

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

The European Standard EN 1504-3:2005 has the status of a
British Standard

ICS 91.080.40; 01.040.91

National foreword

This British Standard is the official English language version of EN 1504-3:2005.

EN 1504-3 is a candidate "harmonized" European standard and fully takes into account the requirements of the European Commission mandate M/128, Products related to concrete, mortar and grout, given under the EU Construction Products Directive (89/106/EEC), and is intended to lead to CE marking. The date of applicability of EN 1504-3 as a harmonized European Standard, i.e. the date after which this standard may be used for CE marking purposes, is subject to an announcement in the *Official Journal of the European Communities*.

The Commission in consultation with Member States has agreed a transition period for the co-existence of harmonized European Standards and their corresponding national standard(s). It is intended that this period will comprise a period, usually nine months, after the date of the European Standard, during which any required changes to national regulations are to be made, followed by a further period, usually of 12 months, for the implementation of CE marking. At the end of this co-existence period, the national standards(s) will be withdrawn.

EN 1504-3 is the subject of transitional arrangements agreed under the Commission mandate. In the UK, there are no corresponding national standards of national origin.

The UK participation in preparation of EN 1504-3:2005 was entrusted by Technical Committee B/517, Concrete, to Subcommittee B/517/8, Protection and repair of concrete structures, which has the responsibility to:

- aid enquirers to understand the text;
- present to the responsible international/European committee any enquiries on the interpretation, or proposals for change, and keep UK interests informed;
- monitor related international and European developments and promulgate them in the UK.

A list of organizations represented on this committee can be obtained on request to its secretary.

Summary of pages

This document comprises a front cover, an inside front cover, page i, a blank page, the EN title page, pages 2 to 25 and a back cover.

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English Version

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

Produits et systèmes pour la protection et la réparation des structures en béton - Définitions, exigences, maîtrise de la qualité et évaluation de la conformité - Partie 3 : Réparation structurale et réparation non structurale

Produkte und Systeme für den Schutz und die Instandsetzung von Betontragwerken - Definitionen, Anforderungen, Qualitätsüberwachung und Beurteilung der Konformität - Teil 3: Statisch und nicht statisch relevante Instandsetzung

This European Standard was approved by CEN on 29 April 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 1504-3:2005) 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 2006, and conflicting national standards shall be withdrawn at the latest by December 2008.

It has been developed by sub-committee 8 "Products and systems for the protection and repair of concrete structures" (Secretariat AFNOR).

This European Standard does not supersede any other European Standard.

European Standard 1504 has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association and supports essential requirements of EU Construction Products Directive (89/106/EC). For the relationship between Part 3 and the EU Directive, see compulsory informative Annex ZA, which is an integral part of this document.

This European Standard includes an informative Annex A, dealing with factory production control, informative Annex B, dealing with special applications and an informative Annex C dealing with the release of dangerous substances.

This document is one part of the European Standard on "*Products and systems for the protection and repair of concrete structures – Definitions, requirements, quality control and evaluation of conformity*". The other parts are listed below:

- *Part 1: Definitions*
- *Part 2: Surface protection systems for concretes*
- *Part 4: Structural bonding*
- *Part 5: Concrete injection*
- *Part 6: Anchoring of reinforcing steel bar¹*
- *Part 7: Reinforcement corrosion protection¹*
- *Part 8: Quality control and evaluation of conformity*
- *Part 9: General principles for use of products and systems²*
- *Part 10: Site application of products and systems and quality control of the works*

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.

¹ To be published.

² ENV 1504-9 will be modified when adopted as EN according to finalisation of this European Standard.

1 Scope

This European Standard specifies requirements for the identification, performance (including durability) and safety of products and systems to be used for the structural and non-structural repair of concrete structures.

This European Standard covers repair mortars and concretes, possibly used in conjunction with other products and systems, to restore and/or to replace defective concrete and to protect reinforcement, necessary to extend the service life of a concrete structure exhibiting deterioration. The fields of application covered are in accordance with ENV 1504-9 as follows:

Principle 3	Concrete restoration	Method 3.1	Applying mortar by hand
		Method 3.2	Recasting with concrete
		Method 3.3	Spraying mortar or concrete
Principle 4	Structural strengthening	Method 4.4	Adding mortar or concrete
Principle 7	Preserving or restoring passivity	Method 7.1	Increasing cover to reinforcement with mortar or concrete
		Method 7.2	Replacing contaminated concrete

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 1015-17, *Methods of test for mortars for masonry – Part 17: Determination of water-soluble chloride content of fresh mortars*

EN 1504-1:2005, *Products and systems for the protection and repair of concrete structures – Definitions requirements, quality control and evaluation of conformity – Part 1: Definitions*

EN 1504-8:2004, *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 1504-9:1997, *Products and systems for the protection and repair of concrete structures – Definitions, requirements, quality control and evaluation of conformity – Part 9: General principles for 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*

EN 1767, *Products and systems for the protection and repair of concrete structures – Test methods – Infrared analysis*

EN 1770, *Products and systems for the protection and repair of concrete structures – Test methods – Determination of the coefficient of thermal expansion*

