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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

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Produits et systemes pour la protection et la réparation de structures en béton - Définitions, prescriptions, maîtrise de la qualité et évaluation de la conformité - Partie 10: Application sur site des produits et systemes et contrôle de la qualité des travaux

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**EN 1504-10**

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**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**

Produits et systèmes pour la protection et la réparation de structures en béton - Définitions, prescriptions, maîtrise de la qualité et évaluation de la conformité - Partie 10: Application sur site des produits et systèmes et contrôle de la qualité des travaux

Produkte und Systeme für den Schutz und die Instandsetzung von Betontragwerken - Definitionen, Anforderungen, Qualitätsüberwachung und Beurteilung der Konformität - Teil 10: Anwendung von Produkten und Systemen auf der Baustelle, Qualitätsüberwachung der Ausführung

This European Standard was approved by CEN on 28 February 2003.

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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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## Contents

Page

1	Scope .....	6
2	Normative references .....	6
3	Terms and definitions.....	9
4	Structural stability during preparation, protection and repair .....	12
5	General requirements.....	12
6	Methods of protection and repair.....	12
7	Preparation of substrate .....	21
7.1	General.....	21
7.2	Preparation of concrete.....	23
7.2.1	General.....	23
7.2.2	Cleaning.....	23
7.2.3	Roughening .....	23
7.2.4	Concrete removal.....	23
7.3	Preparation of reinforcement.....	24
7.3.1	General.....	24
7.3.2	Cleaning.....	24
8	Application of products and systems.....	24
8.1	General.....	24
8.2	Defects in concrete and structural strengthening.....	28
8.2.1	Bonding.....	28
8.2.2	Hand applied mortar and concrete.....	28
8.2.3	Sprayed mortar or concrete.....	28
8.2.4	Cast mortar or concrete .....	28
8.2.5	Curing.....	29
8.2.6	Cracks and joints .....	29
8.2.7	Surface coatings and other treatments .....	29
8.2.8	Anchoring .....	30
8.2.9	Plate bonding .....	30
8.3	Defects caused by reinforcement corrosion.....	30
8.3.1	Coating reinforcement.....	30
8.3.2	Removal.....	30
8.3.3	Replacement.....	31
9	Quality control.....	31
9.1	General.....	31
9.2	Quality control tests and observations .....	31
10	Maintenance .....	42
11	Health, safety and the environment .....	42
Annex A (informative).....		43
Foreword.....		43
A.2	Informative references .....	43
A.3	Definitions.....	43
A.4	Structural stability during preparation, protection and repair .....	44
A.5	General requirements.....	44
A.6	Methods of protection and repair.....	44
A.7	Preparation of substrate .....	46
A.7.2.1	General.....	46
A.7.2.2	Cleaning.....	47
A.7.2.3	Roughening .....	47
A.7.2.4	Concrete removal.....	47

A.7.3.1	General.....	49
A.7.3.2	Cleaning.....	49
A.8	Application of products and systems.....	49
A.8.1	General.....	49
A.8.2.1	Bonding .....	49
A.8.2.2	Hand applied mortar or concrete .....	50
A.8.2.3	Sprayed concrete and mortar .....	50
A.8.2.4	Cast mortar or concrete .....	50
A.8.2.5	Curing .....	50
A.8.2.6	Cracks and joints .....	51
A.8.2.7	Surface coatings and other treatments .....	51
A.8.2.9	Plate bonding .....	52
A.8.3.1	Coating reinforcement.....	52
A.8.3.2 and A.8.3.3	Removal and replacement .....	52
A.9	Quality control.....	52
A.9.1	General.....	52
A.9.2	Quality control tests and observations .....	53
A.11	Health, safety and the environment.....	61

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[SIST EN 1504-10:2004](https://standards.iteh.ai/catalog/standards/sist/5912230b-c400-4f75-a224-cd021b786b14/sist-en-1504-10-2004)

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**EN 1504-10:2003 (E)****Foreword**

This document (EN 1504-10:2003) has been prepared by Technical Committee CEN/TC 104 "Concrete and related products", 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 2004, and conflicting national standards shall be withdrawn at the latest by June 2004.

