International Standard

ISO 16840-10

Wheelchair seating —

Part 10: Requirements and test method for the assessment of resistance to ignition of postural support devices

Sièges de fauteuils roulants —

Partie 10: Exigences et méthode d'essai pour l'évaluation de la résistance à l'inflammation des dispositifs de soutien postural

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Contents

Page

Foreword ... **iv**
Introduction ... **v**
1 Scope ... **1**
2 Normative references ... **1**
3 Terms and definitions ... **1**
4 Principle ... **2**
5 Health and safety of test personnel ... **2**
5.1 General ... 2
5.2 Enclosure ... 2
5.3 Extinguishers ... 3
6 Apparatus ... **3**
6.1 Test enclosure ... 3
6.2 Timer ... 3
6.3 Heat source ... 3
6.3.1 General ... 3
6.3.2 Wire coil ... 3
6.3.3 Power supply and connection to wire coil ... 4
6.3.4 Conditioning the wire coil ... 4
6.3.5 Paper calibration strip ... 4
6.4 Test environment ... 5
6.5 Test sample ... 5
7 Test procedure ... **5**
7.1 Sample preparation ... 5
7.2 Sample conditioning ... 5
7.3 Selection of testing orientation ... 5
7.4 Heat source calibration ... 5
7.5 Wire coil cleaning between tests ... 6
7.6 Horizontal test ... 6
7.7 Vertical test ... 7
7.8 Smaller PSDs ... 8
8 Requirements ... **9**
9 Test report ... **9**
Annex A (informative) **Guidance on fabrication of the test coil apparatus** ... **11**
Annex B (informative) **Selection of surface(s) at risk, to be used for testing** ... **18**
Annex C (informative) **Test report example** ... **19**
Bibliography ... **22**

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Foreword

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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).

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This document was prepared by Technical Committee ISO/TC 173, *Assistive products*, Subcommittee SC 1, *Wheelchairs*.

This third edition cancels and replaces the second edition (ISO 16840-10:2021) which has been technically revised. It also incorporates the Amendment ISO 16840-10:2021/Amd. 1:2024.

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The main changes are:

— removal of the original test method and incorporation of the test method from the amendment.

A list of all parts in the ISO 16840 series can be found on the ISO website.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

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Introduction

The ignition and subsequent burning of wheelchairs is very rare, but this can occur as a result of

— being close to a burning object such as a fire beside the wheelchair,

— overheating of any electrical or electronic device on the wheelchair, and

— contact from sparks or flames (such as welding sparks, cigarettes, or matches).

Wheelchair occupants are at particular risk of injury or death from these fires and resulting fumes because it is very possible that they do not have the ability to move away from the wheelchair.

NOTE In the United States, data collected in the 1990s showed that only a small number of individuals per million wheelchair users had died due to fire[5]. Public FDA records indicate most 21st century flammability incidents involving wheelchairs are from electrical faults[6].

Wheelchairs can be considered to comprise the following components:

a) structural components such as the frame, wheels, etc., that are essential to the mechanical integrity of the wheelchair;

b) power-related components such as motors, energy sources, controllers etc., that are required for the functioning of powered devices on wheelchairs.

c) integrated or non-integrated devices to manage tissue integrity, such as seat and back support cushions, that are intended to have primarily a clinical function to minimize the risks of skin damage (these can also be intended to control or accommodate posture);

d) postural support devices, including, but not limited to, sling seats, sling back supports, arm supports, foot supports, pelvic positioning supports (hip belts), anterior trunk supports (harnesses and chest belts), lateral pelvic/trunk supports (lateral pads) etc., that are attached to the wheelchair and are primarily intended to give positioning and postural support to the wheelchair occupant (these can also be intended to aid in pressure redistribution);

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Each of the above components has a different severity of risk associated with its likelihood of igniting and its resulting harm to the wheelchair occupant. This document specifies requirements and a test method to help manufacturers and purchasers of wheelchairs to design and procure wheelchairs and their components that are appropriate for the risk of ignition balanced against the functional needs of the wheelchair occupant. The aim of this document is to provide appropriate alternatives to using furniture-based flammability standards, to reflect the uses and purposes of wheelchairs and their accessories.

There is yet no International Standard on the resistance to ignition of structural components [see list item a) above].

