

## English Version

## Products and systems for the protection and repair of concrete structures - Definitions, requirements, quality control and AVCP - Part 8: Quality control and Assessment and verification of the constancy of performance (AVCP)

Produits et systèmes pour la protection et la réparation de structures en béton - Définitions, prescriptions, maîtrise de la qualité et EVCP - Partie 8 : Maîtrise de la qualité et évaluation et vérification de la constance des performances (EVCP)

Produkte und Systeme für den Schutz und die Instandsetzung von Betontragwerken - Definitionen, Anforderungen, Qualitätskontrolle und AVCP - Teil 8: Qualitätskontrolle und Bewertung und Überprüfung der Leistungsbeständigkeit (AVCP)

This European Standard was approved by CEN on 12 March 2016.

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## European foreword

This document (EN 1504-8:2016) 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of an identical text or by endorsement, at the latest by November 2016, and conflicting national standards shall be withdrawn at the latest by February 2018.

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

This document supersedes EN 1504-8:2004.

This document has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association.

The main changes that have been made in this new edition are as follows:

The wording has been adapted to the CPR (Regulation (EU) No. 305/2011).

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 AVCP*.

- *Part 1: Definitions*
- *Part 2: Surface protection systems for concrete*
- *Part 3: Repair concrete and mortars*
- *Part 4: Structural bonding*
- *Part 5: Concrete injection*
- *Part 6: Anchoring of reinforcing steel bar*
- *Part 7: Reinforcement corrosion protection*
- *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*

According to the CEN-CENELEC Internal Regulations, the national standards organizations 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.

## 1 Scope

This Part of EN 1504 specifies procedures for sampling, quality control, assessment and verification of the constancy of performance (AVCP) including marking and labelling of products and systems for the protection and repair of concrete according to EN 1504-2 to EN 1504-7.

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

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

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

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

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

EN 1504-6, *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*

EN 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*

## 3 Terms and definitions

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

### 3.1

#### **batch**

quantity of material made in a single operation, or in the case of continuous production for a defined quantity (in tonnes) which shall be demonstrated by the producer to have a uniform composition and shall not exceed one day's production

### 3.2

#### **identification test**

test carried out to verify a declared value of the composition or property of the product or system in terms of consistency of the production

Note 1 to entry: This is to ensure that the product or system being tested corresponds to the product or system subjected to the initial type test, within the permitted tolerances.

### 3.3

#### **performance test**

test carried out to verify a value for essential characteristics of the product or system in terms of its specified performance during application and use

Note 1 to entry: This is to ensure that the product or system conforms to its specified performance characteristics.

### 3.4

#### **declared value**

value declared and documented by the manufacturer for identification or essential characteristics

## **4 Sampling**

### **4.1 General**

Sampling shall be carried out in such a way that the resulting sample is homogeneous and representative of the batch or product to be inspected. Samples shall be clearly labelled to uniquely identify the source, location and time of sampling. The sample size shall be sufficient for all the required testing in accordance with the relevant test method standards.

A part of the sample should be retained for future reference until the use by date.

### **4.2 Record**

All information relevant to the sampling shall be recorded, including in particular:

- a) date of manufacture and sampling;
- b) unique identification of the product and of the sample(s);
- c) type of material and quantity of sample(s);
- d) name of the manufacturer;
- e) manufacturer's batch identification number;
- f) quantity of batch or product represented by the sample;
- g) physical state;
- h) colour or appearance;
- i) name(s) of the person(s) responsible for sampling;
- j) method of sampling.

### **4.3 Frequency of sampling**

For frequency of sampling see frequency of testing in EN 1504-2 to EN 1504-7.

## 5 Assessment and verification of the constancy of performance (AVCP)

### 5.1 General

The compliance of the products and systems for the protection and repair of concrete structures with the requirement of this standard and with the performances declared by the manufacturer in the DoP shall be demonstrated by:

- determination of the product-type;
- factory production control by the manufacturer, including product assessment.

The manufacturer shall always retain the overall control and shall have the necessary means to take responsibility for the conformity of the product with its declared performance(s).

NOTE The assignment of tasks to the notified bodies and the manufacturer is shown in the Annexes ZA (Table ZA.3 and following Tables) of the relevant part of the EN 1504 series.

### 5.2 Type testing

#### 5.2.1 General

All performances related to characteristics included in this standard shall be determined when the manufacturer intends to declare the respective performances unless the standard gives provisions for declaring them without performing tests. (e.g. use of previously existing data, CWFT and conventionally accepted performance).

