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Respiratory protective devices — Human factors —

Part 5: Thermal effects

Appareils de protection respiratoire — Facteurs humains — Partie 5: Effets thermiques

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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).

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For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 94, *Personal safety — Personal protective equipment*, Subcommittee SC 15, *Respiratory protective devices*.

This first edition of ISO 16976-5 cancels and replaces the second edition (ISO/TS 16976-5:2020), which has been technically revised.

The main changes are as follows:

— requirements more specified.

A list of all parts in the ISO/TS 16976 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

For an appropriate design, selection and use of respiratory protective devices, basic physiological demands of the user should be considered. The function of a respiratory protective device, the way it is designed and used and the properties of its material can have a thermal effect on the human body.

This document belongs to a series of documents providing basic physiological and anthropometric data on humans. It contains information about thermal effects associated with wearing respiratory protective devices.

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Respiratory protective devices — Human factors —

Part 5: Thermal effects

1 Scope

This document is one part of a series of International Standards that provide information on factors related to human anthropometry, physiology, ergonomics and performance for the preparation of standards for design, testing and use of respiratory protective devices. This document contains information related to thermal effects of respiratory protective devices on the human body. In particular information is given for:

— temperatures of surfaces associated with discomfort sensation and harmful effects on human tissues;

— thermal effects of breathing gas temperatures on lung airways and tissues;

— effects of breathing gas temperature and humidity on respiratory heat exchange;

— effects of respiratory protective devices on overall body heat exchange.

The information represents data for adult healthy men and women in the age 20 years to 60 years.

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 11079, *Ergonomics of the thermal environment — Determination and interpretation of cold stress when using required clothing insulation (IREQ) and local cooling effects*

ISO 13732-1, *Ergonomics of the thermal environment — Methods for the assessment of human responses to contact with surfaces — Part 1: Hot surfaces*

ISO 13732-3, *Ergonomics of the thermal environment — Methods for the assessment of human responses to contact with surfaces — Part 3: Cold surfaces*

ISO 16972, *Respiratory protective devices — Vocabulary and graphical symbols*

3 Terms, definitions and abbreviations

3.1 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 16972 and the following apply.

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

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

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

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3.1.1
clo
unit for the expression of the thermal insulation of clothing

Note 1 to entry: 1 clo is equal to 0,155 K m^2/W.

3.1.2
insulation required
IREQ
required clothing insulation for the preservation of body heat balance at defined levels of physiological strain

[SOURCE: ISO 11079:2007, 3.1.1]

Note 1 to entry: As determined according to ISO 11079.

3.1.3
predicted heat strain
PHS
analytical determination and interpretation of the thermal stress (in terms of water loss and rectal temperature) experienced by an average person in hot environments

Note 1 to entry: As determined according to ISO 7933.

3.2 Abbreviated terms and symbols

IREQ Insulation required

PHS Predicted heat strain

PPE Personal protective equipment

PMV Predicted mean vote

PPD Predicted percentage dissatisfied

RPD Respiratory protective device

SCBA Self-contained breathing apparatus

T_s Surface temperature (temperature of the surface contacted by skin)

T_a Ambient temperature (temperature of the air surrounding the body or inhaled)

T_c Contact temperature (temperature of the interface between skin and contacted surface)

4 Local thermal effects

4.1 General

The effects of heat and cold described in this document will vary according to individual sensitivity.

Notice should be taken of the assessment scales given in ISO 8996.

4.2 Effects on skin contact by the RPD

Heat transfer by conduction takes place via the hands when handling the equipment and via face, head and torso during the actual use of the equipment.

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