



BSI Standards Publication

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

Part 5: Concrete injection

National foreword

This British Standard is the UK implementation of EN 1504-5:2013. It supersedes BS EN 1504-5:2004 which is withdrawn.

The UK participation in its preparation was entrusted to Technical Committee B/517/8, Protection and repair of concrete structures.

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

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ISBN 978 0 580 78943 4

ICS 91.080.40

Compliance with a British Standard cannot confer immunity from legal obligations.

This British Standard was published under the authority of the Standards Policy and Strategy Committee on 30 April 2013.

Amendments issued since publication

Date	Text affected
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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 5: Concrete injection

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 5 : Produits et systèmes d'injection du béton

Produkte und Systeme für den Schutz und die Instandsetzung von Betontragwerken - Definitionen, Anforderungen, Qualitätsüberwachung und Beurteilung der Konformität - Teil 5: Injektion von Betonbauteilen

This European Standard was approved by CEN on 20 January 2013.

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Contents

Page

Foreword.....	3
Introduction	5
1 Scope.....	6
2 Normative references.....	6
3 Terms and definitions	8
4 Performance characteristics in relation to the general principles of protection and repair	10
5 Requirements	14
5.1 Identification requirements.....	14
5.2 Performance requirements	16
5.3 Special applications.....	24
5.4 Dangerous substances	24
6 Sampling.....	24
7 Evaluation of conformity.....	24
7.1 General	24
7.2 Initial type-testing.....	25
7.3 Factory production control.....	25
7.4 Assessment, surveillance and certification	25
8 Marking and labelling.....	25
Annex A (normative) Classification of injection products	26
Annex B (informative) Special applications	28
Annex C (informative) Minimum frequency of testing for Factory Production Control	30
Annex ZA (informative) Clauses of this European Standard addressing the provisions of the EU Construction Products Directive	31
ZA.1 Scope and relevant characteristics.....	31
ZA.2 Attestation of conformity	34
ZA.2.1 Systems of attestation of conformity	34
ZA.2.2 EC Certificate and Declaration of conformity	35
ZA.3 CE marking and labelling.....	36
Bibliography.....	39

Foreword

This document (EN 1504-5:2013) 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 October 2013, and conflicting national standards shall be withdrawn at the latest by October 2013.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN [and/or CENELEC] shall not be held responsible for identifying any or all such patent rights.

This document supersedes EN 1504-5:2004.

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 Directive(s).

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

Compared with the previous version, the following changes have been made:

- a) changes in Table 1, Table 2, Table 4, Table 6, Table 7 and Table 8;
- b) modification of Annexes A, B, C and ZA;
- c) revision of normative references;
- d) renumbering of the tables.

EN 1504 consists of the following parts, under the general title *Products and systems for the protection and repair of concrete structures — Definitions, requirements, quality control and evaluation of conformity*:

- *Part 1: Definitions*;
- *Part 2: Surface protection systems for concrete*;
- *Part 3: Structural and non-structural repair*;
- *Part 4: Structural bonding*;
- *Part 5: Concrete injection*;
- *Part 6: Anchoring of reinforcing steel bar*;
- *Part 7: Reinforcement corrosion protection*;
- *Part 8: Quality control and evaluation of conformity*;
- *Part 9: General principles for the use of products and systems*;
- *Part 10: Site application of products and systems and quality control of the works*.

Part 5 of EN 1504 includes a normative Annex A dealing with classification, an informative Annex B dealing with special applications and an informative Annex C dealing with Factory Production Control on products.

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

According to the CEN-CENELEC Internal Regulations, the national standards organisations of the following countries are bound to implement this European Standard: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

Introduction

Concrete injection is used as a method for the following principles defined in EN 1504-9:

- principle 1 [IP]: Protection against ingress and waterproofing;
- Filling cracks (method 1.5);
- principle 4 [SS]: Structural strengthening;
- Injecting cracks, voids or interstices (method 4.5);
- Filling cracks, voids or interstices (pressureless) (method 4.6).

Injection is used to avoid the harmful consequences of voids and cracks in concrete:

- to achieve impermeability and hence watertightness;
- to avoid penetration of agents that might induce corrosion of steel reinforcement;
- to strengthen the structure by strengthening the concrete.

1 Scope

This European Standard specifies requirements and conformity criteria for the identification, performance (including durability aspects) and safety of injection products for the repair and protection of concrete structures, used for:

- force transmitting filling of cracks, voids and interstices in concrete (category F, see 3.1);
- ductile filling of cracks, voids and interstices in concrete (category D, see 3.1);
- swelling fitted filling of cracks, voids and interstices in concrete (category S, see 3.1).

The performance requirements in this part of this document 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.

This European Standard does not cover:

- the treatment of cracks by widening them and sealing them with an elastomeric sealing compound;
- external filling of cavities, that is, the placement of product outside the structure (generally within the surrounding foundation soils, or at the interface between the structure and the soil); this is covered by EN 12715 [2], under contact grouting;
- preliminary injection works, if necessary, to temporarily stop water passage during waterproofing injection.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

EN 196-3, *Methods of testing cement — Part 3: Determination of setting times and soundness*

EN 196-2, *Methods of testing cement — Part 2: Chemical analysis of cement*

EN 445, *Grout for prestressing tendons — Test methods*

EN 1240, *Adhesives — Determination of hydroxyl value and/or hydroxyl content*

EN 1242, *Adhesives — Determination of isocyanate content*

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*

EN 1504-9:2008, *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 1543, *Products and systems for the protection and repair of concrete structures — Test methods — Determination of tensile strength development for polymers*

- EN 1767, *Products and systems for the protection and repair of concrete structures — Test methods — Infrared analysis*
- EN 1771, *Products and systems for the protection and repair of concrete structures — Test methods — Determination of injectability and splitting test*
- 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 12614, *Products and systems for the protection and repair of concrete structures — Test methods — Determination of glass transition temperatures of polymers*
- EN 12618-1, *Products and systems for the protection and repair of concrete structures — Test methods — Part 1: Adhesion and elongation capacity of injection products with limited ductility*
- EN 12618-2:2004, *Products and systems for the protection and repair of concrete structures — Test methods — Part 2: Determination of the adhesion of injection products, with or without thermal cycling — Adhesion by tensile bond strength*
- EN 12618-3, *Products and systems for the protection and repair of concrete structures — Test methods — Part 3: Determination of the adhesion of injection products, with or without thermal cycling — Slant shear method*
- EN 12637-1, *Products and systems for the protection and repair of concrete structures — Test methods — Compatibility of injection products — Part 1: Compatibility with concrete*
- EN 14068, *Products and systems for the protection and repair of concrete structures — Test methods — Determination of watertightness of injected cracks without movement in concrete*
- EN 14117, *Products systems for the protection and repair of concrete structures — Test methods — Determination of time of efflux of cementitious injection products*
- EN 14497, *Products and systems for the protection and repair of concrete structures — Test methods — Determination of the filtration stability*
- EN 14498, *Products and systems for the protection and repair of concrete structures — Test methods — Volume and weight changes of injection products after air drying and water storage cycles*
- EN ISO 527-1, *Plastics — Determination of tensile properties — Part 1: General principles (ISO 527-1)*
- EN ISO 527-2, *Plastics — Determination of tensile properties — Part 2: Test conditions for moulding and extrusion plastics (ISO 527-2)*
- EN ISO 2811-1, *Paints and varnishes — Determination of density — Part 1: Pyknometer method (ISO 2811-1)*
- EN ISO 2811-2, *Paints and varnishes — Determination of density — Part 2: Immersed body (plummet) method (ISO 2811-2)*
- EN ISO 3219, *Plastics — Polymers/resins in the liquid state or as emulsions or dispersions — Determination of viscosity using a rotational viscometer with defined shear rate (ISO 3219)*
- EN ISO 3251, *Paints, varnishes and plastics — Determination of non-volatile matter content (ISO 3251)*