Assessment previously performed in accordance with the provisions of this standard, may be taken into account provided that they were made to the same or a more rigorous test method, under the same AVCP system on the same product or products of similar design, construction and functionality, such that the results are applicable to the product in question.

NOTE 1 Same AVCP system means testing by an independent third party *[only for products covered by system 1+, 1 and 3]*, under the responsibility of a notified product certification body *[only for products covered by system 1+ and 1]*.

For the purposes of assessment, the manufacturer's products may be grouped into families, where it is considered that the results for one or more characteristics from any one product within the family are representative for that same characteristics for all products within that same family

NOTE 2 Products may be grouped in different families for different characteristics.

Reference to the assessment method standards should be made to allow the selection of a suitable representative sample.

In addition, the determination of the product-type shall be performed for all characteristics included in the standard for which the manufacturer declares the performance:

- at the beginning of the production of a new or modified product or system for the protection and repair of concrete structures (unless a member of the same product range), or
- at the beginning of a new or modified method of production (where this may affect the stated properties); or
- they shall be repeated for the appropriate characteristic(s), whenever a change occurs in the product or system for the protection and repair of concrete structures design, in the raw material or in the supplier of the components, or in the method of production (subject to the definition of a family), which would affect significantly one or more of the characteristics.

Where components are used whose characteristics have already been determined, by the component manufacturer, on the basis of assessment methods of other product standards, these characteristics need not be re-assessed. The specifications of these components shall be documented.

Products bearing regulatory marking in accordance with appropriate harmonized European specifications may be presumed to have the performances declared in the DoP, although this does not replace the responsibility on the product or system for the protection and repair of concrete structures manufacturer to ensure that the product or system for the protection and repair of concrete structures as a whole is correctly manufactured and its component products have the declared performance values.

### **5.2.2 Test samples, testing and compliance criteria**

The number of samples of products and systems for the protection and repair of concrete structures to be tested/assessed shall be as specified by the materials specification part of this standard (EN 1504-2 to EN 1504-7).

### **5.2.3 Test reports**

The results of the determination of the product-type shall be documented in test reports. All test reports shall be retained by the manufacturer for at least 10 years after the last date of production of the products and systems for the protection and repair of concrete structures to which they relate.

### **5.2.4 Shared other party results**

A manufacturer may use the results of the product-type determination obtained by someone else (e.g. by another manufacturer, as a common service to manufacturers, or by a product developer), to justify his own declaration of performance regarding a product that is manufactured according to the same design (e.g. dimensions) and with raw materials, constituents and manufacturing methods of the same kind, provided that:

- the results are known to be valid for products with the same essential characteristics relevant for the product performance;
- in addition to any information essential for confirming that the product has such same performances related to specific essential characteristics, the other party who has carried out the determination of the product-type concerned or has had it carried out, has expressly accepted<sup>1</sup> to transmit to the manufacturer the results and the test report to be used for the latter's product-type determination, as well as information regarding production facilities and the production control process that can be taken into account for FPC;
- the manufacturer using other party results accepts to remain responsible for the product having the declared performances and he also:
  - a) ensures that the product has the same characteristics relevant for performance as the one that has been subjected to the determination of the product-type, and that there are no significant differences with regard to production facilities and the production control process compared to that used for the product that was subjected to the determination of the product-type; and
  - b) keeps available a copy of the determination of the product-type report that also contains the information needed for verifying that the product is manufactured according to the same design and with raw materials, constituents and manufacturing methods of the same kind.

### 5.2.5 Cascading determination of the product-type result

For some construction products, there are companies (often called "system houses") which supply or ensure the supply of, on the basis of an agreement<sup>1)</sup>, some or all of the components (e.g. in case of windows: profiles, gaskets, weather strips)<sup>2)</sup> to an assembler who then manufactures the finished product (referred to below as the "assembler") in his factory.

Provided that the activities for which such a system house is legally established include manufacturing/assembling of products as the assembled one, the system house may take the responsibility for the determination of the product-type regarding one or several essential characteristics of an end product which is subsequently manufactured and/or assembled by other firms in their own factory.

When doing so, the system house shall submit an "assembled product" using components manufactured by it or by others, to the determination of the product-type and then make the determination of the product-type report available to the assemblers, i.e. the actual manufacturer of the product placed on the market.

To take into account such a situation, the concept of cascading determination of the product-type might be taken into consideration in the technical specification, provided that this concerns characteristics for which either a notified product certification body or a notified test laboratory intervene, as presented below.

