BRITISH STANDARD

BS EN
1504-4:2004

Products and systems for the protection and repair of concrete structures — Definitions, requirements, quality control and evaluation of conformity —

Part 4: Structural bonding

The European Standard EN 1504-4:2004 has the status of a British Standard

ICS 91.080.40

BSI
British Standards

National foreword

This British Standard is the official English language version of EN 1504-4:2004.

EN 1504-4 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 1504-4:2004 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 availability 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 At the end of this co-existence period, the national standard(s) will be withdrawn.

EN 1504-4:2004 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 its preparation 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 the UK interests informed;
- monitor related international and European developments and promulgate them in the UK.

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

Cross-references

The British Standards which implement international or European publications referred to in this document may be found in the *BSI Catalogue* under the section entitled "International Standards Correspondence Index", or by using the "Search" facility of the *BSI Electronic Catalogue* or of British Standards Online.

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

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

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 4: Collage structural

Produkte und Systeme für den Schutz und die Instandsetzung von Betontragwerken - Definitionen, Anforderungen, Qualitätsüberwachung und Beurteilung der Konformität - Teil 4: Kleber für Bauzwecke

This European Standard was approved by CEN on 23 April 2004.

CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration. Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the Central Secretariat or to any CEN member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the Central Secretariat has the same status as the official versions.

CEN members are the national standards bodies of Austria, Belgium, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Slovakia, Slovenia, Spain, Sweden, Switzerland and United Kingdom.

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Foreword

This document (EN 1504-4:2004) has been prepared by Technical Committee CEN/TC 104 “Concrete and related products”, the secretariat of which is held by DIN.

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

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 February 2005, and conflicting national standards shall be withdrawn at the latest by August 2006.

This Part 4 of EN 1504 does not supersede any other document.

This document 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 relationship with EU Directive(s), see informative Annex ZA, which is an integral part of this document.

This Part 4 of EN 1504 includes an Informative Annex A dealing with special applications and an Informative Annex B dealing with release of dangerous substances.

This Part of this European Standard is one of the Parts of this Standard on products and systems for the repair and protection of concrete structures, the other Parts are listed below:

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, *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*

prEN 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*

prEN 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*

prEN 1504-6, Products and systems for the protection and repair of concrete structures - Definitions, requirements, quality control and evaluation of conformity - Part 6: Anchoring of reinforcing steel bar

prEN 1504-7, *Products and systems for the protection and repair of concrete structures - Definitions, requirements, quality control and evaluation of conformity - Part 7: Reinforcement corrosion protection*

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*

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 Scope

This Part 4 of EN 1504 specifies requirements for the identification, performance (including durability) and safety of structural bonding products and systems to be used for the structural bonding of strengthening materials to an existing concrete structure, including:

1) The bonding of external plates of steel or other suitable materials (e.g. fibre reinforced composites) to the surface of a concrete structure for strengthening purposes, including the laminating of plates in such applications.

2) The bonding of hardened concrete to hardened concrete, typically associated with the use of precast units in repair and strengthening.

3) The casting of fresh concrete to hardened concrete using an adhesive bonded joint where it forms a part of the structure and is required to act compositely.

The performance requirements in this Part of this Standard may not be applicable to highly specialised applications in extreme environmental conditions, e.g. cryogenic use, nor do they cover specialised circumstances such as accidental impact, e.g. due to traffic or ice, or earthquake loading where specific performance requirements will apply.

