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Thermal insulating products for building equipment and industrial installations — Determination of the coefficient of thermal expansion

Produits isolants thermiques pour l'équipement du bâtiment et les installations industrielles — Détermination du coefficient de dilatation thermique

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Foreword

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The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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This document was prepared by Technical Committee ISO/TC 163, *Thermal performance and energy use in the built environment*, Subcommittee SC 1, *Test and measurement methods*, in collaboration with the European Committee for Standardization (CEN) Technical Committee CEN/TC 88, *Thermal insulating materials and products*, in accordance with the Agreement on technical cooperation between ISO and CEN (Vienna Agreement).

This second edition cancels and replaces the first edition (ISO 18099:2013), which has been technically revised.

The main changes are as follows:

— EN 13471:2001 and ISO 18099:2013 have been merged into one document;

— Clause 2, Normative references, has been added and the numbering of the following clauses has been changed accordingly;

— editorial revisions.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

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Thermal insulating products for building equipment and industrial installations — Determination of the coefficient of thermal expansion

1 Scope

This document specifies the equipment and procedures for determining the coefficient of linear thermal expansion. It is applicable to thermal insulating products within the temperature range –196 °C to 850 °C, subject to the possible temperature limitation of the test specimens. It is not applicable to products which experience dimensional changes during the test due to the loss of hydration water or which undergo other phase changes.

2 Normative references

There are no normative references in this document.

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

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

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

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

3.1
linear thermal expansion
reversible changes in the length of a product resulting from a change in temperature

3.2
mean coefficient of linear thermal expansion, α_m, between different temperatures
reversible change in length divided by the length at the reference temperature and the temperature difference between the test temperatures

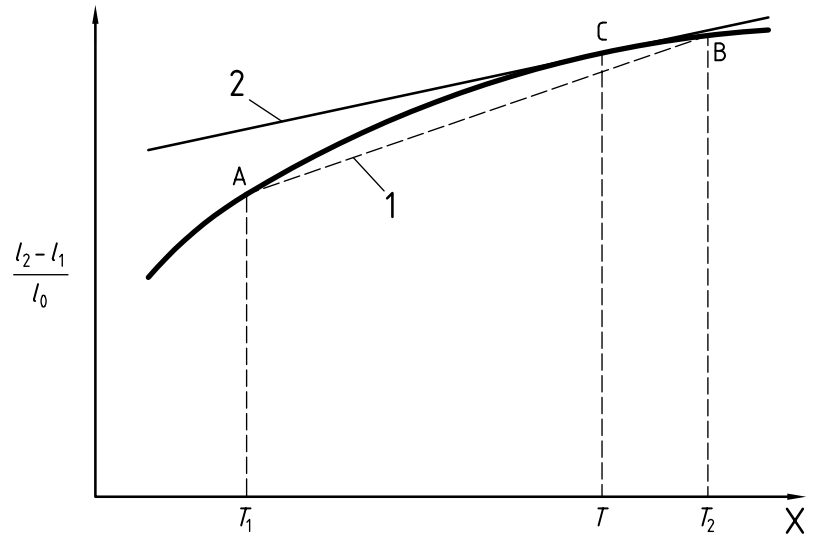
Note 1 to entry: See Figure 1.

3.3
coefficient of thermal expansion, α_t, at the temperature T
limit value of α_m as the higher temperature approaches the lower temperature

Note 1 to entry: See Figure 1.

Note 2 to entry: The definition of α_m and α_t assumes that the function giving the length variation in relation to the temperature variation is continuous. This excludes the use of the mean coefficient of linear thermal expansion, α_m, when the test specimen experiences physical change due to change of phase, e.g. recrystallisation or loss of water of hydration. The curve giving the length variation as a function of the temperature variation can be reported, but the mean coefficient of thermal expansion should not be calculated for parts of the curve, which are not continuous.

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Key

X temperature

1 mean coefficient of thermal expansion between T_1 and T_2 (illustrated by the gradient of the dotted line between the points A and B)

2 coefficient of thermal expansion at T (illustrated by the gradient of the tangent at point C)

Figure 1 — Relative length variation as a function of temperature

4 Principle

The changes in a product's linear dimensions, as its temperature is changed, are measured and characterised. It shall be done in a continuous way when the full curve over a temperature range is needed or only at two specified temperatures if only a mean coefficient of linear thermal expansion between these temperatures is needed.

5 Apparatus

5.1 Dilatometer, with appropriate dimensions and suitable for the temperature range (see Figure 2).

NOTE The usual dilatometers are of the tube or rod type, fabricated of high-purity vitreous silica. Modern dilatometers incorporate the essential features described below.

5.2 Micrometer calliper, a calliper with micrometer indication permitting direct reading of the test specimen lengths at different temperatures. The accuracy of these measurements shall be such that consecutive measurements at the same temperature are determined to $2 \times 10^{-4} \times l_0$ for the length and to $2 \times 10^{-5} \times l_0$ for the length variations.

5.3 Electrical furnace, for high temperatures, an electrical furnace, capable of maintaining the mean temperature of the test specimen to within ±2 K of the desired test temperature and the maximum and minimum temperature of the test specimen to within ±2 K.

The electrical furnace shall be capable of limiting the rate of temperature change to 1 °C/min during the change from one test temperature to another.

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