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)*

ISO 13320, *Particle size analysis — Laser diffraction methods*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in EN 1504-1:2005, EN 1504-8:2004, EN 1504-9:2008 and the following apply.

3.1 injection products and systems
products and systems which, when injected into a concrete structure, restore the structural integrity and/or durability

[SOURCE: EN 1504-1:2005, 3.2.2]

Note 1 to entry: Injection products can be classified in three categories, according to the intended use.

3.1.1 injection product for force transmitting filling of cracks, voids and interstices in concrete (F)
product able to bond to the concrete surface and transmit forces across it

Note 1 to entry: Products for injection for force transmitting filling of cracks, voids and interstices can also be used for saturation without receiving a force transmitting bond.

Note 2 to entry: Unless otherwise stated, injection products are intended for filling of cracks, voids and interstices, so that in the following only the wording injection products for filling of cracks is used.

3.1.2 injection product for ductile filling of cracks, voids and interstices in concrete (D)
flexible product which is able to accommodate subsequent movement

3.1.3 injection product for swelling fitted filling of cracks, voids and interstices in concrete (S)
product which is able, in the reacted state, to swell repeatedly by water adsorption, where the water molecules are bonded to the molecules of the injection product

Note 1 to entry: This category of products, referred to as gels, are only used for waterproofing purposes for cracks and voids in damp, wet and water - flow conditions.

3.2 injection product formulated with reactive polymer binder (P)
product where the hardening is related to the curing of a reactive polymer binder; the reactive part of a polymer binder involved in the hardening of the binder is the functional group

3.3 injection product formulated with hydraulic binder (H)
product where the hardening is related to the hydration reaction of an hydraulic binder

3.4 pot life for injection products
period of time taken by the freshly mixed product to:

- increase in temperature by 15 °C, for injection products formulated with reactive polymer binder (or the maximum temperature increase if less than 15 °C); or
- to reach a viscosity of 1 000 mPa·s
- to reach a recorded lowering of the filtration stability for injection products formulated with hydraulic binder

Note 1 to entry: Pot life is an identification test carried out under standard laboratory conditions.

Note 2 to entry: Test sample: 1 000 ml.

3.5

workable time for injection products

period of time the mixed injection product remains workable in the batch quantities used and at the limit of conditions that the product is fit for the purpose of use

Note 1 to entry: The workable time is given by the manufacturer.

Note 2 to entry: The workable time depends on temperature, humidity, volume of mixed product (A+B), reactivity of the product, technology of injection. Reactivity of the product and volume of mixed product are best chosen according to those various parameters and to the anticipated time necessary to inject the concrete structure.

3.6

crack width

width of the crack measured on the not mechanical treated surface of the concrete

3.7

injectability

ability of an injection product to penetrate in a crack, which is given by the minimum crack width into which the product is injectable

Note 1 to entry: Following crack widths are considered: 0,1mm | 0,2 mm | 0,3 mm | 0,5 mm | 0,8 mm.

Note 2 to entry: Crack width is expressed in millimetres.

Note 3 to entry: The injectability is declared by the manufacturer, and tested with the injectability test(s) (see Clause 4).

3.8

moisture state of the crack, voids or interstices

water content in the crack or flowing from the crack

Note 1 to entry: The following conditions are considered: dry, damp, wet, flowing water.

3.8.1

dry

no water in the crack or on the crack flanks; migration of water in the crack is excluded during injection and hardening of injection product

Note 1 to entry: A dry crack is indicated if the colour of the crack and dry surface concrete is the same.

3.8.2

damp

no water in the crack, water on the crack flanks, however without a water layer on the surface of the flanks

Note 1 to entry: A difference of colour between the crack surface and the dry surface concrete gives evidence of a damp crack.

3.8.3

wet

standing water in the crack

Note 1 to entry: The presence of water drops on the crack surface is characteristic of a wet crack.

3.8.4

flowing water

water that flows through the crack, voids or interstices

Note 1 to entry: The manufacturer will indicate the moisture state or states with which the product is compatible, based on the results of the injectability and other relevant performance tests specified in Clause 4.

3.9

crack movement

change of crack width as a function of time and actions on structures

Note 1 to entry: Actions on structures are induced by:

- mechanical influences (e.g. by traffic);
- physical influences, which can be daily (for example due to exposure to the sun, change of temperature) or seasonally.

Note 2 to entry: Traffic induced crack movements of 10 μm to 15 μm during cure do not influence the adhesion of injection products formulated with reactive polymer binder.

Note 3 to entry: Gels will not be used for cracks submitted to daily movements unless also injected in excess outside the structure.

Note 4 to entry: Injection products formulated with hydraulic binder will not be used for the injection of cracks submitted to high frequency changes during hardening. These products are normally not used for injection of cracks submitted to daily changes during hardening, unless it can be proved that the adhesion on concrete will be higher than 2 N/mm² within 10 h at the minimum use temperature.

4 Performance characteristics in relation to the general principles of protection and repair

Tables 1, 2 and 3 list the performance characteristics of concrete injection products which are required for "all intended uses" or "for certain intended uses" according to the "principles" and "methods" defined in EN 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". See Annex B for special applications.

The performance characteristics of products are classified as follows:

- basic characteristics, compressive strength, strength related to adhesion, volume change (shrinkage), compatibility with steel and concrete, glass transition temperature, watertightness essential for the intended use;
- workability characteristics, related to the work conditions which the product can be used for (width, moisture state of the crack); these characteristics are declared by the manufacturer, and tested accordingly;
- reactivity characteristics, related to the workable time and the development of strength;
- durability, related to the long term behaviour of the hardened product under climatic conditions.

NOTE Workability and reactivity characteristics are product characteristics for the designer and contractor.

