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SWEDISH STANDARDS INSTITUTE

Bevarande av kulturarv – Specifikationer för temperatur och relativ fuktighet i syfte att förhindra mekaniska skador på organiska, hygroskopiska material

Conservation of Cultural Property – Specifications for temperature and relative humidity to limit climate-induced mechanical damage in organic hygroscopic materials

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The European Standard EN 15757:2010 has the status of a Swedish Standard. This document contains the official version of EN 15757:2010.

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Denna standard är framtagen av kommittén för Bevarande av kulturarv, SIS/TK 479.

Har du synpunkter på innehållet i den här standarden, vill du delta i ett kommande revideringsarbete eller vara med och ta fram andra standarder inom området? Gå in på www.sis.se - där hittar du mer information.

EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN 15757

September 2010

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English Version

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

Conservation des biens culturels - Spécifications applicables à la température et à l'humidité relative pour limiter les dommages mécaniques causés par le climat aux matériaux organiques hygroscopiques

Erhaltung des kulturellen Erbes - Festlegungen für Temperatur und relative Luftfeuchte zur Begrenzung klimabedingter mechanischer Beschädigungen an organischen hygroskopischen Materialien

This European Standard was approved by CEN on 30 July 2010.

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

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Foreword

This document (EN 15757:2010) 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of an identical text or by endorsement, at the latest by March 2011, and conflicting national standards shall be withdrawn at the latest by March 2011.

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.

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Introduction

This European Standard is a guide specifying temperature and relative humidity (RH) to preserve cultural property by limiting physical damage induced by strain-stress cycles in objects containing organic hygroscopic materials. This category of objects includes wooden items and structural elements such as floors, doors, panelling and roof timbers, paintings, books, graphic documents, textiles, objects made of bone, ivory or leather. Objects can consist of several hygroscopic materials and different kinds of materials can be used together. To a varying degree, they are vulnerable to changes and fluctuations in ambient RH that produce changes in equilibrium moisture content (EMC) in the materials as they adsorb and release moisture to adapt themselves to the continually changing environmental conditions. The variations in EMC produce dimensional changes of the materials which may lead to high levels of stress and physical damage such as fracture and deformation.

Objects containing organic hygroscopic materials need individually determined levels and ranges of temperature and RH as generally they have become acclimatised to the environments in which they have been exposed for significant periods of time. Over time, as temperature and RH fluctuations cause sufficient internal stress to create fractures, these fractures will open and close as expansion joints enabling a wider range of acceptable temperature and RH fluctuations. The material is said to have "*acclimatised*" as it now responds differently to atmospheric conditions, though this acclimatisation should not be given a positive connotation because it is due to internal fracturing and results in a form of damage. The associated loss of historical value, aesthetic value and also monetary depends on the size and location of the crack.

The determination of the temperature and RH ranges, which are optimal for preservation, is not simple due to the variety and complexity of the materials the objects comprise. Temperature has a direct effect on preservation but also an indirect effect as it controls RH of the air. The changes and fluctuations in temperature and RH should be considered from a static point of view of allowable levels or ranges and from a dynamic point of view, i.e. rate of change, duration of cycles and frequency at which cycles are repeated should be taken into account.

Deterioration is often of a cumulative nature and may be exacerbated by the number and the intensity of the individual environmental hazards. Changes and fluctuations of temperature and RH cause non-recoverable physical changes in materials although this is not always perceptible to the human eye. Vulnerability to deterioration mechanisms may increase with ageing. The same temperature and RH fluctuations may generate different effects depending on the type of object and its age.

Given the extreme complexity of the response of materials found in cultural property to variations of temperature and RH, this standard proposes a methodology leading to general specifications to limit climate-induced physical damage of organic hygroscopic materials. Therefore the standard deals with a selected category of damage and does not cover other important deterioration processes affecting other materials influenced by microclimatic factors such as oxidation, acid hydrolysis, biodeterioration, corrosion reactions and dissolution of associated materials due to deliquescence, salt crystallisation among others.

