degrees C to +65 degrees C.

10) Obstacle Climbing for Electric Wheelchairs (Final)

This test determines the ability of a powered wheelchair to climb a step or curb both from a standing start and from a run of 0.5 meters.

For the test, the simulated step is progressively increased from 20 to 200 mm (3/4 inch to 8 inches) and the maximum heights recorded. As in other tests, the dummy size is specified, although a person of the same weight may be used.

11) Test Dummies (Final)

This part of the ANSI/RESNA national wheelchair standard outlines the construction of test dummies of nominal mass 25, 50, 75, and 100 kg (55, 110, 165, 220 pounds). The dummies are intended for tests in which the wheelchair is required to be loaded.

13) Coefficient of Friction of Test Surfaces (Final)

Several test procedures for wheelchairs require that the coefficient of friction of the test surface be within specified limits.

This part of the standard specifies a method for determining the coefficient of friction of a test surface that has a rough texture, such as unfinished concrete.

14) Power and Controls (Under Development)

This standard embodies a series of tests to ensure electrical safety, controller performance, and safety from unintentional access to hazardous areas and pinch points.

15) Disclosure Requirements (Under Development)

This standard specifies the information that is required to be disclosed in the user manuals,

product literature, and other documentation related to wheelchairs.

91) Burning Behavior (Under Development)

This standard specifies a procedure for determining the ignitability characteristics of a wheelchair's upholstered surface.

93) Overall Dimensions (Final)

This standard defines the maximum dimensions recommended for manual and powered wheelchairs. This standard serves as a reference for environmental designers to enable wheelchair-accessible hotels, buses, trains, etc., to be designed (28 inches wide, 51 inches long, and 43 inches high).