



# SLOVENSKI STANDARD

## SIST EN 14487-1:2006

01-maj-2006

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### Brizgani beton – 1. del: Definicije, zahteve in skladnost

Sprayed concrete - Part 1: Definitions, specifications and conformity

Spritzbeton - Teil 1: Begriffe, Festlegungen und Konformität

Béton projeté - Partie 1: Définitions, spécifications et conformité

Ta slovenski standard je istoveten z: **EN 14487-1:2005**

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#### **ICS:**

01.040.91	Gradbeni materiali in gradnja (Slovarji)	Construction materials and building (Vocabularies)
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**SIST EN 14487-1:2006**

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EUROPEAN STANDARD  
NORME EUROPÉENNE  
EUROPÄISCHE NORM

**EN 14487-1**

November 2005

ICS 91.100.30; 01.040.91

English Version

## Sprayed concrete - Part 1: Definitions, specifications and conformity

Béton projeté - Partie 1: Définitions, spécifications et conformité

Spritzbeton - Teil 1: Begriffe, Festlegungen und Konformität

This European Standard was approved by CEN on 25 May 2005.

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

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

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

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## Contents

	Page
Foreword.....	3
Introduction.....	4
1 Scope .....	5
2 Normative references .....	5
3 Terms and definitions .....	7
4 Classification.....	11
5 Requirements for sprayed concrete .....	14
6 Specification for sprayed concrete.....	19
7 Assessment of conformity.....	20
Annex A (informative) Guidelines for definitions, specification and conformity for sprayed concrete.....	30
Bibliography .....	36

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## Foreword

This European Standard (EN 14487-1:2005) 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 May 2006, and conflicting national standards shall be withdrawn at the latest by December 2007.

This European Standard has taken EN 206-1 as a basis. Some clauses which apply to sprayed concrete refer to EN 206-1 because of their importance. Other clauses have been modified to meet the specific requirements of sprayed concrete.

This European Standard is only operable with product standards for constituent materials (i.e. cement, aggregates, additions, admixtures, fibres and mixing water) and related test methods for sprayed concrete which form the package defined below. For this reason, the latest date of withdrawal of national standards (DOW) conflicting with this document is determined by TC 104 to be December 2007.

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

EN 450-1, *Fly ash for concrete - Part 1: Definition, specifications and conformity criteria*

EN 12620, *Aggregates for concrete* (standards.iteh.ai)

EN 1008, *Mixing water for concrete — Specification for sampling, testing and assessing the suitability of water, including water recovered from processes in the concrete industry, as mixing water for concrete*

EN 934-2, *Admixtures for concrete, mortar and grout — Part 2: Concrete admixtures — Definitions and requirements, conformity, marking and labelling*

EN 934-5, *Admixtures for concrete, mortar and grout — Part 5: Admixtures for sprayed concrete — Definitions, requirements, conformity, marking and labelling*

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

EN 13263-1, *Silica fume for concrete — Part 1: Definitions, requirements and conformity criteria.*

EN 14487-2, *Sprayed concrete — Part 2: Execution*

EN 14488 (all parts), *Testing sprayed concrete*

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

**EN 14487-1:2005 (E)****Introduction**

This European Standard will be applied in Europe under different climatic and geographical conditions, different levels of protection and under different, well-established, regional traditions and experience. Classes for concrete properties have been introduced to cover this situation. Where such general solutions were not possible, the relevant clauses contain permission for the application of EN 206-1 or other standards valid in place.

This European Standard incorporates rules for the use of constituent materials that are covered by European Standards. Other by-products of industrial processes, recycled materials etc. are in current use based on local experience. Until European specifications for these materials are available, this document will not provide rules for their use, but instead refers to the recommendations given in EN 206-1 to apply national standards or provisions valid in the place of use of the concrete.

This European Standard defines tasks for the specifier, producer and user. For example, the specifier is responsible for the specification of concrete, Clauses 5 and 6 and the producer is responsible for conformity and production control, Clause 7. The user is responsible for placing the concrete in the structure. In practice there may be several different parties specifying requirements at various stages of the design and construction process e.g. the client, the designer, the contractor, the concreting sub-contractor. Each is responsible for passing the specified requirements, together with any additional requirements, to the next party in the chain until they reach the producer. In the terms of this document, this final compilation is known as the "specification".

Further explanations and guidance on the application of this document are given in Annex A.

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## 1 Scope

This European Standard is applicable to sprayed concrete, to be used for repair and upgrading of structures, for new structures and for strengthening of ground.

This European Standard covers:

- classification related to consistence of wet mix;
- environmental exposure classes; young, hardened and fibre reinforced concrete;
- requirements for constituent materials, for concrete composition and for basic mix, for fresh and hardened concrete and all types of fibre reinforced sprayed concrete;
- specification for designed and prescribed mixes;
- conformity.

This European Standard is applicable to wet mix as well as dry mix sprayed concrete.

