SLOVENSKI STANDARD
SIST EN 17888-1:2024

01-julij-2024

Toplotne značilnosti stavb - Preskušanje gradbenih preskusnih struktur na mestu vgradnje - 1. del: Zbiranje podatkov za preskus skupnih toplotnih izgub

Thermal performance of buildings - In situ testing of building test structures - Part 1: Data collection for aggregate heat loss test

Wärmetechnisches Verhalten von Gebäuden - In-situ-Messung von Gebäudeteststrukturen - Teil 1: Datenerfassung für den Gesamtwärmeverlusttest

Performance thermique des bâtiments - Mesurage in-situ de bâtiment d'essai - Partie 1 : Collecte des données pour le test de perte de chaleur globale

Ta slovenski standard je istoveten z: **EN 17888-1:2024**

ICS:

91.120.10	Toplotna izolacija stavb	Thermal insulation of buildings

SIST EN 17888-1:2024 **en,fr,de**

EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN 17888-1

May 2024

ICS 91.120.10

English Version

Thermal performance of buildings - In situ testing of building test structures - Part 1: Data collection for aggregate heat loss test

Performance thermique des bâtiments - Essais in situ des structures de bâtiments d'essai - Partie 1 : Collecte de données pour l'essai de déperdition thermique globale

Wärmetechnisches Verhalten von Gebäuden - In-situ-Messung an Bauwerksprüfkörpern - Teil 1: Datenerfassung für die Prüfung des Gesamtwärmeverlustes

This European Standard was approved by CEN on 27 February 2024.

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EUROPÄISCHES KOMITEE FÜR NORMUNG

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European foreword

This document (EN 17888-1:2024) has been prepared by Technical Committee CEN/TC 89 “Thermal performance of buildings and building components”, the secretariat of which is held by SIS.

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of an identical text or by endorsement, at the latest by November 2024, and conflicting national standards shall be withdrawn at the latest by November 2024.

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Introduction

The world's energy resources are being consumed at a significant rate that will result in the depletion of non-renewable resources. It is imperative that energy be conserved. The building sector, through its use of energy, can represent up to 40 % of the total energy consumed (in mild climates, where heating and cooling correspond to the major energy demand in buildings). Conservation of energy in buildings can result in a slowing down of non-renewable resource usage and consequently of the build-up of greenhouse gases.

A critical contribution to the conservation of energy in buildings is made by minimizing the heat loss from a building. This is achieved by creating building envelopes that are both airtight and highly insulated. Standardized test methods exist for establishing the *in situ* air permeability or air leakage rate of a building, EN ISO 12569 and EN ISO 9972. This document provides a method for measuring the total *in situ* heat loss from a building test structure. The total heat loss is a combination of the heat lost through air infiltration and envelope heat transfer, and since the air infiltration rate can be measured and the heat loss associated with this approximated, the value for envelope heat transfer can be estimated, together with their combined uncertainty.

In the design process for new buildings, and increasingly for refurbishment, an energy consumption calculation is carried out; normally this uses a calculated value for total heat loss based upon assumptions regarding air infiltration rates and calculated U-values for the plane building elements and openings, and Ψ values for thermal bridges at the junctions between the plane elements (e.g. openings, intermediate floors). The assumptions on air infiltration can be confirmed by testing to standardized methodologies and the design calculation is often adjusted post-testing to include the actual measured air permeability or air leakage rate of the building that is achieved once construction is complete. This document provides a test methodology that will allow the actual *in situ* building test structure aggregate heat loss to be quantified.

This building aggregate heat loss test methodology can be used for the general confirmation of energy performance, as might be required by the building certifier or consumer. It can also enable a comparison to be made between the measured *in situ* values and the calculated values that are currently used.

Without a building aggregate heat loss test methodology, there is currently no way to check and confirm actual energy performance *in situ.* Consequently, this could lead to the adoption of practices in both design and workmanship that could make the calculated values invalid or inappropriate. In addition, wider scale assumptions regarding the potential reductions in energy consumption that could be achieved through the provision of new and refurbished energy efficient buildings, would be made on the basis of calculated whole building performance, without validation by confirmation of actual aggregate *in situ* performance.

This document provides an *in situ* test methodology for measuring the aggregate heat transfer coefficient (H_{agg}) from a building test structure composed of opaque elements. It will allow for the comparison of calculated and measured thermal performance of the building test structure. Part 1 details the test procedure and data collection while Part 2 details steady-state data analysis.

This test method is comparable to FprEN 17887-1:2023 which deals with completed buildings, with the difference being that this method is applicable to simpler building structures especially built for the purpose of the test. This offers a more robust control of each step of testing, including workmanship and product installation for the fabric and the envelope, as well as including measurement equipment, apparatus, sensors and monitoring. External climate conditions occurring during the period of test remain free.

1 Scope

This document specifies a test method for the *in situ* testing of the thermal performance of building structures especially built for the purpose of the test.

This document also specifies the apparatus to be used and the measurement procedures to collect the data and the reporting format for the apparatus including the building test structure and the test conditions.

NOTE The analysis of the data and the reporting format for the analysis are referred to in FprEN 17888-2.

This document is not applicable to:

— existing buildings;

— building structures allowing direct solar gains through glazing surfaces;

— the determination of the thermal performance of a specific building product, material, component or element.