The determination of the product-type report that the system house has obtained with regard to tests carried out by a notified body, and which is supplied to the assemblers, may be used for the regulatory marking purposes without the assembler having to involve again a notified body to undertake the determination of the product-type of the essential characteristic(s) that were already tested, provided that:

- the assembler manufactures a product which uses the same combination of components (components with the same characteristics), and in the same way, as that for which the system house has obtained the determination of the product-type report. If this report is based on a combination of components not representing the final product as to be placed on the market, and/or is not assembled in accordance with the system house's instruction for assembling the components, the assembler needs to submit his finished product to the determination of the product-type;
- the system house has notified to the manufacturer the instructions for manufacturing/assembling the product and installation guidance;
- the assembler (manufacturer) assumes the responsibility for the correct assembly of the product in accordance with the instructions for manufacturing/assembling the product and installation guidance notified to him by the system house;
- the instructions for manufacturing/assembling the product and installation guidance notified to the assembler (manufacturer) by the system house are an integral part of the assembler's Factory Production Control system and are referred to in the determination of the product-type report;
- the assembler is able to provide documented evidence that the combination of components he is using, and his way of manufacturing, correspond to the one for which the system house has

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<sup>1)</sup> The formulation of such an agreement can be, for instance, a contract, a license or any other type of written agreement, which should also contain clear provisions with regard to responsibility and liability of the component producer (system house, on the one hand, and the assembler of the finished product, on the other hand).

<sup>2)</sup> These companies may produce components but they are not required to do so.



obtained the determination of the product-type report (he needs to keep a copy of the system house's determination of the product-type report);

- regardless the possibility of referring, on the basis of the agreement signed with the system house, to the latter's responsibility and liability under private law, the assembler remains responsible for the product being in compliance with the declared performances, including both the design and the manufacture of the product, which is given when he affixes the regulatory marking on his product.

### **5.3 Factory Production Control (FPC)**

#### **5.3.1 General**

The manufacturer shall establish, document and maintain an FPC system to ensure that the products placed on the market comply with the declared performance of the essential characteristics.

The FPC system shall consist of procedures, regular inspections and tests and/or assessments and the use of the results to control raw and other incoming materials or components, equipment, the production process and the product.

All the elements, requirements and provisions adopted by the manufacturer shall be documented in a systematic manner in the form of written policies and procedures.

This factory production control system documentation shall ensure a common understanding of the evaluation of the constancy of performance and enable the achievement of the required product performances and the effective operation of the production control system to be checked. Factory production control therefore brings together operational techniques and all measures allowing maintenance and control of the compliance of the product with the declared performances of the essential characteristics.

In case the manufacturer has used shared or cascading product-type results, the FPC shall also include the appropriate documentation as foreseen in 5.2.4 and 5.2.5.

#### **5.3.2 Requirements**

##### **5.3.2.1 General**

The manufacturer is responsible for organizing the effective implementation of the FPC system in line with the content of this product standard. Tasks and responsibilities in the production control organization shall be documented and this documentation shall be kept up-to-date.

The responsibility, authority and the relationship between personnel that manages, performs or verifies work affecting product constancy, shall be defined. This applies in particular to personnel that need to initiate actions preventing product non-constancies from occurring, actions in case of non-constancies and to identify and register product constancy problems.

Personnel performing work affecting the constancy of performance of the product shall be competent on the basis of appropriate education, training, skills and experience for which records shall be maintained.

In each factory the manufacturer may delegate the action to a person having the necessary authority to:

- identify procedures to demonstrate constancy of performance of the product at appropriate stages;
- identify and record any instance of non-constancy;
- identify procedures to correct instances of non-constancy.

The manufacturer shall draw up and keep up-to-date documents defining the factory production control. The manufacturer's documentation and procedures should be appropriate to the product and

manufacturing process. The FPC system should achieve an appropriate level of confidence in the constancy of performance of the product. This involves:

- a) the preparation of documented procedures and instructions relating to factory production control operations, in accordance with the requirements of the technical specification to which reference is made;
- b) the effective implementation of these procedures and instructions;
- c) the recording of these operations and their results;
- d) the use of these results to correct any deviations, repair the effects of such deviations, treat any resulting instances of non-conformity and, if necessary, revise the FPC to rectify the cause of non-constancy of performance.

Where subcontracting takes place, the manufacturer shall retain the overall control of the product and ensure that he receives all the information that is necessary to fulfill his responsibilities according to this European standard.

If the manufacturer has part of the product designed, manufactured, assembled, packed, processed and/or labelled by subcontracting, the FPC of the subcontractor may be taken into account, where appropriate for the product in question.