EN 1877-1, *Products and systems for the protection and repair of concrete structures – Test methods – Reactive functions related to epoxy resins – Part 1: Determination of epoxy equivalent*

- EN 1877-2, *Products and systems for the protection and repair of concrete structures – Test methods – Reactive functions related to epoxy resins – Part 2: Determination of amine functions using the total basicity number*
- EN 12190, *Products and systems for the protection and repair of concrete structures – Test methods – Determination of compressive strength of repair mortar*
- EN 12192-1, *Products and systems for the protection and repair of concrete structures – Granulometry analysis - Part 1: Test method for dry components of premixed mortar*
- EN 12617-4, *Products and systems for the protection and repair of concrete structures – Test methods – Part 4: Determination of shrinkage and expansion*
- EN 13036-4, *Road and airfield surface characteristics – Test methods – Part 4: Method for measurement of slip/skid resistance of a surface – The pendulum test*
- EN 13057, *Products and systems for the protection and repair of concrete structures – Test methods – Determination of resistance of capillary absorption*
- EN 13294, *Products and systems for the protection and repair of concrete structures – Test methods – Determination of stiffening time*
- EN 13295, *Products and systems for the protection and repair of concrete structures – Test methods – Determination of resistance to carbonation*
- EN 13395-1, *Products and systems for the protection and repair of concrete structures – Test methods – Determination of workability – Part 1: Test for flow of 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 13412, *Products and systems for the protection and repair of concrete structures – Test methods – Determination of modulus of elasticity in compression*
- EN 13501-1, *Fire classification of construction products and building elements – Part 1: Classification using test data from reaction to fire tests*
- EN 13687-1, *Products and systems for the protection and repair of concrete structures – Test methods – Determination of thermal compatibility – Part 1: Freeze-thaw cycling with de-icing salt immersion*
- EN 13687-2, *Products and systems for the protection and repair of concrete structures – Test methods – Determination of thermal compatibility – Part 2: Thunder-shower cycling (thermal shock)*
- EN 13687-4, *Products and systems for the protection and repair of concrete structures – Test methods – Determination of thermal compatibility – Part 4: Dry thermal cycling*
- EN ISO 3251, *Paints, varnishes and plastics – Determination of non-volatile matter content (ISO 3251:2003)*
- EN ISO 9514, *Paints and varnishes – Determination of the pot life of multicomponent coating systems – Preparation and conditioning of samples and guidelines for testing (ISO 9514:2005)*
- EN ISO 11358, *Plastics – Thermogravimetry (TG) of polymers – General principles (ISO 11358:1997)*

3 Terms and definitions

For the purposes of this European Standard, the terms and definitions given in EN 1504-1:2005, EN 1504-8:2004 and ENV 1504-9:1997 and the following apply.

3.1

bonding agent

component of a repair system used to promote adhesion of a repair mortar or concrete to a concrete substrate, for the purposes of achieving a permanent bond, which is not affected by moisture and strong alkali in service

3.2

stiffening time

time beyond which the workability of a hydraulic or polymer modified hydraulic cement repair concrete or mortar is lost

3.3

restrained shrinkage/expansion

ability of a repair product or system, when bonded onto a prepared concrete substrate, to accommodate stresses due to volume change

3.4

capillary absorption

ability of the repair product or system to absorb water without application of hydrostatic pressure

3.5

thermal compatibility

property of a repair product or system, when bonded onto a prepared concrete substrate, to accommodate cyclic changes in temperature

3.6

high flow mortar or concrete

repair product formulated to exhibit extremely high flow characteristics, outside the limits of normal methods of test, and which flows through narrow gaps and around areas of congested reinforcement, without bleeding or segregation

4 Performance characteristics for intended uses

Table 1 lists the performance characteristics of structural and non-structural repair products and systems which are required for "all intended uses" or "for certain intended uses" according to the "principles" and "methods" defined in ENV 1504-9.

Performance characteristics which are required for "all intended uses" are marked with ■ .

All other performance characteristics which are marked with □ may be required for "certain intended uses".

The repair system shall be selected based on an assessment of the actual or potential causes of deterioration and consideration of the appropriate principles and methods for protection and repair specified in ENV 1504-9.

Table 1 — Performance characteristics of structural and non-structural repair products for all intended uses and certain intended uses

