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Masonry and masonry products - Methods for determining thermal properties

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Standard on jõustunud sellekohase teate avaldamisega EVS Teatajas	This standard has been endorsed with a notification published in the official bulletin of the Estonian Centre for Standardisation.
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Maçonnerie et éléments de maçonnerie - Méthodes pour la détermination des propriétés thermiques

Mauerwerk und Mauerwerksprodukte - Verfahren zur Bestimmung von wärmeschutztechnischen Eigenschaften

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European foreword

This document (EN 1745:2020) has been prepared by Technical Committee CEN/TC 125 “Masonry”, the secretariat of which is held by BSI.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by January 2021, and conflicting national standards shall be withdrawn at the latest by January 2021.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN shall not be held responsible for identifying any or all such patent rights.

This document supersedes EN 1745:2012.

The following is a list of significant technical changes since the last edition EN 1745:2012:

— replacement of Figure 1 by Tables 1 a and 1 b;

— editorial improvement;

— changes in the definitions 3.1.5 and 3.1.10;

— correction of term in Annex A;

— amendment heading of column in Annex A;

— addition of Annex G.

According to the CEN-CENELEC Internal Regulations, the national standards organisations of the following countries are bound to implement this European Standard: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Republic of North Macedonia, Romania, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

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Introduction

This document provides methods for the determination of dry and design thermal conductivity and thermal resistance values of masonry products and masonry.

The following types of masonry unit are covered by this document:

— solid masonry units;

— masonry units with formed voids;

— composite masonry units.

Methods are described for the determination of the dry thermal conductivity of solid masonry units ($\lambda_{10,dry,unit}$) and of mortar ($\lambda_{10,dry,mor}$) and for the determination of equivalent dry thermal conductivity of masonry units with formed voids and composite masonry units ($\lambda_{10,dry,unit}$). Procedures are also described for the determination of the design thermal values of masonry units and masonry. The different methods are illustrated in Table 1.

The value in dry state is a characteristic of a masonry material, masonry unit or of masonry.

The determination of thermal values can be based on tabulated data, measurements, calculations or a combination of these.

Design thermal values may be determined according to procedures given in this European standard according to the intended application, environmental and climatic conditions, bearing in mind the purpose of this determination, such as:

— energy consumption;

— design of heating and cooling equipment;

— surface temperature determination;

— compliance with national building regulations;

— consideration of non-steady-state thermal conditions in buildings.

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Table 1 a — Determination of thermal properties of masonry units and masonry

Overview of methods to determine $\lambda_{10,dry,unit}$			
Method (Clause)	**Masonry units**	**Determination of $\lambda_{10,dry,unit}$** [a] [b]	**Required parameters**
S1 (4.2.1)	solid	using tabulated value from Annex A for the $\lambda_{10,dry,mat}$ / net dry density relationship	Net dry density of unit/material [a]
S2 (4.2.2)	solid	based on determination of dry thermal conductivity by measurement and of the masonry unit material / dry density curve	Net dry density and thermal conductivity of unit/material [a]
S3 (4.2.3)	solid	based on determination of the thermal transmittance (U_{mas}) of masonry, then adjusting for the influence of the mortar	Net dry density and percentage area of units; thermal conductivity and percentage area of mortar
P1 (5.3.1.3)	with formed voids	based on determination of dry thermal conductivity of the masonry unit material, then using Annex B	Net dry density and thermal conductivity of unit/material and configuration of the units
P2 (5.3.1.4)	with formed voids	using tabulated values from Annex A, then using Annex B	Net dry density of unit/material and configuration of the units
P3 (5.3.2.2)	with formed voids and composite	by calculation according to 5.2, using dry thermal conductivity by measurement of the masonry unit material and any infill	Net dry density and thermal conductivity of unit/infill material and configuration of the units
P4 (5.3.2.3)	with formed voids and composite	by calculation according to 5.2 using tabulated thermal conductivity of the masonry unit material from Annex A and thermal conductivity of any infill material	Net dry density and thermal conductivity of unit/infill material and configuration of the units
P5 (5.3.3)	with formed voids and composite	based on determination of the thermal transmittance (U_{mas}) of masonry, then adjusting for the influence of the mortar	Gross dry density and percentage area of units, thermal conductivity and percentage area of mortar

[a] Methods S1 and S2 are also applicable for the determination of $\lambda_{10,dry,mor}$.

[b] If necessary, moisture correction according to Clause 6.