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 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 1504-8, *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 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 1799, *Products and systems for the protection and repair of concrete structures - Test methods - Tests to measure the suitability of structural bonding agents for application to concrete surface*

EN 12188, *Products and systems for the protection and repair of concrete structures - Test methods - Determination of adhesion steel-to-steel for characterisation of structural bonding agents*

EN 12189, *Products and systems for the protection and repair of concrete structures - Test methods - Determination of open time*

EN 12190, *Products and systems for the protection and repair of concrete structures - Test methods - Determination of compressive strength of repair mortar*

EN 12192-2, *Products and systems for the protection and repair of concrete structures - Granulometry analysis - Part 2: Test method for fillers for polymer bonding agents*

EN 12614, *Products and systems for the protection and repair of concrete structures - Test methods - Determination of glass transition temperatures of polymers*

EN 12615, *Products and systems for the protection and repair of concrete structures - Test methods - Determination of slant shear strength*

EN 12617-1, *Products and systems for the protection and repair of concrete structures - Test methods - Part 1: Determination of linear shrinkage for polymers and surface protection systems (SPS)*

EN 12617-3, *Products and systems for the protection and repair of concrete structures - Test methods - Part 3: Determination of early age linear shrinkage for structural bonding agents*

EN 12618-2, *Products and systems for the protection and repair of concrete structures - Test methods - Part 2: Determination of the adhesion of injection products, with our without thermal cycling - Adhesion by tensile bond strength*

EN 12636, *Products and systems for the protection and repair of concrete structures - Test methods - Determination of adhesion concrete to 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 13733, *Products and systems for the protection and repair of concrete structures - Tests methods - Determination of the durability of structural bonding agents*

EN ISO 178, *Plastics - Determination of flexural properties (ISO 178:2001)*

EN ISO 3451-1, *Plastics - Determination of ash - Part 1: General methods (ISO 3451-1:1997)*

EN ISO 9514, *Paints and varnishes - Determination of the pot-life of liquid systems - Preparation and conditioning of samples and guidelines for testing (ISO 9514:1992)*

EN ISO 11358, *Plastics - Thermogravimetry (TG) of polymers - General principles (ISO 11358:1997)*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in EN 1504-1, EN 1504-8and ENV 1504-9 and the following apply.

3.1
structural bonding products and systems
products and systems applied to concrete to provide a durable structural bond to additional applied material

3.2
polymer mortars and polymer concretes (PC)
blended mixtures of polymer binder and graded aggregates which set by polymer reaction

3.3
open time
the maximum time interval between the completion of mixing of the bonding agent to closing of the joint at which the bond strength requirement defined in this document can be met

3.4
pot life for structural bonding products
the period of time taken by the mixed bonding agent to reach a specified temperature in the mixing container

NOTE Pot life is an identification test carried out under standard laboratory conditions.

3.5
workable life for structural bonding products
the period of time the mixed bonding agent remains workable in the batch quantities used and at the limit of conditions that the material is fit for the purpose of use

4 Performance characteristics for intended uses

Table 1 lists the performance characteristics of structural bonding 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”.

Performance requirements are given in 5.2.

The properties of the bonding may be adversely affected by fire and therefore appropriate protection measures will need to be taken where fire is anticipated.

Table 1 — Performance characteristics for all and certain intended uses

Performance characteristic	Principle of repair 4 Structural strengthening (Note 7)	
	Repair method 4.3 Bonded plate reinforcement (Note 1)	Repair method 4.4 Bonded mortar or concrete (Note 2)
1. Suitability for application:		
a) to vertical surfaces & soffits	□	□
b) to top horizontal surfaces	□	□
c) by injection	□	□
2. Suitability for application and curing under the following special environmental conditions:		
a) low or high temperature (Note 3)	□	□
b) wet substrate		■
3. Adhesion:		
a) plate to plate	■	
b) plate to concrete	■	
c) corrosion protected steel to corrosion protected steel (Note 4)	□	
d) corrosion protected steel to concrete (Note 4)	□	
e) hardened concrete to hardened concrete		■
f) fresh concrete to hardened concrete (Note 5)		■
4. Durability of composite system:		
a) thermal cycling	■	■
b) moisture cycling	■	■
5. Material characteristics for the designer:		
a) open time (note 5) (note 6)	■	■
b) workable life (note 6)	■	■
c) modulus of elasticity in compression	■	■
d) modulus of elasticity in flexure	□	□
e) compressive strength		■
f) shear strength	■	■
g) glass transition temperature	■	■
h) coefficient of thermal expansion	■	■
i) shrinkage	■	■

