
**Thermal performance of buildings —
Calculation of internal temperatures of
a room in summer without mechanical
cooling — General criteria and validation
procedures**

*Performance thermique des bâtiments — Calcul des températures
intérieures en été d'un local sans dispositif de refroidissement —
Critères généraux et procédures de validation*



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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 13791 was prepared by Technical Committee ISO/TC 163, *Thermal performance and energy use in the built environment*, Subcommittee SC 2, *Calculation methods*.

This second edition cancels and replaces the first edition (ISO 13791:2004), which has been technically revised. The main changes compared to the previous edition are given in the following table:

Clause/subclause	Changes
2	Added ISO 9050, ISO 10292, ISO 15099, ISO 15927-2 and EN 673
3.2	Deleted q_a and v_m and added m_a
4.2.1	Amended Equation (1) Deleted $m_{a,i}$ and added the descriptions of ρ_a and v_{ai}
4.5.6.1	Replaced q_a by m_a
8.3.9.1	Amended the values in Tables 22 and 23
8.3.9.2	Amended the values in Tables 24 and 25
1.2.2	Replaced m by m_a Amended Equation (I.1) and added the descriptions of n and Δp_0 Amended Equation (I.4) and added the description of ΔC_w Amended the unit used in Table I.1
1.2.3	Replaced m , m_w and m_T by m_a , $m_{a,w}$ and $m_{a,T}$, respectively Amended Equations (I.5), (I.6), (I.9), (I.10), (I.11), (I.12), (I.13) and (I.14) Replaced A by A_T in Equation (I.13) Replaced Δc_p by ΔC_w Added the descriptions of Equations (I.8) and (I.10)
1.2.3.3.3	Amended the description 1.2.3.3.3
1.3.2	Replaced Δc_p by ΔC_w Replaced m_w by $m_{a,w}$
1.3.3	Replaced m_T by $m_{a,T}$
Annex J	Amended the values in Tables J.1 and J.2
Annex K	Added as a new annex

Introduction

This International Standard is intended for use by specialists to develop and/or validate methods for the hourly calculation of the internal temperatures of a single room.

Examples of application of such methods include:

- a) assessing the risk of internal overheating;
- b) optimizing aspects of building design (building thermal mass, solar protection, ventilation rate, etc.) to provide thermal comfort conditions;
- c) assessing whether a building requires mechanical cooling.

Criteria for building performance are not included. They can be considered at national level. This International Standard can also be used as a reference to develop more simplified methods for the above and similar applications.

Thermal performance of buildings — Calculation of internal temperatures of a room in summer without mechanical cooling — General criteria and validation procedures

1 Scope

This International Standard specifies the assumptions, boundary conditions, equations and validation tests for a calculation procedure, under transient hourly conditions, of the internal temperatures (air and operative) during warm periods, of a single room without any cooling/heating equipment in operation. No specific numerical techniques are imposed by this International Standard. Validation tests are included in Clause 8. An example of a solution technique is given in Annex A.

This International Standard does not contain sufficient information for defining a procedure able to determine the internal conditions of special zones such as attached sun spaces, atria, indirect passive solar components (trombe walls, solar panels) and zones in which the solar radiation may pass through the room. For such situations different assumptions and more detailed solution models are needed (see Bibliography).

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 6946, *Building components and building elements — Thermal resistance and thermal transmittance — Calculation method*

ISO 7345, *Thermal insulation — Physical quantities and definitions*

ISO 9050, *Glass in building — Determination of light transmittance, solar direct transmittance, total solar energy transmittance, ultraviolet transmittance and related glazing factors*

ISO 9251, *Thermal insulation — Heat transfer conditions and properties of materials — Vocabulary*

ISO 9288, *Thermal insulation — Heat transfer by radiation — Physical quantities and definitions*

ISO 9346, *Hygrothermal performance of buildings and building materials — Physical quantities for mass transfer — Vocabulary*

ISO 10077-1, *Thermal performance of windows, doors and shutters — Calculation of thermal transmittance — Part 1: General*

ISO 10077-2, *Thermal performance of windows, doors and shutters — Calculation of thermal transmittance — Part 2: Numerical method for frames*

ISO 10292, *Glass in building — Calculation of steady-state U values (thermal transmittance) of multiple glazing*

ISO 13370, *Thermal performance of buildings — Heat transfer via the ground — Calculation methods*

ISO 15099, *Thermal performance of windows, doors and shading devices — Detailed calculations*

ISO 15927-2, *Hygrothermal performance of buildings — Calculation and presentation of climatic data — Part 2: Hourly data for design cooling load*

EN 410, *Glass in building — Determination of luminous and solar characteristics of glazing*

EN 673, *Glass in building — Determination of thermal transmittance (U value) — Calculation method*

3 Terms, definitions, symbols and units

3.1 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 7345, ISO 9251, ISO 9288, ISO 9346 and the following apply.

3.1.1

internal environment

closed space delimited from the external environment or adjacent spaces by the building fabric

3.1.2

room element

wall, roof, ceiling, floor, door or window that separates the internal environment from the external environment or an adjacent space

3.1.3

room air

air of the internal environment

3.1.4

internal air temperature

temperature of the room air

3.1.5

internal surface temperature

temperature of the internal surface of a building element

3.1.6

mean radiant temperature

uniform surface temperature of an enclosure in which an occupant would exchange the same amount of radiant heat as in the actual non-uniform enclosure

3.1.7

operative temperature

uniform temperature of an enclosure in which an occupant would exchange the same amount of heat by radiation plus convection as in the actual non-uniform environment