
Sistemi organskih premazov in prevlek za protikorozijsko zaščito industrijskih naprav in obratov v kemijsko agresivnih pogojih - 1. del: Terminologija, načrtovanje in priprava podlage

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

Beschichtungen und Auskleidungen aus organischen Werkstoffen zum Schutz von industriellen Anlagen gegen Korrosion durch aggressive Medien - Teil 1: Terminologie, Konstruktion und Vorbereitung des Untergrundes

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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 1 : Terminologie, conception et préparation des subjectiles

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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

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This European Standard was approved by CEN on 22 July 2005.

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.

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Foreword

This European Standard (EN 14879-1:2005) has been prepared by Working Group CEN/BT/TF 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of an identical text or by endorsement, at the latest by March 2006, and conflicting national standards shall be withdrawn at the latest by March 2006.

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 lining 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, Slovakia, Slovenia, Spain, Sweden, Switzerland and United Kingdom.

EN 14879-1:2005 (E)**1 Scope**

This European Standard describes the terminology, the design and the preparation of the substrate of industrial apparatus for the protection against corrosion caused by aggressive media. These industrial apparatus include, for example, reaction tanks, storage tanks, floors in industrial plants, in general for production and handling of chemicals.

The protection is applicable to metallic and concrete structures.

Beside the protection of the apparatus, the protection of the media itself against pollution is also considered in this series of European Standards EN 14879.

A protection against corrosion caused by atmospheric exposure (as for example according to EN ISO 12944-4) is not included in the scope of this series of European Standards EN 14879.

Corrosion protection systems according to this series of European Standards EN 14879 are:

- 1) Thick coatings normally of 1 mm or more thick.
- 2) Linings made of pre-fabricated sheets respectively plate materials.
- 3) Combined linings with tile and brick layers.

2 Normative references

The following referenced documents are indispensable for the application of this European Standard. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

EN 206-1, *Concrete — Part 1: Specification, performance, production and conformity*

EN 1504-1, *Products and systems for the protection and repair of concrete structures — Definitions, requirements, quality control and evaluation of conformity — Part 1: Definitions*

EN 1504-2, *Products and systems for the protection and repair of concrete structures — Definitions, requirements, quality control and evaluation of conformity — Part 2: Surface protection systems for concrete*

EN 1504-3, *Products and systems for the protection and repair of concrete structures — Definitions, requirements, quality control and evaluation of conformity — Part 3: Structural and non-structural repair*

EN 1504-4, *Products and systems for the protection and repair of concrete structures — Definitions, requirements, quality control and evaluation of conformity — Part 4: Structural bonding*

EN 1504-5, *Products and systems for the protection and repair of concrete structures — Definitions, requirements, quality control and evaluation of conformity — Part 5: Concrete injection*

EN 1504-8, *Products and systems for the protection and repair of concrete structures — Definitions, requirements, quality control and evaluation of conformity — Part 8: Quality control and evaluation of conformity*

ENV 1504-9, *Products and systems for the protection and repair of concrete structures — Definitions, requirements, quality control and evaluation of conformity — Part 9: General principles for the use of products and systems*

EN 1504-10, *Products and systems for the protection and repair of concrete structures — Definitions, requirements, quality control and evaluation of conformity — Part 10: Site application of products and systems and quality control of the works*