Notes

1. Repair method 4.3 is in accordance with ENV 1504-9. The bonding of external plates to the surface of a concrete structure for strengthening purposes, and the laminating of plates in such applications. An acceptable bond is unlikely to be achieved with stainless steel.
2. Repair method 4.4 is in accordance with ENV 1504-9. The bonding of hardened concrete to hardened concrete, typically associated with the use of precast units or the bonding of fresh concrete to hardened concrete where it forms a significant part of the structure and is required to act compositely.
3. Temperatures may be specified by the producer for the intended use.
4. In this context corrosion protection implies the application of a corrosion inhibiting priming coat to mild steel.
5. Not applicable to injection techniques.
6. At minimum, standard and maximum application temperatures.

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

Item No	Property	Test Method	Requirement/Tolerance
1	Colour	Visual	Uniform and similar to the description provided by the manufacturer.
2	Granulometry size grading of fillers for polymer bonding agents.	EN 12192-2	Declared value ±5 %
3	Ash content by direct calcination	EN ISO 3451-1	Declared value ±5 % or ±1 percentage point of the total product, whichever is the greater.
4	Thermogravimetry of polymers: temperature scanning method.	EN ISO 11358	Declared value ±5 % or ±1 percentage point of the total product, whichever is the greater.
5	Infrared analysis of the resin and hardener	EN 1767	The positions and relative intensities of the main absorption bands shall match those of the reference spectrum.
6	Pot life	EN ISO 9514	Declared value ±20 %
7	Compressive strength	EN 12190	Declared value ±20 %

5.2 Performance requirements

The manufacturer shall undertake initial performance tests on the product in accordance with Table 3.1 (bonding agents for bonded plate reinforcement) or Table 3.2 (bonding agents for bonded mortar or concrete) and the product shall comply with the requirements.

Table 3.1 — Performance requirements of bonding agent for bonded plate reinforcement

Item No	Performance Characteristic	Reference concrete or mortar	Test Method	Requirements (See Note)
1	Modulus of elasticity in flexure	—	EN ISO 178	≥2 000 N/mm^2
2	Shear strength	—	EN 12188	≥12 N/mm^2
3	Open time	EN1766 MC(0.40)	EN 12189	Declared value ±20%
4	Workable life	—	EN ISO 9514	Declared value. Informative Note The workable life is dependent upon the batch quantity and ambient conditions. Users should note that the workable life will usually be less than the pot life.
5	Modulus of elasticity in compression	—	EN 13412	≥2 000 N/mm^2
6	Glass transition temperature	—	EN 12614 .	≥40 C
7	Coefficient of thermal expansion	—	EN 1770	≤100 × 10^{-6} per K
8a	Total shrinkage for structural bonding agents	—	EN 12617-1	≤0,1 %
8b	Total shrinkage for structural bonding agents (alternative test method)	—	EN 12617-3	≤0,1 %
9	Suitability for application to vertical surfaces and soffits	—	EN 1799	The material shall not sag flow by more than 1 mm when spread in thicknesses less than 3 mm.
10	Suitability for application to horizontal surfaces	—	EN 1799	The surface area of the bonding agent at the end of the squeezability test shall not be less than 3 000 mm^2 (60 mm diameter).
11	Suitability for injection	EN 1766 MC(0.40)	EN 12618-2	For the test performed in the dry, failure shall occur in the concrete.
12	Suitability for application and curing under special environmental conditions	—	EN 12188 NOTE The test method may need to be performed under environmental conditions other than those specified in EN 12188.	The slant shear strength of scarf-jointed prisms tested in compression at various angles θ shall not be less than the values σ_o N/mm^2 tabulated below. θ σ_o (N/mm^2) 50° 50 60° 60 70° 70