Performance characteristics	Repair principle			
	3		4	7
	Repair method			
	3.1, 3.2	3.3 ^a	4.4	7.1, 7.2
Compressive strength	■	■	■	■
Chloride ion content ^b	■	■	■	■
Adhesive bond	■	■	■	■
Restrained shrinkage/expansion ^c	■	■	■	■
Durability a) Carbonation resistance ^{b d}	■	■	■	■
Durability b) Thermal compatibility Part 1 or Part 2 or Part 4 of EN 13687 ^e	□	□	□	□
Elastic modulus	□	□	■	□
Skid Resistance ^f	□		□	□
Coefficient of thermal expansion ^{c g}	□	□	□	□
Capillary absorption (water permeability) ^{e h}	□	□	□	□
Repair methods as defined in ENV 1504-9:1997				
3.1 Concrete restoration by applying mortar by hand.				
3.2 Concrete restoration by recasting with concrete.				
3.3 Concrete restoration by spraying mortar or concrete.				
4.4 Structural strengthening by adding mortar or concrete.				
7.1 Increasing cover to reinforcement with additional cementitious mortar or concrete.				
7.2 Replacing contaminated or carbonated concrete.				
■ For all intended uses.				
□ For certain intended uses.				
^a Because of the nature of the method of application, some of the test methods may be modified. Refer to EN 14487-1.				
^b This requirement is not relevant for repair of unreinforced concrete.				
^c If thermal cycling is undertaken this test is not required in addition.				
^d Where the repair system includes a surface protection system with proven protection against carbonation (see EN 1504-2) or is a PC mortar this test is not relevant.				
^e Depending on environmental exposure conditions.				
^f Relevant to trafficked areas only.				
^g Relevant to PC only.				
^h Corrosion resistance is addressed by the requirements for the chloride content and water permeability of the product.				

5 Requirements

5.1 Identification requirements

The manufacturer shall undertake selected representative initial identification tests for the product or system as specified in Table 2. These tests may be used to confirm the composition of the product at any time. Acceptable tolerances are given in Table 2. The manufacturer shall hold the test records.

Table 2 — Identification requirements

Property	Test method	Tolerances on values declared by manufacturer
Granulometry of dry components	EN 12192-1	Manufacturers declared values and tolerances
Infrared analysis ^a	EN 1767	Confirmed by comparison ^b
Compressive strength	EN 12190	Greater than 80 % of manufacturers declared value
Density	EN 12190	± 5 %
Stiffening time ^c	EN 13294	Manufacturers declared value and tolerances
Workability – thixotropic mortar ^d	EN 13395-1	Manufacturers declared value and tolerances
Workability – flow of mortar ^d	EN 13395-2	Manufacturers declared value and tolerances
Workability – flow of concrete ^d	EN 13395-3	Manufacturers declared value and tolerances
Thermogravimetric analysis ^a	EN ISO 11358	Confirmed by comparison ^b
Epoxide equivalent ^e	EN 1877-1	± 5 %
Amine function ^e	EN 1877-2	± 6 %
Pot life ^e	EN ISO 9514	± 20 %
Volatile/non-volatile matter in liquid components ^a	EN ISO 3251	± 10 %

^a For all products containing organic materials.
^b Check for signs of change in composition.
^c As an alternative method, the change in workability with time by methods EN 13395 Parts 1, 2 and 3 may be used.
^d Depending on the nature of the material.
^e For PCs only.

5.2 Performance requirements

The manufacturer shall undertake initial performance tests on repair products in accordance with Table 3 and the product shall comply with the requirements.

Table 3 — Performance requirements for structural and non-structural repair products

Item No.	Performance characteristic	Reference substrate (EN 1766)	Test method	Requirement			
				Structural		Non-Structural	
				Class R4	Class R3	Class R2	Class R1
1	Compressive strength	None	EN 12190	≥ 45 MPa	≥ 25 MPa	≥ 15 MPa	≥ 10 MPa
2	Chloride ion Content	None	EN 1015-17	≤ 0,05 %		≤ 0,05 %	
3	Adhesive bond	MC(0,40)	EN 1542	≥ 2,0 MPa	≥ 1,5 MPa	≥ 0,8 MPa ^a	
4	Restrained shrinkage / expansion ^{b c}	MC(0,40)	EN 12617-4	Bond strength after test ^{d e}			No requirement
				≥ 2,0 MPa	≥ 1,5 MPa	≥ 0,8 MPa ^a	
5	Carbonation ^f Resistance	None	EN 13295	$d_k \leq$ control concrete (MC(0,45))		No requirement ^g	
6	Elastic modulus	None	EN 13412	≥ 20 GPa	≥ 15 GPa	No requirement	
7	Thermal compatibility ^{f h} Part 1, Freeze-thaw	MC(0,40)	EN 13687-1	Bond strength after 50 cycles ^{d e}			Visual inspection after 50 cycles ^e
				≥ 2,0 MPa	≥ 1,5 MPa	≥ 0,8 MPa	
8	Thermal compatibility ^{f h} Part 2, Thunder shower	MC(0,40)	EN 13687-2	Bond strength after 30 cycles ^{d e}			Visual inspection after 30 cycles ^e
				≥ 2,0 MPa	≥ 1,5 MPa	≥ 0,8 MPa ^a	
9	Thermal compatibility ^{f h} Part 4, Dry cycling	MC(0,40)	EN 13687-4	Bond strength after 30 cycles ^{d e}			Visual inspection after 30 cycles ^e
				≥ 2,0 MPa	≥ 1,5 MPa	≥ 0,8 MPa ^a	
10	Skid resistance	None	EN 13036-4	Class I : > 40 units wet tested Class II : > 40 units dry tested Class III : > 55 units wet tested		Class I : > 40 units wet tested Class II : > 40 units dry tested Class III : > 55 units wet tested	
11	Coefficient of thermal expansion ^c	None	EN 1770	Not required if tests 7, 8 or 9 are carried out, otherwise declared value		Not required if tests 7,8 or 9 are carried out, otherwise declared value	
12	Capillary Absorption	None	EN 13057	≤ 0,5 kg·m ⁻² ·h ^{-0,5}		≤ 0,5 kg·m ⁻² ·h ^{-0,5}	No requirement
<p>Requirements for Repair Principles 3, 4 and 7: Method 3.1 - Concrete restoration by applying mortar by hand. Method 3.2 - Concrete restoration by recasting with concrete. Method 3.3 - Concrete restoration by spraying mortar or concrete. Method 4.4 - Structural strengthening by adding mortar or concrete. Method 7.1 - Increasing cover to reinforcement with additional cementitious mortar or concrete. Method 7.2 - Replacing contaminated or carbonated concrete.</p>							
<p>^a The value of 0,8 MPa is not required where cohesive failure occurs in the repair material. If cohesive failure occurs a minimum tensile strength of 0,5 MPa is required. ^b Not required for Repair Method 3.3. ^c Not required if thermal cycling is undertaken. ^d Mean value with no single value less than 75 % of the minimum requirement. ^e Maximum permissible average crack width ≤ 0,05 mm with no crack ≥ 0,1 mm and no delamination. ^f For durability. ^g Not suitable for protection against carbonation unless the repair system includes a surface protection system with proven protection against carbonation (see EN 1504-2). ^h Choice of method depends on the exposure conditions. When a product satisfies Part 1 it is deemed to satisfy Part 2 and Part 4.</p>							

