SLOVENSKI STANDARD
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Ergonomija toplotnega okolja - Načela in uporaba mednarodnih standardov na tem področju (ISO 11399:1995)

Ergonomics of the thermal environment - Principles and application of relevant International Standards (ISO 11399:1995)

Ergonomie des Umgebungsklimas - Grundsätze und Anwendung relevanter Internationaler Normen (ISO 11399:1995)

Ergonomie des ambiances thermiques - Principes et application des Normes internationales pertinentes (ISO 11399:1995)

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EUROPEAN STANDARD
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English version

Ergonomics of the thermal environment - Principles and application of relevant International Standards (ISO 11399:1995)

Ergonomie des ambiances thermiques - Principes et application des Normes internationales pertinentes (ISO 11399:1995)

Ergonomie des Umgebungsklimas - Grundsätze und Anwendung relevanter Internationaler Normen (ISO 11399:1995)

This European Standard was approved by CEN on 18 October 2000.

CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration. Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the Management Centre or to any CEN member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the Management Centre has the same status as the official versions.

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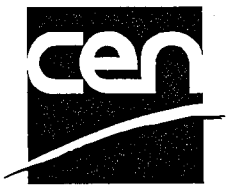

EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

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Ref. No. EN ISO 11399:2000 E

Foreword

The text of the International Standard from Technical Committee ISO/TC 159 "Ergonomics" of the International Organization for Standardization (ISO) has been taken over as an European Standard by Technical Committee CEN/TC 122 "Ergonomics", the secretariat of which is held by DIN.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by May 2001, and conflicting national standards shall be withdrawn at the latest by May 2001.

The annexes A and B are informative.

This standard includes a Bibliography.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and the United Kingdom.

Endorsement notice

The text of the International Standard ISO 11399:1995 has been approved by CEN as a European Standard without any modification.

INTERNATIONAL STANDARD

ISO 11399

First edition
1995-12-15

Ergonomics of the thermal environment — Principles and application of relevant International Standards

Ergonomie des ambiances thermiques — Principes et application des Normes internationales pertinentes

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Contents

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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.

Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

International Standard ISO 11399 was prepared by Technical Committee ISO/TC 159, *Ergonomics*, Subcommittee SC 5, *Ergonomics of the physical environment*.

Annexes A, B and C of this International Standard are for information only.

Introduction

This International Standard is one of a series of standards which specify methods of measuring and evaluating hot, moderate or cold thermal environments. It provides the underlying principles behind the assessment of human response to thermal environments in general and, in particular, those used in the development of each International Standard. It also demonstrates the relationships between the standards and how they can be used in a complementary way to evaluate the whole range of thermal environments.

Ergonomics of the thermal environment — Principles and application of relevant International Standards

1 Scope

The purpose of this International Standard is to specify information which will allow the correct, effective and practical use of International Standards concerned with the ergonomics of the thermal environment.

This includes:

a) a description of each relevant International Standard and the complementary way in which these standards can be used in the ergonomic assessment of thermal environments;

b) a description of the underlying principles used in each relevant International Standard;

c) a description of the underlying principles concerning the ergonomics of the thermal environment.

This International Standard applies to the application of those International Standards listed in clause 2. These standards cover thermal environments over the whole range of ergonomics investigation.

The information provided in this International Standard is not sufficient for the assessment of thermal environments. For that purpose, the appropriate International Standard should be used (see clause 2).

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this International Standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

ISO 7243:1989, *Hot environments — Estimation of the heat stress on working man, based on the WBGT-index (wet bulb globe temperature).*

ISO 7726:1985, *Thermal environments — Instruments and methods for measuring physical quantities.*

ISO 7730:1994, *Moderate thermal environments — Determination of the PMV and PPD indices and specification of the conditions for thermal comfort.*

ISO 7933:1989, *Hot environments — Analytical determination and interpretation of thermal stress using calculation of required sweat rate.*

ISO 8996:1990, *Ergonomics — Determination of metabolic heat production.*

ISO 9886:1992, *Evaluation of thermal strain by physiological measurements.*

ISO 9920:1995, *Ergonomics of the thermal environment — Estimation of the thermal insulation and evaporative resistance of a clothing ensemble.*

ISO 10551:1995, *Ergonomics of the thermal environment — Assessment of the influence of the thermal environment using subjective judgement scales.*

ISO/TR 11079:1993, *Evaluation of cold environments — Determination of requisite clothing insulation (IREC).*

3 Ergonomics of the thermal environment — Principles

Ergonomic investigations of thermal environments involve an understanding of a number of underlying concepts and principles concerning human response to thermal environments and measurement methods. Of fundamental importance are the basic parameters which describe human thermal environments. These are air temperature, mean radiant temperature, humidity, air velocity, clothing insulation and metabolic heat production. Other important concepts and terms include human thermoregulation, heat transfer, the heat balance equation, direct, empirical and rational thermal indices, acclimatization, body core and shell temperatures, surface temperature, thermal sensation and thermal comfort, skin wettedness, derived parameters, required sweat rate, required clothing insulation and others. Many of the above terms are used and some are explained in the relevant International Standards.