Table 3.1 *(continued)*

Item No	Performance Characteristic	Reference concrete or mortar	Test Method	Requirements (See Note)
13	Adhesion	—	EN 12188	The tensile stress carried by the bonded joint in a pull off test shall not be less than 14 N/mm^2. The slant shear strength of scarf-jointed prisms tested in compression at various angles θ shall not be less than the values σ_0 N/mm^2 tabulated below. θ σ_0 (N/mm^2) 50° 50 60° 60 70° 70
14	Durability (thermal and moisture)	—	EN 13733 NOTE The test method is not applicable for plates other than steel	The compressive shear load at failure of the hardened concrete specimens after exposure to thermal cycling or the warm-moist environment shall not be less than the tensile strength of the concrete. The steel to steel specimens shall not fail after exposure to thermal cycling or the warm-moist environment.

NOTE Threshold requirements apply to the mean value of the relevant performance characteristic for any batch of the product as defined in EN 1504-8.

Table 3.2 — Performance requirements of bonding agent for bonded mortar or concrete

Item No	Performance characteristic	Reference concrete or mortar	Test Method	Requirements (See Note)
1	Modulus of elasticity in flexure.	—	EN ISO 178	≥2 000 N/mm^2
2	Compressive strength	—	EN 12190	≥30 N/mm^2
3	Shear strength	—	EN 12615	≥6 N/mm^2
4	Open time	EN 1766 MC(0.40)	EN 12189	Declared value ±20 %
5	Workable life	—	EN ISO 9514	Declared value. Informative Note The workable life is dependent upon the batch quantity and ambient conditions. As such it is the responsibility of the producer. However, users should note that the workable life will usually be less than the pot life.
6	Modulus of elasticity in compression	—	EN 13412	≥2 000 N/mm^2

Table 3.2 *(continued)*

Item No	Performance characteristic	Reference concrete or mortar	Test Method	Requirements (See Note)
7	Glass transition temperature	—	EN 12614	≥ 40 C
8	Coefficient of thermal expansion	—	EN 1770	$\leq 100 \times 10^{-6}$ per °C
9a	Total shrinkage for structural bonding agents	—	EN 12617-1	≤ 0,1 %
9b	Total shrinkage for structural bonding agents (alternative test method)	—	EN 12617-3	≤ 0,1 %
10	Suitability for application to vertical surfaces and soffits	—	EN 1799	The material shall not sag flow by more than 1 mm when spread in thicknesses less than 3 mm.
11	Suitability for application to horizontal surfaces	—	EN 1799	The surface area of the bonding agent at the end of the squeezability test shall not be less than 3 000mm^2 (60 mm diameter).
12	Suitability for injection	EN 1766 MC(0.40)	EN 12618-2	For the test performed in the dry failure shall occur in the concrete.
13a	Suitability for application and curing under special environmental conditions	EN 1766 MC(0.40)	EN 12636	For hardened concrete-to-hardened concrete, the tensile bending test shall result in fracture in the concrete. For fresh concrete-to-hardened concrete, the pull off test shall result in fracture in the concrete.
13b	Suitability for application and curing under special environmental conditions (alternative test method)	EN 1766 C(0.40) or MC(0.40)	EN 12615	The slant shear test shall result in fracture in the concrete.
14a	Adhesion	EN 1766 MC (0.40)	EN 12636	For hardened concrete-to-hardened concrete, the tensile bending test shall result in fracture in the concrete. For fresh concrete-to-hardened concrete, the pull off test shall result in fracture in the concrete.
14b	Adhesion (alternative test method)	EN 1766 C (0.40) or MC (0.40)	EN 12615	The slant shear test shall result in fracture in the concrete.
15	Durability (thermal and moisture)	EN 1766 MC (0.40)	EN 13733	The compressive shear load at failure of either the hardened concrete to hardened concrete, or fresh concrete to hardened concrete specimens after exposure to thermal cycling or the warm-moist environment shall not be less than the lowest tensile strength exhibited by either the bonded or the original concrete.

