SLOVENSKI STANDARD
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Veličine in enote - 5. del: Termodinamika (ISO/DIS 80000-5:2016)

Quantities and units - Part 5: Thermodynamics (ISO/DIS 80000-5:2016)

Größen und Einheiten - Teil 5: Thermodynamik (ISO/DIS 80000-5:2016)

Grandeurs et unités - Partie 5: Thermodynamique (ISO/DIS 80000-5:2016)

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ICS:

01.060	Veličine in enote	Quantities and units
17.200.01	Termodinamika na splošno	Thermodynamics in general

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Quantities and units —

Part 5:
Thermodynamics

Grandeurs et unités —

Partie 5: Thermodynamique

ICS: 01.060

ISO/CEN PARALLEL PROCESSING

This draft has been developed within the International Organization for Standardization (ISO), and processed under the **ISO lead** mode of collaboration as defined in the Vienna Agreement.

This draft is hereby submitted to the ISO member bodies and to the CEN member bodies for a parallel five month enquiry.

Should this draft be accepted, a final draft, established on the basis of comments received, will be submitted to a parallel two-month approval vote in ISO and formal vote in CEN.

To expedite distribution, this document is circulated as received from the committee secretariat. ISO Central Secretariat work of editing and text composition will be undertaken at publication stage.

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ISO copyright office
Ch. de Blandonnet 8 • CP 401
CH-1214 Vernier, Geneva, Switzerland
Tel. +41 22 749 01 11
Fax +41 22 749 09 47
copyright@iso.org
www.iso.org

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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 80000-5 was prepared by Technical Committee ISO/TC 12, *Quantities and units*.

This second edition cancels and replaces the first edition of ISO 80000-5:2007. The major technical changes from the previous standard are the following:

— the tables of quantities and units are arranged so that the quantities and the corresponding units are presented on the same pages;

— the *normative references* have been changed;

ISO 80000 consists of the following parts, under the general title *Quantities and units*:

— *Part 1: General*

— *Part 2: Mathematics*

— *Part 3: Space and time*

— *Part 4: Mechanics*

— *Part 5: Thermodynamics*

— *Part 7: Light and Radiation*

— *Part 8: Acoustics*

— *Part 9: Physical chemistry and molecular physics*

— *Part 10: Atomic and nuclear physics*

— *Part 11: Characteristic numbers*

— *Part 12: Condensed matter physics*

IEC 80000 consists of the following parts (in collaboration with IEC/TC 25), under the general title *Quantities and units*:

— *Part 6: Electromagnetism*

— *Part 13: Information science and technology*

— *Part 14: Telebiometrics related to human physiology*

Quantities and units — Part 5: Thermodynamics

1 Scope

ISO 80000-5 gives names, symbols and definitions for quantities and units of thermodynamics. Where appropriate, conversion factors are also given.

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 80000-1:2006, *Quantities and units — Part 1: General*

ISO 80000-3:2006, *Quantities and units — Part 3: Space and time*

ISO 80000-4:2006, *Quantities and units — Part 4: Mechanics*

ISO 80000-9:2006, *Quantities and units — Part 9: Physical chemistry and molecular physics*

3 Quantities, units and definitions

Item No.	Quantity			Unit	Remarks
	Name	Symbol	Definition	Symbol	
5-1	thermodynamic temperature	T, Θ	thermodynamic temperature is the quantity that is measured with a primary thermometer, examples of which are gas thermometers of different kinds, noise thermometers, or radiation thermometers	K	Differences of thermodynamic temperatures or changes may be expressed either in kelvin, symbol K, or in degrees Celsius, symbol ℃ (item 5-2). **The International Temperature Scale of 1990** For the purpose of practical measurements, the International Temperature Scale of 1990, ITS-90, was adopted by CIPM in 1989, which is a close approximation to the thermodynamic temperature scale. The quantities defined by this scale are denoted T_{90} and t_{90}, respectively (replacing T_{68} and t_{68} defined by the International Practical Temperature Scale of 1968, IPTS-68), where $\frac{t_{90}}{1\ ℃} = \frac{T_{90}}{1\ \mathrm{K}} - 273{,}15$ The units of T_{90} and t_{90} are the kelvin, symbol K, and the degree Celsius, symbol ℃ (item 5-2), respectively. For further information, see [1], [2]. For ready conversion between temperatures reported on the International Temperature Scale and thermodynamic temperatures the systematic deviations can be found in [3].

