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## Ergonomics — Evaluation of thermal strain by physiological measurements

*Ergonomie — Évaluation de l'astreinte thermique par mesures physiologiques*



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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 9886 was prepared by Technical Committee ISO/TC 159, *Ergonomics*, Subcommittee SC 5, *Ergonomics of the physical environment*.

This second edition cancels and replaces the first edition (ISO 9886:1992), which has been technically revised.

## Introduction

This document is part of a series of standards concerned with the assessment of thermal stress and strain.

This series of International Standards aims in particular at

- a) establishing specifications for the methods of measuring physical parameters characterising thermal environments;
- b) establishing methods for assessing thermal stress in cold, moderate and hot environments.

The analysis methods described by these latter standards allow the prediction of the average physiological response of subjects exposed to a thermal environment. Some of these methods are not applicable under exceptional climatic circumstances, when the characteristics of the exposed subjects differ greatly from the average or when special means of protection are used.

In these cases, or for the sake of research, it may be useful or even necessary to measure directly the physiological strain experienced by the subject.

This International Standard gives a series of specifications concerning the methods of measurement and interpretation of the physiological parameters considered as reflecting the response of the human organism placed in a hot or cold environment.

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# Ergonomics — Evaluation of thermal strain by physiological measurements

## 1 Scope

This International Standard describes methods for measuring and interpreting the following physiological parameters:

- body core temperature;
- skin temperatures;
- heart rate;
- body-mass loss.

The choice of variables to be measured and techniques to be used is at the discretion of those responsible for the health of the employees. These persons will have to take into account not only the nature of the thermal conditions, but also the degree of acceptance of these techniques by the employees concerned.

It should be emphasised that direct measurements on the individual can only be carried out on two conditions.

- a) If the person has been fully informed about the discomfort and the potential risks associated with the measurement technique and gives free consent to such measurements.
- b) If the measurements present no risk for the person, which is unacceptable in view of general or specific codes of ethics.

In order to simplify this choice, Annex A presents a comparison of the different methods concerning their field of application, their technical complexity, the discomfort and the risks that they might involve.

This standard defines the conditions which are to be met in order to ensure the accuracy of the data gathered from the different methods. The measurement methods are described in Annex B. Limit values are proposed in Annex C (informative).

This standard is not concerned with experimental conditions for which investigators may develop alternative methods intended to improve knowledge in this area. It is however recommended, when conducting such studies in the laboratory, to use the methods described below as references, so that results may be compared.

Before using the evaluations methods described in this International Standard, the user is required to follow the ethics and legal rules in force in his country or institution. Accordingly, ethical committees will be consulted and rules concerning free written consent, freedom of participation, confidentiality, etc. will be strictly followed.

## 2 Normative references

The following referenced documents are indispensable for the application 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 7933, *Ergonomics of the thermal environment — Analytical determination and interpretation of heat stress using calculation of the predicted heat strain*