The performance characteristics of injection products used in relation to Principle 1 [IP]: *Protection against ingress and waterproofing – Filling cracks* (method 1.5 as described in EN 1504-9:2008) are listed in the following tables:

- Table 1: "Injection products for force transmitting filling of cracks (F) — Performance characteristics" when category F products are used for these purpose;
- Table 2: "Injection products for ductile filling of cracks (D) — Performance characteristics" when category D products are used for these purpose;
- Table 3: "Injection products for swelling fitted filling of cracks (S) — Performance characteristics" when category S products are used for these purpose.

Only products formulated with reactive polymer binder can be considered for category D and category S injection.

The performance characteristics of injection products used in relation to Principle 4 [SS]: *Structural Strengthening – Injecting cracks, voids and interstices* (method 4.5 as described in EN 1504-9:2008) and *Filling cracks, voids or interstices* (method 4.6) are listed in Table 1: "Injection products for force transmitting filling of cracks (F) — Performance characteristics".

Corrosion behaviour of injection products formulated with hydraulic binder is assessed by measuring chloride content. Injection products formulated with reactive polymer binder for category F and category D injection are deemed to have no corrosive effect on reinforcement.

The certain intended uses are subject to specific conditions on the works:

- a) glass transition temperature shall be considered if the temperature of the hardened product in the crack can be:
 - 1) higher than 21 °C (temperature conditions by measuring adhesion strengths) for category F products formulated with reactive polymer binder;
 - 2) lower than 3 °C (temperature conditions by measuring elongation ability) for category D products;
- b) chloride content and corrosion behaviour shall be considered by injection of reinforced concrete;
- c) watertightness shall be considered for waterproofing injection.

The injectability test (into dry or non-dry medium) is performed at the minimum crack width declared by the manufacturer and the least favourable moisture state of the crack declared by the manufacturer for the tested product.

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 — Injection products for force transmitting filling of cracks (F) — Performance characteristics

Performance characteristics Methods 1.5, 4.5 and 4.6	Intended use
BASIC CHARACTERISTICS	
Adhesion by tensile bond strength (H, P)	■
Compressive strength (H)	■
Adhesion by slant shear strength (H, P)	□
Non-volatile matter (P)	■
Bleeding (H)	■
Volume change (H)	■
Glass transition temperature (P)	□
Chloride content (H)	□
WORKABILITY CHARACTERISTICS	
Injectability into dry medium crack widths: 0,1 mm – 0,2 mm – 0,3 mm: determination of injectability and splitting test (H, P) crack widths: 0,5 mm – 0,8 mm or where EN 1771 is not suitable : covered by: adhesion by tensile bond strength (H, P)	■
Injectability into non-dry medium crack widths: 0,1 mm – 0,2 mm – 0,3 mm: determination of injectability and splitting test (H, P) crack widths: 0,5 mm – 0,8 mm or where EN 1771 is not suitable: covered by: adhesion by tensile bond strength (H, P)	■
Viscosity (P)	■
Time of efflux (H)	■
REACTIVITY CHARACTERISTICS	
Workable time (H, P)	■
Tensile strength development for polymers (P)	■
Setting time (H)	■
DURABILITY	
Adhesion by tensile bond strength after thermal and wet-drying cycles (H, P)	■
Compatibility with concrete (H, P)	■
<p>■ For all intended uses. □ For certain intended uses. (H) Injection product formulated with hydraulic binder. (P) Injection product formulated with reactive polymer binder.</p>	

Table 2 — Injection products for ductile filling of cracks (D) — Performance characteristics

Performance characteristics Method 1.5	Intended use
BASIC CHARACTERISTICS	
Adhesion and elongation capacity of ductile injection products (P)	■
Watertightness (P)	□
Glass transition temperature (P)	□
WORKABILITY CHARACTERISTICS	
Injectability into dry medium crack widths: 0,1 mm – 0,2 mm – 0,3 mm: determination of injectability and splitting test (P) crack widths: 0,5 mm – 0,8 mm or where EN 1771 is not suitable : covered by: adhesion by tensile bond strength (P)	■
Injectability into non-dry medium crack widths: 0,1 mm – 0,2 mm – 0,3 mm: determination of injectability and splitting test (P) crack widths: 0,5 mm – 0,8 mm or where EN 1771 is not suitable: covered by: adhesion by tensile bond strength (P)	■
Viscosity (P)	■
REACTIVITY CHARACTERISTICS	
Workable time (P)	
DURABILITY	
Compatibility with concrete (P)	■
■ For all intended uses. □ For certain intended uses. (P) Injection product formulated with reactive polymer binder.	

Table 3 — Injection products for swelling fitted filling of cracks (S) — Performance characteristics

Performance characteristics Method 1.5	Intended use
BASIC CHARACTERISTICS	
Watertightness (P)	■
Corrosion behaviour (P)	□
WORKABILITY CHARACTERISTICS	
Viscosity (P)	■
Expansion ratio and rate by water storage (P)	■
REACTIVITY CHARACTERISTICS	
Workable time (P)	■
DURABILITY	
Sensitivity to water: expansion ratio caused by water storage (P)	■
Sensitivity to drying-wet cycles (P)	■
Compatibility with concrete (P)	■
■ For all intended uses. □ For certain intended uses. (P) Injection product formulated with reactive polymer binder.	

5 Requirements

5.1 Identification requirements

The manufacturer shall undertake selected representative initial identification tests for the product or system as specified in Tables 4 and 5.

These tests may be used to confirm the composition of the product at any time. Acceptable tolerances are given in Tables 4 and 5. Test records shall be held by the manufacturer.

Table 4 — Identification requirements for injection products formulated with reactive polymer binder

Property	Test method	Requirements (% deviation from the manufacturers declared value)
Individual components		
* Related to the functional group		
Epoxy equivalent	EN 1877-1	± 5
Amine functions	EN 1877-2	± 6
Hydroxyl value	EN 1240	± 10
Isocyanate content	EN 1242	± 10
Other functional group	To be determined, according to the nature of the functional group	
* Specific weight	EN ISO 2811 (Part 1 or Part 2)	± 3
* Infrared analysis	EN 1767	The positions and relative intensities of the main absorption bands shall match those of the reference spectrum.
Freshly mixed product		
* Viscosity	EN ISO 3219 Viscosity shall be measured 5 min after mixing of the product has been completed. The separate components of the product shall be maintained at a constant temperature of (21 ± 2) °C before mixing. The temperature of the freshly mixed product shall be measured and recorded before the viscosity is measured. For products that harden in less than 5 min, viscosity shall be measured on unmixed components.	± 20
* Pot life	EN ISO 9514 The test shall be performed at three conditioning and test temperatures: 21 °C and the minimum and maximum use temperatures recommended by the manufacturer, with a tolerance of ± 2 °C. NOTE Definition 3.4 applies. Test sample: 1 000 ml	± 20
* Determination of non-volatile matter	EN ISO 3251	± 5
Identification on the hardened mixture		
* Tensile strength, elongation and elastic modulus (F, D)	EN ISO 527-1 EN ISO 527-2 The test shall be performed after 7 days conditioning under the standard conditions for injection products formulated with reactive polymer binder, which are poured on to a non-adherent substrate to a thickness of 3 mm.	± 20
* Strength properties (S)	A compressive load is applied with a speed of 100 mm/min on the product specimen, obtained from the pot life test, with a stamp Ø 20 mm provided by a conical head (angle: 60 °); the load/deformation curve is reported. The test is performed after 24 h conditioning under the standard conditions.	± 20

