

English version

**Admixtures for concrete, mortar and grout - Part 4: Admixtures  
for grout for prestressing tendons - Definitions, requirements,  
conformity, marking and labelling**

Adjuvants pour béton, mortier et coulis - Partie 4: Adjuvants  
pour coulis pour câbles de précontrainte - Définitions,  
exigences, conformité, marquage et étiquetage

Zusatzmittel für Beton, Mörtel und Einpressmörtel - Teil 4:  
Zusatzmittel für Einpressmörtel für Spannglieder -  
Definitionen, Anforderungen, Konformität, Kennzeichnung  
und Beschriftung

This European Standard was approved by CEN on 2 May 2001.

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

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### Foreword

This European Standard has been prepared by Technical Committee CEN/TC 104 "Concrete", 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of an identical text or by endorsement, at the latest by January 2002, and conflicting national standards shall be withdrawn at the latest by April 2003.

This European Standard supersedes EN 934-4:2000.

This European standard 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 standard.

This standard is a part of the series EN 934 "Admixtures for concrete, mortar and grout" which additionally comprises the following parts

- Part 2: Concrete admixtures - Definitions, requirements, conformity, marking and labelling
- Part 3: Admixtures for masonry mortar - Definitions, requirements, conformity, marking and labelling
- Part 5: Admixtures for sprayed concrete - Definitions, requirements, conformity, marking and labelling
- Part 6: Sampling, conformity control and evaluation of conformity

This European Standard is used with the standards of the series EN 480 which comprises test methods for admixtures.

The annexes A and ZA are informative.

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

## 1 Scope

This European Standard defines and specifies requirements and conformity criteria for admixtures for the use in grouts for prestressing tendons according to EN 447. It covers admixtures for use in site<sup>1)</sup> mixed grout only. Provisions for the use of grout admixtures are not part of this standard but are covered by EN 447.

## 2 Normative references

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

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

EN 196-6, *Methods of testing cement – Determination of fineness.*

EN 197-1, *Cement – Part 1: Composition, specifications and conformity criteria for common cements.*

EN 445, *Grout for prestressing tendons – Test methods.*

EN 446, *Grout for prestressing tendons – Grouting procedures.*

EN 447, *Grout for prestressing tendons – Specification for common grout.*

EN 480-6, *Admixtures for concrete, mortar and grout – Test methods – Part 6: Infrared analysis.*

EN 480-8, *Admixtures for concrete, mortar and grout – Test methods – Part 8: Determination of conventional dry material content.*

EN 480-10, *Admixtures for concrete, mortar and grout – Test methods – Part 10: Determination of water soluble*

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<sup>1)</sup> For this standard site includes precast concrete factories.

*chloride content.*

EN 934-6:2001, *Admixtures for concrete, mortar and grout – Part 6: Sampling, conformity control and evaluation of conformity.*

prEN 1008:1996, *Mixing water for concrete – Specification for sampling, testing and assessing the suitability of water, including wash water from recycling installations in the concrete industry, as mixing water for concrete.*

ISO 758, *Liquid chemical products for industrial use – Determination of density at 20 °C.*

ISO 1158, *Plastics – Vinyl chloride homopolymers and copolymers – Determination of chlorine.*

ISO 4316, *Surface active agents – Determination of pH of aqueous solutions – Potentiometric method.*

### 3 Terms and definitions

For the purposes of this standard, the following terms and definitions apply:

#### 3.1

##### **admixture for grout**

a material which improves the characteristics of grouts to be injected into ducts for prestressing tendons by influencing their properties such as fluidity, expansion, volume change and bleeding, individually or in combination

#### 3.2

##### **compliance dosage**

the dosage of an admixture, quoted by the manufacturer in % by mass of cement, which will meet the requirements of this standard and which is within the recommended range of dosage

#### 3.3

##### **recommended range of dosage**

dosages between limits, which the manufacturer recommends for the product and are expressed in % by mass of cement, based on experience on site

NOTE The use of the recommended dosage does not imply that compliance with this standard will be met over the whole range. Trial tests should be carried out with the materials to be used on site to find the dosage necessary to achieve the required result (see EN 446).

#### 3.4

##### **test mix**

a prescribed mix of cement, water and admixture

### 4 Composition and preparation of test mix

#### 4.1 Constituent materials

- a) Cement type CEM I strength class 42,5 complying with EN 197-1, C<sub>3</sub>A content 7 % to 11 % by mass calculated from chemical analysis in accordance with EN 196-2 and a specific surface of 320 m<sup>2</sup>/kg to 400 m<sup>2</sup>/kg determined in accordance with EN 196-6.
- b) Water in accordance with prEN 1008.
- c) Admixture for grout under test used at its compliance dosage.

