SLOVENSKI STANDARD
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Sistemi organskih premazov in prevlek za protikorozijsko zaġļ ito industrijskih naprav in obratov v kemijsko agresivnih pogojih ï 3. del: Prevleke na betonskih delih

Organic coating systems and linings for protection of industrial apparatus and plants against corrosion caused by aggressive media - Part 3: Coatings on concrete components

Beschichtungen und Auskleidungen aus organischen Werkstoffen zum Schutz von industriellen Anlagen gegen Korrosion durch aggressive Medien - Teil 3: Beschichtungen für Bauteile aus Beton

Systemes de revetements organiques de peinture et autres revetements rapportés pour la protection des appareils et installations industriels contre la corrosion par des milieux agressifs - Partie 3: Revetements sur béton

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Organic coating systems and linings for protection of industrial apparatus and plants against corrosion caused by aggressive media - Part 3: Coatings on concrete components

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This European Standard was approved by CEN on 25 October 2006.

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 Central Secretariat 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 Central Secretariat has the same status as the official versions.

CEN members are the national standards bodies of Austria, Belgium, 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.

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COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

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Foreword

This document (EN 14879-3:2006) has been prepared by CEN/BT/Task Force 130 “Organic coating systems and linings for protection of industrial apparatus and plants against corrosion caused by aggressive media”, the secretariat of which is held by DIN.

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 June 2007, and conflicting national standards shall be withdrawn at the latest by June 2007.

EN 14879 "Organic coating systems and linings for protection of industrial apparatus and plants against corrosion caused by aggressive media" consists of the following parts:

— *Part 1: Terminology, design and preparation of substrate*

— *Part 2: Coatings on metallic components*

— *Part 3: Coatings on concrete components*

— *Part 4: Linings on metallic components*

— *Part 5: Linings on concrete components*

— *Part 6: Combined linings with tile and brick layers*

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, 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.

1 Scope

This European Standard specifies the requirements for and methods of testing of organic coatings which are applied to concrete process engineering equipment that will come in contact with aggressive chemical substances (liquids, solids and gases). The requirements specified here may be used for the purposes of quality control (e.g. as agreed between the contract partners).

The standard does not cover coatings as in EN ISO 12944-1, but it does apply to coatings which serve one or more of the following purposes:

— to protect the component from damaging effects of aggressive substances;

— to protect waters (e.g. ground water) from harmful substances;

— to protect the charge from becoming contaminated by components released from the substrate material;

— to achieve a particular surface properties.

The different coating systems are:

a) impregnation, seals, thin coatings (applied by brushing, spraying or rolling);

b) high-build coatings (applied by brushing, spraying, rolling, trowelling or pouring (self-levelling));

c) laminate coatings;

d) resinous screed;

e) mastic asphalt screed with a waterproofing layer;

f) combinations of the above coatings.

Table 1 shows the coating methods to be employed for various types of concrete members.

Handling of aggressive or water pollutant materials is understood to include:

1) storage;

2) filling;

3) loading and unloading;

4) manufacture;

5) treatment;

6) use.

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 59, *Glass reinforced plastics — Measurement of hardness by means of a Barcol impressor*

EN 228, *Automotive fuels — Unleaded petrol — Requirements and test methods*

EN 590, *Automotive fuels — Diesel — Requirements and test methods*

EN 1766, *Products and systems for the protection and repair of concrete structures — Test methods — Reference concretes for testing*

EN 12350-1:1999, *Testing fresh concrete — Part 1: Sampling*

EN 12620, *Aggregates for concrete*

EN 13501-1, *Fire classification of construction products and building elements — Part 1: Classification using test data from reaction to fire tests*

EN 13687-3, *Products and systems for the protection and repair of concrete structures — Test methods — Determination of thermal compatibility — Part 3: Thermal cycling without de-icing salt impact*

EN 13813, *Screed material and floor screeds — Screed material — Properties and requirements*

EN 14879-1:2005, *Organic coating systems and linings for protection of industrial apparatus and plants against corrosion caused by aggressive media — Part 1: Terminology, design and preparation of substrate*

prEN 14879-4, *Organic coating systems and linings for protection of industrial apparatus and plants against corrosion caused by aggressive media — Part 4: Linings on metallic components*

EN ISO 175, *Plastics — Methods of test for the determination of the effects of immersion in liquid chemicals (ISO 175:1999)*

