

Conservation of cultural heritage - Methods of measurement of moisture content, or water content, in materials constituting immovable cultural heritage

EESTI STANDARDI EESSÕNA

NATIONAL FOREWORD

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English Version

**Conservation of cultural heritage - Methods of
measurement of moisture content, or water content, in
materials constituting immovable cultural heritage**

Conservation du patrimoine culturel - Méthodes de
mesurage de la teneur en humidité, ou teneur en eau,
de matériaux constituant un patrimoine culturel
immatériel

Erhaltung des kulturellen Erbes - Verfahren zur
Bestimmung des Feuchte- bzw. Wassergehalts in
Materialien des unbeweglichen kulturellen Erbes

This European Standard was approved by CEN on 25 December 2016.

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European foreword

This document (EN 16682:2017) has been prepared by Technical Committee CEN/TC 346 “Conservation of Cultural Heritage”, 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of an identical text or by endorsement, at the latest by September 2017, and conflicting national standards shall be withdrawn at the latest by September 2017.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN 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, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

Introduction

The specific field of cultural heritage is characterized by particular needs and in most cases the existing standards devised for normal materials cannot be applied. The moisture content, or the water content, in materials is of primary relevance for the preservation of cultural heritage. High content can be very damaging (e.g. salt dissolution and mobilization, fungal infestation, corrosion, swelling) as well as low content (e.g. salt crystallization, shrinkage, wood cracking) or alternating high/low content. It is therefore important to determine and control this variable to assess the risk of damage and take preventive conservation measures.

Different methods exist to measure moisture content, or water content, in modern building materials, based on different physical or chemical principles but most of them are not applicable to cultural heritage and need to be adapted to this aim.

Generally, non-destructive methods are recommended but their accuracy may be limited. In turn, the most accurate methods require sampling and can only exceptionally be used. Readings taken with non-destructive methods may not be comparable especially because they are expressed in different units. The interpretation of measurements may be obscured by a number of factors (e.g. material, salts, temperature) to which the methods are subject.

This European Standard considers and specifies characteristics, operative methodologies, pros and cons of all methods of measurements and establishes a uniform presentation of data and units. It is addressed to anyone who needs to measure or interpret readings of moisture content, or water content, in building materials (particularly masonry and wood), and in general to whoever is responsible for the preservation and maintenance of heritage buildings.

1 Scope

This European Standard is aimed to inform and assist users in the choice and use of the most appropriate method to obtain reliable measurements of the moisture content, or water content, in wood and masonry (including brickwork, stonework, concrete, gypsum, mortars, etc.) in the specific case of the built cultural heritage.

It provides a basic framework to take and interpret this kind of measurements on the above cultural heritage materials that have undergone weathering, pest attack, salt migration or other transformations over time.

It specifies four absolute methods (i.e. gravimetric, Karl Fischer titration, azeotropic distillation and calcium carbide); explains their characteristics, pros and cons, and gives specifications for the transformation of readings into the same unit to make measurements taken with different methods comparable.

It specifies the three principal relative methods (i.e. electrical resistance, capacitance, and relative humidity in equilibrium with the material), pointing out their characteristics and uncertainties when used in the field of cultural heritage.

In addition, it provides an informative overview of ten other relative methods, their characteristics, pros and cons.

It gives specifications for the calibration of the various methods. It also compares the above methods in relation to their accuracy, sampling requirement, sample size, laboratory or field use, and other problems encountered in the field of cultural heritage to prevent instrument misuse, reduce uncertainties and avoid reading misinterpretation.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

EN ISO 374-1, *Protective gloves against chemicals and micro-organisms - Part 1: Terminology and performance requirements*

EN 420:2003+A1:2009, *Protective gloves - General requirements and test methods*

EN 455-1:2000, *Medical gloves for single use - Part 1: Requirements and testing for freedom from holes*

EN 772-10:1999, *Methods of test for masonry units - Part 10: Determination of moisture content of calcium silicate and autoclaved aerated concrete units*

EN 837-1:1996, *Pressure gauges - Part 1: Bourdon tube pressure gauges - Dimensions, metrology, requirements and testing*

EN 1428:2012, *Bitumen and bituminous binders - Determination of water content in bituminous emulsions - Azeotropic distillation method*

EN 13183-1:2002, *Moisture content of a piece of sawn timber - Part 1: Determination by oven dry method*

EN 13183-2:2002, *Moisture content of a piece of sawn timber - Part 2: Estimation by electrical resistance method*

EN 13183-3:2005, *Moisture content of a piece of sawn timber - Part 3: Estimation by capacitance method*

EN 15758:2010, *Conservation of Cultural Property - Procedures and instruments for measuring temperatures of the air and the surfaces of objects*

EN 15898:2011, *Conservation of cultural property - Main general terms and definitions*

EN 16085:2012, *Conservation of Cultural property - Methodology for sampling from materials of cultural property - General rules*

EN 16096:2012, *Conservation of cultural property - Condition survey and report of built cultural heritage*

EN 16242:2012, *Conservation of cultural heritage - Procedures and instruments for measuring humidity in the air and moisture exchanges between air and cultural property*

EN ISO 10304-1:2009, *Water quality - Determination of dissolved anions by liquid chromatography of ions - Part 1: Determination of bromide, chloride, fluoride, nitrate, nitrite, phosphate and sulfate (ISO 10304-1:2007)*

EN ISO 11461:2014, *Soil quality - Determination of soil water content as a volume fraction using coring sleeves - Gravimetric method (ISO 11461:2001)*

EN ISO 13130:2011, *Laboratory glassware - Desiccators (ISO 13130:2011)*

EN ISO 14911:1999, *Water quality - Determination of dissolved Li⁺, Na⁺, NH₄⁺, K⁺, Mn²⁺, Ca²⁺, Mg²⁺, Sr²⁺ and Ba²⁺ using ion chromatography - Method for water and waste water (ISO 14911:1998)*

EN ISO 15512, *Plastics - Determination of water content (ISO 15512)*

ISO 760:1978, *Determination of water — Karl Fischer method (General method)*

ISO 3567:2011, *Vacuum gauges — Calibration by direct comparison with a reference gauge*

ISO 5272:1979, *Toluene for industrial use — Specifications*

ISO 5280:1979, *Xylene for industrial use — Specification*

ISO 7183:2007, *Compressed-air dryers — Specifications and testing*

ISO 11465:1993, *Soil quality — Determination of dry matter and water content on a mass basis — Gravimetric method*

ISO 16979:2003, *Wood-based panels — Determination of moisture content*

ISO Guide 34:2009, *General requirements for the competence of reference material producers*

ISO/IEC Guide 98-3:2008, *Uncertainty of measurement — Part 3: Guide to the expression of uncertainty in measurement (GUM:1995)*

EN ISO/IEC 17025:2005, *General requirements for the competence of testing and calibration laboratories (ISO/IEC 17025:2005)*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in EN 15898:2011 and the following apply.