The substrates to which sprayed concrete can be applied include:

- ground (rock and soil);
- sprayed concrete;
- different types of formwork;
- structural components constituted of concrete, masonry and steel;
- drainage materials;
- insulating materials.

Additional or different requirements may be needed for applications not within this document, for instance-refractory uses.

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

EN 206-1:2000, *Concrete — Part 1: Specification, performance, production and conformity*

EN 933-1, *Tests for geometrical properties of aggregates — Part 1: Determination of particle size distribution — Sieving method*

EN 934-2, *Admixtures for concrete, mortar and grout — Part 2: Concrete admixtures — Definitions, requirements, conformity, marking and labelling*

EN 934-5:2005, *Admixtures for concrete, mortar and grout — Part 5: Admixtures for sprayed concrete — Definitions, requirements, conformity, marking and labelling*

**EN 14487-1:2005 (E)**

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

EN 1008, *Mixing water for concrete — Specification for sampling, testing and assessing the suitability of water, including water recovered from processes in the concrete industry, as mixing water for concrete*

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

EN 1542, *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 12350-3, *Testing fresh concrete — Part 3: Vebe test*

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

EN 12350-6, *Testing fresh concrete — Part 6: Density*

EN 12390-5, *Testing hardened concrete — Part 5: Flexural strength of test specimens*

EN 12390-7, *Testing hardened concrete — Part 7: Density of hardened concrete*

EN 12390-8, *Testing hardened concrete — Part 8: Depth of penetration of water under pressure*

EN 12504-1, *Testing concrete in structures — Part 1: Cored specimens - Testing, examining and testing in compression*

EN 12504-2, *Testing concrete in structures — Part 2: Non-destructive testing — Determination of rebound number*

EN 12620, *Aggregates for concrete* <https://standards.iteh.ai/catalog/standards/sist/126b3873-3682-400b-99aa-4b900b0883d2/sist-en-14487-1-2006>

EN 13412, *Products and systems for the protection and repair of concrete structures — Test methods — Determination of modulus of elasticity in compression*

prEN 14487-2, *Sprayed concrete — Part 2: Execution*

EN 14488-1, *Testing sprayed concrete — Part 1: Sampling fresh and hardened concrete*

prEN 14488-2, *Testing sprayed concrete — Part 2: Compressive strength of young sprayed concrete*

prEN 14488-3, *Testing sprayed concrete — Part 3: Flexural strengths (first peak, ultimate and residual) of fibre reinforced beam specimens*

EN 14488-4, *Testing sprayed concrete — Part 4: Bond strength of cores by direct tension*

prEN 14488-5, *Testing sprayed concrete — Part 5: Determination of energy absorption capacity of fibre reinforced slab specimens*

prEN 14488-7, *Testing sprayed concrete — Part 7: Fibre content of fibre reinforced concrete*

prEN 14889-1:2004, *Fibres for concrete — Part 1: Steel fibres — Definition, specification and conformity*

prEN 14889-2:2004, *Fibres for concrete — Part 2: Polymer fibres — Definition, specification and conformity*

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

ISO 6782, *Aggregates for concrete — Determination of bulk density*



ISO 6784, *Concrete — Determination of static modulus of elasticity in compression*

### 3 Terms and definitions

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

#### 3.1 Mix component

##### 3.1.1 Admixtures

###### 3.1.1.1

###### **admixture for basic mix**

material added during the mixing process of concrete in a quantity not more than 5 % by mass of the cement content of the concrete, to modify the properties of the mix in the fresh and /or hardened state  
[EN 934-2]

###### 3.1.1.2 Admixtures for projection

###### 3.1.1.2.1

###### **sprayed concrete set accelerating admixture**

admixture to develop very early setting and very early hardening of the sprayed concrete differing from set accelerating admixtures as defined and specified in EN 934-2  
[EN 934-5]

###### 3.1.1.2.2

###### **non-alkaline sprayed concrete set accelerating admixture**

sprayed concrete set accelerating admixture according to 3.2.2 of EN 934-5:2005 with an alkali content not exceeding 1 % by mass of the admixture  
[EN 934-5]

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##### 3.1.2

###### **additions**

finely divided material used in concrete in order to improve certain properties or to achieve special properties  
[EN 206-1]

##### 3.1.3

###### **cement**

a finely ground inorganic material which, when mixed with water, forms a paste that sets and hardens by means of hydration reactions and processes and which, after hardening, retains its strength and stability even under water  
[EN 206-1]

##### 3.1.4

###### **aggregate**

granular material used in construction. Aggregate may be natural, manufactured or re-cycled  
[EN 12620]

##### 3.1.5 Fibres

###### 3.1.5.1

###### **steel fibres**

steel fibres are straight or deformed pieces of cold-drawn steel wire, straight or deformed cut sheet fibres, melt extracted fibres, shaved cold drawn wire fibres and fibres milled from steel blocks which are suitable to be homogeneously mixed into concrete or mortar  
[prEN 14889-1]