EN ISO 291, *Plastics — Standard atmospheres for conditioning and testing (ISO 291:2005)*

EN ISO 868, *Plastics and ebonite — Determination of indentation hardness by means of a durometer (Shore hardness) (ISO 868:2003)*

EN ISO 2431, *Paints and varnishes — Determination of flow time by use of flow cups (ISO 2431:1993, including Technical Corrigendum 1:1994)*

EN ISO 2811-1, *Paints and varnishes — Determination of density — Part 1: Pyknometer method (ISO 2811-1:1997)*

EN ISO 2811-2, *Paints and varnishes — Determination of density — Part 2: Immersed body (plummet) method (ISO 2811-2:1997)*

EN ISO 2811-3, *Paints and varnishes — Determination of density — Part 3: Oscillation method (ISO 2811-3:1997)*

EN ISO 2815, *Paints and varnishes — Buchholz indentation test (ISO 2815:2003)*

EN ISO 3251, *Paint, varnishes and plastics — Determination of non-volatile-matter content (ISO 3251:2003)*

EN ISO 4624, *Paints and varnishes — Pull-off test for adhesion (ISO 4624:2002)*

EN ISO 4625-1, *Binders for paints and varnishes — Determination of softening point — Part 1: Ring-and-ball method (ISO 4625-1:2004)*

EN ISO 6272-1, *Paints and varnishes — Rapid-deformation (impact resistance) tests — Part 1: Falling-weight test, large-area indenter (ISO 6272-1:2002)*

ISO 554, *Standard atmospheres for conditioning and/or testing — Specifications*

ISO 2559, *Textile glass — Mats (made from chopped or continuous strands) — Designation and basis for specifications*

ISO 8130 (all parts), *Coating powders*

IEC 60093:1993, *Methods of test for volume resistivity and surface resistivity of solid electrical insulating materials*

IEC 60167, *Methods of test for the determination of the insulation resistance of solid insulating materials*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in EN 14879-1:2005 and the following apply.

NOTE The terms used to designate structural elements requiring surface protection are usually based on the function of the elements in the process plant. For the sake of consistency, the most common of these elements are referred to here on the basis of their function within the structure.

3.1
floor (bottom)
flat or inclined surface, such as the floor of a production or storage area, and the bottom of a container

3.2
wall
vertical or almost vertical limiting surface, such as the wall of a production and storage area, and the wall of a container

3.3
ceiling (top)
upper limiting surface, such as the ceiling of a production and storage area, and the top of a container

3.4
gutter
open indentation, moulded in the floor, through which fluids may drain away

3.5
trench
open or covered element in the floor of any shape or size, whose invert is considerably lower than the floor, and through which fluids may drain away

3.6
pipe
hollow cylinder of any shape or size, through which fluids, gases and vapours may pass

3.7
sump
depression in the floor, designed as the lowest point from which collected substances can be drained off

3.8
secondary containment
leaktight basin or area designed to collect any water pollutants leaking in an emergency

3.9
container
open or closed facility of any shape or size designed to contain permanently fluids, solids, gases and vapours

NOTE Typical designations for containers are basin, cistern, vessel, tank.

3.10
contract partners
coating material manufacturer, component manufacturer, person(s) responsible for applying the coating, and client ordering the coated component(s)

4 Surface protection systems and selection criteria

4.1 Surface protection types and system

Protective coatings for various types of concrete structures are listed in Table 1.

Table 1 — Protective coatings for various types of concrete structures

Protective coating	Coating thickness		Concrete structures according to EN 14879-1								
	Nominal value mm	Limit deviations %	Floors	Walls	Ceilings	Gutters	Channels	Pipes	Sumps	Secondary containment	Tanks
Brushed, sprayed, rolled on	≤ 1	± 50	x	x	x	—	—	x	—	x	—
Brushed, sprayed, rolled on	> 1	+ 30 – 20	x	x	x	—	—	x	—	x	—
Trowelled	2 up to 8	+ 50 – 30	x	x	x	x	x	x	x	x	x
Self levelled	2 up to 3	+ 30 – 20	x	—	—	x	—	—	—	—	—
Laminate coating	2 up to 6	+ 50 – 30	x	x	—	x	x	x	x	x	x
Resinous screed	≥ 5	+ 30 – 20	x	—	—	x	—	—	—	x[a]	—
Mastic asphalt screed	≥ 35	+ 20 – 10	x	—	—	x	—	—	—	x[a]	—
Combined coatings	≥ 3	+ 50 – 30	x	x	—	x	x	—	x	x	x

X Means commonly used

[a] Not to be applied on vertical surfaces.

