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Wheelchair seating —

Part 12: Apparatus and method for cushion envelopment testing

Sièges de fauteuils roulants —

Partie 12: Appareillage et méthode d'essai de l'enveloppement du coussin

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation on the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the WTO principles in the Technical Barriers to Trade (TBT), see the following URL: Foreword — Supplementary information.

The committee responsible for this document is ISO/TC 173, *Assistive products for persons with disability*, Subcommittee SC 1, *Wheelchairs*.

ISO 16840 consists of the following parts, under the general title *Wheelchair seating*:

— *Part 1: Vocabulary, reference axis convention and measures for body segments, posture and postural support surfaces*

— *Part 2: Determination of physical and mechanical characteristics of devices intended to manage tissue integrity — Seat cushions*

— *Part 3: Determination of static, impact and repetitive load strengths for postural support devices*

— *Part 4: Seating systems for use in motor vehicles*

— *Part 6: Simulated use and determination of the changes in properties — Seat cushions*

— *Part 10: Resistance to ignition of non-integrated seat and back support cushions — Requirements and test methods*

— *Part 11: Determination of perspiration dissipation characteristics of seat cushions intended to manage tissue integrity* [Technical Specification]

— *Part 12: Apparatus and method for cushion envelopment testing* [Technical Specification]

The following parts are under preparation:

— *Part 9: Clinical interface pressure mapping guidelines for seating* [Technical Report]

Future parts dealing with methods for determining heat and water vapour characteristics and clinical guideline for the measurement of postural support surfaces and body segments are planned.

Introduction

This part of ISO 16840 provides details of test equipment and a method for the measurement of "performance" of a wheelchair cushion intended to use immersion and envelopment to reduce local areas of pressure (by effectively supporting more tissue). The primary elements that represent the basic cushioning effect of a cushion are immersion and envelopment. Immersion into the cushion (the depth that a body penetrates into the surface) and the envelopment of the body (the intimacy of the cushion to the body) combine to define the potential cushioning performance of the cushion. In this test, the distribution of forces across the surface of the indenter is evaluated with multiple indenter sizes and masses. The accommodation of the cushion to the changes in indenter size and mass are representative of the changes in size and mass of the occupant that can occur in the life of a wheelchair user or between different users.

Issues related to the use of devices that measure the forces between the body and a support surface (i.e. pressure mapping systems) have led to the use of an instrumented indenter, which has fewer sensors, but sensors which are high quality and exhibit repeatability, accuracy, and thus reliability.

Wheelchair seating —

Part 12:
Apparatus and method for cushion envelopment testing

1 Scope

This part of ISO 16840 specifies apparatus, test methods, and disclosure requirements for characterization of wheelchair seat cushion immersion and envelopment properties using instrumented indenters to characterize the interface pressure of each indenter and the test cushion by measuring the cushioning effects of immersion and envelopment. This part of ISO 16840 can be considered to expand the characterization of products intended to manage tissue integrity (ISO 16840-2) and provide a standardized indenter for other wheelchair seating tests. It does not provide information specific to cushion performance for a particular individual user.

This part of ISO 16840 includes a method that is specific to 220 mm and 255 mm indenters. Dimensions and loads are provided for the 380 mm indenter to allow for extension of the methods for bariatric applications.

2 Normative references

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

ISO/IEC Guide 98-3, *Uncertainty of measurement — Part 3: Guide to the expression of uncertainty in measurement (GUM:1995)*

ISO 1302, *Geometrical Product Specifications (GPS) — Indication of surface texture in technical product documentation*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

3.1
adjustable cushion
cushion in which adjustments can be made in a reversible fashion

Note 1 to entry: See 3.2.

3.2
cushion adjustment
modification to the volume, size, hardness, pressure, or other physical characteristics of the cushion surface to accommodate the applied load and the indenter size in accordance with the manufacturer's instructions

3.3
base points
lowest two points of indenter when ready for use

Note 1 to entry: See Figures 6 and 7.

