

**Conservation of cultural property - Indoor climate - Part
1: Guidelines for heating churches, chapels and other
places of worship**

EESTI STANDARDI EESSÕNA

NATIONAL FOREWORD

See Eesti standard EVS-EN 15759-1:2011 sisaldab Euroopa standardi EN 15759-1:2011 ingliskeelset teksti.	This Estonian standard EVS-EN 15759-1:2011 consists of the English text of the European standard EN 15759-1:2011.
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.
Euroopa standardimisorganisatsioonid on teinud Euroopa standardi rahvuslikele liikmetele kättesaadavaks 23.11.2011.	Date of Availability of the European standard is 23.11.2011.
Standard on kättesaadav Eesti Standardikeskusest.	The standard is available from the Estonian Centre for Standardisation.

Tagasisidet standardi sisu kohta on võimalik edastada, kasutades EVS-i veebilehel asuvat tagasiside vormi või saates e-kirja meiliaadressile standardiosakond@evs.ee.

ICS 97.195

Standardite reprodutseerimise ja levitamise õigus kuulub Eesti Standardikeskusele

Andmete paljundamine, taastekitamine, kopeerimine, salvestamine elektroonsesse süsteemi või edastamine ükskõik millises vormis või millisel teel ilma Eesti Standardikeskuse kirjaliku loata on keelatud.

Kui Teil on küsimusi standardite autorikaitse kohta, võtke palun ühendust Eesti Standardikeskusega:
Aru 10, 10317 Tallinn, Eesti; www.evs.ee; telefon 605 5050; e-post info@evs.ee

The right to reproduce and distribute standards belongs to the Estonian Centre for Standardisation

No part of this publication may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying, without a written permission from the Estonian Centre for Standardisation.

If you have any questions about copyright, please contact Estonian Centre for Standardisation:
Aru 10, 10317 Tallinn, Estonia; www.evs.ee; phone 605 5050; e-mail info@evs.ee

ICS 97.195

English Version

**Conservation of cultural property - Indoor climate - Part 1:
Guidelines for heating churches, chapels and other places of
worship**

Conservation des biens culturels - Environnement intérieur
- Partie 1 : Recommandations pour le chauffage des
églises, chapelles et autres édifices cultuels

Erhaltung des kulturellen Erbes - Raumklima - Teil 1:
Leitfaden für die Beheizung von Andachtsstätten

This European Standard was approved by CEN on 8 October 2011.

CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration. Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the CEN-CENELEC Management Centre or to any CEN member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the CEN-CENELEC Management Centre has the same status as the official versions.

CEN members are the national standards bodies of 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, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland and United Kingdom.



EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

Management Centre: Avenue Marnix 17, B-1000 Brussels

Contents

Page

Foreword.....	4
Introduction	5
1 Scope	6
2 Normative references	6
3 Terms and definitions	6
4 General aspects to be considered before and during the application of the standard.....	8
4.1 Overall objective of any intervention.....	8
4.2 The individual character of the building	8
4.3 Professional support.....	8
4.4 The effect of installations	8
4.5 Sustainability and energy efficiency	8
5 Assessment of building, interiors and contents	8
5.1 Building structure and its condition.....	8
5.2 Building interiors and contents.....	9
5.3 Use of the building.....	9
5.4 Air exchange	9
6 Specification for indoor climate	9
6.1 Determine the appropriate indoor climate	9
6.2 Establish the historic indoor climate.....	10
6.3 Indoor climate specification for conservation.....	10
6.3.1 General.....	10
6.3.2 Relative humidity	10
6.3.3 Temperature	10
6.3.4 Air movement.....	11
6.4 Indoor climate specification for thermal comfort.....	11
6.4.1 General.....	11
6.4.2 Relative humidity	11
6.4.3 Temperature	11
6.4.4 Air movement.....	11
6.5 Compromise between thermal comfort and conservation	11
7 Heating strategies.....	12
7.1 Choice of heating strategy.....	12
7.2 Basic strategies	12
7.2.1 No heating	12
7.2.2 Conservation heating	13
7.2.3 Heating for thermal comfort	13
7.3 Distribution in space	13
7.3.1 General heating.....	13
7.3.2 Local heating.....	13
7.4 Distribution in time	13
7.4.1 Continuous heating	13
7.4.2 Intermittent heating	14
7.4.3 Mixed mode heating	14
8 Heating systems and their application.....	14
8.1 Warm-air heating.....	14
8.1.1 General.....	14
8.1.2 Centralised warm-air heating system.....	14
8.1.3 Decentralised warm-air heating system.....	14
8.1.4 Application	15

8.1.5	Thermal comfort	15
8.1.6	Conservation.....	15
8.2	Infrared heating	15
8.2.1	General	15
8.2.2	IR heating from gas combustion	15
8.2.3	IR heating from electric tubular and halogen quartz heaters	16
8.2.4	Thermal comfort	16
8.2.5	Conservation.....	16
8.2.6	Application	16
8.3	Radiators	16
8.3.1	General	16
8.3.2	Thermal comfort	16
8.3.3	Conservation.....	16
8.3.4	Application	16
8.4	Wall heating through pipes mounted in or on the inside of the walls	17
8.4.1	General	17
8.4.2	Thermal comfort	17
8.4.3	Conservation.....	17
8.4.4	Application	17
8.5	Under floor heating	17
8.5.1	General	17
8.5.2	Thermal comfort	17
8.5.3	Conservation.....	17
8.5.4	Application	18
8.6	Pew heating.....	18
8.6.1	General	18
8.6.2	Thermal comfort	18
8.6.3	Conservation.....	18
8.6.4	Application	18
8.6.5	Pew heating systems	18
9	Implementation	19
10	Evaluation.....	20
11	Comments on the application of this standard.....	20
Annex A (informative) Flow chart giving an overview of the standard		21
Bibliography.....		22

Foreword

This document (EN 15759-1:2011) has been prepared by Technical Committee CEN/TC 346 "Conservation of cultural property", the secretariat of which is held by UNI.