EN 1559-1:1997, *Founding — Technical conditions of delivery — Part 1: General*

- EN 1990, *Eurocode — Basis of structural design*
- EN 1992-1-1, *Eurocode 2: Design of concrete structures — Part 1-1: General rules and rules for buildings*
- EN 10025 (all parts), *Hot rolled products of non-alloy structural steels — General technical delivery conditions*
- EN 10028-1, *Flat products made of steels for pressure purposes — Part 1: General requirements*
- EN 10028-2, *Flat products made of steels for pressure purposes — Part 2: Non-alloy and alloy steels with specified elevated temperature properties*
- EN 10088-2, *Stainless steels — Part 2: Technical delivery conditions for sheet/plate and strip of corrosion resisting steels for general and construction purposes*
- EN 10088-3, *Stainless steels — Part 3: Technical delivery conditions for semi-finished products, bars, rods, wire, sections and bright products of corrosion resisting steels for general and construction purposes*
- EN 10130+A1, *Cold rolled low carbon steel flat products for cold forming — Technical delivery conditions*
- EN 10139, *Cold rolled uncoated mild steel narrow steel strip for cold forming — Technical delivery conditions*
- EN 10208-1, *Steel pipes for pipelines for combustible fluids — Technical delivery conditions — Part 1: Pipes of requirement class A*
- EN 10216-2, *Seamless steel tubes for pressure purposes — Technical delivery conditions — Part 2: Non-alloy and alloy steel tubes with specified elevated temperature properties*
- EN 10217-1, *Welded steel tubes for pressure purposes — Technical delivery conditions — Part 1: Non-alloy steel tubes with specified room temperature properties*
- EN 10217-2, *Welded steel tubes for pressure purposes — Technical delivery conditions — Part 2: Electric welded non-alloy and alloy steel tubes with specified elevated temperature properties*
- EN 10217-7, *Welded steel tubes for pressure purposes — Technical delivery conditions — Part 7: Stainless steel tubes*
- EN 10293, *Steel castings for general engineering uses*
- EN 10296-2, *Welded circular steel tubes for mechanical and general engineering purposes — Technical delivery conditions — Part 2: Stainless steel*
- prEN 10340, *Steel castings for structural uses*
- EN 10297-2, *Seamless circular steel tubes for mechanical and general engineering purposes — Technical delivery conditions — Part 2: Stainless steel*
- EN 13813, *Screed material and floor screeds — Screed materials — Properties and requirements*
- prEN 14879-3, *Organic coating systems and linings for protection of industrial apparatus and plants against corrosion caused by aggressive media — Part 3: Coatings on concrete components*
- prEN 14879-5, *Organic coating systems and linings for protection of industrial apparatus and plants against corrosion caused by aggressive media — Part 5: Linings on concrete components*
- EN ISO 4617:2000, *Paints and varnishes — List of equivalent terms (ISO 4617:2000)*
- EN ISO 4618-2:1999, *Paints and varnishes — Terms and definitions for coating materials — Part 2: Special terms relating to paint characteristics and properties (ISO 4618-2:1999)*
- EN ISO 4618-3:1999, *Paints and varnishes — Terms and definitions for coating materials — Part 3: Surface preparation and methods of application (ISO 4618-3:1999)*

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EN ISO 6520-1, *Welding and allied processes — Classification of geometric imperfections in metallic materials — Part 1: Fusion welding (ISO 6520-1:1998)*

EN ISO 7093-1, *Plain washers — Large series — Part 1: Product grade A (ISO 7093-1:2000)*

EN ISO 12944-4, *Paints and varnishes — Corrosion protection of steel structures by protective paint systems — Part 4: Types of surface and surface preparation (ISO 12944-4:1998)*

ISO 4997, *Cold-reduced steel sheet of structural quality*

ISO 9329 (all parts), *Seamless steel tubes for pressure purposes — Technical delivery conditions*

ISO 9330-1, *Welded steel tubes for pressure purposes — Technical delivery conditions — Part 1: Unalloyed steel tubes with specified room temperatures properties*

3 Terms and definitions

For the purposes of this European Standard, the terms and definitions given in EN ISO 4617:2000, EN ISO 4618-2:1999, EN ISO 4618-3:1999 and the following apply.

3.1**surface protection system**

consists of the materials and material combinations listed in the standards of the series EN 14879, which protect and seal concrete parts or metallic components in process plants

3.2**coating**

produced by applying an organic coating material to protect steel or concrete parts against corrosion

3.3**coating material**

liquid to paste like materials applied mainly by means of trowel, brushing, rolling or spraying.

3.4**lining**

thermoplastics, duroplastic or rubber applied as sheets or plates which may or may not (thermoplastics) be bonded to the substrate

3.5**corrosion**

reaction of a metallic material or concrete with its environment which produces a measurable change in the material and can result in an impairment of the function of a component or a complete system

3.6**corrosion protection**

corrosion protection means the isolation of the metallic or concrete material from the attacking medium by applying coatings or linings

3.7**medium, corrosive medium**

environment containing components (chemicals, gases, vapours, etc.) that react with the material during corrosion

3.8**construction joint**

joint in a building or building element caused by interruption during the casting of the concrete

3.9**movement joint**

joint that accommodates movement of structural concrete parts caused by the expansion or contraction of the structure

3.10**dummy joint**

joint formed by cutting the concrete surface, thereby determining the location of arising cracks that may form

3.11**tensile strength**

for the purposes of this European Standard, the tensile strength is a measure based on the maximum load which a concrete structure can accommodate when subjected to uniaxial tension