5.3 Special applications

See Annex B (informative), Table B.1 for special applications of repair products.

5.4 Release of dangerous substances

Repair products shall not release substances dangerous to health, hygiene and the environment. See Annex C (informative).

5.5 Reaction to fire

For repair products to be used in elements subject to fire requirements the manufacturer shall declare the reaction to fire classification of the repair product.

For repair products containing equal or less than 1 % by mass or volume (whichever is the most onerous) of homogeneously distributed organic materials the declaration may be fire Class A1 without the need to test.

Hardened repair products containing more than 1 % by mass or volume (whichever is the most onerous) of homogeneously distributed organic materials shall be classified in accordance with EN 13501-1 and the appropriate reaction to fire class declared.

6 Sampling

General requirements for sampling are set out in Clause 4 of EN 1504-8:2004.

7 Evaluation of conformity

7.1 General

General requirements for procedures for evaluation of conformity are set out in EN 1504-8.

7.2 Initial type testing

General requirements for initial type testing are set out in EN 1504-8.

7.3 Factory production control

The manufacturer shall operate a factory production control (FPC) system to ensure that production continues to meet the identification and performance requirements set out in 5.1 and 5.2 of this document.

For FPC, the manufacturer can select representative identification or performance tests or may select other test methods. Such other FPC test methods shall be correlated to the initial identification and performance test methods to ensure conformity of the product to the requirements of this document. Such correlation shall be clearly documented in the FPC system.

The FPC shall be undertaken in accordance with EN 1504-8.

Guidance on the frequency of identification and performance tests for FPC is given in Annex A . Frequencies may need to be increased during initial production or following an incident of non-conformity.

Any deviation from this guidance shall be justified by documented evidence which demonstrates equivalence.

7.4 Assessment, surveillance and certification of factory production control

Provisions for the assessment, surveillance and certification of FPC are given in EN 1504-8:2004, Annex A.

8 Marking and labelling

Requirements for marking and labelling are set out in Clause 6 of EN 1504-8:2004.

NOTE For CE marking and labelling ZA.3 applies.

Annex A (informative)

Frequency of tests for factory production control

Table A.1 – Frequency of tests for factory production control

Identification characteristics/property	Cement based products	Epoxy resins		
Identification of the components				
General appearance and colour	A	A		
Granulometry of dry components	B	B		
Infra-red analysis ^{a b}	D	C		
Epoxide equivalent ^b	-	C		
Amine function ^b	-	C		
Volatile/non-volatile matter in liquid components	B	B		
Identification of the fresh mixture or the hardened samples				
Stiffening time	B	B		
Workability				
Pot life			-	A
Compressive strength and density			B	B
} alternative				
<p>A Every batch, (as defined in EN 1504-8).</p> <p>B Every 10 batches, every two weeks, or every 1 000 t, whichever is the sooner (that is, whichever requires the most frequent testing).</p> <p>C Twice per year.</p> <p>D Once per year.</p>				
<p>^a For all products containing organic components.</p> <p>^b Documentation supplied by the raw material supplier will be deemed to satisfy this requirement.</p>				

Annex B (informative)

Test methods for special applications

Table B.1 contains a list of additional test methods that may be considered for special applications or may be applicable in specific countries. Conventional repair products and systems will not normally be tested by these test methods.

Such testing may be required for specific projects. Typical examples would be where information on the performance of a product is required under the following extreme conditions: high or low temperature; or exposure to sea water or other sources of high salt concentration.