The power related components [see list item b) above] are the subject of ISO 7176-14 which specifies requirements to prevent overheating in electrical components that could lead to a fire.

The tissue integrity devices [see list item c) above] and postural support devices [see list item d) above] are the subject of this document, regardless of the seating application (whether used on or off a wheelchair), for the same benefits of the support device to the individual. For this purpose, a smouldering cigarette as a standardised heat source is not necessarily a reproducible heat source, since the heat output between cigarettes from within one pack is variable, and between different packs even more so. Since the early furnishing flammability standards were introduced, filter tipped and fire safe cigarettes have evolved, and thus today, testing is not being carried out with the equivalent heat source as when the furnishing flammability standards were first drafted. The aim of this document is to describe a reproducible standardised heat source output which reproduces the burn pattern and potential for ignition of a cigarette.

Cross-lab validation testing has shown that the previously recommended cartridge heater did not reproduce the burn pattern or potential for ignition of a cigarette, and it did not reliably produce the same test results as the hot wire coil.

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Various existing flammability standards allow for active flaming for two-minutes after removal of the heat source. By this time a wheelchair occupant could suffer severe injuries directly or by secondary ignition of other materials in the environment. This current document differs in that it tests for resistance to ignition – no flaming ignition is allowed. Given the full consideration of the wheelchair user's safety and long-term health, this document has been drafted to be used as the flammability standard for all seating textiles/soft components of a wheelchair that interface with the human body.

Global efforts are under way to eliminate the use of chemicals which present a serious risk to humans and the environment. Good practice is also to use biocompatible materials that minimize the risk of exposure to the wheelchair occupant to toxic substances. Materials chosen are required to conform to biocompatibility requirements and risk management guidance of ISO 10993-1. The change of emphasis around the materials to be used minimises the use of toxic and hazardous flame-retardant chemicals, which is preferable due to the minimal contribution of seating system materials to fire severity.

Materials chosen should comply with biocompatibility requirements and risk management guidance of ISO 10993-1, which includes consideration of cytotoxicity, sensitization, and irritation evaluations for devices making contact with intact skin.

The pass criteria within this document have been set at a basic minimal level and can differ from current requirements in some countries. Where practical, manufacturers should use materials with superior resistance to ignition, when the overall risk analysis indicates the benefits outweigh any unintended harm, in accordance with ISO 14971.

The day to day usage of a wheelchair can affect its materials' resistance to ignition through cyclic loading, movement of materials, washing, cleaning, etc. Manufacturers will often take this effect into account as part of their risk assessment when selecting materials for their products to minimize the effects of this normal use. However, although this document can be used on parts that have been used, etc., the test samples specify new or unused parts. Different environments commonly encountered by some wheelchair occupants can also affect the flammability of materials. For example, home oxygen systems, delivery systems for drugs carried in an inflammable medium, etc., can turn an inert material into a flammable one. Dust and other materials accumulated within the chair have also been found to be a source of readily ignitable material. Wheelchair manufacturers and occupants should be aware of these risks, and should design and use wheelchairs accordingly, as covered by ISO 14971.

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Wheelchair seating —

Part 10: Requirements and test method for the assessment of resistance to ignition of postural support devices

1 Scope

This document specifies requirements and a test method to assess the resistance to ignition by a smouldering cigarette equivalent of integrated or non-integrated components of a wheelchair intended either to protect tissue integrity or to provide postural support, or both. The electrical ignition source is also a simulation of other potential sources of environmental ignition hazards.

The test measures only the resistance to ignition of the items tested, and not the ignitability of the complete wheelchair. It gives an indication of, but cannot guarantee, the ignition behaviour of the assembled devices of a complete wheelchair.

This document does not apply to resistance to ignition of structural parts of a wheelchair. This document does not cover changes in resistance to ignition as a result of regular washing or use of the postural support devices.

Sample Document

This document allows for the separate testing of components of a wheelchair that are normally used in the horizontal plane (e.g. a seat cushion) from those normally used in the vertical plane (e.g. a back support).

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This document describes testing an assembly of the composite of materials as used in the component. The results of the test in this document do not give any indication of the resistance to ignition of any of the separate individual materials of the test sample.