The manufacturer who subcontracts all of his activities may in no circumstances pass the above responsibilities on to a subcontractor.

**NOTE** Manufacturers having an FPC system, which complies with EN ISO 9001 standard and which addresses the provisions of the present European standard are considered as satisfying the FPC requirements of the Regulation (EU) No. 305/2011.

### **5.3.2.2 Equipment**

#### **5.3.2.2.1 Testing**

All weighing, measuring and testing equipment shall be calibrated and regularly inspected according to documented procedures, frequencies and criteria.

#### **5.3.2.2.2 Manufacturing**

All equipment used in the manufacturing process shall be regularly inspected and maintained to ensure use, wear or failure does not cause inconsistency in the manufacturing process. Inspections and maintenance shall be carried out and recorded in accordance with the manufacturer's written procedures and the records retained for the period defined in the manufacturer's FPC procedures.

#### **5.3.2.3 Raw materials and components**

The specifications of all incoming raw materials and components shall be documented, as shall the inspection scheme for ensuring their compliance. In case supplied kit components are used, the constancy of performance system of the component shall be that given in the appropriate harmonized technical specification for that component.

#### **5.3.2.4 Traceability and marking**

Individual products and systems for the protection and repair of concrete structures shall be identifiable and traceable with regard to their production origin. The manufacturer shall have written procedures ensuring that processes related to affixing traceability codes and/or markings are inspected regularly.

### 5.3.2.5 Controls during manufacturing process

The manufacturer shall plan and carry out production under controlled conditions.

### 5.3.2.6 Product testing and evaluation

The manufacturer shall establish procedures to ensure that the stated values of the characteristics he declares are maintained. The characteristics, and the means of control, shall be as specified by the materials specification part of this standard (EN 1504-2 to EN 1504-7).

### 5.3.2.7 Non-complying products

The manufacturer shall have written procedures which specify how non-complying products shall be dealt with. Any such events shall be recorded as they occur and these records shall be kept for the period defined in the manufacturer's written procedures.

Where the product fails to satisfy the acceptance criteria, the provisions for non-complying products shall apply, the necessary corrective action(s) shall immediately be taken and the products or batches not complying shall be isolated and properly identified.

Once the fault has been corrected, the test or verification in question shall be repeated.

The results of controls and tests shall be properly recorded. The product description, date of manufacture, test method adopted, test results and acceptance criteria shall be entered in the records under the signature of the person responsible for the control/test.

With regard to any control result not meeting the requirements of this European standard, the corrective measures taken to rectify the situation (e.g. a further test carried out, modification of manufacturing process, throwing away or putting right of product) shall be indicated in the records.

### 5.3.2.8 Corrective action

The manufacturer shall have documented procedures that instigate action to eliminate the cause of non-conformities in order to prevent recurrence.

### 5.3.2.9 Handling, storage and packaging

The manufacturer shall have procedures providing methods of product handling and shall provide suitable storage areas preventing damage or deterioration.

## 5.3.3 Product specific requirements

The FPC system shall address this European Standard and ensure that the products placed on the market comply with the declaration of performance.

The FPC system shall include a product specific FPC, which identifies procedures to demonstrate compliance of the product at appropriate stages, i.e.:

- a) the controls and tests to be carried out prior to and/or during manufacture according to a frequency laid down in the FPC test plan, and/or
- b) the verifications and tests to be carried out on finished products according to a frequency laid down in the FPC test plan.

If the manufacturer uses only finished products, the operations under b) shall lead to an equivalent level of compliance of the product as if FPC had been carried out during the production.

If the manufacturer carries out parts of the production himself, the operations under b) may be reduced and partly replaced by operations under a). Generally, the more parts of the production that are carried out by the manufacturer, the more operations under b) may be replaced by operations under a).

In any case the operation shall lead to an equivalent level of compliance of the product as if FPC had been carried out during the production.

**NOTE** Depending on the specific case, it can be necessary to carry out the operations referred to under a) and b), only the operations under a) or only those under b).

The operations under a) refer to the intermediate states of the product as on manufacturing machines and their adjustment, and measuring equipment etc. These controls and tests and their frequency shall be chosen based on product-type and composition, the manufacturing process and its complexity, the sensitivity of product features to variations in manufacturing parameters etc.

The manufacturer shall establish and maintain records that provide evidence that the production has been sampled and tested. These records shall show clearly whether the production has satisfied the defined acceptance criteria and shall be available for at least three years.