Table B.1 — Test methods for special applications

Property	Test method	Reference concrete	Comments
Chloride ion ingress	EN 13396		Declared value (Not required where a surface protection system is specified)
Creep in compression ^a	EN 13584		Declared value
Chemical resistance	EN 13529 or ISO 2812-1		Declared value (Not required where a surface protection system is specified.)
Overhead application (for example repairs on the soffit of bridge beams)	EN 13395-4	MC (0,40)	Adhesive bond strength should satisfy requirement in line 3 Table 3 according to Class
^a For PCC repair mortars used in structural applications this test is not usually required if 60 % of the compressive strength at 28 d is used in design criteria.			

Annex C
(informative)

Release of dangerous substances

In the absence of specific requirements relating to substances dangerous to health, hygiene and the environment in this document, see Annex ZA.

Annex ZA (informative)

Clauses of this European Standard addressing the provisions of EU Construction Products Directive

ZA.1 Scope and relevant characteristics

This European Standard has been prepared under mandate M/128 "Products related to concrete, mortar and grout" given to CEN by the European Commission and the European Free Trade Association.

The clauses of this and other European Standards shown in this Annex meet the requirements of this Mandate given under the EU Construction Products Directive (89/106/EEC).

Compliance with these clauses confers a presumption of fitness of repair products and systems covered by this Annex for the intended uses indicated herein: reference shall be made to the information accompanying the CE marking.

WARNING Other requirements and other EU Directives, not affecting the fitness for intended uses, can be applicable to the construction product falling within the scope of this European Standard.

NOTE 1 In addition to any specific clauses relating to dangerous substances contained in this standard, there may be other requirements applicable to the products falling within its scope (e.g. transposed European legislation and national laws, regulations and administrative provisions). In order to meet the provisions of the EU Construction Products Directive, these requirements need also to be complied with, when and where they apply.

NOTE 2 An informative database of European and national provisions on dangerous substances is available at the Construction web site on EUROPA (accessed through <http://europa.eu.int/comm/enterprise/construction/internal/dangsub/dangmain.htm>).

This Annex establishes the conditions for the CE marking of the repair products and systems intended for the uses indicated in Table ZA.1 and shows the relevant clauses applicable.

This Annex has the same scope as Clause 1 of this standard and is defined by Table ZA.1.

Table ZA.1 — Scope and relevant clauses

Construction products:	Structural and non structural repair products for concrete, used by applying mortar by hand, by recasting with concrete, by spraying concrete or mortar, by increasing cover to reinforcement with additional cementitious mortar or concrete and structural strengthening by adding mortar or concrete, as covered in the scope of this Part of the European Standard.		
Intended use:	In buildings and civil engineering works		
Essential characteristics	Requirement clauses in this European Standard	Level(s) or class(es)	Notes: (expression of results)
Compressive strength	5.2 Performance requirements Table 3 (1) Compressive strength	None	Declared Class (subject to a threshold value in MPa)
Chloride ion content	5.2 Performance requirements Table 3 (2) Chloride ion content	None	Threshold value, %
Adhesive Bond	5.2 Performance requirements Table 3 (3) Adhesive bond	None	Threshold value, in MPa
Restrained shrinkage / expansion (dimensional stability), where required. Not required if thermal cycling is carried out	5.2 Performance requirements Table 3 (4) Restrained shrinkage / expansion	None	Declared value, in MPa (subject to a threshold value)
Carbonation Resistance (For durability of corrosion protection or inhibition), where relevant	5.2 Performance requirements Table 3 (5) Carbonation resistance	None	Pass/Fail
Elastic Modulus, where relevant	5.2 Performance requirements Table 3 (6) Elastic Modulus	None	Declared Value, in GPa (subject to a threshold value)
Thermal Compatibility (For durability) where relevant	5.2 Performance requirements Table 3 (7, 8 or 9) Thermal compatibility	None	Threshold value, in MPa
Skid resistance where relevant	5.2 Performance requirements. Table 3 (10) Skid resistance	None	According to National Regulations
Coefficient of thermal expansion (only for polymer concretes, where relevant)	5.2 Performance requirements Table 3 (11) Coefficient of thermal expansion	None	Declared value, per K ⁻¹
Capillary Absorption, where relevant	5.2 Performance requirements Table 3 (12) Capillary Absorption	None	Threshold value, kg·m ⁻² h ^{-0,5}
Reaction to fire	5.5 Reaction to fire	Euroclasses	Declared class
Dangerous substances	5.4 Release of dangerous substances	None	See NOTE 1 in ZA.1 and NOTE after Figure ZA.1. Manufacturer's declaration

The requirement on a certain essential characteristic is not applicable in those Member States (MSs) where there are no requirements on that characteristic. In this case, manufacturers placing their products on the market of these MSs are not obliged to determine nor to declare the performance of their products with regard to this characteristic and the option "No performance determined" (NPD) in the information accompanying the CE marking (see ZA.3) may be used.