Note 2 to entry: The base points correspond with the ischial tuberosities on the human pelvis.

3.4
elevation
sensor locations relative to the base points of indenter when ready for use

Note 1 to entry: See Figure 6.

Note 2 to entry: — Elevation$_1$: Sensors at the base points of the indenter (a total of two sensors).

— Elevation$_2$: All sensors 5 mm superior to the base points (a total of eight sensors).

— Elevation$_3$: All sensors 20 mm superior to the base points (a total of six sensors).

— Elevation$_4$: Sensors 40 mm superior to the base point (a total of two sensors).

Note 3 to entry: When in use, the base points of the indenter (Elevation 1) aim to represent the lowest points of the ischial tuberosities.

3.5
envelopment
ability of a cushion to conform, so as to fit or mould around the irregular shape of the body

3.6
immersion
depth to which a body penetrates into a cushion from an uppermost plane

3.7
instrumented indenter
anatomical form that is loaded with a prescribed force and has embedded sensors that return pressure values

3.8
multiplexer
electronics board that converts the signal from the sensors into pressure data

3.9
load distribution
relative comparison of force or pressure values read by the sensors

3.10
offloading
clinical practice of reducing or removing pressure from one area of the body to another in an effort to reduce risk of injury

EXAMPLE Reducing the pressure under the ischial tuberosities and increasing pressure on the thighs or other parts of the seated body.

4 Indenter construction

4.1 Materials

The indenter shall be constructed from hardwood or similar material that is sufficiently rigid to not deform when subjected to the forces required for simulating the application of human body mass to surfaces. The material shall be treated (if necessary) to minimize the effects of moisture, and shall not be adversely affected by normal laboratory testing conditions (0 °C to 35 °C; 25 % to 75 % relative humidity). Surface finish to at least N7 (according to ISO 1302; approximate average surface roughness).

4.2 Tolerances and finishes

Unless otherwise stated, all dimensions in Clause 4 shall be ±0,5 mm and all edges and corners shall be finished with a minimum 5 mm radius. Surface finish to at least N7 (according to ISO 1302; approximate average surface roughness).

4.3 Indenter elements

4.3.1 Trochanter bar

Use a 375 mm × 50 mm × 20 mm bar with a series of slots carved in the beam to allow for wire routing. The bulbous indenter halves and trochanter buttons are fixed to the trochanter bar. Refer to Figure 1.

Dimensions in millimetres

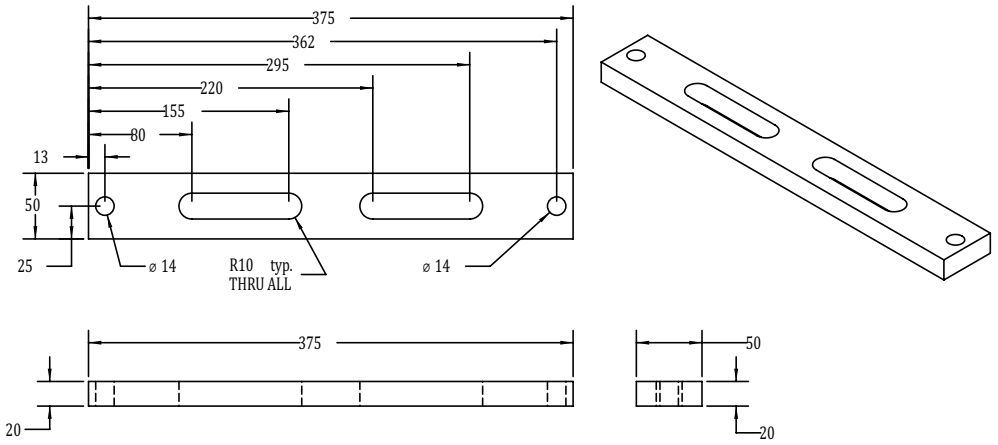

Figure 1 — Trochanter bar construction

4.3.2 Trochanter buttons

51 mm × 25 mm × 19 mm blocks emulate the trochanters. Each trochanter button shall have a flat section where the sensor is located. Refer to Figure 2.

