

SVENSK STANDARD

SS-EN 16782:2016

Fastställt/Approved: 2016-05-09
Publicerad/Published: 2016-05-10
Utgåva/Edition: 1
Språk/Language: engelska/English
ICS: 97.195

Bevarande av kulturarv – Rengöring av porösa oorganiska material – Rengöring av kulturminnen med laserteknik

Conservation of cultural heritage – Cleaning of porous inorganic materials – Laser cleaning techniques for cultural heritage

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EUROPEAN STANDARD

EN 16782

NORME EUROPÉENNE

EUROPÄISCHE NORM

May 2016

ICS 97.195

English Version

Conservation of cultural heritage - Cleaning of porous inorganic materials - Laser cleaning techniques for cultural heritage

Conservation du patrimoine culturel - Nettoyage des matériaux inorganiques poreux - Techniques de nettoyage au laser des biens culturels

Erhaltung des kulturellen Erbes - Reinigung von porösen anorganischen Materialien - Laserstrahlreinigungsverfahren für kulturelles Erbe

This European Standard was approved by CEN on 27 February 2016.

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

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European foreword

This document (EN 16782:2016) 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of an identical text or by endorsement, at the latest by November 2016, and conflicting national standards shall be withdrawn at the latest by November 2016.

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

A cleaning method can be applied out if it follows the ethical code of conservation practice as stated in International Charters.

Laser cleaning consists in the removal of the unwanted surface materials from a substrate by using laser irradiation. The removal of unwanted substances on surfaces of artworks is done by photo-thermal processes and/or photomechanical processes, and/or photochemical processes.

Laser cleaning is generally characterized by a high precision and selectivity, which may allow the process to be stopped at a pre-determined level.

Laser cleaning requires very precise control to be selective and prevent surface damage. As with other cleaning systems, laser cleaning can only be performed by trained operators with sufficient knowledge of all relevant laser safety regulations and guidelines.

This standard specifies the requirements for the selection of laser cleaning methods and devices applicable to natural stone, ceramics and mortars (plasters, renders and stucco). When it is not possible to identify a safe working fluence (for example for certain stone lithologies or some painted artworks containing sensitive materials), laser cleaning is not suitable.

1 Scope

This European standard applies to porous inorganic materials constituting cultural heritage. It provides the fundamental requirements of the laser parameters and guidelines for the choice of the laser operational parameters, in order to optimize the cleaning procedure.

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

EN 16572:2015, *Conservation of cultural heritage — Glossary of technical terms concerning mortars for masonry, renders and plasters used in cultural heritage*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in EN 15898:2011, EN 16572:2015 and the following apply.

3.1 cleaning

removal of unwanted material from an object

Note 1 to entry: The criteria for something being “unwanted” can always be stated, e.g. potentially damaging, obscuring detail, unaesthetic, etc.

[SOURCE: EN 15898:2011, 3.5.3]

3.2 mortar

material traditionally composed of one or more (usually inorganic) binders, aggregates, water, possible additives and admixtures combined to form a paste used in masonry to provide for bedding, jointing and bonding, and for surface finishing (plastering and rendering) of masonry units, which subsequently sets to form a stiff material

[SOURCE: EN 16572:2015, 3.1.1]

3.3 plaster

coating composed of one or more mortar layers applied in one accomplishment sequence, used on internal masonry surface such as ceiling, walls, and partition

Note 1 to entry: Plaster is a traditional English term.

[SOURCE: EN 16572:2015, 3.2.5]

3.4

render

coating composed of one or more mortar layers applied in one accomplishment sequence, used on external masonry surfaces and which has protection function and surface finishing

Note 1 to entry: Render(ing) is a traditional English term.

[SOURCE: EN 16572:2015, 3.2.6]

3.5

stucco

mortars used for making decorative mouldings, architectural castings and other decorations on the facades and in the interiors of the buildings

[SOURCE: EN 16572:2015, 3.2.8]

3.6

laser

Light Amplification by Stimulated Emission of Radiation

radiation source that generates a coherent, monochromatic and very powerful beam of light in the range of ultraviolet, visible or infrared wavelengths

3.7

laser ablation

removal of material from an object induced by the laser radiation absorption, in the form of molecular radicals, vapours and particles of different sizes

3.8

photo thermal ablation

ablation process caused by heat generated by the laser radiation absorption

3.9

photo mechanical ablation

ablation process caused by mechanical stress and strains induced by the laser radiation absorption

3.10

photo chemical ablation

ablation process caused by chemical bond cleavages induced by the laser radiation absorption

3.11

light

radiation that is considered from the point of view of its ability to excite the visual system

Note 1 to entry: It corresponds to the so-called visible radiation in the range between 380 nm and 780 nm.

Note 2 to entry: In the field of conservation, this term sometimes extends the range outside the visible portion, including parts of the ultraviolet (UV) and near infrared (IR) regions.

[SOURCE: CIE S 017/E:2011]

3.12

infrared radiation

part of the electromagnetic spectrum with wavelength longer than those of the visible radiation, from about 780 nm to tens of micrometres

[SOURCE: CEN/TS 16163:2014, 3.18]

3.13

ultraviolet radiation

part of the electromagnetic spectrum with wavelengths from 10 nm to 380 nm

[SOURCE: CEN/TS 16163:2014, 3.36]

3.14

irradiated area

spot

area of the object subject to the laser beam during one single shot, in cm^2

3.15

laser fluence

amount of energy divided by the irradiated area, in joules per square centimetre (J/cm^2)

Note 1 to entry: The energy density can be changed at the sample surface if lenses are placed in the path of the laser beam.

3.16

power density

power divided by the irradiated surface, in watt per square centimeter (W/cm^2)

3.17

laser continuous wave emission

CW emission

stationary emission of a radiation laser at a constant power, in which the interaction of the laser beam and a surface is largely thermal

3.18

average power for laser continuous wave emission

energy emitted by a laser in one second, in watts (W)

3.19

laser pulsed emission

mode of laser emission consisting of successive temporal pulses having a constant duration and characterized by an instantaneous power (see 3.16) much higher than the average power.

Note 1 to entry: In pulse mode, the interaction of the laser beam and a surface is commonly believed to be a combination of thermal and mechanical processes.

3.20

peak power

single pulse energy divided by the duration of the pulse, in watts (W)

3.21

average power for laser pulsed emission

result of multiplication of pulse energy by the repetition rate, in watts (W)