NOTE Threshold requirements apply to the mean value of the relevant performance characteristic for any batch of the product as defined in EN 1504-8.

5.3 Special applications

See Annex A (informative), Table A.1 for special applications of structural bonding agents.

5.4 Release of dangerous substances

Hardened structural bonding agents shall not release substances dangerous to health, hygiene and the environment. See Annex B (informative).

5.5 Reaction to fire

For structural bonding agents to be used in elements subject to fire requirements the manufacturer shall declare the reaction to fire classification of the hardened structural bonding agent.

Hardened structural bonding agents 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 procedures are set out in EN 1504-8.

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 part of EN 1504.

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 C (informative). 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 (informative)

Where required, provisions for the assessment, surveillance and certification of FPC are given in EN 1504-8 Annex A .

8 Marking and labelling

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

NOTE For CE marking and labelling clause ZA.3 of Annex ZA applies.

Annex A
(informative)

Special applications

Table A.1 of Annex A (informative) contains a list of test methods that may be considered for Special Applications. Such testing may be required for specific projects where the strengthened structure may be subjected to dynamic loading.

Table A.1 — Test Methods for Special Applications

Property	Test Method
Fatigue under dynamic loading	
Part 1 : During cure	EN 13894-1
Part 2 : After hardening	EN 13894-2

References (Informative)

EN 13894-1, *Products and systems for the protection and repair of concrete structures: Test methods — Determination of fatigue under dynamic loading — Part 1: During cure.*

EN 13894-2, *Products and systems for the protection and repair of concrete structures: Test methods — Determination of fatigue under dynamic loading — Part 2: After hardening*

Annex B
(informative)

Release of dangerous substances

In the absence of specific requirements relating to substances dangerous to health, hygiene and the environment in this document, Annex ZA.1, paragraph “WARNING” applies.

Annex C
(informative)

Minimum frequency of testing for factory production control

Identification/performance characteristic	Polymer resins
Identification of the components	
Granulometry size grading of fillers	B
Ash content	B
Thermogravimetry	B
Infrared analysis	C
Identification of the fresh mixture	
Colour	A
Pot life	A
Identification of the hardened sample/product and performance characteristic	
Compressive strength	A

Frequency
- A every batch (as defined in EN 1504-8
- B every 10 batches, every two weeks, or every 1,000 tonnes, whichever is the sooner (that is, whichever requires the most frequent testing
- C twice per year

NOTE 1 Ash content and Thermogravimetry are alternative methods. The manufacturer should decide which is appropriate.

NOTE 2 Documentation provided by a raw material supplier will be deemed to satisfy.

Annex ZA
(informative)

Clauses addressing the provisions of EU Construction Products Directive.

ZA.1 Scope and relevant characteristics

This European Standard and this Annex ZA have been prepared under a 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 the structural bonding 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 annex.

NOTE 1 There may be other requirements relating to dangerous substances applicable to the products falling within the scope of this standard (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 website on EUROPA (CREATE, accessed through http://europa.eu.int/comm/enterprise/construction/internal/dangsub/dangmain.htm).

This Annex establishes the conditions for the CE marking of the structural bonding products and systems intended for the uses indicated in tables ZA.1a and ZA.1b and shows the relevant clauses applicable.

The Scope of this Annex is defined in tables ZA.1a and ZA.1b.