NOTE Trochanter buttons are not required on the 380 mm indenter.

Dimensions in millimetres

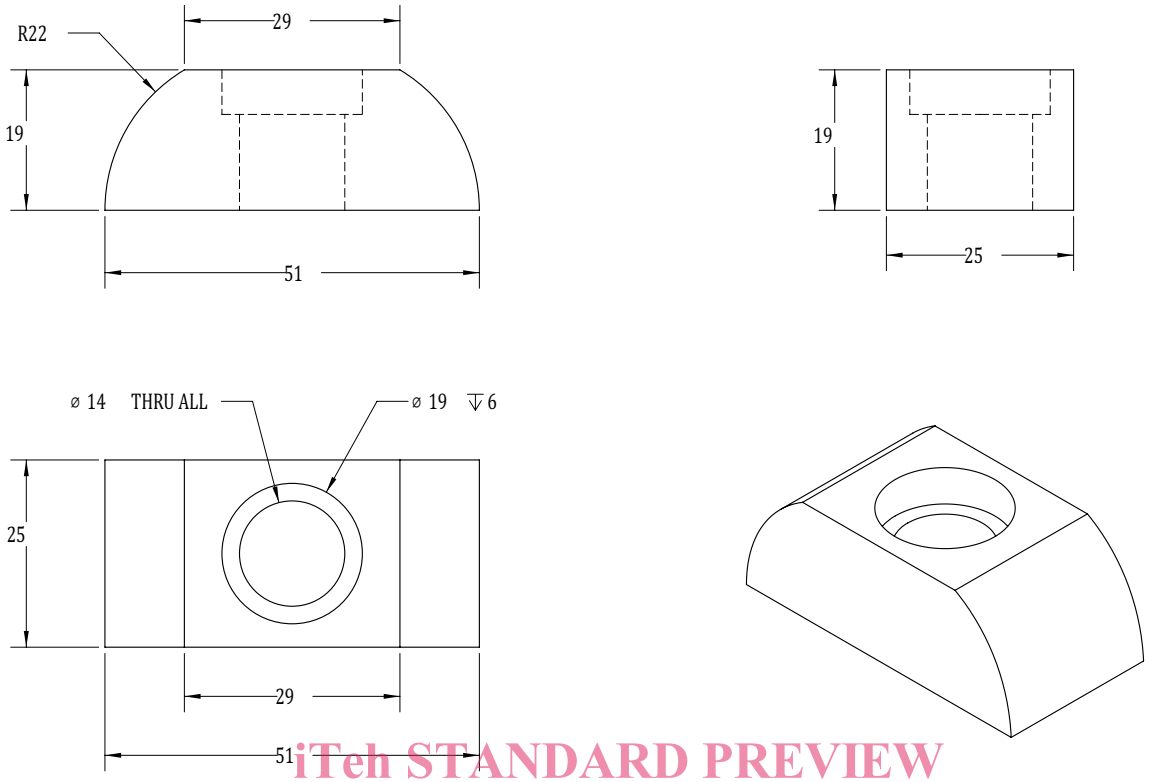

Figure 2 — Trochanter button construction

4.3.3 Bulbous indenter half

This is a disc with a convex curve outwards (see Figure 3). The outwards curve diameter defines the size of the indenter (e.g. a 220 mm indenter has a 220 mm diameter) as referenced in Table 1. The disc diameter is a function of the outward curve and the height of the curve. Each half has eight sensor locations, as described in 4.5.