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 May 2012, and conflicting national standards shall be withdrawn at the latest by May 2012.

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

According to the CEN/CENELEC Internal Regulations, the national standards organizations 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, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland and the United Kingdom.

Introduction

Churches, chapels and other places of worship such as mosques and synagogues (referred to collectively in the text of this standard as “places of worship”) are an important part of European cultural heritage. The buildings and their interiors, containing cultural heritage objects, are documents of our heritage that society agrees need to be preserved for present and future generations. The indoor climate is a critical factor in conserving the fabric of buildings and the objects they house.

This European Standard is motivated by the need to reflect the special characteristics of places of worship, conditions which are not addressed in standards for the heating of other kinds of buildings. The defining characteristics of these buildings are their construction (often early building techniques); the fact that they were not designed as living or working spaces; their intermittent use; and the vulnerability of their surface decoration and contents. Originally, most historic places of worship had little or no heating. Nowadays, buildings in cold climate regions may be heated in order to:

- a) provide thermal comfort for worshippers, staff and visitors (referred collectively in this text as “users”);
- b) improve the indoor climate conditions for the conservation of the building and its contents;
- c) achieve a combination of (a) and (b) in buildings where both conservation and thermal comfort have to be considered.

The conventional climate requirements for thermal comfort can sometimes be in conflict with the requirements for conservation and may therefore call for compromise.

A decision on changing or replacing the heating system in a place of worship generally depends on a variety of factors: the pattern of use of the building (e.g. frequency, numbers of users, opening hours for visitors), its liturgical uses, the significance, condition, and vulnerability of the building and its often valuable contents, thermal comfort of the users, costs (installation, operation and maintenance), energy efficiency and sustainability, visual and audible impact, aesthetics, impact on the building structure, safety, and national laws and regulations.

This standard provides guidelines in order to facilitate the best possible decision on behalf of the end users. The standard is divided into the following steps:

- a) assessment of the building, its interior and contents;
- b) determine an indoor climate specification with respect to conservation and thermal comfort;
- c) determine an appropriate heating strategy;
- d) select and design an appropriate heating system;
- e) implement the proposed changes;
- f) evaluate the effectiveness of the heating system with respect to the specification.

This is the first standard in a series of standards on indoor climate and climate control in cultural heritage buildings. The air exchange of a building has a fundamental influence on its indoor climate and climate control; general considerations are given in Clause 5. Ventilation will be dealt with fully in the second part of the series of standards on indoor climate in cultural heritage buildings, prEN 15759-2, *Conservation of cultural property — Indoor climate — Part 2: Ventilation*.

1 Scope

This European Standard provides guidelines for the selection of heating strategies and heating systems in churches, chapels and other places of worship such as mosques and synagogues, in order to prevent damage to cultural property while at the same time creating an indoor climate that allows for a sustainable use of these buildings. It applies to most kinds of places of worship regardless of size and construction. This European Standard applies not only to the introduction of new heating systems but also to the replacement of old ones.

This European Standard applies to buildings that are part of cultural heritage or that house cultural heritage objects. This European Standard deals with indoor climate conditions, heating strategies and technical solutions for their implementation but not with the technical equipment itself.

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.

EN 15757, *Conservation of Cultural Property — Specifications for temperature and relative humidity to limit climate-induced mechanical damage in organic hygroscopic materials*

EN 15758, *Conservation of Cultural Property — Procedures and instruments for measuring temperatures of the air and the surfaces of objects*

prEN 16095¹⁾, *Conservation of cultural property — Condition report of movable heritage — Visual inspection and description of the condition of movable heritage*

prEN 16096¹⁾, *Conservation of cultural property — Condition survey of immovable heritage*

prEN 16242¹⁾, *Conservation of cultural property — Procedures and instruments for measuring humidity in the air and moisture exchanges between air and cultural property*

EN ISO 7730, *Ergonomics of the thermal environment — Analytical determination and interpretation of thermal comfort using calculation of the PMV and PPD indices and local thermal comfort criteria (ISO 7730:2005)*

EN ISO 11079:2007, *Ergonomics of the thermal environment — Determination and interpretation of cold stress when using required clothing insulation (IREQ) and local cooling effects (ISO 11079:2007)*

3 Terms and definitions

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

3.1
climate
statistics of temperature, humidity, atmospheric pressure, wind, rainfall, and other meteorological elements in a given location over a long period of time

3.2
preservation heating
heating used to improve the indoor climate for conservation purposes

1) Under publication.