Table ZA.1a — Scope and relevant clauses

Construction products:	**Structural bonding products for bonded plate reinforcement as covered in the scope of this standard**		
Intended use:	**In buildings and civil engineering works**		
Essential characteristics	**Requirement clauses in this standard**	**Level(s) or class(es)**	**Notes: (expression of results)**
Bond/adhesion strength	5.2 Performance requirements Table 3.1(13) Adhesion	None	Complying with the threshold values in N/mm^2
Shear strength	5.2 Performance requirements Table 3.1(2) Shear strength	None	Complying with the threshold value in N/mm^2
Shrinkage/expansion	5.2 Performance requirements Table 3.1(8a) Total shrinkage	None	Complying with the threshold value as a %
Workability	5.2 Performance requirements Table 3.1(4) Workable life	None	Declared value, in minutes
Modulus of elasticity	5.2 Performance requirements Table 3.1(5) Modulus of elasticity in compression	None	Complying with the threshold value in N/mm^2
Coefficient of thermal expansion	5.2 Performance requirements Table 3.1(7) Coefficient of thermal expansion	None	Complying with the threshold value per K
Glass transition temperature	5.2 Performance requirements Table 3.1 (6) Glass transition temperature	None	Complying with the threshold value in °C
Reaction to fire	5.5 Reaction to fire	Euroclasses	Declared class
Durability	5.2 Performance requirements Table 3.1(14) Durability (thermal and moisture)	None	pass/fail criteria
Dangerous substances	5.4 Dangerous Substances	None	See Note 1 in ZA.1 and note after Fig. ZA.1. Manufacturer's declaration

Table ZA.1b — Scope and relevant clauses

Construction products:	**Structural bonding products for bonded mortar or concrete as covered in the scope of this standard**		
Intended use:	**In buildings and civil engineering works**		
Essential characteristics	**Requirement clauses in this standard**	**Level(s) or class(es)**	**Notes: (expression of results)**
Bond/adhesion strength	5.2 Performance requirements Table 3.2(14a) Adhesion	None	pass/fail criteria
Shear strength	5.2 Performance requirements Table 3.2(3) Shear strength	None	Complying with the threshold value in N/mm^2
Compressive strength	5.2 Performance requirements Table 3.2(2) Compressive strength	None	Complying with the threshold value in N/mm^2
Shrinkage/expansion	5.2 Performance requirements Table 3.2(9a) Total shrinkage	None	Complying with the threshold value as a %
Workability	5.2 Performance requirements Table 3.2(5) Workable life	None	Declared value, in minutes
Sensitivity to water	5.2 Performance requirements Table 3.1(13a) Suitability for application and curing under special environmental conditions	None	pass/fail criteria
Modulus of elasticity	5.2 Performance requirements Table 3.2(6) Modulus of elasticity in compression	None	Complying with the threshold value in N/mm^2
Coefficient of thermal expansion	5.2 Performance requirements Table 3.2(8) Coefficient of thermal expansion	None	Complying with the threshold value per K
Glass transition temperature	5.2 Performance requirements Table 3.2(7) Glass transition temperature	None	Complying with the threshold value in °C
Reaction to fire	5.5 Reaction to fire	Euroclasses	Declared class
Durability	5.2 Performance requirements Table 3.2(15) Durability (thermal and moisture)	None	pass/fail criteria
Dangerous substances	5.4 Dangerous Substances	None	See Note 1 in ZA.1 and note after Fig. ZA.1. Manufacturer's declaration

The cumulative use of Tables ZA.1a and ZA.1b is possible for products which may be used for both bonded plate reinforcement and bonded mortar or concrete.

The requirement on a certain essential characteristic is not of application in those Member States where there are no regulations for such characteristic. In this case, manufacturers willing to place their products in the market of these Member States are not obliged to determine nor to declare the performance of their products with regard to this characteristic and the option “no performance determined” in the information accompanying the CE mark 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 tables ZA.1a and ZA.1b, in accordance with the decision of the Commission 1999/469/EC as amended, 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*, A2*, B*, C*	1
		A1**, A2**, B**, C**, D, E	3
		(A1 to E)***, F	4
System 1: See CPD, Annex III.2(1), 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			
* 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) ** Products/materials not covered by footnote (*) *** 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 structural bonding products in tables ZA.1a and ZA.1b shall be based on the evaluation of conformity procedures indicated in table(s) ZA.3a to ZA.3f resulting from the application of those clauses of this or other European standards indicated therein.