**EN 14487-1:2005 (E)****3.1.5.2****polymer fibres**

polymer fibres can be straight or deformed pieces of extruded orientated and cut material which are suitable to be homogeneously mixed into concrete or mortar and which are not affected over time by the high pH of concrete [prEN 14889-2]

**3.2 Product****3.2.1****basic mix**

mixture of cement, aggregates and any other constituents as fed into the spraying machine, excluding any component added at the nozzle. The basic mix may be dry or wet. The basic mix may also contain:

- additions;
- admixtures;
- fibres;
- water

**3.2.2 Dry mix****3.2.2.1****factory blended dry mix**

basic mix with a minimum moisture content not exceeding 0,5 % by mass for the dry process (excluding any component at the nozzle)

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**3.2.2.2****site batched dry mix**

basic mix with a maximum moisture content of the aggregate not exceeding 6 % by mass for the dry process

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**3.2.3****fibre reinforced sprayed concrete**

sprayed concrete, including reinforcing fibres to improve certain properties of concrete

**3.2.4****fresh sprayed concrete**

concrete prior to setting

**3.2.5****rebound**

part of material that, having been sprayed through the nozzle, does not adhere to the surface of application

**3.2.6****reference sprayed concrete**

sprayed concrete which does not contain admixtures for projection

NOTE This definition cannot be applied to sprayed concrete produced with factory blended dry mix containing admixtures for projection, in this case the admixture compatibility should be controlled according to EN 934-5. The reference sprayed concrete is usually used as reference material for the evaluation of mechanical properties changes with time of sprayed concrete (e.g. strength losses)

**3.2.7****sprayed concrete**

concrete produced with basic mix and projected pneumatically from a nozzle into place to produce a dense homogeneous mass by its own momentum

**3.2.8****wet mix**

basic mix to be used in the wet process

**3.2.9****young sprayed concrete**

sprayed concrete up to an age of 24 h

**3.3 Process****3.3.1****curing**

measures to reduce harmful evaporation from concrete

**3.3.2****dense flow conveying**

pump conveying of a wet mix to the nozzle, where it is pneumatically projected and compacted by adding high-pressure air. Dense flow conveying can only be used in the wet process

**3.3.3****dry process**

method of spraying a dry mix (the necessary amount of additional water is added in the nozzle)

**3.3.4****nozzle**

general term for the end of the conveying line, through which the mix is discharged. It consists of a mixing unit, into which – depending on the process – water, compressed air and/or admixtures are injected into the flow of the basic mix

**3.3.5****thin flow conveying**

conveying of the basic mix through hoses or pipes in a continuous stream of high pressure air to the nozzle, where the force of the transportation is used to project and compact the mix

**3.3.6****wet process**

method of spraying a wet mix with an established water/cement ratio

**3.4 Properties****3.4.1****early age strength**

strength developed by young sprayed concrete

**3.4.2****energy absorption capacity**

energy, in Joule, absorbed in loading a fibre reinforced plate, as described in prEN 14488-5

**3.4.3****first peak flexural strength**

stress at the determined first peak load which fibre reinforced concrete withstands when subjected to a flexural test as specified in prEN 14488-3

**3.4.4****open time**

time between mixing and latest possible spraying of the basic mix. It depends on type and quantity of cement, moisture content for the dry mix and temperature

**EN 14487-1:2005 (E)****3.4.5****residual strength**

the calculated stress in fibre reinforced concrete corresponding to a load in the load-deflection curve recorded during the flexural test as defined in prEN 14488-3

**3.4.6****ultimate flexural strength**

stress corresponding to the maximum load which unreinforced or fibre reinforced concrete can withstand when subjected to a flexural test as specified in EN 12390-5 and prEN 14488-3

**3.5 Execution****3.5.1****free-standing structure**

structure formed by spraying concrete against temporary or permanent formwork, which does not act compositely with the ground or an existing structure

**3.5.2****repair**

replacement of inferior or deteriorated parts of concrete or masonry members

**3.5.3****shadow effect**

phenomenon of a poorer concrete compaction or voids on the rear side, of for example, a reinforcement bar, which is being sprayed on from one side only

**3.5.4****strengthening of ground**

formation of a temporary or permanent composite structure by spraying concrete against the ground

**3.5.5****substrate**

surface to which the sprayed concrete is applied

**3.5.6****surface improvement**

use of layer of sprayed concrete in order to improve the durability or the appearance of the structure

**3.5.7****upgrading**

placing of additional sprayed concrete – with or without reinforcement – in order to increase the load bearing capacity or the integrity of the structure

**3.6 Operative****3.6.1****nozzleman**

operator who controls and regulates the application of the sprayed concrete

**3.7 Test and inspection****3.7.1****preliminary test for sprayed concrete**

test or tests to check how a sprayed concrete is composed in order to meet all the specified requirements in the fresh and hardened state

**3.7.2****preconstruction test**

test or tests performed with the proposed personnel, materials, equipment and spray method which the contractor will carry out before the start of the spraying work to ensure that the specified properties are met