#### **5.3.4 Initial inspection of factory and of FPC**

Initial inspection of factory and of FPC *[only for products covered by AVCP system 1+, 1 and 2+]* shall be carried out when the production process has been finalized and in operation. The factory and FPC documentation shall be assessed to verify that the requirements of 5.3.2 and 5.3.3 are fulfilled.

During the inspection it shall be verified:

- a) that all resources necessary for the achievement of the product characteristics included in this European standard are in place and correctly implemented, and
- b) that the FPC-procedures in accordance with the FPC documentation are followed in practice, and
- c) that the product complies with the product-type samples, for which compliance of the product performance to the DoP has been verified.

All locations where final assembly or at least final testing of the relevant product is performed shall be assessed to verify that the above conditions a) to c) are in place and implemented. If the FPC system covers more than one product, production line or production process, and it is verified that the general requirements are fulfilled when assessing one product, production line or production process, then the assessment of the general requirements does not need to be repeated when assessing the FPC for another product, production line or production process.

All assessments and their results shall be documented in the initial inspection report.

#### **5.3.5 Continuous surveillance of FPC *[only for products covered by AVCP system 1+, 1 and 2+]***

Surveillance of the FPC shall be undertaken once per year. The surveillance of the FPC shall include a review of the FPC test plan(s) and production processes(s) for each product to determine if any changes have been made since the last assessment or surveillance. The significance of any changes shall be assessed.

Checks shall be made to ensure that the test plans are still correctly implemented and that the production equipment is still correctly maintained and calibrated at appropriate time intervals.

The records of tests and measurement made during the production process and to finished products shall be reviewed to ensure that the values obtained still correspond with those values for the samples submitted to the determination of the product-type and that the correct actions have been taken for non-compliant products.

### 5.3.6 Procedure for modification

If modifications are made to the product, production process or FPC system that could affect any of the product characteristics declared according to this standard, then all the characteristics for which the manufacturer declares performance, which may be affected by the modification, shall be subject to the determination of the product-type, as described in 5.2.1.

Where relevant, a re-assessment of the factory and of the FPC system shall be performed for those aspects, which may be affected by the modification.

All assessments and their results shall be documented in a report.

### 5.3.7 One-off products, pre-production products (e.g. prototypes) and products produced in very low quantity

The products and systems for the protection and repair of concrete structures produced as a one-off, prototypes assessed before full production is established, and products produced in very low quantities shall be assessed as follows.

For type assessment, the provisions of 5.2.1, 3rd paragraph apply, together with the following additional provisions:

- in case of prototypes, the test samples shall be representative of the intended future production and shall be selected by the manufacturer;
- on request of the manufacturer, the results of the assessment of prototype samples may be included in a certificate or in test reports issued by the involved third party.

The FPC system of one-off products and products produced in very low quantities shall ensure that raw materials and/or components are sufficient for production of the product. The provisions on raw materials and/or components shall apply only where appropriate. The manufacturer shall maintain records allowing traceability of the product.

For prototypes, where the intention is to move to series production, the initial inspection of the factory and FPC shall be carried out before the production is already running and/or before the FPC is already in practice. The following shall be assessed:

- the FPC-documentation; and
- the factory.

In the initial assessment of the factory and FPC it shall be verified:

- a) that all resources necessary for the achievement of the product characteristics included in this European standard will be available, and
- b) that the FPC-procedures in accordance with the FPC-documentation will be implemented and followed in practice, and
- c) that procedures are in place to demonstrate that the factory production processes can produce a product complying with the requirements of this European standard and that the product will be the same as the samples used for the determination of the product-type, for which compliance with this European standard has been verified.

Once series production is fully established, the provisions of 5.3 shall apply.

## 6 Marking and labelling

When products and systems for the protection and repair of concrete structures are supplied in containers they shall be clearly marked with the following information. When the material is supplied into a bulk container at the point of delivery, the same information shall be provided in writing at the time of delivery as follows:

- a) the name, address, trademark and any other means of identification of the manufacturer or his authorized representative established in the EEA, and place of production;
- b) the identification of the product, i.e. brand name, batch number;
- c) type of product or system and the number, date and relevant part of EN 1504;
- d) a summary of storage requirements, including requirements on storage life which shall be clearly marked e.g.: "This product shall not be taken to comply with EN 1504 after ...";
- e) guidance for use including any particular precautions relating to its use, including any necessary safety precautions as required by local regulations.

NOTE For CE marking refer to the Annex ZA of the relevant product standards of the EN 1504 series.

## Bibliography

EN ISO 9001, *Quality management systems - Requirements (ISO 9001)*