This document is part of the series of European standards EN 1504 "Products and systems for the protection and repair of concrete structures". The other parts of the standard are given in clause 2 – Normative references.

This European Standard shall be given the status of National Standard, either by the publication of an identical text or by endorsement.

This European standard specifies requirements for the execution of protection and repair of concrete structures.

It has been prepared by CEN/TC 104, Subcommittee 8 "Products and systems for the protection and repair of concrete structures", the secretariat of which is held by AFNOR.

Annex A is informative.

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According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Luxembourg, Malta, Netherlands, Norway, Portugal, Slovakia, Spain, Sweden, Switzerland and the United Kingdom.

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## Introduction

This standard is part of the EN 1504 series of European standards which define and specify products and systems for the protection and repair of concrete structures. This Standard defines and specifies site application of these products and systems and quality control of the works.

The execution of this work is an important and integral part of the complex process of protection and repair, and this Standard specifies how it shall be carried out. The Specifications in this Standard are part of the definition of the intended use for the relevant products and systems. The execution shall be in accordance with this series of standards, ENV 13670-1, EN 1990, ENV 1992-2-4, EN 206-1 and any other relevant EN and European Technical Approval.

The specification for products and systems for protection and repair of concrete structures are given in Parts 2 - 7 of this standard. They can only be satisfied if the rules given in part 9 of this standard and this part of the standard are followed.

This standard contains an Annex A which provides guidance and background information to the normative text. The contents of the Annex A are numbered in the same way as the normative text to facilitate reference, but prefixed with "A".

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**EN 1504-10:2003 (E)****1 Scope**

This part of EN 1504 gives requirements for substrate condition before and during application including structural stability, storage, the preparation and application of products and systems for the protection and repair of concrete structures including quality control, maintenance, health and safety, and the environment.

**2 Normative references**

This part of this European standard incorporates by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this European Standard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies.

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

EN 1008, *Mixing water for concrete – Specification for sampling, testing and assessing the suitability of water, including water recovered from processes in the concrete industry, as mixing water for concrete.*

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.*

prEN 1504-2:2000-03, *Products and systems for the protection and repair of concrete structures - Definitions, requirements, quality control and evaluation of conformity - Part 2: Surface protection systems.*

prEN 1504-3:2001-03, *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.*

prEN 1504-4:2000-04, *Products and systems for the protection and repair of concrete structures - Definitions, requirements, quality control and evaluation of conformity - Part 4: Structural bonding.*

prEN 1504-5:2002-01, *Products and systems for the protection and repair of concrete structures - Definitions, requirements, quality control and evaluation of conformity - Part 5: Concrete injection.*

prEN 1504-6:2001-12, *Products and systems for the protection and repair of concrete structures - Part 6: Grouting to anchor reinforcement or to fill external voids.*

prEN 1504-7<sup>1)</sup>, *Products and systems for the protection and repair of concrete structures - Definitions, requirements, quality control, evaluation of conformity - Part 7: Reinforcement corrosion prevention.*

prEN 1504-8:2000-10, *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 1542, *Products and systems for the protection and repair of concrete structures - Test methods - Measurement of bond strength by pull-off.*

EN 1766, *Products and Systems for the protection and repair of concrete structures – Test methods - Reference concretes for testing.*

prEN 1881:2003-06, *Products and systems for the protection and repair of concrete structures - Test methods - Pull-out test of rebar from concrete.*

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1) currently under preparation



