INTERNATIONAL STANDARD

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Building construction — Expression of users' requirements —

Part 1: Thermal requirements

Construction immobilière — Expression des exigences de l'utilisateur — Partie 1: Confort thermique

Reference number
ISO 6242-1:1992(E)

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 6242-1 was prepared by Technical Committee ISO/TC 59, *Building construction*, Sub-Committee SC 3, *Functional/user requirements and performance in building construction*.

ISO 6242 consists of the following parts, under the general title *Building construction — Expression of users' requirements*:

— *Part 1: Thermal requirements*

— *Part 2: Air purity requirements*

— *Part 3: Acoustical requirements*

— *Part 4: Lighting requirements*

Annex A of this part of ISO 6242 is for information only.

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Introduction

This part of ISO 6242 is one of a set dealing with the expression of environmental requirements for buildings, in terms suitable for use in regulations and briefs for building projects. The parameters defined can be used for routine verification of the performance of buildings, either by calculation (for example at the design stage) or measurement (for example of spaces or whole buildings), and are meant to provide readily understood information on users' requirements throughout the building process.

This set of International Standards is not intended to represent the complete state of knowledge about these aspects of environmental science, some of which are the concern of other ISO Technical Committees.

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Building construction — Expression of users' requirements —

Part 1:
Thermal requirements

1 Scope

This part of ISO 6242 defines how the thermal requirements of building users can be identified, expressed and quantified. It describes users' objectives and the parameters used to express them. For each parameter, it specifies units of measurement, preferred increments for values and means of evaluation. It also lists the environmental and human factors affecting the choice of a value (criterion) for each parameter.

It is intended for use

a) in preparing briefs for building projects;

b) in formulating building laws and regulations;

c) in drafting standards and other normative documents; and

d) more generally when specifying the required performance of buildings in terms of users' requirements.

Some of the parameters given in this part of ISO 6242 apply only to certain types of building. Compliance with this part of ISO 6242 does not therefore depend on implementing the whole of its contents in every case.

2 Users' objectives

2.1 Control of the thermal environment within buildings shall fulfil the following objectives:

a) to provide conditions which will prevent occupants suffering from heat stress or cold stress; and

b) to provide a suitable standard of thermal comfort for occupants.

2.2 Criteria meeting these objectives shall reflect the following:

a) activities to be accommodated;

b) clothing;

c) age and health of the occupants;

d) proportion of likely occupants it is intended to satisfy;

e) time during which the requirements must be satisfied (taking account of climatic extremes); and

f) any facility for local control of the thermal environment by the occupants.

The choice of parameters and criteria will differ, depending on the type of climate in which the building is placed.

3 Parameters for expressing users' requirements

Thermal comfort and freedom from thermal stress depend on the following environmental factors:

a) air temperature;

b) radiation gains and losses;

c) air humidity;

d) air velocity;

e) metabolic rate; and

f) clothing.

Requirements can be defined separately for each of these factors, although, because their physiological effects are interdependent, it may be necessary to give several, cross-related requirements for different ranges of bands of values. It is often convenient to integrate several of the factors into a combined index, such as resultant temperature or operative temperature.

In view of the inevitable variation in the thermal environment over space and time, it is vital that statements of users' requirements should not only include limiting values but should also define locations and tolerances for the values: as this kind of information is common to several of the parameters, its expression is given first in 3.1.

3.1 Location, uniformity and tolerance for thermal parameters

For most spaces within buildings, specified temperatures should apply on a plane 1 m above finished floor level. On this plane, under continuous operating conditions, the required values (set separately for winter and summer, where applicable) should be met to within a tolerance of $\pm$ 1,5 °C, excluding the effects of solar radiation through windows or roof-lights. In certain cases, for example auditoria, it may be necessary to define other planes covering all or part of the space.

The maximum temperature gradient in the vertical plane will need to be specified. For most rooms or spaces of normal height (not exceeding 3 m) the temperature should not vary by more than 3 °C.

Where heating is intermittent, or where night setback or other periods of reduced heat input are employed, it may be necessary to specify

a) wider tolerance limits within the first and last hours of use or occupancy;

b) supplementary specified temperatures for periods of zero or reduced heat input.

3.2 Expression of thermal parameters

Details of means of expression, together with associated information, are given in table 1.

4 Factors affecting the choice of criteria

Details of factors likely to affect the choice of criteria for particular applications, together with associated information, are given in table 2.

