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

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

(https://standards.iteh.ai)

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

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

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If this draft becomes a European Standard, 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.

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

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Foreword

This document (prEN 15757:2008) has been prepared by Technical Committee CEN/TC 346 "Conservation of Cultural Property", the secretariat of which is held by UNI.

This document is currently submitted to the CEN Enquiry.

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Introduction

This European Standard gives general specifications for temperature (T) and relative humidity (RH) to preserve cultural heritage by limiting mechanical damage induced by strain-stress cycles of organic materials in indoor environments of museums, galleries, archives, libraries, churches and historical buildings

Materials may be divided into classes, depending on their response to relative humidity (RH):

- Class 1: materials having a negligible vulnerability to RH variability, e.g. gold, glass, fossils. No special specifications for T and RH are necessary for this Class.
- Class 2: porous materials impregnated with hygroscopic salts, metals sensitive to corrosion or to hydrolysis e.g. marine or archaeological remains, ceramics or heavily oxidised metals from excavations, photographic materials, objects made of cellulose acetate or nitrate. These should be preserved in a constant, dry atmosphere. Such target T and RH intervals are specified in other European Standards.
- Class 3: metastable minerals that may suffer for humidity-related phase transition, deliquescence, efflorescence, and/or hydration, e.g., thenardite, mirabilite, hanksite, melanterite, borax, bonattite. Each of these minerals should be preserved within precise T, RH intervals, which are the same for all samples of the same material. Such target intervals are specified in other European Standards.
- Class 4: organic materials susceptible to fracture and deformation, or composite objects including hygroscopic materials, with high vulnerability to RH variability, e.g. wooden artefacts, paints, books, organs, bone, ivory, leather or textiles fixed to frames. These need individual T, RH intervals being conditioned by the past climate history of each object; however, some general recommendations are possible, as follows.

The determination of values and allowable variations of T and RH which are optimal for the preservation of Class 4 objects is not simple due to the variety and complexity of the materials and the objects they comprise. 2010 Temperature has a direct effect on preservation but also an indirect one as it controls RH of the air. Changes in ambient RH produce changes in the equilibrium moisture content (EMC) as hygroscopic materials absorb and release moisture to adapt to the continually changing environment. The variations in EMC produce dimensional changes of the materials which may lead to high levels of stress and mechanical damage. For this reason a stable climate is fundamental for preservation.

The variability in T and RH should not be considered only from the static point of view of allowable levels or ranges, but also from the dynamic point of view, i.e. temporal features like rate of change, duration of cycles and frequency at which cycles are repeated should be taken into account. When cycles repeat before the material has relaxed, it accumulates internal stress, which in turn may lead to microscopic or macroscopic forms of deterioration.

The deterioration is of cumulative nature and progresses with the number and the intensity of the individual environmental hazards. T and RH variability accelerates material ageing although this is not always perceptible to human eye. The vulnerability to deterioration mechanisms increases with ageing and damage is irreversible. The same T and RH fluctuation may generate different effects in relationship to the object type and its ageing.

When past T and RH fluctuations accumulated enough internal stress to create fractures, these fractures open and close as expansion joints, with the result of widening the interval of acceptable T, RH fluctuations. The material is said having "acclimatized" because now has a different response, i.e. less sensitivity, to the T, RH fluctuations. This acclimatisation should not be considered a positive factor, because is due to internal fracturing and actually is a form of damage.