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Ergonomics of the thermal environment — Evaluation of the thermal environment in vehicles —

Part 3: Evaluation of thermal comfort using human participants

Ergonomie des ambiances thermiques — Évaluation des ambiances thermiques dans les véhicules —

Partie 3: Évaluation du confort thermique en ayant recours à des participants humains

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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 document 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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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 159, *Ergonomics*, Subcommittee SC 5, *Ergonomics of the physical environment,* in collaboration with the European Committee for Standardization (CEN) Technical Committee CEN/TC 122, *Ergonomics,* in accordance with the Agreement on technical cooperation between ISO and CEN (Vienna Agreement).

This second edition cancels and replaces the first edition (ISO 14505-3:2006), which has been technically revised.

The main changes are as follows:

— revision of references.

A list of all parts in the ISO 14505 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

Direct methods for the assessment of thermal environments (hot, moderate, cold) in vehicles involve measurements of the responses of human participants. There are three types:

— subjective methods;

— objective methods;

— behavioural methods.

Subjective methods quantify the responses of people to an environment using subjective scales. Objective methods are those which quantify the physical, physiological or mental condition of a person by the use of instrumentation or measures of an output such as performance measures. Behavioural methods quantify or represent human behaviour in response to an environment.

Each of these methods has been developed according to basic principles and the most appropriate form of the method and combination of methods used in concert for the assessment of thermal environments in vehicles will depend upon the context and vehicle environment of interest. This document provides both principles and application of methods for the assessment of thermal comfort in vehicle environments using human participants. The most appropriate methods for evaluating thermal comfort in vehicles are subjective. The principles for the construction of subjective assessment scales are given in ISO 10551 and are used in the development of the test method specified in this document. Physiological measurements on human participants are described in ISO 9886 and are beyond the scope of this document.

This document complements standards concerned with the ergonomics of thermal environments and can be used together with thermal indices that are valid for use in vehicle environments.

This document is a basic ergonomics standard which can contribute to the development of standards concerned with specific vehicles and products.

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Ergonomics of the thermal environment — Evaluation of the thermal environment in vehicles —

Part 3:
Evaluation of thermal comfort using human participants

1 Scope

This document specifies and gives guidelines for a standard test method for the assessment, using human participants, of thermal comfort in vehicles. It is not restricted to any particular vehicle but provides the general principles that allow assessment and evaluation. The method can be used to determine a measure of the performance of a vehicle for conditions of interest, in terms of whether it provides thermal comfort to people or not. This can be used in vehicle development and evaluation.

This document is applicable to all types of vehicles, including cars, buses, trucks, off-road vehicles, trains, aircraft, ships, submarines, and to the cabins of cranes and similar spaces. It applies where people are enclosed in a vehicle and when they are exposed to outside conditions. For those exposed to outside conditions, such as riders of bicycles or motorcycles, drivers of open sports cars and operators of fork lift trucks without cabins, vehicle speed and weather conditions can dominate responses. The principles of assessment, however, still apply.

This document applies to both passengers and operators of vehicles where its application does not interfere with the safe operation of the vehicle.

It describes the principles of the assessment and evaluation of thermal comfort, including the use of test methods and trials. It also describes subjective methods that can be used in assessment.

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 12894:2001, *Ergonomics of the thermal environment — Medical supervision of individuals exposed to extreme hot or cold environments*

ISO 13731, *Ergonomics of the thermal environment — Vocabulary and symbols*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 13731 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

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

3.1
HVAC-system
heating, ventilation and air-conditioning system
system providing heating, ventilation and air-conditioning to the vehicle or cabin

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