Table 1 — Parameters

Parameter	Definition	Means of expression: units; preferred increments	Nature of criterion	Means of evaluation
Dry-bulb air temperature (t_a)	The temperature of the air indicated by a thermometer shielded from radiation[1]	Degrees Celsius (°C); whole °C	Maximum and/or minimum	Calculation: in accordance with national standards or codes of practice on thermal design Measurement: using any method of static or dynamic (aspirated) temperature measurement capable of accurately measuring the average dry-bulb temperature of the air in a room, space or zone
Mean radiant temperature ($\bar{t}_r$)	The uniform surface temperature of a radiantly black enclosure in which the occupant would exchange the same amount of radiant energy as in the actual non-uniform space[2]	Degrees Celsius (°C); whole °C	Maximum and/or minimum	Calculation: as the resulting effect of the integral, at a particular point, of incident radiant fluxes to and from all directions, including gains from and losses to windows and roof-lights Measurement: not directly measurable
Air velocity (v_a)	The velocity of the air, when sufficient in volume and duration to affect thermal comfort	Metres per second (m/s)	Maximum and/or minimum	Calculation: in accordance with national standards or codes of practice on thermal design Measurement: using any method capable of accurately measuring air velocity with an averaging time of 1 s to 2 s, and of distinguishing the direction of air movement
Operative temperature (t_o)	The uniform temperature of a radiantly black enclosure in which the occupant would exchange the same amount of heat by radiation plus convection as in the actual non-uniform environment[2]	Degrees Celsius (°C); whole °C	Maximum and/or minimum	Calculation: it is normally sufficient to compute the operative temperature as $t_o = \frac{t_a + \bar{t}_r}{2}$ For higher precision the following expression should be used: $t_o = At_a + (1 - A)\bar{t}_r$ where A depends on air velocity, as follows: v_a | $< 0,2$ | 0,2 to 0,6 | 0,6 to 1 A | 0,5 | 0,6 | 0,7
Wet-bulb air temperature (t_{nw})	The temperature indicated by a sensing element kept wet as a measure of the rate of evaporation	Degrees Celsius (°C); whole °C	Maximum and/or minimum	Calculation: in accordance with national standards or codes of practice on thermal design Measurement: using a wet-bulb thermometer or other instrument giving equivalent measurements

1) From BLIGH J. and JOHNSON K.G. Glossary of terms for thermal physiology. *Journal of Applied Physiology*, *35* (6), December 1973.

2) From ANSI/ASHRAE 55:1981, *Thermal environmental conditions for human occupancy.*

Table 2 — Factors affecting criteria

Factor	Examples of classes/categories	Means of expression	Sources of information
Activities and tasks in relation to the thermal comfort	Reclining Sedentary Standing Light activity Medium activity Heavy activity	Metabolic rate of human body (based on standard data relating to average, healthy adults), expressed either in W/m^2 or met[1] units	ISO 7730:1984, annex B ANSI/ASHRAE 55:1981, table 3 ISO 8996:1990
Clothing	Underwear Tropical wear Summer wear Winter wear	Insulation value of clothing, expressed either in $m^2 \cdot °C/W$ or clo[2]	ISO 7730:1984, annex C ANSI/ASHRAE 55:1981, table
Age and health	Children Healthy adults Disabled adults Medical patients Elderly	Alternative or supplementary values for metabolic rate, related to activities	
Proportion of occupants to be satisfied	80 % 90 % 95 %	Predicted Percentage of Dissatisfied (PPD), expressed in terms of Predicted Mean Vote (PMV)	ISO 7730:1984, clauses 3 and 5
Time during which requirements must be satisfied	90 % 95 % 99 %	Usually governed by the choice of climatic extremes used for the design of heating or air-conditioning systems, which will have a specific chance of being exceeded. Also influenced by factors such as overcapacity of such systems, and the uniformity of their performance in providing thermal comfort in different parts of a building	

1) 1 met = 58 W/m^2

2) 1 clo = 0,16 $m^2 \cdot °C/W$

Annex A
(informative)

Bibliography

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[2] ISO 6241:1984, *Performance standards in building — Principles for their preparation and factors to be considered.*

[3] ISO 7162:1992, *Performance standards in building — Contents and format of standards for evaluation of performance.*

[4] ISO 7164-1:—[1], *Performance standards in building — Part 1: Definitions and means of expression for the performance of a whole building.*

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

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

[7] ISO 7730:1984, *Moderate thermal environments — Determination of the PMV and PPD indices and specification of the conditions for thermal comfort.*

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

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

[10] ANSI/ASHRAE 55:1981, *Thermal environmental conditions for human occupancy.*

1) To be published.