## 4.2 Water/cement ratio

This shall be adjusted to provide the fluidity in 4.3 and shall not exceed 0,42.

## 4.3 Fluidity

The fluidity, measured in accordance with EN 445, at  $(20 \pm 2)$  °C, immediately after mixing shall be as follows:

- Immersion method  $(40 \pm 10)$  s
- or cone method  $(15 \pm 3)$  s

## 4.4 Mixing

This shall be carried out mechanically, with a high shear mixer, to obtain a homogeneous grout. Any recommendations from the manufacturer of the admixture, regarding the mixing sequence, shall be followed.

# 5 Requirements

## 5.1 General

Admixtures for grout shall comply with Table 1 and the relevant requirements in EN 934-6:2001.

Test mixes shall comply with Table 2.

## 5.2 Release of dangerous substances

For content and release of substances from the hardened grout dangerous to health, hygiene and the environment see annex A (informative).

NOTE For requirements which lead to the CE-marking, see ZA.1

Table 1 – General requirements

No	Property	Test method	Requirements
1	Homogeneity <sup>a</sup>	Visual	Homogeneous when used. Segregation shall not exceed the limit stated by the manufacturer. <sup>a</sup>
2	Colour <sup>a</sup>	Visual	Uniform and similar to the description provided by the manufacturer.
3	Effective component <sup>a</sup>	EN 480-6 <sup>b</sup>	IR spectra to show no significant change with respect to the effective component when compared to reference spectrum provided by the manufacturer.
4	Relative density (for liquids only) <sup>a</sup>	ISO 758	$D \pm 0,03$ if $D > 1,10$ $D \pm 0,02$ if $D \leq 1,10$ where $D$ is manufacturer's stated value
5	Conventional dry material content <sup>a</sup>	EN 480-8 <sup>c</sup>	$0,95 T \leq X < 1,05 T$ for $T < 20 \%$ $0,90 T \leq X < 1,10 T$ for $T \geq 20 \%$ $T$ is manufacturer's stated value % by mass; $X$ is test result % by mass
6	pH value (for liquids only) <sup>a</sup>	ISO 4316	Manufacturer's stated value $\pm 1$ or within manufacturer's stated range.
7	Total chlorine <sup>a d</sup>	ISO 1158 <sup>e</sup>	Either $\leq 0,10 \%$ by mass or not above the manufacturer's stated value.
8	Water soluble chloride (Cl) <sup>a</sup>	EN 480-10	Either $\leq 0,10 \%$ by mass <sup>g</sup> or not above the manufacturer's stated value.
9	Corrosion behaviour	<sup>f</sup>	Shall not contain any substance in quantities which could adversely affect the grout or cause corrosion of the prestressing tendons e. g. thiocyanates, sulfides. <sup>f</sup>
<sup>a</sup>	Manufacturer's stated value shall be provided in writing to the user.		
<sup>b</sup>	If the method in EN 480-6 is not suitable the manufacturer shall recommend an alternative test method.		
<sup>c</sup>	If the method in EN 480-8 is not suitable the manufacturer shall recommend an alternative test method.		
<sup>d</sup>	If there is no significant difference between total chlorine content and water soluble chloride content it is permitted to determine only the water soluble chloride content in subsequent tests.		
<sup>e</sup>	The procedure in ISO 1158 shall be modified as follows: - Increase of the sample size to 0,1 g of dry admixture; - Use of silver nitrate and ammonium thiocyanate solutions 0,01 N.		
<sup>f</sup>	Until there is an accepted European Standard the national regulations in the place of use shall apply. when required.		
<sup>g</sup>	Where the chloride content is $\leq 0,10 \%$ by mass, the admixture may be described as "chloride free".		

Table 2 – Requirements for test mix<sup>a</sup>

No	Property	Test method	Requirement
1	Fluidity 30 min after mixing	EN 445	Immersion method $\leq 80$ s or cone method $\leq 25$ s
2	Compressive strength	EN 445	$\geq 30$ MPa at 28 days
3	Bleeding	EN 445	$\leq 2$ % of initial volume at 3 h
4	Range of volume change at 24 h	EN 445 Cylinder method	$-1 \% \leq S \leq 5 \%$ $0 \leq S \leq 5 \%$ , when testing expanding admixtures, where $S$ is the volume change
<sup>a</sup> These requirements correspond with EN 447.			

## 6 Sampling

Requirements for sampling are given in EN 934-6:2001.

## 7 Conformity control

Requirements for conformity control are given in EN 934-6:2001. The frequency of testing in connection with factory production control is given in Table 3.