Table 5 — Identification requirements for injection products formulated with hydraulic binder

Property	Test method	Requirements (% deviation from the manufacturers declared value)
Individual components		
* Particle size analysis by laser diffraction	ISO 13320	Confirmed by comparison
Freshly mixed product		
* Time of efflux (Marsh Funnel)	EN 14117 Viscosity shall be measured 5 min after the end of the mixing of the product has been completed.	± 20
* Setting time	EN 196-3	± 20
* Pot life	EN ISO 9514 The test shall be performed at three conditioning and test temperatures: 21 °C; minimum and maximum temperatures recommended by the manufacturer, with a tolerance of ± 2 °C. Test sample: 1 000 ml, instead of 300 ml. NOTE Definition 3.4 applies.	± 20
* Filtration stability	EN 14497	≤ provided value (μ)
Mixed and hardened product		
* Compression strength and density	EN 12190	± 15

5.2 Performance requirements

The manufacturer shall undertake initial performance tests of the product in accordance with Table 6 (injection products for force transmitting filling of cracks), Table 7 (injection products for ductile filling of cracks), or Table 8 (injection products for swelling fitted filling of cracks) and the product shall comply with the requirements.

The classification of injection products given in Annex A is based on the performance of products in the performance tests specified in Tables 6, 7 and 8.

Table 6 — Injection products for force transmitting filling of cracks (F) — Performance requirements
(1 of 4)

Item No	Performance characteristics	Test method	Requirements
BASIC CHARACTERISTICS			
1	Adhesion by tensile bond strength f_{ct} (H, P)	EN 12618-2 Concrete type MC(040)	Following principle 4 (H, P) F1: $f_{ct} \geq 3,0 \text{ N/mm}^2$ (2,5 N/mm ²) ^a F2: $f_{ct} \geq 2,0 \text{ N/mm}^2$ (1,5 N/mm ²) ^a if $f_{ct} \leq 3,5 \text{ N/mm}^2$ then cohesive failure in the concrete (P) if $f_{ct} > 3,5 \text{ N/mm}^2$ then cohesive or adhesive failure (P) For injection products only intended for filling voids and interstices and following principle 1 for cracks (H) F3: Declared value (H)
2	Compressive strength (H)	EN 12190 after 7 days without sand	F3: $> 20 \text{ N/mm}^2$ after 7 days For injection products only intended for filling voids and interstices (H)
3	Adhesion by slant shear strength (H, P)	EN 12618-3	Monolithic failure (similar pattern of cracking to the control prisms)
4	Non-volatile matter (P)	EN ISO 3251 Weighted sample of fresh mixture is 10 g (initial mass, m1). After 7-day storage at $(21 \pm 2) \text{ }^\circ\text{C}$ and 1 % relative humidity, 3 h drying (exsiccator) at $105 \text{ }^\circ\text{C}$ (final mass, m2)	$> 95 \%$
5	Bleeding (H)	EN 445/3.3	Bleeding $< 1 \%$ of the initial volume after 3 h
6	Volume change (H)	EN 445/3.4	$- 1 \%$ $<$ volume change $< + 5 \%$ of the initial volume
7	Glass transition temperature (P)	EN 12614	$> 40 \text{ }^\circ\text{C}$
8	Chloride content (H)	EN 196-2	$< 0,2 \%$

Table 6 (2 of 4)

Item No	Performance characteristics	Test method	Requirements
WORKABILITY CHARACTERISTICS			
9	Injectability into dry medium. - crack widths 0,1 mm – 0,2 mm – 0,3 mm: determination of injectability and splitting test (H, P)	EN 1771	Injectability class (P) 1: < 4 min (column only) for crack widths 0, 1 mm 2: < 8 min (column only) for crack widths 0, 2 mm 3: < 12 min (column only) for crack widths 0,3 mm Injectability class (H) 3: <12 min + 20 ml surplus – for crack widths 0,3 mm Splitting test > 7 N/mm ² (P) > 3 N/mm ² (H)
	- crack widths 0,5 mm – 0,8 mm or where EN 1771 is not suitable: covered by adhesion by tensile bond strength (H, P)	EN 12618-2 Concrete type MC(040) For crack widths 0,5 mm and 0,8 mm, inert flexible plastic spacers of respectively 0,5 mm and 0,8 mm width shall be used.	When adhesion requirements item (1) fulfilled 5: Percentage of the crack filled > 90 in crack width 0,5 mm 8: Percentage of the crack filled > 90 in crack width 0,8 mm
10	Injectability into non-dry medium - Crack widths 0,1 mm – 0,2 mm – 0,3 mm: determination of injectability and splitting test (H, P)	EN 1771	Injectability class Injectability class (P) 1: < 4 min (column only) for crack widths 0,1 mm 2: < 8 min (column only) for crack widths 0,2 mm 3: < 12 min (column only) for crack widths 0,3 mm Injectability class (H) 3: < 4 min + 20 ml surplus for crack widths 0,3 mm Splitting test > 7 N/mm ² (P) > 3 N/mm ² (H)

Table 6 (3 of 4)

Item No	Performance characteristics	Test method	Requirements
10	- Crack widths 0,5 mm – 0,8 mm or where EN 1771 is not suitable (H, P)	Covered by tensile bond strength EN 12618-2 Concrete type MC(040) For injectability classes 0,5 mm and 0,8 mm, inert flexible plastic spacers of respectively 0,5 mm and 0,8 mm width shall be used.	Injectability class (H, P) When adhesion requirements (item 1) fulfilled 5: Percentage of the crack filled > 90 in crack width 0,5 mm 8: Percentage of the crack filled > 90 in crack width 0,8 mm
11	Viscosity (P)	EN ISO 3219	Declared value
12	Time of efflux (H)	EN 14117	Declared value
REACTIVITY CHARACTERISTICS			
13	Workable time (H, P)	EN ISO 9514 Pot life: see Tables 4 (P) and 5 (H) NOTE: Definitions 3.4 and 3.5 apply.	Declared value
14	Tensile strength development for polymers (P)	EN 1543 The test shall be performed at three conditioning and test temperatures: 21 °C and the minimum and maximum use temperatures recommended by the manufacturer, with a tolerance of ± 2 °C.	Tensile strength > 3 N/mm ² within 72 h at the minimum use temperature, or within 10 h at the minimum use temperature by daily crack movements higher than 10 % or 0,03 mm (the lowest value has to be taken in account).
15	Setting time (H)	EN 196-3 The test shall be performed at three conditioning and test temperatures: 21 °C and the minimum and maximum use temperatures recommended by the manufacturer, with a tolerance of ± 2 °C.	Declared value
DURABILITY			
16	Adhesion by tensile bond strength f_{ct} after thermal and wet-drying cycles (H, P)	EN 12618-2 Concrete type MC(040) Before the artificial aging a slab (300 mm x 300 mm) shall be sawed from the midst of upper half composite specimen. The four sides (flanks) of the slab shall be watertight sealed with epoxy. The maximum test-temperature of the artificial aging is 40 °C. A higher temperature (for example: 60 °C) can be defined by the manufacturer. At the end of each changing period, the temperature has to reach the target temperature ± 2 °C. After cycle storing, five cores with a diameter of 50 mm are to be drilled out for tensile testing. They are to be arranged in such a way, that the distance of the drilling core edges amounts to at least 50 mm of each other and from the record edge.	F1: $f_{ct} \geq 3,0$ N/mm ² (2,5 N/mm ²) (P) * F2: $f_{ct} \geq 2,0$ N/mm ² (1,5 N/mm ²) (P) * Reduction in tensile bond strength less than 30 % of the initial values (H) F3: Declared value (H)