Item No.	Quantity			Unit	Remarks
	Name	Symbol	Definition	Symbol	
5-2	Celsius temperature	t, ϑ	temperature difference from the thermodynamic temperature of the ice point is called the Celsius temperature t, which is defined by the quantity equation: $t = T - T_0$ where T is thermodynamic temperature (item 5-1) and $T_0 := 273{,}15\ \mathrm{K}$.	℃	The unit degree Celsius is a special name for the kelvin for use in stating values of Celsius temperature. The unit degree Celsius is by definition equal in magnitude to the Kelvin. A difference or interval of temperature may be expressed in kelvin or in degrees Celsius. The thermodynamic temperature T_0 is 0,01 K below the thermodynamic temperature of the triple point of water. The symbol ℃ for the degree Celsius shall be preceded by a space (see ISO 80000-1:2006). Prefixes are not allowed in combination with the unit °C.
5-3.1	linear expansion coefficient	α_l	relative expansion divided by the change in temperature: $\alpha_l = \frac{1}{l}\frac{\mathrm{d}l}{\mathrm{d}T}$ where l is length (ISO 80000-3:2006, item 3-1.1) and T is thermodynamic temperature (item 5-1)	K^{-1}	
5-3.2	cubic expansion coefficient	α_V, α, γ	$\alpha_V = \frac{1}{V}\frac{\mathrm{d}V}{\mathrm{d}T}$ where V is volume (ISO 80000-3:2006, item 3-4) and T is thermodynamic temperature (item 5-1)		Also called volumetric expansion coefficient
5-3.3	relative pressure coefficient	α_p	$\alpha_p = \frac{1}{p}\left(\frac{\partial p}{\partial T}\right)_V$		The subscripts in the symbols for items 5-3.3 to 5-5.2 may be omitted when there is no risk of

Item No.	Quantity			Unit	Remarks
	Name	Symbol	Definition	Symbol	
			where p is pressure (ISO 80000-4:2006, item 4-15.1), T is thermodynamic temperature (item 5-1), and V is volume (ISO 80000-3:2006, item 3-4)		confusion.
5-4	pressure coefficient	β	change in pressure divided by the change in temperature: $\beta = \left(\frac{\partial p}{\partial T}\right)_V$ where p is pressure (ISO 80000-4:2006, item 4-15.1), T is thermodynamic temperature (item 5-1), and V is volume (ISO 80000-3:2006, item 3-4)	$\mathrm{Pa/K}$ $\mathrm{m^{-1}\ kg\ s^{-2}\ K^{-1}}$	For the unit Pa (pascal), see ISO 80000-4:2006, item 4-15.a.
5-5.1	isothermal compressibility	$\varkappa_T$	relative volume change as a response to a pressure change: $\varkappa_T = -\frac{1}{V}\left(\frac{\partial V}{\partial p}\right)_T$ where V is volume (ISO 80000-3:2006, item 3-4), p is pressure (ISO 80000-4:2006, item 4-15.1), T is thermodynamic temperature (item 5-1).	$\mathrm{Pa^{-1}}$ $\mathrm{m\ kg^{-1}\ s^2}$	
5-5.2	isentropic compressibility	$\varkappa_S$	$\varkappa_S = -\frac{1}{V}\left(\frac{\partial V}{\partial p}\right)_S$ where V is volume (ISO 80000-3:2006, item 3-4), p is pressure (ISO 80000-4:2006, item 3-1.1), S is entropy (item 5-18).		

Item No.	Quantity			Unit	Remarks
	Name	Symbol	Definition	Symbol	
5-6.1	heat, amount of heat	Q	difference between the increase in the internal energy (item 5-20.2) of a physical system and the work done on the system (ISO 80000-4:2006, item 4-27.5), provided that the amounts of substances within the system are not changed	J $\mathrm{m^2\ kg\ s^{-2}}$	The heat transferred in an isothermal phase transformation should be expressed as the change in the appropriate thermodynamic functions, e. g. $T \times \Delta S$, where T is thermodynamic temperature (item 5-1) and S is entropy (item 5-18), or ΔH, where H is enthalpy (item 5-20.3). NOTE A supply of heat may correspond to an increase in thermodynamic temperature or to other effects, such as phase change or chemical processes see item 5-6.2. For the unit joule, see ISO 80000-4:2006, item 4-27.a.
5-6.2	latent heat	Q	energy released or absorbed by a thermodynamic system during a constant-temperature process	J $\mathrm{m^2\ kg\ s^{-2}}$	See NOTE in item 5-6.1. Examples of latent heat are latent heat of fusion (melting) and latent heat of vaporization (boiling)
5-7	heat flow rate	$\dot{Q}$	rate at which heat (item 5-6.1) crosses a given surface	W $\mathrm{J\ s^{-1}}$ $\mathrm{m^2\ kg\ s^{-3}}$	
5-8	areic heat flow rate, density of heat flow rate	q, φ	heat flow rate divided by area: $q = \frac{\dot{Q}}{A}$ where $\dot{Q}$ is heat flow rate (item 5-7) and A is area (ISO 80000-3:2006, item 3-3) of a given surface	$\mathrm{W/m^2}$ $\mathrm{kg\ s^{-3}}$	