3.12**blast cleaning, abrasive blast cleaning**

impingement of a high-kinetic-energy stream of blast cleaning abrasive on to the surface to be prepared

3.13**abrasive, blast cleaning abrasive**

solid material intended to be used for abrasive blast-cleaning

3.14**dew point**

temperature at which moisture in the air will condense out on to a solid surface

3.15**duroplastic**

plastic which, when cured by heat or other means, changes into a substantially infusible and insoluble product. Contrary to thermoplastics, duroplastic materials remain hard when heated

4 Design and preparation of substrate

4.1 Metallic components

4.1.1 Design of metallic components

4.1.1.1 General

Components to be protected shall be designed and manufactured so that after abrasive blast cleaning the surface protection can be applied without further treatment or modification.

For this reason, the following particulars shall be established beforehand:

- a) coating or lining material;
- b) mode of application and thickness of protective layer;
- c) site at which coating or lining shall take place.

This results in various requirements for the design which are taken into account in Table 3. The examples given are partly taken from EN 1708-1.

The design requirements concerning type and thickness of the lining or coating are based on experience gained in the chemical industry and need not be taken as definitive. Since other designs are equally acceptable, it is recommended that the component manufacturer and the manufacturer of the surface protection reach agreement on the most suitable design to be used.

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Where components are to receive a new lining or coating, it should be borne in mind that removal of the existing lining or coating may subject them to stresses.

Metallic base materials and semi-finished products see 4.1.2.

4.1.1.2 Dimensions of components

The dimensions and masses of the components shall be suitable for the intended surface protection process and shall be selected as a function of the place of manufacture (e.g. construction site), available facilities (e.g. blast-cleaning equipment, immersion vessels, ovens, autoclaves) as well as transportation and lifting facilities.

4.1.1.3 Surfaces

Component surfaces to be protected shall comply with the requirements specified in 4.1.2.

4.1.1.4 Design criteria**4.1.1.4.1 Rigidity**

Components shall be sufficiently rigid so as to preclude any deformation which would result in damage to the intended surface protection, particularly in the case of rigid linings and coatings. Should bracing be required, this shall be fitted to the unlined or uncoated side of the component. It is, however, preferable to select appropriate wall thickness. The permissible deviation is to be agreed upon with the manufacturer of the surface protection. Deformations may also be caused by handling and machining, e.g. during blast cleaning, as well as by storage, transportation and installation.

4.1.1.4.2 Accessibility

Surfaces to be protected shall be accessible to hand tools and be readily visible with the exception of components which are to be lined or coated by such techniques as spreading, flooding or dipping, where adequate protection and assessment are ensured.

Manholes shall be in accordance with national regulations. For vessels, manholes shall be at least of size DN 600, see EN ISO 12944-3. Additional air supply and exhaust openings of at least DN 250 should also be provided. Other larger erection openings, e.g. for scaffolding, may also be required.

4.1.1.4.3 Rotating components

Rotating components, e.g. fan wheels, centrifugal drums shall be balanced prior to the application of the surface protection.

Counter weights shall be mounted so that the coating or lining can be applied properly.

4.1.1.4.4 Cavities

Cavities shall be avoided or they shall be adequately vented by spot-drilling of the unlined or uncoated side. Closing of cavities by welding to make them gas-tight is permitted, provided they will be able to withstand the occurring mechanical stresses (e.g. during vulcanisation) or thermal stresses (e.g. during the removal of the existing coating or lining).

4.1.1.4.5 Dimensional accuracy

The design of the component shall take into account the thickness of the surface protection to be applied as well as of possible deviations of thickness and multiple layers of the surface protection. Particular requirements for the dimensional accuracy of surface protected components, where specified, can only be fulfilled if the components comply with analogous requirements prior to the application of the surface protection. Dimensional corrections by means of the surface protection itself and/or its mechanical treatment shall be permitted to a limited extent with due

consideration given to the material of the surface protection, the coating or lining thickness and the thickness tolerances specified.

4.1.1.4.6 Protective layer/transition areas

Surfaces subject to stresses under service conditions should be fully lined or coated without any interruption. However, if in particular cases it is necessary to interrupt the protective layer, suitable design shall be agreed upon with the manufacturer of the surface protection.

4.1.1.4.7 Joints

4.1.1.4.7.1 Welded joints

Welds shall be continuous on surfaces to be protected. Spot welding shall not be permitted. The surface finish of welds shall be in accordance with 4.1.2.6.