Table 6 (4 of 4)

Item No	Performance characteristics	Test method	Requirements
17	Compatibility with concrete Covered by: Adhesion by tensile bond strength (H, P)	<p>EN 12618-2</p> <p>Concrete type MC(040)</p> <p>Before the artificial aging a slab (300 mm x 300 mm) shall be sawed from the midst of upper half composite specimen. The four sides (flanks) of the slab shall be watertight sealed with epoxy. The maximum test-temperature of the artificial aging is 40 °C. A higher temperature (for example: 60 °C) can be defined by the manufacturer. At the end of each changing period, the temperature has to reach the target temperature ± 2 °C.</p> <p>After cycle storing, five cores with a diameter of 50 mm are to be drilled out for tensile testing. They are to be arranged in such a way, that the distance of the drilling core edges amounts to at least 50 mm of each other and from the record edge.</p>	<p>F1: $f_{ct} \geq 3,0 \text{ N/mm}^2$ (2,5 N/mm² (P)^a)</p> <p>F2: $f_{ct} \geq 2,0 \text{ N/mm}^2$ (1,5 N/mm²) (P)^a</p> <p>Reduction in tensile bond strength less than 30 % of the initial values (H)</p> <p>F3: Declared value (H)</p>
<p>(P) Injection product formulated with reactive polymer binder.</p> <p>(H) Injection product formulated with hydraulic binder.</p> <p>^a The value in brackets is the lowest accepted value of any reading.</p>			

Table 7 — Injection products for ductile filling of cracks (D) — Performance requirements (1 of 2)

Item No	Performance characteristics	Test method	Requirements
BASIC CHARACTERISTICS			
1	Adhesion and elongation capacity of ductile injection products (P)	EN 12618-1	Adhesion: declared value Elongation: > 10 %
2	Watertightness (P)	EN 14068	Watertight at 2×10^5 Pa
3	Glass transition temperature (P)	EN 12614	Declared value
WORKABILITY CHARACTERISTICS			
4	Injectability into dry medium – crack widths 0,1 mm – 0,2 mm – 0,3 mm : determination of injectability (P)	EN 1771	Injectability class 1: < 4 min (column only) for crack widths 0,1 mm 2: < 8 min (column only) for crack widths 0,2 mm 3: < 12 min (column only) for crack widths 0,3 mm
	– crack widths 0,5 mm – 0,8 mm or where EN 1771 is not suitable	Covered by injection between concrete tiles EN 12618-2:2004 (4.3 to 4.6) Concrete type MC(040) For crack widths 0,5 mm and 0,8 mm, inert flexible plastic spacers of respectively 0,5 mm and 0,8 mm width shall be used.	Injectability class 5: Percentage of the crack filled > 90 in crack width 0,5 mm 8: Percentage of the crack filled > 90 in crack width 0,8 mm

Table 7 (2 of 2)

Item No	Performance characteristics	Test method	Requirements
5	<p>Injectability into non-dry medium</p> <p>– crack widths 0,1 mm – 0,2 mm – 0,3 mm:</p> <p>determination of injectability (P)</p> <p>- crack widths 0,5 mm – 0,8 mm or where EN 1771 is not suitable</p>	<p>EN 1771</p> <p>Covered by injection between concrete tiles EN 12618-2:2004 (4.3 to 4.6) Concrete type MC(040)</p> <p>For crack widths 0,5 mm and 0,8 mm, inert flexible plastic spacers of respectively 0,5 mm and 0,8 mm width shall be used.</p>	<p>Injectability class</p> <p>1: < 4 min (column only) for crack widths 0,1 mm</p> <p>2: < 8 min (column only) for crack widths 0,2 mm</p> <p>3: <12 min (column only) 0,3 mm</p> <p>5: Percentage of the crack filled > 90 in crack width 0,5 mm</p> <p>8: Percentage of the crack filled > 90 in crack width 0,5 mm</p>
6	Viscosity (P)	EN ISO 3219	Declared value
REACTIVITY CHARACTERISTICS			
7	Workable time (P)	<p>EN ISO 9514</p> <p>NOTE Definitions 3.4 and 3.5 apply</p> <p>Pot life: see Table 4.</p>	Declared value
DURABILITY			
8	Compatibility with concrete (P)	EN 12637-1	<p>No failure by compressive testing</p> <p>Loss of the deformation work < 20 % related to the loss of the deformation work of the with water prepared, air stored specimen</p>
(P) Injection product formulated with reactive polymer binder.			

Table 8 — Injection products for swelling fitted filling of cracks (S) — Performance requirements
(1 of 2)

Item No	Performance characteristics	Test method	Requirements
BASIC CHARACTERISTICS			
1	Watertightness (P)	EN 14068 The test method described in EN 14068 shall be completed by 500 cycles of pressure modifications, each cycle being constituted as follows: 15 min at 75 % of the maximum pressure – 15 min at 25 % of the maximum pressure. After application of the maximum declared pressure for 7 days, as provided in EN 14068, the pressure shall be lowered to 50 % of the maximum declared pressure, maintained 2 h at this pressure, before beginning the cycles.	Watertight at 2×10^5 Pa
2	Corrosion behaviour (P)	Until there is an accepted European Standard, the national regulations in the place of use shall apply where required.	No promotion of corrosion of steel reinforcement in concrete.
WORKABILITY CHARACTERISTICS			
3	Workability – Viscosity (P)	EN ISO 3219 Where EN ISO 3219 is not suitable, EN 12618-2 shall be applicable. For crack widths 0,3 mm – 0,5 mm and 0,8 mm, inert plastic spacers of respectively 0,3 mm – 0,5 mm and 0,8 mm width shall be used.	≤ 60 mPa·s Percentage of the crack filled > 95
4	Expansion ratio and evolution by water storage Weight changes by air drying and water storage (P)	EN 14498	Declared value
REACTIVITY CHARACTERISTICS			
5	Workable time (P)	EN ISO 9514 Pot life: see Table 4 NOTE Definitions 3.4 and 3.5 apply.	Declared value
DURABILITY CHARACTERISTICS			
6	Sensitivity to water: expansion ratio caused by water storage – Covered by: weight changes by air drying and water storage (P)	EN 14498 (conditioning regime A)	The expansion ratio shall reach a constant level during the water immersion.

