# SLOVENSKI STANDARD

**SIST EN 934-5:2008**

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**Kemijski dodatki za beton, malto in injekcijsko maso - 5. del: Kemijski dodatki za brizgani beton - Definicije, zahteve, skadnost, oznaļevanje in obeleģevanje**

Admixtures for concrete, mortar and grout - Part 5: Admixtures for sprayed concrete - Definitions, requirements, conformity, marking and labelling

Zusatzmittel für Beton, Mörtel und Einpressmörtel - Teil 5: Zusatzmittel für Spritzbeton - Begriffe, Anforderungen, Konformität, Kennzeichnung und Beschriftung



Adjuvants pour béton, mortier et coulis - Partie 5 : Adjuvants pour bétons projetés - Définitions, exigences, conformité, marquage et étiquetage



**Ta slovenski standard je istoveten z:** **EN 934-5:2007**

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91.100.10

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EUROPEAN STANDARD

NORME EUROPÉENNE

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# EN 934-5

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English Version

# Admixtures for concrete, mortar and grout - Part 5: Admixtures for sprayed concrete - Definitions, requirements, conformity, marking and labelling

Adjuvants pour béton, mortier et coulis - Partie 5 : Adjuvants pour bétons projetés - Définitions, exigences, conformité, marquage et étiquetage

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This European Standard was approved by CEN on 13 August 2007.

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



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



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EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
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# Foreword

This document (EN 934-5:2007) 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 April 2008, and conflicting national standards shall be withdrawn at the latest by July 2009.

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 has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association, and supports essential requirements of EC Directive(s).

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

This European Standard is a part of the series EN 934 *Admixtures for concrete, mortar and grout* which is comprised of the following parts:

Part 1: Common requirements [1)]



Part 2: Concrete admixtures — Definitions, requirements, conformity, marking and labelling

Part 3: Admixtures for masonry mortar — Definitions, requirements, conformity, marking and labelling



Part 4: Admixtures for grout for prestressing tendons — 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.

Subject to the provisions in EN 14487-1, *Sprayed concrete – Part 1: Definitions, specifications and conformity* admixtures covered by EN 934-2 may also be considered for the use in sprayed concrete.

A previous draft of EN 934-5 had been submitted to Formal Vote in 2004 and had formally passed the vote by majority of CEN-members in 2005. Together with this vote, however, some members presented severe technical comments which were agreed upon by the relevant CEN/TC 104/SC 3 to be taken into account by an amendment. In order to avoid the need of using two separate papers in practice, CEN/TC 104 decided, however, not to publish the agreed document but to submit a further consolidated version including the amended issues to UAP, which finally should be published.

The amendments to the final draft prEN 934-5:2004-11 are the following:

- Table 1: requirements in line 5 (Conventional dry material content), 7 (Total chlorine) and 8 (Water soluble chloride);

- Table 2: heading of table; curing conditions in footnote [d];

1) This document is under preparation.

- Table 3: heading of table;

- Table 4: heading of table;

- Table 5: minimum frequency of testing of alkali content;

- Annex B: new clauses B.4 and B.5 with more details of testing; new clause B.6, extending the test report;

- Annex C: detailing the testing in clause C.4.

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, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland and the United Kingdom.

## 1 Scope

This European Standard defines and specifies requirements and conformity for admixtures specifically intended for use in sprayed concrete.

The types of admixtures covered are:

— set accelerating and non-alkaline set accelerating admixtures;

— consistence control admixtures;

— bond improving admixtures.

Provisions governing the practical application of these admixtures in the production of sprayed concrete are not part of this European Standard.