NOTE 1 A description of the principles underlying the ergonomics of the thermal environment and the use of the above concepts is provided in annex A.

4 The use of relevant International Standards to assess thermal environments

4.1 General

International Standards dealing with the ergonomics of the thermal environment can be used in an integrated way to allow assessment of human exposure to hot, moderate and cold environments. Guidelines are given in tables 1 and 2 and also described below.

4.2 Hot environments

For the assessment of hot environments, ISO 7243 provides a simple, rapid method of assessment based on the wet bulb globe temperature (WBGT) index. If the WBGT reference values are exceeded or more detailed analysis is required, ISO 7933 provides an analytical method for assessing the environment. If the response of individuals is required, then physiological measurements should be made according to ISO 9886.

The International Standards described in clause 9 will complement the use of standards for assessing hot environments.

4.3 Moderate environments

ISO 7730 allows the calculation of the PMV and PPD and hence the assessment of moderate environments. Average thermal sensation and individual variation in response can be related to thermal comfort and degree of thermal dissatisfaction. Conditions which would produce (average) thermal comfort can also be determined. Individual responses can also be obtained using subjective measurement according to ISO 10551. Where possible, both International Standards should be used in a complementary way to assess moderate environments.

The International Standards described in clause 9 will support and complement the use of standards for assessing moderate environments.

4.4 Cold environments

ISO/TR 11079 (Technical Report) can be used to assess cold environments using $IREQ_{neutral}$, $IREQ_{min}$, WCI and t_{ch}. If IREQ is used to select appropriate clothing for a cold environment, then ISO 9920 can be applied. For the assessment of individuals and specific populations, ISO 9886 will provide guidance on physiological response and ISO 10551 will provide guidance on subjective measurement.

The International Standards described in clause 9 will support and complement the standards for assessing cold environments.

4.5 Contact with solid surfaces

When assessing hot, moderate and cold environments, persons may come into contact with solid surfaces. Future International Standards will be available to assess the thermal sensation and degree of damage which may be caused by contact between bare or covered skin and solid surfaces. For individuals and for non-extreme environments, ISO 10551 will provide guidance for subjective assessment.

Table 1 — Assessment of thermal environments using International Standards

Parameter evaluated	Type of thermal environment		
	Hot	Moderate	Cold
	Means of evaluation		
Comfort and stress	Wet-bulb globe temperature index (WBGT) Required sweat rate (SW_{req})	Predicted mean vote (PMV) and predicted percentage dissatisfied (PPD) indices	Windchill index (WCI) Required clothing insulation (IREQ)
Physiological strain	"Core" and skin temperature, heart rate, mass loss by sweating and respiration		
Psychological strain	Subjective assessment methods		

Table 2 — Ergonomics of the thermal environment — Applicable International Standards

Purpose		Title	Number
General presentation of the set of standards in terms of principles and application		Ergonomics of the thermal environment: principles and application of relevant International Standards	ISO 11399
Standardization of quantities, symbols and units used in the standards		Ergonomics of the thermal environment — Vocabulary	ISO/CD 13731[1)]
Thermal stress evaluation in hot environments	Analytical method	Hot environments — Analytical determination and interpretation of thermal stress using calculation of required sweat rate	ISO 7933
	Diagnostic method	Hot environments — Estimation of the heat stress on working man, based on the WBGT-index (wet bulb globe temperature)	ISO 7243
Comfort evaluation		Moderate thermal environments — Determination of the PMV and PPD indices and specification of the conditions for thermal comfort	ISO 7730
Thermal stress evaluation in cold environments		Evaluation of cold environments — Determination of required clothing insulation (IREQ)	ISO/TR 11079 Technical Report
Data collection standards	Metabolic rate	Ergonomics — Determination of metabolic heat production	ISO 8996
	Requirements for measuring instruments	Thermal environments — Instruments and methods for measuring physical quantities	ISO 7726
	Clothing insulation	Ergonomics of the thermal environment — Estimation of the thermal insulation and evaporative resistance of a clothing ensemble	ISO 9920
Evaluation of thermal strain using physiological measures		Evaluation of thermal strain by physiological measurements	ISO 9886
Subjective assessment of thermal comfort		Assessment of the influence of the thermal environment using subjective judgement scales	ISO 10551
Selection of an appropriate system of medical supervision for different types of thermal exposure		Ergonomics of the thermal environment — Medical supervision of individuals exposed to extreme hot or cold environments	ISO/CD 12894[1)]