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Table 1 b — Determination of thermal properties of masonry units and masonry

Overview of methods to determine $\lambda_{design,unit}$ [a] and $\lambda_{design,mas}$ [b]			
λ_{design} [a] [b] (Clause)	**Masonry units**	**Determination of $\lambda_{design,unit}$ [a] / $\lambda_{design,mas}$ [b]**	**Required parameters**
$\lambda_{design,unit}$ (6)	solid, with formed voids and composite	by applying moisture correction according to Clause 6 upon $\lambda_{10,dry,unit}$	Thermal conductivity in dry state and moisture conversion factor of unit
$\lambda_{design,mas}$ (7.2.1)	solid, with formed voids and composite	by using a simplified calculation based on $\lambda_{design,unit}$ and $\lambda_{design,mor}$	Design thermal conductivity of unit and mortar and percentage area of mortar joints
$\lambda_{design,mas}$ (7.2.2)	solid, with formed voids and composite	by numerical calculation based on $\lambda_{design,mat}$	Design thermal conductivity of materials and configuration
$\lambda_{design,mas}$ (7.3)	with formed voids	using of Annex B and application of the correction according to 6.3	Net dry density and thermal conductivity of unit/material and respective moisture conversion factors
S4/P6 $\lambda_{design,mas}$ (7.4)	solid, with formed voids and composite	by applying moisture correction according to Clause 6 onto the thermal transmittance (U_{mas}) of masonry	Thermal transmission of masonry and moisture conversion factor

[a] Or alternatively the design thermal resistance of the unit $R_{design,unit}$.

[b] Or alternatively the design thermal resistance of the masonry $R_{design,mas}$.

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1 Scope

This document specifies methods for the determination of thermal properties of masonry and masonry products.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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.

EN 772-3, *Methods of test for masonry units — Part 3: Determination of net volume and percentage of voids of clay masonry units by hydrostatic weighing*

EN 772-4, *Methods of test for masonry units — Part 4: Determination of real and bulk density and of total and open porosity for natural stone masonry units*

EN 772-13, *Methods of test for masonry units — Part 13: Determination of net and gross dry density of masonry units (except for natural stone)*

EN 772-16, *Methods of test for masonry units — Part 16: Determination of dimensions*

EN 1015-10, *Methods of test for mortar for masonry — Part 10: Determination of dry bulk density of hardened mortar*

EN 1934, *Thermal performance of buildings — Determination of thermal resistance by hot box method using heat flow meter — Masonry*

EN 1936, *Natural stone test methods — Determination of real density and apparent density, and of total and open porosity*

EN 12664, *Thermal performances of building materials and products — Determination of thermal resistance by means of guarded hot plate and heat flow meter methods — Dry and moist products of medium and low thermal resistance*

EN 12667, *Thermal performance of building materials and products- Determination of thermal resistance by means of guarded hot plate and heat flow meter methods – Products of high and medium thermal resistance*

EN ISO 6946, *Building components and building elements — Thermal resistance and thermal transmittance — Calculation methods (ISO 6946)*

EN ISO 7345, *Thermal performance of buildings and building components — Physical quantities and definitions (ISO 7345)*

EN ISO 10211, *Thermal bridges in building construction — Heat flows and surface temperatures — Detailed calculations (ISO 10211)*

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EN ISO 10456:2007,[1] *Building materials and products — Hygrothermal properties — Tabulated design values and procedures for determining declared and design thermal values (ISO 10456:2007)*

3 Terms, definitions and symbols

For the purposes of this document, the following terms, definitions and symbols and those given in EN ISO 7345 apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— IEC Electropedia: available at http://www.electropedia.org/

— ISO Online browsing platform: available at http://www.iso.org/obp

3.1 Terms and definitions

3.1.1
masonry
assemblage of masonry units laid in a specified pattern and joined together with masonry mortar

3.1.2
masonry product
masonry units, masonry mortars, rendering and plastering mortars

3.1.3
solid masonry unit
masonry unit containing no perforations except external indentations such as grip holes, grooves, etc.

3.1.4
masonry unit with formed voids
masonry unit with a system of intentionally formed voids

3.1.5
composite masonry unit
masonry unit incorporating additional material

3.1.6
thermal value
common term for either the thermal conductivity (W/(m K)) or the thermal resistance ($m^2 \cdot K/W$)

3.1.7
dry state
state after drying under conditions stated in the relevant standards

3.1.8
thermal value in dry state
value of a thermal property of a building material or product in a dry state determined according to this European Standard as a basis for the calculation of design thermal values

Note 1 to entry: The dry thermal value can be expressed as thermal conductivity or thermal resistance.

[1] As impacted by EN ISO 10456:2007/AC:2009.

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