- EN 1990:2002, *Eurocode - Basis of structural design.*
- ENV 1992-2:1996, *Eurocode 2: Design of concrete structures – Part 2: Concrete bridge.*
- ENV 1992-3:1998, *Eurocode 2: Design of concrete structures – Part 3: Concrete foundations.*
- ENV 1992-4:2000, *Eurocode 2: Design of concrete structures – Part 4: Liquid retaining and containment structures.*
- prEN 10080–1:1999-07, *Steel for reinforcement of concrete - Weldable reinforcing steel - Part 1: General requirements.*
- EN 12190, *Products and systems for the protection and repair of concrete structures – Test Methods - Determination of compressive strength of repair mortar.*
- EN 12350-1, *Testing fresh concrete - Part 1: Sampling.*
- EN 12350-2, *Testing fresh concrete - Part 2: Slump test.*
- EN 12350-3, *Testing fresh concrete - Part 3: Vebe test.*
- EN 12350-4, *Testing fresh concrete - Part 4: Degree of compactability.*
- EN 12350-5, *Testing fresh concrete - Part 5: Flow Table test.*
- EN 12350-6, *Testing fresh concrete - Part 6: Density.*
- EN 12350-7, *Testing fresh concrete - Part 7: Air Content - Pressure methods.*
- EN 12390-1, *Testing hardened concrete - Part 1: Shape, dimension and other requirements for specimens and moulds.*
- EN 12390-2, *Testing hardened concrete – Part 2: Making and curing specimens for strength tests.*
- EN 12390-3, *Testing hardened concrete - Part 3: Compressive strength of test specimens.*
- EN 12390-7, *Testing hardened concrete - Part 7: Density of hardened concrete.*
- EN 12390-8, *Testing hardened concrete - Part 8: Depth of penetration of water under pressure.*
- EN 12504-1, *Testing concrete in structures – Part 1: Cored specimens - Taking, examining and testing in compression.*
- EN 12504-2, *Testing concrete in structures – Part 2: Non destructive testing - determination of rebound number.*
- prEN 12504-4:1998-07, *Testing concrete in structures – Part 4: Determination of ultrasonic pulse velocity.*
- EN 12696, *Cathodic protection of steel in concrete.*
- EN 13395-1, *Products and systems for the protection and repair of concrete structures - Test methods - Determination of workability - Part 1: Test for flow thixotropic mortars.*
- EN 13395-2, *Products and systems for the protection and repair of concrete structures - Test methods - Determination of workability - Part 2: Test for flow of grout or mortar.*
- EN 13395-3, *Products and systems for the protection and repair of concrete structures - Test methods - Determination of workability - Part 3: Test for flow of repair concrete.*
- EN 13395-4, *Products and systems for the protection and repair of concrete structures - Test methods - Determination of workability - Part 4: Application of repair mortar overhead.*
- ENV 13670-1, *Execution of concrete structures - Part 1: Common.*

**EN 1504-10:2003 (E)**

PrCEN/TS 14038-1:2000-09, *Electrochemical re-alkalisation of re-inforced concrete – Part 1: Re-alkalisation.*

prEN 14038-2<sup>1)</sup>, *Electrochemical re-alkalisation and chloride extraction treatments for reinforced concrete – Part 2: Chloride extraction.*

prEN 14487-1:2002-06, *Sprayed concrete – Part 1: Definitions, specifications and conformity.*

prEN 14487-2:2003, *Sprayed concrete – Part 2: Execution of structures.*

prEN 14629:2003-03, *Products and systems for the protection and repair of concrete structures – Test methods - Determination of chloride content in hardened concrete.*

prEN 14630:2003-03, *Products and systems for the protection and repair of concrete structures – Test methods - Determination of carbonation depth in hardened concrete by the phenolphthalein method.*

EN 24624, *Paint and varnishes – Pull-off test (ISO 6424:1978).*

EN ISO 2409-6, *Method for tests for paints - Part 6: Cross Cut Test.*

EN ISO 2808, *Paint and varnishes – Determination of film thickness (ISO 2808:1997).*

EN ISO 3274, *Geometrical Product Specifications (GPS) - Surface texture: Profile method - Nominal characteristics of contact (stylus) instruments (ISO 3274:1996).*

EN ISO 4288:1997, *Geometrical Product Specifications (GPS) – Surface texture: Profile Method – Rules and procedures of the assessment of surface texture (ISO 4288:1996).*

EN ISO 4628-1:2003, *Paints and varnishes - Evaluation of degradation of coatings - Designation of quantity and size of defects, and of intensity of uniform changes in appearance - Part 1: General introduction and designation system (ISO 4628-1:2003)*

EN ISO 4628-2:2003, *Paints and varnishes - Evaluation of degradation of coatings - Designation of quantity and size of defects, and of intensity of uniform changes in appearance - Part 2: Assessment of degree of blistering (ISO 4628-2:2003).*