Dimensions in millimetres

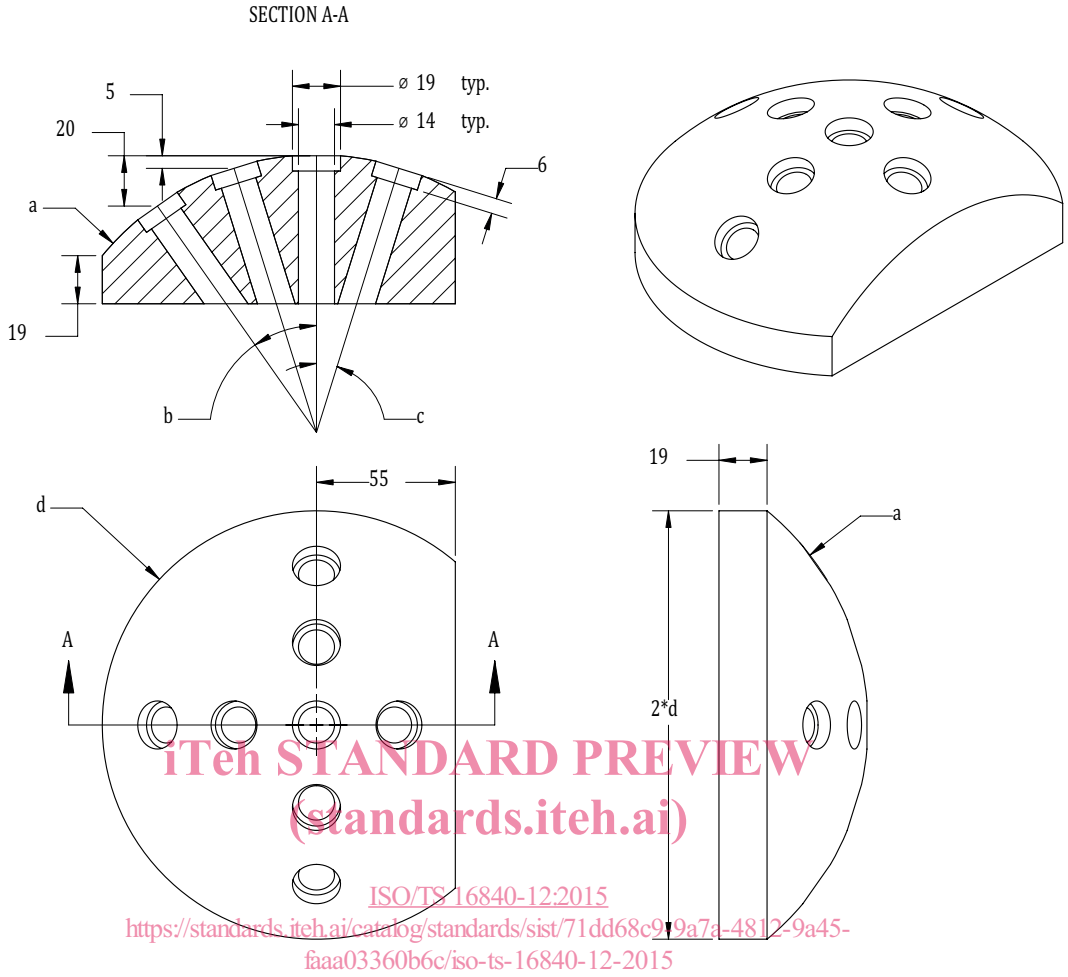

Figure 3 — Bulbous indenter half

Table 1 — Bulbous Indenter dimensions

INDENTER	a	b	c	d
220 mm	110 mm	35,0°	17,5°	85,0 mm
255 mm	127,5 mm	32,5°	16,0°	92,5 mm
380 mm	190 mm	26,5°	13,0°	128,5 mm

4.4 Indenter assembly

Assemble the indenter using appropriate fasteners that will maintain the structural integrity of the indenter in all aspects of testing. Assembly drawings are shown in Figure 3 for the 220 mm and 255 mm indenter and Figure 4 for the 380 mm indenter.