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## **Ergonomics of the thermal environment — Analytical determination and interpretation of thermal comfort using calculation of the PMV and PPD indices and local thermal comfort criteria**

*Ergonomie des ambiances thermiques — Détermination analytique et interprétation du confort thermique par le calcul des indices PMV et PPD et par des critères de confort thermique local*



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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.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. 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.

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.

ISO 7730 was prepared by Technical Committee ISO/TC 159, *Ergonomics*, Subcommittee SC 5, *Ergonomics of the physical environment*.

This third edition cancels and replaces the second edition (ISO 7730:1994), which has been technically revised. A method for long term evaluation has been added, as well as information on local thermal discomfort, non-steady-state conditions and adaptation, and an annex stating how thermal comfort requirements can be expressed in different categories.

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## Introduction

This International Standard covering the evaluation of moderate thermal environments was developed in parallel with the revised ASHRAE<sup>1)</sup> standard 55 and is one of a series of ISO documents specifying methods for the measurement and evaluation of the moderate and extreme thermal environments to which human beings are exposed (ISO 7243, ISO 7933 and ISO/TR 11079, all three dealing with extreme environmental conditions, are others in the series).

A human being's thermal sensation is mainly related to the thermal balance of his or her body as a whole. This balance is influenced by physical activity and clothing, as well as the environmental parameters: air temperature, mean radiant temperature, air velocity and air humidity. When these factors have been estimated or measured, the thermal sensation for the body as a whole can be predicted by calculating the predicted mean vote (PMV). See Clause 4.

The predicted percentage dissatisfied (PPD) index provides information on thermal discomfort or thermal dissatisfaction by predicting the percentage of people likely to feel too warm or too cool in a given environment. The PPD can be obtained from the PMV. See Clause 5.

Thermal discomfort can also be caused by unwanted local cooling or heating of the body. The most common local discomfort factors are radiant temperature asymmetry (cold or warm surfaces), draught (defined as a local cooling of the body caused by air movement), vertical air temperature difference, and cold or warm floors. Clause 6 specifies how to predict the percentage dissatisfied owing to local discomfort parameters.

Dissatisfaction can be caused by hot or cold discomfort for the body as a whole. Comfort limits can in this case be expressed by the PMV and PPD indices. But thermal dissatisfaction can also be caused by local thermal discomfort parameters. Clause 7 deals with acceptable thermal environments for comfort.

Clauses 6 and 7 are based mainly on steady-state conditions. Means of evaluating non-steady-state conditions such as transients (temperature steps), cycling temperatures or temperature ramps are presented in Clause 8. The thermal environments in buildings or at workplaces will change over time and it might not always be possible to keep conditions within recommended limits. A method for long-term evaluation of thermal comfort is given in Clause 9.

Clause 10 gives recommendations on how to take into account the adaptation of people when evaluating and designing buildings and systems.

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1) American Society of Heating, Refrigerating and Air-conditioning Engineers.