## 2 Normative references

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

EN 196-1, *Methods of testing cement — Part 1: Determination of strength*



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

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



EN 480-1, *Admixtures for concrete, mortar and grout — Test methods — Part 1: Reference concrete and reference mortar for testing*

EN 480-2, *Admixtures for concrete, mortar and grout — Test methods — Part 2: Determination of setting time*

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 the conventional dry material content*

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

EN 480-12, *Admixtures for concrete, mortar and grout — Test methods — Part 12: Determination of the alkali content of admixtures*

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

EN 1542:1999, *Products and systems for the protection and repair of concrete structures — Test methods — Measurement of bond strength by pull-off*

EN 12350-2, *Testing fresh concrete — Part 2: Slump test*

EN 12350-5, *Testing fresh concrete — Part 5: Flow table test*

EN 12390-3, *Testing hardened concrete — Part 3: Compressive strength of test specimens*

EN ISO 1158, *Plastics — Vinyl chloride homopolymers and copolymers — Determination of chlorine content (ISO 1158:1998)*

ISO 758, *Liquid chemical products for industrial use — Determination of density at 20 degrees C*

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

## 3 Terms and definitions

For the purposes of this European Standard, the following terms and definitions apply.

### 3.1 General definitions

**3.1.1**
**performance**
ability of an admixture to be effective in its intended use without detrimental effects

**3.1.2**
**compliance dosage**
dosage of an admixture, expressed in % by mass of cement, stated by the manufacturer, which will meet the requirements of this European Standard

NOTE The compliance dosage should be within the recommended range of dosage.



**3.1.3**
**recommended range of dosage**
dosages between limits expressed in % by mass of cement that the manufacturer recommends for the product based on experience on site



NOTE The use of the recommended dosage does not imply that compliance with this European 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.

**3.1.4**
**maximum recommended dosage**
upper limit of the recommended range of dosage

**3.1.5**
**control mix**
prescribed mix without admixture

**3.1.6**
**test mix**
prescribed mix incorporating an admixture

### 3.2 Specific definitions

**3.2.1**
**sprayed concrete admixture**
material added to the concrete mix before or during the spraying process, in a quantity not exceeding 5 % by mass of cement, except for sprayed concrete set accelerating admixture, where the dosage should not exceed 12 %, to modify the properties of the mix in the fresh and/or hardened state

**3.2.2**
**sprayed concrete set accelerating admixture**
admixture to develop very early setting of the sprayed concrete differing from set accelerating admixtures as defined and specified in EN 934-2

**3.2.3**
**non-alkaline sprayed concrete set accelerating admixture**
sprayed concrete set accelerating admixture according to 3.2.2 with an alkali content (given as $Na_2O$-equivalent) not exceeding 1,0 % by mass of the admixture

**3.2.4**
**consistence control admixture**
admixture that retains consistency for a long period

NOTE This type of admixture is normally used in combination with a compatible sprayed concrete set accelerating admixture.

**3.2.5**
**bond improving admixture**
admixture added to the concrete mix before or during the process of spraying and which improves the bond between the sprayed concrete layers and/or the substrate surface

# 4 Requirements

## 4.1 General requirements

All the admixtures defined in this European Standard shall conform to the general requirements given in Table 1.

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



## 4.2 Specific requirements



Additional to the general requirements in 4.1, the admixtures defined in 3.2.1 to 3.2.5 shall conform to the following specific requirements:

| | |
|---|---|
| Sprayed concrete set accelerating admixture | Table 2 |
| Non-alkaline sprayed concrete set accelerating admixture | Table 2 |
| Consistence control admixture | Table 3 |
| Bond improving admixture | Table 4 |

These requirements shall be satisfied within the recommended range of dosage.

**Table 1 — General requirements** [i]

| | Property | Test method | Requirements |
|---|---|---|---|
| 1 | Homogeneity [a] | Visual | Homogeneous when used. Segregation shall not exceed the limit stated by the manufacturer. |
| 2 | Colour[a] | Visual | Uniform and similar to the description declared by the manufacturer. |
| 3 | Effective component [a] | EN 480-6 [b] | Infrared spectra to show no significant change with respect to the effective component when compared to reference spectrum provided by the manufacturer. |
| 4 | Relative density [a] | ISO 758 | D ± 0,03 if D > 1,10<br>D ± 0,02 if D ≤ 1,10<br>Where D is the manufacturer's stated value of density. |
| 5 | Conventional dry material content [a] | EN 480-8 [c] | 0,95 T ≤ X < 1,05 T, if T ≥ 20 %<br>0,90 T ≤ X < 1,10 T, if T < 20 %<br>T is manufacturer's stated value % m/m.; X is test result % by mass on dry material content. |
| 6 | pH-Value [a] (only for liquid admixtures) | ISO 4316 | Manufacturer's stated value ± 1 or within manufacturer's stated range. |
| 7 | Total chlorine [a d] | EN ISO 1158 [e] | Either ≤ 0,10 % by mass or not above the manufacturer's stated range. |
| 8 | Water soluble chloride [a] | EN 480-10 | Either ≤ 0,10 % by mass[h] or not above the manufacturer's stated range. |
| 9 | Alkali content ($Na_2O$-equivalent) [a] | EN 480-12 | Not above the manufacturer's stated maximum.<br>≤ 1,0 % by mass for non-alkaline sprayed concrete set accelerating admixture. |
| 10 | Corrosion behaviour | [f g] | No corrosion promotion effects on steel embedded in concrete. |