EN ISO 4628-3:2003, *Paints and varnishes - Evaluation of degradation of coatings - Designation of quantity and size of defects, and of intensity of uniform changes in appearance - Part 3: Assessment of degree of rusting (ISO 4628-3:2003).*

EN ISO 4628-4:2003, *Paints and varnishes - Evaluation of degradation of coatings - Designation of quantity and size of defects, and of intensity of uniform changes in appearance - Part 4: Assessment of degree of cracking (ISO 4628-4:2003).*

prEN ISO 4628-5:2003-04, *Paints and varnishes – methods of tests for paints, designation of intensity, quantity and size of common types of defects – Part 5: Designation of degree of flaking.*

EN ISO 4628-6, *Paints and varnishes - Evaluation of degradation of paint coatings - Designation of intensity, quantity and size of common types of defect - Part 6: Rating of degree of chalking by tape method (ISO 4628-6:1990).*

EN ISO 8501-1, *Preparation of steel substrates before application of paints or related products - Visual assessment of surface cleanliness - Part 1: Rust grades and preparation grades of uncoated steel substrate and of steel substrate after overall removal of previous coatings (ISO 8501-1:1988).*

EN ISO 8501-1, *Supplement to Part 1, Preparation of steel substrates before application of paints or related products - Visual assessment of surface cleanliness – Informative Supplement to Part 1: Representative photographic examples of the change of appearance imparted to steel when blast-cleaned with different abrasives (ISO 8501-1:1988/Suppl:1994).*

ENV ISO 8502-1, *Preparation of steel substrates before application of paints or related products – Tests for the assessment of surface cleanliness – Part 1: Field test for soluble iron corrosion products (ISO/TR 8502-1:1991).*

EN ISO 8502-2, *Preparation of steel substrates before application of paints or related products – Tests for the assessment of surface cleanliness – Part 2: Laboratory determination of chloride on cleaned surfaces (ISO 8502-2:1992).*

EN ISO 8502-3, *Preparation of steel substrates before application of paints or related products – Tests for the assessment of surface cleanliness – Part 3: Assessment of dust on steel surfaces prepared for painting (pressure-sensitive tape method) (ISO 8502-3:1992).*

EN ISO 8502-4, *Preparation of steel substrates before application of paints or related products - Tests for the assessment of surface cleanliness – Part 4: Guidance on the estimation of the probability of condensation prior to paint application (ISO 8502-4:1993).*

ISO 4677-1, *Atmospheres for conditioning and testing - Determination of relative humidity - Part 1: Aspirated psychrometer method.*

ISO 4677-2, *Atmospheres for conditioning and testing - Determination of relative humidity - Part 2: Whirled psychrometer method.*

ISO 7031, *Concrete hardened - Determination of permeability.*

ISO 8047, *Concrete hardened - Determination of ultrasonic pulse velocity testing.*

### 3 Terms and definitions

For the purposes of this European Standard, the following terms and definitions apply in addition to those given in parts 1 and 9 of this standard some of which are included to assist users of this standard.

#### 3.1

##### **appropriate person**

the freeholder and if different the person in legal occupation  
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#### 3.2

##### **bond**

the adhesion of the applied product or system to the substrate

#### 3.3

##### **cement grout**

mixture of cement, water and in some cases admixtures

#### 3.4

##### **cementitious repair products and systems**

hydraulic or polymer hydraulic mortars, concretes and grouts

#### 3.5

##### **coating**

treatment to produce a continuous layer on the surface of concrete. The thickness is typically 0.1 mm to 5.0 mm. Particular applications may require a thickness greater than 5.0 mm

#### 3.6

##### **dew point**

temperature at which water vapour condenses

#### 3.7

##### **hydrophobic impregnation**

treatment of concrete to produce a water repellent surface. The pores and capillaries are not filled, but only lined. The visual appearance remains nearly unaffected

**EN 1504-10:2003 (E)****3.8****hydraulic mortars and hydraulic concrete (CC)**

mortars or concrete based on a hydraulic binder which is blended together with graded aggregates and may include admixtures and additions which, when mixed with mortar, set by hydrated reaction

**3.9****impregnation**

the treatment of concrete to reduce surface porosity and to strengthen the surface. The pores and capillaries are partly or totally filled. Usually the treatment results in a discontinuous thin film of 10 µm to 100 µm thickness on the concrete surface