**Table 3 – Minimum frequency of test for factory production control for admixtures for grout for prestressing tendons**

Tests	Frequency
Homogeneity, colour	B
Relative density (for liquids only)	B
Conventional dry material content	B
pH value (for liquids only)	B
Chloride content (Cl) <sup>a</sup>	4
Compressive strength	1
Fluidity	A
Bleeding	A
Volume change	A

Numbers in this table denote minimum frequency of test per year, spread according to production; if the production is less frequent every batch has to be tested.

A: means test for every 500 t with a minimum of 2 times a year  
B: means test for each batch

<sup>a</sup> Total chlorine content also has to be tested at this frequency if it is significantly different from the chloride content.

NOTE Effective component (infra red analysis) and effect on setting time at maximum recommended dosage need not be included in the programme of factory production control. They shall be included in initial type testing.

## 8 Evaluation of conformity

Requirements for evaluation of conformity are given in EN 934-6:2001.

## 9 Marking and labelling

### 9.1 General

When admixtures for grout are supplied in containers they shall be clearly marked with the relevant 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.

NOTE For CE-marking and labelling see ZA.3.

### 9.2 Designation of admixtures

Admixtures for concrete shall be designated by:

- Name of type of admixture in the language of one member country,
- Number of standard: EN 934-4:2001,
- Code, to identify the type of admixture, consisting of the number of this standard and the number of the table which gives the additional performance requirements for the particular type of admixture.



EXAMPLE Admixture for grout; EN 934-4: T2.

### 9.3 Additional Information

- a) batch number and production plant;
- b) a summary of storage requirements including any special requirements on storage life which shall be clearly marked, e. g.: This admixture shall not be taken to comply with EN 934-4:2001 after "date";
- c) instructions for homogenisation, before use, when necessary;
- d) instructions for use and any necessary safety precautions, e. g. if caustic, toxic or corrosive;
- e) the manufacturer's recommended range of dosage.

**Annex A**  
(Informative)

**Content and release of dangerous substances**

In the absence of specific requirements for substances dangerous to health, hygiene and environment in this standard, the requirements of ZA.1 (paragraph "Warning") and ZA.3 apply.

## Annex ZA (informative)

### Provisions for the CE marking of admixtures for concrete under the EU Construction Products Directive

#### ZA.1 Clauses of this European standard addressing the essential characteristics of the EU Construction Products Directive

This European Standard and this annex ZA have been prepared under a mandate<sup>1)</sup> given to CEN by the European Commission and the European Free Trade Association.

The clauses of this European Standard shown in Table ZA.1 meet the requirements of this mandate given under the EU Construction Products Directive (89/106/EEC).

Compliance with this annex ZA confers a presumption of fitness of the admixtures for concrete covered herein for the intended uses under consideration in Table ZA.

**WARNING** Other requirements and other EU Directives, not affecting the fitness for intended uses, can be applicable to the admixtures for concrete falling within the scope of this annex.

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

NOTE 2 An informative database of European and national provision on dangerous substances is available at the construction web site on EUROPA (CREATE, accessed through <http://europa.eu.int>).

This annex establishes both the conditions for the CE-marking of the construction products intended for the uses indicated in Table ZA.1 and the relevant clauses applicable:

The scope of this Annex is defined by Table ZA.1.

**Table ZA.1 – Scope and relevant clauses of this standard**

<b>Product:</b> Admixtures as covered under the scope of this standard			
<b>Intended use(s):</b> for grout for prestressing tendons			
<b>Essential characteristics</b>	<b>Requirement clauses in this standard</b>	<b>Mandated level(s) or class(es):</b>	<b>Notes</b>
Chloride ion content	Table 1 (8)	None	Requirement is for upper limit or declared maximum value.
Thiocyanate content	Table 1 (9)	None	Requirement is for declared maximum value.
Sulfide content	Table 1 (9)	None	Requirement is for declared maximum value.
Corrosion behaviour	Table 1 (9)	None	Applies to all admixtures . Requirements are dependant on regulations in the place of use.
Dangerous substances	annex ZA	None	Applies to all admixtures. Requirements are dependant on regulations in the place of use.

<sup>1)</sup> M128 "Products related to concrete, mortar and grout"

<b>Product:</b> Admixtures			
<b>Intended use(s):</b> for grout for prestressing tendons			
Essential characteristics	Requirement clauses in this standard	Mandated level(s) or class(es):	Notes
Durability	---	---	Durability relates to the grout incorporating admixtures
Compressive strength	Tables 2 (2)	None	Requirements are for lower limits in test grout (with admixtures)
Bleeding	Table 2 (3)	None	Requirement is for an upper limit in test grout (with admixture)
Consistency (Fluidity)	Table 2 (1)	None	Requirement is for an upper and a lower limit for time of flow in test grout (with admixture)
Range of volume change	Table 2 (4)	None	-

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 Procedure for attestation of conformity of admixtures for concrete

### ZA.2.1 System of attestation of conformity

The system of attestation of conformity for the admixtures for concrete indicated in Table ZA.1, in accordance with the decision of the Commission of nn/yy/EC of yyyy-mm-dd as given 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	Level(s) or class(es)	Attestation of conformity system
Admixtures	For grout	--	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.			