[a] Manufacturer's stated value shall be provided in writing, to the user, on request.

[b] If the method in EN 480-6 is not suitable, the manufacturer shall recommend an alternative test method.

[c] If the method in EN 480-8 is not suitable, the manufacturer shall recommend an alternative test method.

[d] If there is no significant difference between total chlorine content and water soluble chloride content, only the water soluble chloride content shall be determined in subsequent tests on the admixture involved.

[e] The procedure in EN ISO 1158 shall be modified as follows:

— increase the sample size to 0,1 g of dry admixture;

— use silver nitrate and ammonium thiocyanate solutions 0,01 N.

[f] For testing, cement CEM I with $C_3A$ content less than 5 % by mass shall be used.

[g] If admixtures are tested for corrosion behaviour, tests should be performed in accordance with EN 480-14

[h] Where the chloride content is ≤ 0,10 % by mass, the admixture may be described as "chloride free".

[i] Table 1 including European provisions for corrosion behaviour will be incorporated in EN 934-1, "Admixtures for concrete, mortar and grout - Part 1: Common requirements" which is currently under development. Table 1 shall be used when EN 934-1 is published.

**Table 2 — Specific requirements for sprayed concrete set acceleration and non-alkaline set acceleration admixtures at equal w/c ratio**

| | Property | Reference mortar | Test method | Requirements |
|---|---|---|---|---|
| 1 | Setting time | Reference mortar EN 480-1 [a b] | EN 480-2 [c] | Initial setting time ≤ 10 min<br>Final setting time ≤ 60 min<br>(average of three tests) |
| 2 | Compressive strength | Reference mortar EN 480-1 [a d e] | EN 196-1 | At 28 days:<br>Compressive strength of test mix ≥ 75 % compressive strength of control mix or ≥ 90 % for non-alkaline accelerators.<br>At 90 days:<br>Compressive strength of test mix ≥ compressive strength of test mix at 28 days. |

[a] The w/c ratio shall be ≤ 0,50 and such that the test mix shall have the standard consistence defined in EN 196-3 immediately prior to addition of the admixture.

[b] In difference to EN 480-1, the set accelerating admixture is added to a cement mortar of standard consistence, just before the end of the mixing time. Adding the admixture, mixing and filling the mould, without undue segregation or vibration, shall be completed in a time not exceeding 30 s.

[c] The difference to EN 480-2, the total mass of the moving parts of the Vicat shall be (300 ± 2) g.

[d] All components of the mortar shall be conditioned to a temperature of (5 ± 1) °C. The test specimen shall be stored at (20 + 2) °C.

[e] The set accelerating admixture is added to the mortar just before the end of the mixing time. The filling and compacting of the mould with the mortar shall then be completed as quickly as possible.



**Table 3 — Specific requirements for consistence control admixtures at equal consistence**

| | Property | Reference concrete | Test method | Requirements |
|---|---|---|---|---|
| 1 | Retention of consistence | Annex B | EN 12350-2 (slump) or EN 12350-5 (flow) | Control mix:<br>Initial slump: 180 mm to 230 mm, or<br>initial flow: 480 mm to 550 mm.<br>6 h after addition of the admixture, the consistence of the test mix shall be ≥ 80 % of the initial consistence of the test mix. |
| 2 | Compressive strength | Annex B | EN 12390-3 | At 28 days:<br>Compressive strength of test mix ≥ compressive strength of control mix |