Table ZA.3a — Assignment of evaluation of conformity tasks for structural bonding products of Euroclasses A1*, A2*, B* or C*, 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 (F.P.C)	Parameters related to all characteristics in table ZA.1a and ZA.1b	EN 1504-8, 5.5 and clause 7.3 of this standard
	Further testing of samples taken at the factory	All relevant characteristics of table ZA.1a and ZA.1b	EN 1504-8:, 5
	Initial type testing	All relevant characteristics of table ZA.1a and ZA.1b except: Reaction to fire	EN 1504-8, 5.2
Tasks for the notified body	Initial type testing	Reaction to fire	EN 1504-8, 5.2
	Initial inspection of factory and of F.P.C.	Parameters related to all characteristics of table ZA.1a and ZA.1b	EN 1504-8, 5.5 and clause 7.3 of this standard
	Continuous surveillance, assessments and approval of F.P.C.	Parameters related to all characteristics of table ZA.1a and ZA.1b, in particular: Reaction to fire	EN 1504-8, 5.5 and 7 Clause 7.3 of this standard

Table ZA.3b — Assignment of evaluation of conformity tasks for structural bonding products of Euroclasses A1*, A2*, B* or C*, 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 (F.P.C)	Parameters related to all characteristics in table ZA.1a and ZA.1b	EN 1504-8, 5.5 and Clause 7.3 of this standard
	Further testing of samples taken at the factory	All relevant characteristics of table ZA.1a and ZA.1b	EN 1504-8, 5
	Initial type testing	All relevant characteristics of table ZA.1a and ZA.1b except: Reaction to fire	EN 1504-8, 5.2
Tasks for the notified body	Initial type testing	Reaction to fire	EN 1504-8, 5.2
	Initial inspection of factory and of F.P.C.	Parameters related to all characteristics of table ZA.1a and ZA.1b.	EN 1504-8, 5.5 and Clause 7.3 of this standard
	Continuous surveillance, assessments and approval of F.P.C.	Parameters related to all characteristics of table ZA.1a and ZA.1b, in particular: Reaction to fire	EN 1504-8, 5.5 and 7 Clause 7.3 of this document

Table ZA.3c — Assignment of evaluation of conformity tasks for structural bonding products of Euroclasses A1, A2**, B**, C**, D or E intended for uses 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 (F.P.C)		Parameters related to all characteristics in table ZA.1a and ZA.1b	EN 1504-8, 5.5 and Clause 7.3 of this standard
	Further testing of samples taken at the factory		All relevant characteristics of table ZA.1a and ZA.1b	EN 1504-8, 5
	Initial type testing		All relevant characteristics of table ZA.1a and ZA.1b except: Reaction to fire	EN 1504-8, 5.2
Tasks for the notified body	Initial type testing		Reaction to fire	EN 1504-8, 5.2
	Certification of F.P.C. on the basis of	Initial in-spection of factory and of F.P.C.	Parameters related to all characteristics of table ZA.1a and ZA.1b.	EN 1504-8, 5.5 and Clause 7.3 of this standard
		Continuous surveillance, assessment and approval of F.P.C.	Parameters related to all characteristics of table ZA.1a and ZA.1b, in particular: Reaction to fire	EN 1504-8, 5.5 and 7 Clause 7.3 of this document

Table ZA.3d — Assignment of evaluation of conformity tasks for structural bonding products of Euroclasses A1, A2**, B**, C**, 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 (F.P.C)	Parameters related to all characteristics in table ZA.1a and ZA.1b	EN 1504-8, and 7.3 of this document
	Initial type testing	All relevant characteristics of table ZA.1a and ZA.1b except: Reaction to fire	EN 1504-8, 5.2
Tasks for the notified body	Initial type testing	Reaction to fire	EN 1504-8, 5.2