Welding shall not be permitted after the application of the surface protection.

4.1.1.4.7.2 Bolted connections

Bolted connections shall be avoided in zones which are in contact with the corrosive media. Where this is not possible, the following solutions can be applied among others:

- a) Bolts, screws, nuts and washers shall be of suitable corrosion-resistant materials. An additional soft washer may be provided to prevent any damage to the surface protection (see Table 3, item 2.1).
- b) Where bolts, screws and nuts are to be protected, they may be provided with screw-on caps with gasket (see Table 3, item 2.3).
- c) Where the permissible load of the gasket or surface protection in the joint area is too low, pressure relief shall be provided and the gasket shall be located in a secondary non-positive connection (see Table 3, item 2.3).
- d) Countersunk bolts and screws with applied surface protection.
- e) The size of the bolt holes shall be selected as a function of the type and thickness of the surface protection to be applied. Edges and radii shall be in accordance with 4.1.1.4.9.

4.1.1.4.7.3 Rivet assemblies

Rivet assemblies shall not be permitted.

4.1.1.4.7.4 Flanged connections

The specifications of 4.1.1.4.7.2 shall apply analogously to flanged connections. Threaded flanges shall not be permitted. Fitting dimensions shall be selected as a function of the thickness of the surface protection, also see 4.1.1.4.5. Edges and radii shall be in accordance with 4.1.1.4.9. Examples of flanged connections are given in Table 3, items 3.1 to 3.13.

Type, material and permissible surface pressure of the gasket shall be selected as a function of the surface protection. Soft gaskets should be used for rigid surface protection materials, e.g. hard rubber linings or duroplastic linings, and rigid gaskets should be used for soft materials.

The design of the gasket shall be such that the sealing pressure can act only on that part of the gasket which is supported by the component. Where high surface pressure is given, the gasket shall be located in the secondary non-positive connection. Ring-joint gaskets shall be used for high pressures. For examples of the design see Table 3.

4.1.1.4.7.5 Other joints

Other continuous joints without gap on the surface to be protected, e.g. soldered or bonded joints, are permissible as a function of the method of application of the surface protection (e.g. temperature influence).

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4.1.1.4.8 Nozzles and outlets

Nozzles, outlets, connections etc. may be designed as set-in, set-on, butt-welded types or may be extruded with the limitations as given in Table 3, items 4.1 to 4.9. Their lengths should not exceed the nominal size in mm + 100 mm. A nominal size of at least DN 100 shall be provided for trowelled and laminate coatings. Where due to the technical process smaller nominal sizes are required it is allowed to use sleeves instead of the intended coating. In the case of thermoplastic linings of small nominal sizes (\leq DN 200), the tube inside diameters shall be selected to suit the respective thermoplastic semi-finished products.

Threaded nozzles are not permitted.

Set-through and weld-in nozzles as well as nozzles with weld-on bends are not permitted (see Table 3, items 4.4, 4.6 and 4.8).

4.1.1.4.9 Edges, fillets and corners

Edges, fillets and corners shall be smoothly finished to the minimum radii specified in Table 1. Flange radii shall be designed so as not to impair the performance of the flange facings.

Examples of the design are given in Table 3, items 5.1 to 5.6.

The transition from shell to vessel end shall be considered as special design of the fillet. Examples of the design are given in Table 3, items 6.1 and 6.7.

4.1.1.4.10 Supports and welding attachments

End support rings, holding devices and the like shall be fixed by welding prior to the application of the surface protection. Attention shall be paid to ensure a uniform load distribution and that the permissible surface pressure is not exceeded. Also see 4.1.1.4.5, 4.1.1.4.6, 4.1.1.4.7.2 and 4.1.1.4.9. Examples of design see Table 3, items 7.1 and 7.2.

Table 1 — Minimum radii

Surface protection Material	Minimum radius in mm	
	Edges	Fillets
Powder coatings	2	3
Coatings applied by spraying or brush application	3	6
Trowelled coatings	10	15
Laminate coatings	10	10
Duroplastic linings	5	10
Rubber linings	3	3 + lining thickness ^a
Thermoplastic linings	3 ^b	3 + lining thickness ^b
^a Fillets shall be formed in the base material. In particular cases, it is permissible upon agreement with the manufacturer of the surface protection system, to form the minimum radius by further measures, e.g. luting, trowelling. ^b For manufacturing reasons, some thermoplastics may require an edges design.		