The proposed methodology is based on an analysis of a particular historical climate environment and a condition survey of the most vulnerable and/or valuable objects. The decision therefore is made on the harmlessness (or otherwise) of the existing climatic conditions. This approach usually allows for target temperatures and RH ranges that are more flexible than the single target values that are commonly accepted as ideal conditions for preservation of cultural property. This in turns allows a reduction in the environmental control needed to ensure good preservation of objects. Less and simpler equipment is required and investment, maintenance costs can be reduced. The control of temperature and RH can be further minimised by enhancing the passive control capacity of the building. High standards of preservation in historical buildings can be maintained through the use of affordable and efficient low energy solutions despite increase in the cost of energy.

Any change affecting (or concerning) the environment of an object or a collection have to be decided upon by a team of relevant professionals, which always includes a suitably qualified conservator, experienced in assessing the condition of collections and an expert in environmental control.

1 Scope

This European Standard is a guide specifying temperature and relative humidity levels to limit climate-induced physical damage of hygroscopic, organic materials, kept in long-term storage or exhibition (more than one per year) in indoor environments of museums, galleries, storage areas, archives, libraries, churches and modern or historical buildings.

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.

prEN 15898:2010, *Conservation of cultural property — Main general terms and definitions concerning conservation of cultural property*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in prEN 15898:2010 and the following apply.

3.1
active control
use of devices able to force exchanges of heat, moisture or air, integrated with real-time processing sensors and controllers

3.2
air temperature
T
temperature read on a thermometer which is exposed to air in a position sheltered from direct solar radiation or other energy sources

NOTE If objects are exposed to direct radiation black globe or black strip thermometers should be used. For definition see also EN 15758.

3.3
equilibrium moisture content
EMC
moisture content at which a hygroscopic material neither loses nor gains moisture from the surrounding atmosphere at given relative humidity and temperature levels

3.4
Heating, Ventilating or Air Conditioning Systems
HVAC
active systems operated to control air temperature (heating), air temperature and humidity (air conditioning), or ventilation in a building

3.5
historical climate
climatic conditions in a microenvironment where a cultural heritage object has always been kept, or has been kept for a long period of time (at least one year) and to which it has become acclimatized

3.6
hygroscopic material
material which adsorbs moisture when the environmental relative humidity rises, and loses moisture when relative humidity drops

3.7
indoor environment
area within a building where cultural heritage objects are preserved

3.8
microclimate
climate on a small spatial scale

NOTE Typically refers to the microenvironment that interacts with the objects under consideration.

3.9
Relative Humidity
RH
ratio of the actual water vapour pressure to the saturation vapour pressure

3.10
target level
RH level that should be maintained to best ensure preservation

NOTE Determined by the historical climate of a given environment that has been proved not to be harmful to the preservation of objects. Otherwise, it should be specified by a qualified conservation professional.

3.11
target range
range of RH fluctuations that should be not be exceeded to best ensure preservation

NOTE Determined by the historical climate of a given environment that has been proved not to be harmful to the preservation of objects. Otherwise, it should be specified by a qualified conservation professional.

4 General recommendations for organic hygroscopic materials

In general, organic hygroscopic materials require a mid RH range as the extremes (high and low RH ranges), affecting the EMC, can result in structural damage, deformation and cracking.

However, a material that has been stored for significant periods of time even in a poor quality environment will have become acclimatised to the conditions. Careful analysis of the material's needs is required to ensure that specified standard levels do not generate further damage.

Any change from a particular historical climatic environment may be problematic, even though the new conditions appear better for long-term preservation. If the change is sudden, the strain-stress may generate a climatic 'shock' leading to more intense levels of damage. Even if the change is slow, it may still generate stress and result in damage.

Therefore, the strategy of this standard focuses on maintaining the microclimate in terms of levels, seasonal cycles and fluctuations of temperature and RH, to which the materials have become acclimatized for a long time if this microclimate has been proved not to be harmful. Before a decision is made on the harmfulness or otherwise of pre-existing climatic conditions, the professional conservator involved in the project should carry out a condition report on the most vulnerable and/or valuable objects to be subjected to any environmental control proposal.

If the material has to be moved to a different climatic environment, then a careful, frequent monitoring of the condition of the material is necessary to detect symptoms of deterioration allowing stabilisation of environmental conditions which are appropriate for the needs of the materials.