ZA.2 Attestation of conformity

ZA.2.1 System(s) of attestation of conformity

The system of attestation of conformity for the products indicated in Table ZA.1 in accordance with the decision of the Commission 1999/469/EC as amended by 01/596/EC, as given for this product family in Annex III of the Mandate M/128 "Products related to concrete, mortar and grout", is shown in Table ZA.2 for the indicated intended use:

Table ZA.2 — System of attestation of conformity

Product(s)	Intended use(s)	Level(s) or class(es)	Attestation of conformity system(s)
Concrete protection and repair products	For uses with low performance requirements in buildings and civil engineering works	-	4
	For uses in buildings and civil engineering works	-	2+
Concrete protection and repair products	For uses subject to reaction to fire regulations	A1 ¹ , A2 ¹ , B ¹ , C ¹	1
		A1 ² , A2 ² , B ² , C ² , D, E	3
		(A1 to E) ³ , F	4
System 1: See CPD, Annex III.2 (i), without audit-testing of samples.			
System 2+: See CPD Annex III.2 (ii) (First possibility, including certification of the factory production control by an approved body on the basis of initial inspection of factory and of factory production control as well as of continuous surveillance, assessment and approval of factory production control).			
System 3: See CPD, Annex III.2(ii), Second possibility.			
System 4: See CPD Annex III.2(ii), Third possibility.			
¹ Products/materials for which a clearly identifiable stage in the production process results in an improvement of the reaction to fire classification (e.g. an addition of fire retardants or a limiting of organic material).			
² Products/materials not covered by footnote ¹ .			
³ Products/materials that do not require to be tested for reaction to fire (e.g. Products/materials of class A1 according to the Decision 96/603/EC, as amended by Decision 2000/605/EC).			

The attestation of conformity of the repair products in Table ZA.1 shall be based on the evaluation of conformity procedures indicated in Tables ZA.3 a) to ZA 3 f) resulting from the application of those clauses of this or other European Standards indicated therein.

Table ZA.3 a) — Assignment of evaluation of conformity tasks for repair products of Euroclasses A1¹, A2¹, B¹ or C¹, intended for uses other than those with low performance subject to reaction to fire regulations (system 2+ plus 1)

Tasks		Content of the task	Evaluation of conformity clauses to apply
Tasks for the manufacturer	Factory production control (FPC)	Parameters related to all characteristics in Table ZA.1	EN 1504-8, clause 5.5 clause 7 of EN 1504-3
	Further testing of samples taken at the factory	All relevant characteristics of Table ZA.1	EN 1504-8, clause 5.5
	Initial type testing	All relevant characteristics of Table ZA.1 except: Reaction to fire	EN 1504-8, clause 5.2 EN 1504-3, clause 7.2
Tasks for the Notified Body	Initial type testing	Reaction to fire	EN 1504-8, clause 5.2
	Initial inspection of factory and of FPC	Parameters related to all characteristics of Table ZA.1	EN 1504-8, clause 5.5 EN 1504-3, clause 7.3
	Continuous surveillance, assessments and approval of FPC	Parameters related to all characteristics of Table ZA.1, in particular: Reaction to fire	EN 1504-8, clause 7 EN 1504-3, clause 7.3

Table ZA.3 b) — Assignment of evaluation of conformity tasks for repair products of Euroclasses A1¹, A2¹, B¹ or C¹, intended for uses with low performance subject to reaction to fire regulations (system 4 plus 1)

Tasks		Content of the task	Evaluation of conformity clauses to apply
Tasks for the manufacturer	Factory production control FPC	Parameters related to all characteristics in Table ZA.1	EN 1504-8, clause 5.5 clause 7 of EN 1504-3
	Further testing of samples taken at the factory	All relevant characteristics of Table ZA.1	EN 1504-8, clause 5.5
	Initial type testing	All relevant characteristics of Table ZA.1 except: Reaction to fire	EN 1504-8, clause 5.2 EN 1504-3, clause 7.2
Tasks for the Notified Body	Initial type testing	Reaction to fire	EN 1504-8, clause 5.2
	Initial inspection of factory and of FPC	Parameters related to all characteristics of Table ZA.1.	EN 1504-8, clause 5.5 EN 1504-3, clause 7.3
	Continuous surveillance, assessments and approval of FPC	Parameters related to all characteristics of Table ZA.1, in particular: Reaction to fire	EN 1504-8, clause 7 EN 1504-3, clause 7.3

Table ZA.3 c) — Assignment of evaluation of conformity tasks for repair products of Euroclasses A1², A2², B², C², D or E intended for use other than those with low performance subject to reaction to fire regulations (system 2+ plus 3)

Tasks		Content of the task	Evaluation of conformity clauses to apply
Tasks for the manufacturer	Factory production control (FPC)	Parameters related to all characteristics in Table ZA.1	EN 1504-8, clause 5.5 clause 7 of EN 1504-3
	Further testing of samples taken at the factory	All relevant characteristics of Table ZA.1	EN 1504-8, clause 5.5
	Initial type testing by the manufacturer	All characteristics of Table ZA.1 except reaction to fire	EN 1504-8, clause 5.2 EN 1504-3, clause 7.2
Tasks for the notified test body	Initial type testing by the notified test body	Reaction to fire	EN 1504-8, clause 5.2
Tasks for the notified certification body	Certification of FPC by the FPC certification body on the basis of	Initial inspection of factory and of FPC	EN 1504-8, clause 5.5 EN 1504-3, clause 7.3
		Continuous surveillance, assessments and approval of FPC	EN 1504-8, clause 7 EN 1504-3, clause 7.3