4.2 Selection criteria

4.2.1 General

The stress to be encountered by a protective coating shall be known before the requirements for it can be specified. For the scope or this European Standard, the stress types detailed in 4.2.2 to 4.2.8 are the most relevant. Where necessary, grades have been used to describe different levels of stress.

4.2.2 Exposing media

Aggressive substances or water pollutants may occur as solids, fluids or gases. Their aggressive action on concrete usually occurs when they are in a liquid state (e.g. aqueous solutions or condensates). The substances may exist in their pure state, or as mixtures and may occur in different intervals.

These substances shall be designated using the Geneva nomenclature, IUPAC[1)] nomenclature or CAS[2)] number. They may also be designated by trivial names which have become established in the literature. Concentrations and any changes to these shall be given as a percentage by mass or volume, or as g/l, g/kg, mol/l etc. The pH value shall also be given for aqueous solutions.

All constituents, including traces and impurities, shall be named, even if they do not attack concrete. Successive exposure shall be represented accordingly.

Table 2 lists commonly used chemicals which may have the properties mentioned above.

1) International Union of Pure and Applied Chemistry.

2) Chemical Abstract Service.

Table 2 — Classification of frequently (commonly) used chemicals

Type of chemical	Examples	
I. Inorganic chemicals		
Inorganic, non-oxidizing acids	HCl	Hydrochloric acid
	H_2SO_4	Sulfuric acid, up to 70 %
	H_3PO_4	Phosphoric acid
Inorganic, oxidizing acids	HNO_3	Nitric acid
	H_2SO_4	Sulfuric acid, over 70 %
	CrO_3, H_2CrO_4	Chromic acid
	$HClO_3$	Chloric acid
Inorganic acids, dissolving SiO_2	HF	Hydrofluoric acid
	H_2SiF_6	Hexafluorosilicic acid (containing HF)
	HBF_4	Tetrafluoroboric acid (containing HF)
Salts	NaCl	Sodium chloride
	$FeSO_4$	Iron(II) sulfate
	Na_2CO_3	Sodium carbonate
Bases	NaOH	Sodium hydroxide
	KOH	Potassium hydroxide
	CaO, $Ca(OH)_2$	Calcium oxide Calcium hydroxide
	NH_4OH	Ammonia solution (Ammonium hydroxide solution)
Oxidizing bases	NaOCl	Sodium hypochlorite
II. Organic chemicals		
Organic acids	HCOOH	Formic acid
	CH_3COOH	Acetic acid
	$CH_2ClCOOH$	Chloroacetic acid
	$(COOH)_2$	Oxalic acid
	$CH_3CHOHCOOH$	Lactic acid
Aliphatic hydrocarbons	C_6H_{14}	Hexane
	C_8H_{18}	Octane
Aromatic hydrocarbons	C_6H_6	Benzene
	$C_6H_5CH_3$	Toluene
	$C_6H_4(CH_3)_2$	Xylene
Alcohols	CH_3OH	Methanol
	C_2H_5OH	Ethanol
	C_4H_9OH	Butanol
	CH_2OHCH_2OH	Ethanediol
Aldehydes, ketones, esters	CH_2O	Formaldehyde
	CH_3COCH_3	Acetone
	$C_2H_5COCH_3$	Methyl ethyl ketone (2-butanone)
	$CH_3COOC_2H_5$	Ethyl acetate
Aliphatic halogenated hydrocarbons	CH_2Cl_2	Dichloromethane
	C_2HCl_3	Trichloroethylene
	$C_2Cl_3F_3$	Trichlorotrifluoroethane
Aromatic halogenated hydrocarbons	C_6H_5Cl	Chlorobenzene
	$ClC_6H_4CF_3$	Chlorobenzotrifluoride
Aliphatic amines and pyridine	CH_3NH_2	Methylamine
	$(C_2H_5)_3N$	Triethylamine
	$NH_2C_2H_4NH_2$	Ethylene diamine
Aromatic amines	$C_6H_5NH_2$	Aniline
	C_5H_5N	Pyridine
Phenols	C_6H_5OH	Phenol
	$CH_3C_6H_4OH$	Cresol
Fats, oils		Vegetable and animal fats and oils

4.2.3 Type and frequency of fluid loading

The requirements for the protective or sealing function of a surface protection system are linked to the type and frequency of the fluid loads to which it will be exposed. Exposure shall be graded as follows.