Table ZA.3e — Assignment of evaluation of conformity tasks for structural bonding products of any intended for uses other than those with low performance not subject to reaction to fire regulations or of Euroclasses (A1 to E)* 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 (F.P.C)		Parameters related to all characteristics in table ZA.1a and ZA.1b	EN 1504-8, 5.5 and Clause 7.3 of this standard
	Further testing of samples taken at the factory		All relevant characteristics of table ZA.1a and ZA.1b	EN 1504-8, 5
	Initial type testing		All relevant characteristics of table ZA.1a and ZA.1b	EN 1504-8, 5.2
Tasks for the notified body	Certification of F.P.C. on the basis of	Initial in-spection of factory and of F.P.C.	Parameters related to all characteristics of table ZA.1a and ZA.1b.	EN 1504-8, 5.5 and Clause 7.3 of this standard
		Continuous surveillance, assessment and approval of F.P.C.	Parameters related to all characteristics of table ZA.1a and ZA.1b, in particular: Reaction to fire	EN 1504-8, 5.5 and 7. Clause 7.3 of this document

Table ZA.3f — Assignment of evaluation of conformity tasks for structural bonding products intended for uses with low performance not subject to reaction to fire regulations or of Euroclasses (A1 to E)* 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 (F.P.C)	Parameters related to all characteristics in table ZA.1a and ZA.1b	EN 1504-8, 5.5 and Clause 7.3 of this standard
	Initial type testing	All relevant characteristics of table ZA.1a and ZA.1b	EN 1504-8, 5.2

ZA.2.2 EC Certificate and Declaration of conformity

Structural bonding 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 1504-4);

— 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 1504-4);

— 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.

Structural bonding 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 representaive 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 1504-4);

— 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;

— 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, 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.

Structural bonding products under system 2+ plus 4 or under system 4: When compliance with this Annex is achieved, the manufacturer of 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 1504-4);

— 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;

— 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, 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 affixing of the CE marking and the relevant information will be done preferably on the packaging (when not possible it shall be done on the accompanying label or on the accompanying documents e.g. delivery note)

NOTE The manufacturer or his authorised representative established within the EU or EFTA is responsible for the affixing of the CE marking.

The CE conformity symbol to affix shall be in accordance with Directive 93/68/EC and must be accompanied by the following information:

Identification number of the certification body (only for products under system 1 or 2+)

Name or identifying mark of the producer

Registered address of the producer

The last two digits of the year in which the marking is affixed

Number of the EC Certificate (for products under system 1) or Certificate of factory production control (for products under system 2+)

Reference to this European Standard

Information on those relevant essential characteristics listed in tables ZA.1a and ZA.1b 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 tables ZA.1a and ZA.1b, and;

— “No performance determined” option for characteristics where this is relevant.

Figure 1 gives an example of the information accompanying the CE marking.

CE 01234	CE conformity marking consisting of the CE symbol given in directive 93/68/EEC Identification number of the notified body (for products under systems 1 or 2+)
AnyCo Ltd, PO Bx 21, B-1050 00	Name or identifying mark and registered address of the producer Last two digits of the year in which the marking was affixed
0123-CPD-0456 EN 1504-4 Structural bonding product for bonded plate reinforcement for uses other than low performance requirements	Number of the EC Certificate (for products under system 1) or the FPC certificate (for products under system 2+) No of European standard **Description** and
Bond/adhesion strength: Pull off strength ≥14 N/mm^2 Slant shear strength at: 50° ≥ 50 N/mm^2 60° ≥ 60 N/mm^2 70° ≥ 70 N/mm^2 Shear strength: ≥12 N/mm^2 Shrinkage/expansion: ≤0,1 % Workability: 40 minutes at 20 °C Modulus of elasticity: ≥2 000 N/mm^2 Coefficient of thermal expansion: ≤100 × 10^{-6} per K Glass transition temperature: ≥45 °C Reaction to fire..... Euroclass B Durability..... Pass Dangerous substances comply with 5.4	information on product and on regulated characteristics

Figure ZA.1 — CE marking information

This 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.

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