Table ZA.3 d) — Assignment of evaluation of conformity tasks for repair products of Euroclasses A1², A2², B², C², D or E intended for uses with low performance subject to reaction to fire regulations (system 4 plus 3)

Tasks		Content of the task	Evaluation of conformity clauses to apply
Tasks for the manufacturer	Factory production control (FPC)	Parameters related to all characteristics in Table ZA.1	EN 1504-8, clause 5.5 EN 1504-3, clause 7.3
	Initial type testing by the manufacturer	All relevant characteristics of Table ZA.1 except: Reaction to fire	EN 1504-8, clause 5.2 EN 1504-3, clause 7.2
Tasks for the notified test body	Initial type testing by the notified test body	Reaction to fire	EN 1504-8, clause 5.2

Table ZA.3 e) — Assignment of evaluation of conformity tasks for repair products of any intended uses other than those with low performance not subject to reaction to fire regulation or of Euroclasses (A1 to E)³ or F intended for uses other than those with low performance subject to reaction to fire regulations (system 2+ plus 4)

Tasks		Content of the task	Evaluation of conformity clauses to apply
Tasks for the manufacturer	Factory production control (FPC)	Parameters related to all characteristics in Table ZA.1	EN 1504-8, clause 5.5 clause 7 of EN 1504-3
	Further testing of samples taken at the factory	All relevant characteristics of Table ZA.1	EN 1504-8, clause 5.5
	Initial type testing by the manufacturer	All relevant characteristics of Table ZA.1 except: Reaction to fire	EN 1504-8, clause 5.2 EN 1504-3, clause 7.2
Tasks for the notified certification body	Certification of FPC by the FPC certification body on the basis of	Initial inspection of factory and of FPC	EN 1504-8, clause 5.5 EN 1504-3, clause 7.3
		Continuous surveillance, assessments and approval of FPC	Parameters related to all characteristics of Table ZA.1, in particular: Reaction to fire

Table ZA.3 f) — Assignment of evaluation of conformity tasks for repair products intended for uses with low performance not subject to reaction to fire regulations or of Euroclasses (A1 to E)³ or F intended for uses with low performance subject to reaction to fire regulations (system 4 plus 4)

Tasks		Content of the task	Evaluation of conformity clauses to apply
Tasks for the manufacturer	Factory production control (FPC)	Parameters related to all characteristics in Table ZA.1	EN 1504-8, clause 5.5 clause 7 of EN 1504-3
	Initial type testing	All relevant characteristics of Table ZA.1	EN 1504-8, clause 5.2

ZA.2.2 EC Certificate and Declaration of conformity

Repair products under system 2+ plus 1 or under system 4 plus 1: When compliance with the conditions of this Annex is achieved, the certification body shall draw up a certificate of conformity (EC Certificate of conformity), which entitles the manufacturer to affix the CE marking. The certificate shall include:

- name, address and identification number of the certification body;
- name and address of the manufacturer, or his authorised representative established in the EEA, and place of production;
- description of the product (type, identification, use);
- provisions to which the product conforms (Annex ZA of EN 1504-3);
- particular conditions applicable to the use of the product (e.g. provisions for use under certain conditions, etc.);
- the number of the certificate;

- conditions and period of validity of the certificate, where applicable;
- name of, and positions held by, the person empowered to sign the certificate.

In addition, the manufacturer shall draw up a declaration of conformity (EC Declaration of conformity) including the following:

- name and address of the manufacturer, or his authorised representative established in the EEA;
- name and address of the certification body;
- description of the product (type, identification, use, ...) and a copy of the information accompanying the CE marking;
- provisions to which the product conforms (Annex ZA of EN 1504-3);
- particular conditions applicable to the use of the product (e.g. provisions for use under certain conditions, etc.);
- number of the accompanying EC Certificate of conformity;
- name of, and position held by, the person empowered to sign the declaration on behalf of the manufacturer or of his authorised representative.

Repair products under system 2+ plus 3 or under system 4 plus 3: When compliance with the conditions of this Annex is achieved, and once the notified body has drawn up the certificate mentioned below, the manufacturer or his agent established in the EEA shall prepare and retain a declaration of conformity, which entitles the manufacturer to affix the CE marking. This declaration shall include:

- name and address of the manufacturer, or his authorised representative established in the EEA, and the place of production;
- description of the product (type, identification, use,), and copy of the information accompanying the CE marking;
- provisions to which the product conforms (Annex ZA of EN 1504-3);
- particular conditions applicable to the use of the product (e.g. provisions for use under certain conditions, etc.);
- the number of the accompanying factory production control certificate (for system 2+ plus 3);
- name of, and position held by, the person empowered to sign the declaration on behalf of the manufacturer or of his authorised representative;
- name and address of the notified laboratory(ies).

The declaration shall be accompanied by a factory production control certificate (for system 2 plus 3) drawn up by the notified body, which shall contain, in addition to the information above, the following:

- name and address of the notified body;
- the number of the factory production control certificate;
- conditions and period of validity of the certificate, where applicable;
- name of, and position held by, the person empowered to sign the certificate.