Table 8 (2 of 2)

Item No	Performance characteristics	Test method	Requirements
7	Sensitivity to drying-wet cycles – Covered by: weight changes by air drying and water storage (P)	EN 14498 (conditioning regime B) For "conditioning regime B": drying temperature: (40+/-2) °C The specimens shall be kept in a permeable bag (e.g. geotextile). Constant weight is reached for this test when the weight variation during three consecutive measures at 24 h interval is less than 10 %.	After each drying-wet cycle, the weight of the test specimens shall be higher or equal to the initial weight. At the latest after 28 days of the final storing in water, the change of weight (swelling) shall have reached a constant level, and be at least +10 % of initial weight.
8	Compatibility with concrete (P)	The test is performed on specimens according to EN 14498, (conditioning regime A). Sample: 3 specimens, each of 25 mm thickness. Conditioning: 3 specimens shall be conditioned in Ca(OH) ₂ saturated solution. Constant weight is reached for this test when the weight variation during 3 consecutive measures at 24 h interval is less than 10 %.	At the latest after 28 days in solution, the weight change (swelling) shall have reached a constant level and be at least + 10 % of initial weight.

(P) Injection product formulated with reactive polymer binder.

5.3 Special applications

See Annex B (informative), Tables B.1, B.2 and B.3 for special applications.

5.4 Dangerous substances

National regulations on dangerous substances may require verification and declaration on release, and sometimes content, when construction products covered by this standard are placed on those markets.

In the absence of European harmonised test methods, verification and declaration on release/content should be done taking into account national provisions in the place of use.

NOTE An informative database covering European and national provisions on dangerous substances is available at the Construction web site on EUROPA accessed through: <http://ec.europa.eu/enterprise/construction/cpd-ds/>.

6 Sampling

General requirements for sampling procedures 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 procedures 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

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

8 Marking and labelling

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

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

Annex A (normative)

Classification of injection products

Injection products are classified according to the products corresponding to the performance requirements, using the UW classification system (U: intended use; W: workability) (see 5.2).

Firstly, the letter U for intended use is given, followed by one letter and one number between brackets indicating the intended use:

a) F: Injection product for force transmitting filling of cracks:

Following principle 4 (note introduction) for injection of cracks, voids and interstices:

- 1) F1: Adhesion by tensile bond strength $> 3,0 \text{ N/mm}^2$ ($2,5 \text{ N/mm}^2$) (H, P);
- 2) F2: Adhesion by tensile bond strength $> 2,0 \text{ N/mm}^2$ ($1,5 \text{ N/mm}^2$) (H, P).

NOTE 1 The value in brackets is the lowest accepted value of any reading.

Following principle 1 for cracks (note introduction) and restricted to filling of voids and interstices:

- 3) F3: Adhesion by tensile bond strength: declared value and compressive strength $> 20 \text{ N/mm}^2$ after 7 days (H).

b) D: Injection product for ductile filling of cracks:

- 1) D1: Watertight at $2 \times 10^5 \text{ Pa}$.

c) S: Injection product for swelling fitted filling of cracks:

- 1) S1: Watertight at $2 \times 10^5 \text{ Pa}$.

The letter W for workability is followed by three or four groups of numbers between brackets:

d) first group (one number): Allowed minimum thickness of crack, measured in tenths of millimetre (1 – 2 – 3 – 5 – 8);

NOTE 2 This classification results from the injectability tests.

e) second group (one or more numbers): Moisture state of the crack (1 for dry, 2 for damp, 3 for wet, 4 for flowing water);

NOTE 3 This classification results from the injectability tests and relevant performance related tests (adhesion and durability tests for F, elongation capacity and watertightness for D, watertightness for S).

f) third group (two numbers): Minimum and maximum use temperature;

g) fourth group (one number): applicable only to F:

- 1) (1) usable for cracks subject to daily movements higher than 10 % or 0,03 mm, during curing;
- 2) (0) usable for cracks without daily movements or lower than 10 % or 0,03 mm, during curing.

For example, the following classification:

U(F1) W(1) (1/2) (5/30) (1)

identifies an injection product which is:

- for force transmitting filling of cracks;
- injectable in cracks of 0,1 mm, dry or damp;
- fit for use from 5 °C to 30 °C;
- usable for cracks subject to daily movements higher than 10 % or 0,03 mm, during cure.

Annex B (informative)

Special applications

Tables B.1, B.2 and B.3 contain a list of test methods that may be considered for special applications (see 5.3).

Such testing may be required for specific projects where:

- injection products for force transmitting filling of cracks harden under dynamic loading (P) (simulation of the injection under traffic);
- injection products for ductile filling of cracks with required watertightness at 7×10^5 Pa, watertightness after elongation for response to the crack movement after the filling, come into contact with polymeric inserts or are submitted to thermal and wet-drying cycles;
- injection products for swelling fitted filling of cracks come into contact with polymeric inserts or are submitted to freezing temperatures, or is filled in a crack with decreasing and reducing crack width.

Table B.1 — Injection products for force transmitting filling of cracks (F) — Test methods and performance requirements for special applications

Performance characteristics	Test method	Requirements
Hardening under dynamic loading (P)	Until there is an accepted European Standard, the test method valid in the place of use shall apply where required.	Cohesive failure in the concrete

Table B.2 — Injection products for ductile filling of cracks (D) — Test methods and performance requirements for special applications

Performance characteristics	Test method	Requirements
Basic characteristics		
Watertightness (P)	EN 14068	Watertight at 7×10^5 Pa
Watertightness (P) after elongation	Until there is an accepted European Standard, the test method valid in the place of use shall apply where required.	after elongation (declared value: 5 %; 10 %, or defined by manufacturer) watertight at 1×10^5 Pa
Effect on polymeric inserts	EN 12637-3 [1]	After 70 days, the changes in elongation shall be lower than 20 % of the initial value.
Durability Adhesion and elongation after thermal and wet-drying cycles	EN 12618-1 and EN 13687-3 [3] The specimens specified in EN 12618-1 shall be submitted to 24 thermal and wet-drying cycles according to EN 13687-3:2002, 7.1 and 7.2. The adhesion and elongation capacity shall then be measured as specified in EN 12618-1. The maximum test-temperature of the artificial aging is 40 °C. A higher temperature (for example: 60 °C) can be defined by the manufacturer.	Adhesion: loss of adhesion lower than 20 % of the initial value Elongation: > 10 %

Table B.3 — Injection products for swelling fitted filling of cracks (S) — Test methods and performance requirements for special applications

Performance characteristics	Test method	Requirements
Basic characteristics		
Watertightness (P)	EN 14068	Watertight at 7×10^5 Pa
Effect on polymeric inserts	EN 12637-3 [1]	After 70 days, the changes in elongation shall be lower than 20 % of the initial value.
Freezing point ^a	ISO 11357-3 [4]	Declared value
own strength	Until there is an accepted European Standard the test method valid in the place of use shall apply where required.	The swelling product shall not be pushed out of the crack.
^a If a freezing point is showed by DSC analysis, the mechanical properties are determined in function of the temperature by compression testing in following conditions: <ul style="list-style-type: none"> — cylindrical stamp of diameter: 50 mm; — height of the sample: 35 mm; — diameter of the sample: 100 mm; — speed: 50 mm/min. 		