The attestation of conformity of the construction products in Table ZA.1 shall be based on the evaluation of conformity procedures in Table ZA.3 resulting from application of the clauses of this or other European Standard indicated therein.

Table ZA.3 – Assignment of evaluation of conformity tasks

Tasks		Content of the task	Clauses to apply
Tasks for the manufacturer	Factory production control (F.P.C)	Parameters related to all relevant characteristics of Table ZA.1	EN 934-4:2001, clause 7 (relevant tests of table 3) EN 934-6:2001, 5.4
	Initial type testing	All relevant characteristics of Table ZA.1	EN 934-6:2001, 5.3
	Testing of samples taken at the factory	All relevant characteristics of Table ZA.1	EN 934-6:2001, 5.4.4.4
Tasks for the notified body	I.Certification of F.P.C on the basis of	Initial inspection of factory and of F.P.C	EN 934-6:2001, clause 5
		Continuous surveillance, assessment and approval of F.P.C.	EN 934-4:2001, clause 7 (relevant tests of Table 3) EN 934-6:2001, 5.4

### ZA.2.2 EC certification and declaration of conformity

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 place of production,
- description of the product (trade name, type, identification, use,...), and a copy of the information accompanying the CE-marking
- provisions to which the product conforms (e. g. annex ZA of this EN),
- particular conditions applicable to the use of the product (e. g. provisions for the use of the product under certain conditions, etc.),
- the number of the accompanying factory production control certificate,
- conditions and period of validity of the 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.

The above mentioned declaration and certificate shall be presented, on demand, 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 EU or EFTA is responsible for the affixing of the CE marking. The CE marking symbol to affix shall be in accordance with directive 93/68/EC and shall be shown as follows: When admixtures for concrete are supplied in containers the affixing shall be done on the container; when the material is supplied in bulk the affixing shall be done on the accompanying documents. The following information shall accompany the CE-marking symbol:

- Identification number of the notified body,
- Name or identifying mark and registered address of the producer,

- The last two digits in which the marking is affixed,
- Number of the factory production control certificate,
- Reference to this European Standard,
- Description of the product: generic name, material, dimensions, ... and intended use,
- Information on the relevant essential characteristics listed in Table ZA.1:
  - presented as standard designation in accordance with 9.2,
  - given as declared values and, where relevant, level or class to declare for each essential characteristic as indicated in "Notes" in table ZA.1, for those essential characteristics not covered by the standard designation,
  - making use of the "No performance determined" (NPD) option when 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.

In addition to any specific information relating to dangerous substances from hardened concrete shown above, the product should also be accompanied, when and where required and in the appropriate form, by documentation listing any other legislation on dangerous substances for which compliance is claimed, together with any information required by that legislation.

NOTE European legislation without national derogations need not be mentioned.

Format of the CE marking and accompanying information:

Figure ZA.1 gives one example for the CE marking and labelling of admixtures for concrete

<p><b>CE</b></p> <p><b>0123-CPD-0001</b></p>	<p><i>CE conformity marking, consisting of the "CE"-symbol given in directive 93/68/EEC</i></p> <p><i>Identification number of the notified body</i></p>
<p><b>AnyCo Ltd, PO Box 21, B-1050</b></p> <p><b>00</b></p> <p><b>0123-CPD-0456</b></p> <p><b>EN 934-4</b></p> <p>Admixture for grout EN 934-4: T2</p> <p>Maximum chloride content:.....% by mass Maximum thiocyanate content:....% by mass Maximum sulfide content:.....% by mass Range of volume change:.....% by mass Corrosion behaviour<sup>1)</sup>: NEN 3532 Dangerous substances X<sup>1)</sup>: less than ... ppm</p> <p><sup>1)</sup> Only required when placed on the market in a member state which regulates these items.</p>	<p><i>Name or identifying mark and registered address of the producer</i></p> <p><i>Last two digits of the year in which the marking was affixed</i></p> <p><i>Number of the certificate of factory production control</i></p> <p><i>No. of European Standard</i></p> <p><i>Description and/or designation</i></p> <p style="text-align: center;"><i>and</i></p> <p><i>information on product and on regulated characteristics</i></p>

**Figure ZA.1 - Example of CE-marking information**