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Repair products under system 2+ plus 4 or under system 4 plus 4: When compliance with this Annex is achieved, the manufacturer or his agent established in the EEA shall prepare and retain a declaration of conformity (EC Declaration of conformity), which entitles the manufacturer to affix the CE marking. This declaration shall include:

- name and address of the manufacturer, or his authorised representative established in the EEA, and the place of production;
- description of the product (type, identification, use, ...), and copy of the information accompanying the CE marking;
- provisions to which the product conforms (Annex ZA of EN 1504-3);
- particular conditions applicable to the use of the product (e.g. provisions for use under certain conditions, etc.);
- name of, and position held by, the person empowered to sign the declaration on behalf of the manufacturer or of his authorised representative.

The declaration shall be accompanied by a factory production control certificate (for system 2+ plus 4), drawn up by the notified body, which shall contain, in addition to the information above, the following:

- name and address of the notified body;
- the number of the factory production control certificate;
- conditions and period of validity of the certificate, where applicable;
- name of, and position held by, the person empowered to sign the certificate.

The above mentioned EC Declarations and EC Certificate shall be presented in the official language or languages of the Member State in which the product is to be used.

ZA.3 CE marking and labelling

The manufacturer or his authorised representative established within the EEA is responsible for the affixing of the CE marking. The CE marking symbol to affix shall be in accordance with Directive 93/68/EC and shall be shown on the repair product (or when not possible it may be on the accompanying label, the packaging or on the accompanying commercial documents e.g. a delivery note). The following information shall accompany the CE marking symbol:

- identification number of the certification body (only for products under systems 1+, 1 and 2+);
- name or identifying mark and registered address of the producer;
- the last two digits of the year in which the marking is affixed;
- number of the EC Certificate of conformity or factory production control certificate (if relevant);
- reference to this European Standard;
- description of the product: generic name, material, dimensions, ... and intended use;

- information on those relevant essential characteristics listed in Table ZA.1 which are to be declared presented as :
 - declared values and, where relevant, level or class (including "pass" for pass/fail requirements, where necessary) to declare for each essential characteristic as indicated in "Notes" in Table ZA.1;
 - "No performance determined" for characteristics where this is relevant;
 - as an alternative, a standard designation which shows some or all of the relevant characteristics (where the designation covers only some characteristics, it will need to be supplemented with declared values for other characteristics as above).

The "No performance determined" (NPD) option may not be used where the characteristic is subject to a threshold level. Otherwise, the NPD option may be used when and where the characteristic, for a given intended use, is not subject to regulatory requirements in the Member State of destination.

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Figure ZA.1 gives an example for a repair mortar Class R3 for the repair principles 3.1,3.2,4.4,71.and 7.2 of the information accompanying the CE-marking.


 01234	<p><i>CE conformity marking, consisting of the "CE"-symbol given in Directive 93/68/EEC.</i></p> <p><i>Identification number of the certification body (where relevant)</i></p>
<p>AnyCo Ltd, PO Box 21, B-1050</p> <p>05</p> <p>01234-CPD-00234</p>	<p><i>Name or identifying mark and registered address of the producer</i></p> <p><i>Last two digits of the year in which the marking was affixed</i></p> <p><i>Certificate number (where relevant)</i></p>
<p>EN 1504-3</p> <p>Concrete repair product for structural repair CC mortar (based on hydraulic cement)</p> <p>Compressive strength: class R 3</p> <p>Chloride ion content: $\leq 0,05 \%$</p> <p>Adhesive Bond: $\geq 1,5 \text{ MPa}$</p> <p>Carbonation resistance: Passes</p> <p>Elastic modulus: 21 GPA</p> <p>Thermal compatibility part 1: $\geq 1,5 \text{ MPa}$</p> <p>Capillary absorption: $\leq 0,5 \text{ kg} \cdot \text{m}^{-2} \cdot \text{h}^{-0,5}$</p> <p>Dangerous substances: comply with 5.4</p> <p>Reaction to fire: Euroclass E</p>	<p><i>No. of European Standard</i></p> <p><i>Description of product</i></p> <p><i>and</i></p> <p><i>information on regulated characteristics</i></p>

Figure ZA.1 — Example CE marking information

The product should be accompanied, when and where required and in the appropriate form, by documentation listing any legislation on dangerous substances for which compliance is claimed, together with any information required by that legislation.

NOTE European legislation without national derogations need not be mentioned.

Bibliography

- [1] 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*
- [2] 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*
- [3] EN 13396, *Products and systems for the protection and repair of concrete structures – Test methods – Measurement of chloride ion ingress*
- [4] EN 13529, *Products and systems for the protection and repair of concrete structures – Test methods – Resistance to severe chemical attack*
- [5] EN 13584, *Products and systems for the protection and repair of concrete structures – Test methods – Determination of creep in compression for repair products*
- [6] EN 14487-1, *Sprayed concrete – Part 1: Definitions, specifications and conformity*
- [7] ISO 2812-1, *Paints and varnishes – Determination of resistance to liquids – Part 1: General methods*