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

EN IEC 62053-21, *Electricity metering equipment — Particular requirements — Part 21: static meters for AC active energy (classes 0,5, 1 and 2) (IEC 62053-21)*

EN 13187, *Thermal performance of buildings — Qualitative detection of thermal irregularities in building envelopes — Infrared method (ISO 6781 modified)*

EN ISO 7726, *Ergonomics of the thermal environment — Instruments for measuring physical quantities (ISO 7726)*

EN ISO 9229, *Thermal insulation — Vocabulary (ISO 9229)*

EN ISO 9972, *Thermal performance of buildings — Determination of air permeability of buildings — Fan pressurization method (ISO 9972)*

EN ISO 12569, *Thermal performance of buildings and materials — Determination of specific airflow rate in buildings — Tracer gas dilution method (ISO 12569)*

EN ISO 13789:2017, *Thermal performance of buildings — Transmission and ventilation heat transfer coefficients — Calculation method (ISO 13789:2017)*

EN ISO 15927-1:2003, *Hygrothermal performance of buildings — Calculation and presentation of climatic data — Part 1: Monthly and annual means of single meteorological elements (ISO 15927-1: 2003)*

EN ISO 52016-1:2017, *Energy performance of buildings — Energy needs for heating and cooling, internal temperatures and sensible and latent heat loads — Part 1: Calculation procedures (ISO 52016-1)*

ISO 9060, *Solar energy — Specification and classification of instruments for measuring hemispherical solar and direct solar radiation*

ISO 9869-1:2014, *Thermal insulation — Building elements — In situ measurement of thermal resistance and thermal transmittance — Part 1: Heat flow meter method*

3 Terms, definitions, symbols and units

For the purposes of this document, the terms and definitions given in EN ISO 7345, EN ISO 9229 and the following apply.

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

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

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

3.1 Terms and definitions

3.1.1
aggregate heat loss
total rate of heat loss attributable to an entire building fabric obtained by measurement of the aggregate heat loss rates from plane elements, thermal bridges and air infiltration

3.1.2
aggregate heat loss test
metric of a building's thermal performance capable of measuring the heat loss attributable to a building fabric according to this test standard

3.1.3
aggregate heat transfer coefficient
sum of the transmission and infiltration component of the ventilation heat transfer coefficient based upon measurement according to this test standard

3.1.4
air leakage rate
air flow rate across the building envelope

Note 1 to entry: This movement includes flow through joints, cracks and porous surfaces, or a combination thereof, inducted naturally or by air-moving equipment used in this International standard

[SOURCE: EN ISO 9972:2015, 3.1.1]

3.1.5
air permeability
air leakage rate per the envelope area across the building envelope

[SOURCE: EN ISO 9972:2015, 3.1.4]

3.1.6
building energy need for heating
heat to be delivered to the test zone by heating system to maintain the set point temperature during a given period of time

3.1.7
building structure
organized combination of connected building elements designed to provide some measure of rigidity, or a construction works having such arrangement

3.1.8
building test structure
building structure especially designed for testing thermal performance including any guarded spaces, comprising walls, floor and roof, representative of a simplified building, inclusive of the specific building products, elements or thermal insulation system to be tested

3.1.9
external (internal) air temperature
temperature of the external (internal) air measured by external (internal) air temperature sensor

3.1.10
guarded zones
non-tested zones separated to the test zone by a thermal guard aiming to minimize the heat loss so that the separation wall can be supposed adiabatic

3.1.11
heat transfer coefficient
heat flow rate divided by temperature difference between two environments

Note 1 to entry: Specifically used for heat transfer coefficient by transmission or ventilation.

[SOURCE: EN ISO 13789:2017, 3.5]

3.1.12
infiltration air
uncontrolled passage of air into a space through leakage paths in the building envelope

3.1.13
***in situ* testing**
testing in real building or in realistic full-scale representation built specifically for testing, which is exposed to a realistic internal environment and the natural external environment in a manner that is representative of its normal end-use application

3.1.14
internal set-point temperature
internal building structure air temperature required to achieve the minimum temperature difference (ΔT) for the duration of the test

3.1.15
quasi steady-state
state under which the internal conditions within the test building are maintained constant, while the external conditions are allowed to vary

Note to entry: In such a state, transient stages within the test building are minimised

3.1.16
solar heat gain
heat provided by solar radiation entering, directly or indirectly (after absorption in building elements), into the building through windows, opaque walls and roofs, or passive solar devices such as sunspaces, transparent insulation and solar walls

Note 1 to entry: Active solar devices such as solar collectors are considered part of the technical building system.

[SOURCE: ISO 52000-1:2017, 3.6.10]

3.1.17
temperature difference
difference between the internal temperature and external air temperature

3.1.18
test zone
part of building test structure where the test is being performed

3.1.19
thermal envelope
elements of a building that enclose conditioned spaces through which thermal energy is transferred to or from the external environment or to or from unconditioned spaces

3.1.20
thermal insulation system
combination of a thermal insulation product(s) and associated component(s), such as breather membrane and/or vapour control layer, including air spaces when contributing to the global thermal performance of the system

3.1.21
transmission heat transfer coefficient
heat flow rate due to thermal transmission through the fabric of a building, divided by the difference between the environment temperatures on either side of the construction

Note 1 to entry: By convention, if the heat is transferred between a conditioned space and the external environment, the sign is positive if the heat flow is from the space to outside (heat loss).

[SOURCE: EN ISO 13789:2017, 3.6]

3.1.22
ventilation heat transfer coefficient
heat flow rate due to air entering a conditioned space by infiltration or ventilation, divided by the temperature difference between the internal air and the supply air temperature

Note 1 to entry: The supply temperature for infiltration is equal to the external temperature.

Note 2 to entry: In this analysis, the ventilation component of the ventilation heat transfer coefficient is typically omitted and only the infiltration component is included in the heat transfer coefficient, as intended ventilation routes are sealed during the test.

[SOURCE: EN ISO 13789:2017, 3.7, modified – Note 2 to entry has benn added]