Grade 0: no exposure to fluids;

Grade 1: sporadic exposure to droplets of fluid (e.g. laboratory floors, floors in small units, walls);

Grade 2: frequent, short-term exposure to splashes of fluid, where the surfaces are regularly flushed (e.g. floors of closed production plants);

Grade 3: exceptional and limited exposure to fluids during operations (e.g. due to plant failure) in, for example, secondary containment;

Grade 4: constant or frequent exposure to a film of fluid, due to wetness, condensation, puddles, trickles and the like (e.g. floors in production plants, electroplating plants or pumping stations);

Grade 5: operational exposure to a constant flow of fluid involving no significant hydrostatic pressure (e.g. open gutters, trenches and their pump sumps, closed trenches and pipes);

Grade 6: constant exposure of containers to fluid contents for unlimited periods (e.g. vessels, pits).

4.2.4 Thermal loading

The thermal load caused by medium effect or other sources of heat affects the effectiveness of a surface protection system in the following way:

a) Aggressiveness of medium

Elevated temperatures increase the aggressiveness of the medium by raising the levels of its chemical reactions and diffusion, and also through the accumulation of volatile substances in the headspace.

b) Thermal stress

Temperatures which deviate from the installation temperature cause thermal stress between the substrate and the surface protection system and may cause peeling, cracks etc. This may result from the direct action of hot or cold media, or from radiant heat and extreme ambient temperature.

The maximum thermal load shall be stated in °C.

4.2.5 Changes in temperature

Changes in temperature include:

a) temperature changes at the protective surface during exposure to fluid loads of grades 3 to 5 as in 4.2.3 caused by increased/decreased medium temperatures;

b) temperature changes as otherwise constantly heated or cooled surfaces, resulting from operational circumstances, such as start-up and shutdown;

c) temperature changes, possibly involving thermal shock, which occur during cleaning operations;

d) process-related changes in the temperature of the medium under loading conditions corresponding to grade 6 (as in 4.2.3).

Temperature changes due to climatic influences are dealt with in 4.2.7.

The extent, direction, speed and frequency of temperature changes shall be taken into consideration when assessing their effect.

The following grades serve in assessing the effects of temperature changes, whereby details of the frequency and the duration of temperature changes are to be given for grades 1 to 4.

Grade 0: no temperature changes;

Grade 1: infrequent temperature changes up to 50 K;

Grade 2: infrequent temperature changes of more than 50 K;

Grade 3: frequent temperature changes up to 50 K;

Grade 4: frequent temperature changes of more than 50 K.

Grade 5: temperature changes involving thermal shock.

4.2.6 Mechanical loading

The effectiveness of a surface protection system may be impaired through exposure to mechanical loads or hydrostatic pressure during operation or assembly. The following grades shall be used to assess such loads.

Grade 0: no loads, or hydrostatic pressure up to 0,05 bar;

Grade 1: loads up to 0,2 N/mm^2 (e.g. pedestrian traffic, light transport, static loading);

Grade 2: loads up to 1 N/mm^2 (e.g. vehicles with pneumatic tires, static loading);

Grade 3: loads over 1 N/mm², for example

a) loads of 1 N/mm^2 to 7 N/mm^2 (e.g. vehicles with Vulkollan wheels, static loading);

b) loads over 7 N/mm^2 (e.g. vehicles with polyamide wheels, static loading);

Grade 4: impact loads, such as those resulting from setting down sharp-edged objects (e.g. barrels), and from scraping (e.g. shovel loaders);

Grade 5: hydrostatic pressure from 0,05 bar to 0,5 bar;

Grade 6: hydrostatic pressure greater than 0,5 bar.

4.2.7 Weather factors

Climatic influences may affect the durability of a surface protection system, and shall be graded as follows:

Grade 0: no climatic influences: the component is located inside a building and is not exposed to climatic influences;

Grade 1: limited climatic influences: a roof protects the component, which is exposed to limited climatic influences;

Grade 2: full climatic influences: the component is located outside, and is fully exposed to climatic influences.