NOTE 1 The intent of this document is primarily to address components that interface with the human body, such as cushions for positioning, or whose described purpose is that of protecting skin tissue against pressure, shear, and maceration related damage, as well as textile, foam, and plastic-based postural support devices.

NOTE 2 The pass criteria within this document have been set at a basic minimal level and can differ from current requirements in some countries.

NOTE 3 Requirements for the control of risks from sources of fire created by electrical and electronic components are included in ISO 7176-14.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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 7176-26, *Wheelchairs — Part 26: Vocabulary*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 7176-26 and the following apply.

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

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— IEC Electropedia: available at https://www.electropedia.org/

3.1
flaming
undergoing combustion in the gaseous phase with the emission of light

3.2
non-integrated
detachable without the use of tools

Note 1 to entry: Seat or back support cushions held in place by hook and loop fastenings are also considered non-integrated.

3.3
postural support device
PSD
structure, attached to a wheelchair, that has a surface that contacts the occupant's body and is used either to support, correct or stabilise the occupant's sitting posture

EXAMPLE Seat support, back support, lateral support, head support, pelvic positioning belt, anterior trunk support.

[SOURCE: ISO 7176-26:2007, 4.7.3 modified — The deprecated term "postural support" has been removed; in the definition, "modify or accommodate" has been changed to "support, correct or stabilise".]

3.4
smouldering
exothermic oxidation, not accompanied by *flaming* (3.1), that is self-propagating, i.e. without an external ignition source

Note 1 to entry: It is possible that smouldering is accompanied by incandescence.

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4 Principle

Test materials used in integrated and non-integrated seat and back supports, and other postural support devices as used in wheelchairs are assembled in either horizontal or vertical samples and subjected to a heat source that is equivalent to a smouldering cigarette in its thermal output and capacity to ignite materials used in wheelchair seating. The resulting effects on the test materials are observed and measured.

NOTE The tests are repeated a second time to ensure that they are repeatable, but without incurring the costs of more tests than needed as a minimum.

5 Health and safety of test personnel

5.1 General

WARNING — The following test requirements call for the use of procedures that can be hazardous to health if adequate precautions are not taken.

Ensure that there is no hidden smouldering of the sample before disposal.

5.2 Enclosure

For safety, the tests should be conducted in a non-combustible fume cupboard. If such a cupboard is not available, a test enclosure shall be constructed (see 6.1) so that the operator is protected from the fumes.

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5.3 Extinguishers

Adequate means of extinguishing the assembly shall be provided, bearing in mind that some product combinations can produce severe flaming during the test.

NOTE A hand and/or a fixed water spray that can be directed over the burning area can be useful. Other means such as fire extinguishers (water and halogenated hydrocarbons), fire blankets, and a bucket of water will assist in extinguishing. In some cases, smouldering can be difficult to extinguish completely and complete immersion in water can be necessary.

6 Apparatus

6.1 Test enclosure

The test enclosure shall consist of either a room or a smaller enclosure designed to extract smoke and fumes for the protection of the lab technician. In absence of such conditions, the technician shall take other precautions against smoke inhalation. The enclosure shall be capable of controlled air flow to meet the requirements specified in 6.4.

NOTE This airflow has been determined to provide adequate airflow to exhaust smoke and feed oxygen for ignition, without extinguishing any burning.

6.2 Timer

A means of measuring time for a period of 5 s to 1 000 s with an accuracy of ±0,1 s.

6.3 Heat source

Sample Document

6.3.1 General

A hot wire coil of NiCr alloy resistance wire, heated by a DC power supply that has a constant current output mode.

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NOTE 1 This source has been designed and validated to approximate the heat output and thermal mass of a burning cigarette as determined by observing the ignition behaviour and resulting burn patterns from a variety of cigarettes. The repeatability of the ignition behaviour and resulting burn pattern from the device was validated through interlaboratory testing.

6.3.2 Wire coil

The wire shall be made from a nickel-chromium alloy containing 60 % to 80 % nickel, commonly known as Nichrome 60, 70, or 80. The wire shall have a nominal size of 0,4 mm diameter (26 AWG).

NOTE 1 The heat source calibration protocol (7.4) accounts for small differences in electrical resistance due to the alloy or diameter.

The wire shall be wound to produce a wire coil with the specifications shown in Figure 1.

NOTE 2 A method for winding the wire coil to these specifications is provided in Annex A.

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