**3.10****mortars or concrete**

hydraulic, polymer hydraulic and polymer mortar and concrete

**3.11****polymer hydraulic cement mortars and concrete (PCC)**

hydraulic mortars or concrete modified by the addition of a polymer

**3.12****polymer mortars and polymer concretes (PC)**

blended mixture of polymer binder and graded aggregate which set by polymerisation reaction

**3.13****preformed hole**

hole or slot formed or cut in concrete into which reinforcement or other fixing is to be anchored

**3.14****quality plan**

a programme to ensure that the activities of a process are undertaken to the intended design

**3.15****removal**

removing of contaminated, damaged and or sound parts of the substrate

**3.16****roughness**

the degree of irregularity of a surface

**3.17****roughening**

removal of the substrate by removing matter of the substrate to a maximum of 15 mm

**3.18****smoothing coat**

a coating applied to a surface to fill voids, cracks, and cavities or to level an uneven surface. The purpose is to prepare the surface for the application of protection systems

**3.19****spray fog**

air born debris resulting from the application of sprayed concrete or mortar which may form an unwanted coat on the substrate

**3.20****sprayed mortar or concrete**

mortar or concrete applied under pressure through a nozzle delivered through pipes

**3.21****substrate**

the surface on which a protection or repair material is to be applied

**3.22****wet on wet**

application of a cementitious mortar or concrete onto the surface of a similar material which has set but not hardened

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**EN 1504-10:2003 (E)****4 Structural stability during preparation, protection and repair**

Safety and stability before, during and after repair shall be maintained in accordance with Part 9 of this Standard.

Any period required for gain of strength of the repair products and systems shall be a part of the duration of the repair.

**5 General requirements**

Consideration shall be given to the chemical, electrochemical and physical condition of the substrate and any contaminants, the ability of the structure to accept loading, movement and vibration during protection and repair, ambient conditions, and the characteristics of the materials contained in the structure and those of the protection and repair products and systems.

The following requirements shall be met:

- The achievement of the required condition of the substrate regarding cleanliness, roughness, cracking, tensile and compressive strength, chloride or other contaminant and their penetration, depth of carbonation, moisture content, temperature and degree of corrosion of reinforcement.
- The achievement of the compatibility of the original concrete and reinforcement with the protection or repair products and systems and compatibility between any different products and systems, including avoiding the risk of creating conditions which may cause corrosion.
- The achievement of the specified properties of products and systems when applied and in their hardened condition regarding the fulfilment of their purpose for protection and repair of the structure.
- The achievement of the required storage and application conditions regarding ambient temperature, humidity and dew point, wind force and precipitation and any temporary protection which is needed.

**6 Methods of protection and repair**

The principles and methods of protection and repair given in ENV 1504-9 are described below excluding those methods specified in another EN or European Technical Approval.

The excluded methods are given below. Information on methods 1.4, 1.6 and 11.3 is given in informative Annex A, on 7.3 and 7.5 in a standard in preparation and on 10.1 in the EN 12696.

The information on methods 1.4, 1.6 and 11.3 is for information only and is not to be regarded as part of this standard.

Methods excluded :

Method 1.4	Locally bandaged cracks	(See informative Annex A)
Method 1.6	Transferring cracks into joints	(See informative Annex A)
Method 1.7	Erecting external panels	
Method 1.8	Applying membranes	
Method 2.3	Sheltering or overcladding	
Method 2.4	Electrochemical treatment	
Method 3.4	Replacing elements	

Method 4.7	Prestressing (post tensioning)	
Method 7.3	Electrochemical re-alkalisation of carbonated concrete	(See prEN 14038-1:2000-09)
Method 7.5	Electrochemical chloride extraction	(See EN 14038-2 <sup>1</sup> )
Method 10.1	Applying electrical potential	(See EN 12696)
Method 11.3	Applying inhibitors in or to the concrete	(See informative Annex A)

The preparation, application, quality control and maintenance for each method shall comply with Clauses 7,8,9 and 10 of part of EN 1504.

The relevant sub-clauses are given below in Table 1 for each method together with any deviations, additions, necessary precautions and limitations.

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