Annex C (informative)

Minimum frequency of testing for Factory Production Control

The tests and frequency of testing on the products are listed in Table C.1.

Table C.1 — Factory production control — Frequency of testing

Characteristics	Protection and repair products based on			
	Epoxy resins	Polyurethane resins	Gels	Hydraulic binders
Particle size analysis by laser diffraction				a
Liquid components				
A specific weight	a	a	a	—
epoxy equivalent ^a	c	—	—	—
hydroxyl value ^a	—	c	—	—
viscosity	—	—	a	—
infra-red analysis	c	c	c	—
B specific weight	a	a	a	—
amine functions ^a	c	—	—	—
isocyanate content ^a	—	c	—	—
viscosity	—	—	a	—
infra-red analysis	c	c	c	—
L ^b determination of volatile and non-volatile matter	—	—	—	a
infra-red analysis	—	—	—	a
Fresh mixture				
viscosity	a	a	—	—
pot life ^c	c	c	c ^d	—
determination of volatile and non-volatile matter	c	c	—	—
setting time	—	—	—	b
filtration stability	—	—	—	b
viscosity (Marsh Funnel)	—	—	—	b
Hardened mixture				
compression strength	—	—	—	c
strength properties	—	—	c	—
tensile strength, elongation and elastic modulus	c	c	—	—
Frequency:				
a Every batch (as defined in EN 1504-8).				
b Every 10 batches, every two weeks, or every 1 000 t, whichever is the sooner (that is, whichever requires the most frequent testing).				
c Twice per year.				
^a Documentation supplied by the raw materials suppliers will be deemed to satisfy this requirement.				
^b L: Liquid component if the injection product based on hydraulic binder is a two component system.				
^c Only at 21 °C.				
^d With the maximum and minimum accelerator content.				

Annex ZA (informative)

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

ZA.1 Scope and relevant characteristics

This European Standard has 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 European Standard 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 concrete injection products covered by this annex for the intended uses indicated herein: reference shall be made to the information accompanying the CE marking.

This annex establishes the conditions for the CE marking of the concrete injection products intended for the uses indicated in Tables ZA.1 a), ZA.1 b) and ZA.1 c) shows the relevant clauses applicable.

This annex has the same scope as the relevant part in Clause 1 of this standard related to the aspect covered by the mandate and is defined by Tables ZA.1 a) to ZA.1 c).

Table ZA.1 a) — Scope and relevant clauses

Construction products: Concrete injection for force transmitting filling of cracks, (F). Intended use: In buildings and civil engineering works.			
Essential characteristics (EC)	Requirements clauses in this standard	Level(s) or class(es)	Notes (expression of results)
Adhesion by tensile bond strength	5.2 Performance requirements Table 6 (1) Adhesion by tensile bond strength	None	Complying with the threshold value or declared value in N/mm ²
Compressive strength	5.2 Performance requirements Table 6 (2) compressive strength	None	Complying with the threshold value or declared value in N/mm ²
Adhesion by slant shear strength	5.2 Performance requirements Table 6 (3) Adhesion by slant shear strength	None	Monolithic failure
Shrinkage	5.2 Performance requirements Table 6 (4) (P) Non-volatile matter	None	Complying with the threshold value in %
	(5) (H) Bleeding	None	Complying with the threshold value in %
	(6) (H) Volume change	None	Complying with the threshold value in %
Glass transition temperature	5.2 Performance requirements Table 6 (7) (P) Glass transition temperature	None	Complying with the threshold value in °C
Workability	5.2 Performance requirements Table 6 (9) Injectability into dry medium	None	Declared value in mm (for crack width) and declared moisture state(s) of the crack
	(10) Injectability into non-dry medium	None	
Chloride content	5.2 Performance requirements Table 6 (8) (H) Chloride content	None	Complying with the threshold value in %
Durability	5.2 Performance requirements Table 6 (16) Adhesion by tensile bond strength after thermal and wet-drying cycles	None	Complying with the threshold value in N/mm ²
Corrosion behaviour	See Clause 4	None	
Release of dangerous substances	See 5.4 Dangerous substances.	None	

Table ZA.1 b) — Scope and relevant clauses

Construction products: Concrete injection for ductile filling of cracks, (D). Intended use: In buildings and civil engineering works.			
Essential characteristics (EC)	Requirements clauses in this standard	Level(s) or class(es)	Notes (expression of results)
Adhesion and elongation capacity	5.2 Performance requirements Table 7 (1) Adhesion and elongation capacity of ductile injection products	None	Adhesion: declared value in N/mm ² Elongation: complying with the threshold value in %
Watertightness	5.2 Performance requirements Table 7 (2) Watertightness	None	Complying with the threshold value in Pa
Glass transition temperature	5.2 Performance requirements Table 7 (3) Glass transition temperature	None	Declared value in °C
Workability	5.2 Performance requirements Table 7 (4) Injectability into dry medium (5) Injectability into non-dry medium	None None	Declared value in mm (for crack width) and declared moisture state(s) of the crack
Durability	5.2 Performance requirements Table 7 (8) compatibility with concrete	None	Complying with the threshold value in %
Corrosion behaviour	See Clause 4		
Release of dangerous substances	See 5.4 Dangerous substances.		

Table ZA.1 c) — Scope and relevant clauses (1 of 2)

Construction products: Concrete injection for swelling fitted filling of cracks, (S). Intended use: In buildings and civil engineering works.			
Essential characteristics (EC)	Requirements clauses in this standard	Level(s) or class(es)	Notes (expression of results)
Watertightness	5.2 Performance requirements Table 8 (1) Watertightness	None	Complying with the threshold values in Pa
Workability	5.2 Performance requirements Table 8 (3) Viscosity	None	Complying with the threshold value in mPa·s
Corrosion behaviour	5.2 Performance requirements Table 8 (2) Corrosion behaviour	None	Pass/fail criteria
Expansion ratio and evolution by water storage	5.2 Performance requirements	None	Declared value
	Table 8 (4) Weight changes by air drying and water storage		

(continued)

Table ZA.1 c) (2 of 2)

Construction products: Concrete injection for swelling fitted filling of cracks, (S). Intended use: In buildings and civil engineering works.			
Essential characteristics (EC)	Requirements clauses in this standard	Level(s) or class(es)	Notes (expression of results)
Durability	5.2 Performance requirements Table 8		
	(6) Sensitivity to water	None	Declared value in % (which shall reach a constant level)
	(7) Sensitivity to drying-wet cycles	None	Pass / fail criteria
	(8) Compatibility with concrete	None	Pass / fail criteria
Release of dangerous substances	See 5.4 Dangerous substances.		

The requirement on a certain characteristic is not applicable in those Member States (MSs) where there are no regulatory requirements on that characteristic for the intended use of the product. In this case, manufacturers placing their products on the market of these MSs are not obliged to determine nor 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. The NPD option may not be used, however, where the characteristic is subject to a threshold level.

ZA.2 Attestation of conformity

ZA.2.1 Systems of attestation of conformity

The system of attestation of conformity for the products indicated in Table ZA.1 a) to Table ZA.1 c) in accordance with the decision of the Commission 1999/469/EC as amended by the Commission Decision 01/596/EC, as given for this product family in Annex III of the Mandate M128 "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
Concrete protection and repair products	For other uses in buildings and civil engineering works	—	2+

System 2+: See Directive 89/106/EEC (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 4: See Directive 89/106/EEC (CPD) Annex III.2.(ii). Third possibility.

The attestation of conformity of the injection products in Table ZA.1 a) to Table ZA.1 c) shall be based on the evaluation of conformity procedure indicated in Table ZA.3 a) and Table ZA.3 b) resulting from the application of those clauses of this standard.

Table ZA.3 a) — Assignment of evaluation of conformity tasks for injection products of any intended for uses other than those with low performance (system 2+)

Tasks		Content of the task	Evaluation of conformity clauses to apply
Tasks for the manufacturer	Factory production control (FPC)	Parameters related to EC (Essential characteristics) of relevant Table ZA.1 a), ZA.1 b) or ZA.1 c) relevant for the intended use which are declared	EN 1504-8:2004, 5.5 and EN 1504-5:2013, 7.3
	Initial type testing	EC of relevant Table ZA.1 a), ZA.1 b) or ZA.1 c) relevant for the intended use which are declared	EN 1504-8:2004, 5.2 and EN 1504-5:2013, 7.3
	Testing of samples taken at the factory	EC of Table ZA.1 relevant for the intended use which are declared	EN 1504-8:2004, 5.5 and EN 1504-5:2013, 7.3
Tasks for the notified body	Certification of FPC on the basis of	Initial inspection of factory and of FPC	EN 1504-8:2004, 5.5 and EN 1504-5:2013, 7.3
		Continuous surveillance, assessment and approval of FPC	EN 1504-8:2004, Clause 7

Table ZA.3 b) — Assignment of evaluation of conformity tasks for injection products for uses with low performance (system 4)

Tasks		Content of the task	Evaluation of conformity clauses to apply
Tasks for the manufacturer	Factory production control (FPC)	Parameters related to EC (Essential characteristics) of Tables ZA.1 a), ZA.1 b) and ZA.1 c) relevant for the intended use	EN 1504-8:2004, 5.5 and EN 1504-5:2013, 7.3
	Initial type testing	EC of EC Tables ZA.1 a), ZA.1 b), and ZA.1 c) relevant for the intended use which are declared	EN 1504-8:2004, 5.2

ZA.2.2 EC Certificate and Declaration of conformity

Injection products under system 2+: 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;

NOTE 1 The manufacturer may also be the person responsible for placing the product onto the EEA market, if he takes responsibility for CE marking.

- description of the product (type, identification, use,...), and a copy of the information accompanying the CE marking;

NOTE 2 Where some of the information required for the Declaration is already given in the CE marking information, it does not need to be repeated.

- provisions to which the product conforms (i.e. Annex ZA of this European Standard);
- 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 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.

Injection products under system 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 place of production;

NOTE 3 The manufacturer may also be the person responsible for placing the product onto the EEA market, if he takes responsibility for CE marking.

- description of the product (type, identification, use,...), and a copy of the information accompanying the CE marking;

NOTE 4 Where some of the information required for the Declaration is already given in the CE marking information, it does not need to be repeated.

- provisions to which the product conforms (i.e. Annex ZA of this European Standard);
- 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 above mentioned declaration and 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/EEC and shall be shown preferably on the packaging. When it is not possible, it shall be indicated on the accompanying label or on the accompanying commercial documents.

The following information shall accompany the CE marking symbol:

- identification number of the certification body (only for products under system 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;
- certificate of factory production control (for products under system 2+);
- reference to this European Standard with the date of version;
- description of the product: generic name, material, dimensions, ... and intended use.

Information on those relevant essential characteristics listed in Table ZA.1 a), Table ZA.1 b) or Table ZA.1 c) 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 a), Table ZA.1 b) and Table ZA.1 c);
- "No performance determined" option for characteristics where this is relevant.

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.

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


 0123-CPD-0001	CE conformity marking consisting of the CE symbol given in Directive 93/68/ECC
AnyCo Ltd, PO BX 21, B-1050 13	Identification number of the notified body (for system 2+)
0123-CPD-0456 EN 1504-5:2013 Concrete injection product U (F1) W (1) (1/2) (5/30) (1) Intended use Allowed minimum thickness of crack Moisture state of the crack Minimum and maximum use temperature Crack movements during cure Adhesion by tensile bond strength: > 3,0 N/mm ² Adhesion by slant shear strength: monolithic failure Non-volatile matter: > 95 % Glass transition temperature: > 40 °C Workability crack width from 0,1 mm moisture state of the crack: dry and damp Durability: Pass Corrosion behaviour: deemed to have no corrosive effect Dangerous substances: NPD	Name or identifying mark and registered address of the producer Last two digits of the year in which the marking was affixed
	Number of the FPC certificate (for system 2+) N° of European Standard with date of version Description
	Force transmitting and filling of cracks 0,1 mm
	Dry and damp cracks
	5 °C to 30 °C
	Usable for cracks subject to daily movements higher than 10 % or 0,03 mm during cure
	Information on product and on regulated characteristics

Figure ZA.1 — CE marking information

Bibliography

- [1] EN 12637-3, *Products and systems for the protection and repair of concrete structures — Test methods — Compatibility of injection products — Part 3: Effect of injection products on elastomers*
- [2] EN 12715, *Execution of special geotechnical work — Grouting*
- [3] EN 13687-3:2002, *Products and systems for the protection and repair of concrete structures — Test methods — Determination of thermal compatibility — Part 3: Thermal cycling without de-icing salt impact*
- [4] ISO 11357-3, *Plastics — Differential scanning calorimetry (DSC) — Part 3: Determination of temperature and enthalpy of melting and crystallization*

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