SLOVENSKI STANDARD
SIST EN 14487-1:2023

01-januar-2023

Nadomešča:
SIST EN 14487-1:2006

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 14487-1:2022**

ICS:

01.040.91	Gradbeni materiali in gradnja (Slovarji)	Construction materials and building (Vocabularies)
91.100.30	Beton in betonski izdelki	Concrete and concrete products

SIST EN 14487-1:2023 **en,fr,de**

EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN 14487-1

November 2022

ICS 01.040.91; 91.100.30

Supersedes EN 14487-1:2005

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 2 October 2022.

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EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

CEN-CENELEC Management Centre: Rue de la Science 23, B-1040 Brussels

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European foreword

This document (EN 14487-1:2022) has been prepared by Technical Committee CEN/TC 104 "Concrete and related products", the secretariat of which is held by SN.

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of an identical text or by endorsement, at the latest by May 2023, and conflicting national standards shall be withdrawn at the latest by May 2023.

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 14487-1:2005.

In comparison with the previous edition, the following technical modifications have been made:

— Table 3 has been added;

— Table 13 has been modified;

— Normative references have been updated.

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

This document 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 DAV + 6 months.

Any feedback and questions on this document should be directed to the users' national standards body. A complete listing of these bodies can be found on the CEN website.

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

Introduction

This document 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 or other standards valid in the place of use.

This document 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 to apply national standards or provisions valid in the place of use of the concrete.

This document 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.

1 Scope

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

This document 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 document 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 documents are referred to in the text in such a way that some or all of their content constitutes requirements 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 206:2013+A2:2021, *Concrete — 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 934-5:2007, *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, assessment and verification of the constancy of performance*

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

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

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

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 12390-13, *Testing hardened concrete — Part 13: Determination of secant modulus of elasticity in compression*

EN 12504-1, *Testing concrete in structures — Part 1: Cored specimens — Taking, 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*

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

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

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

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

EN 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*

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

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

EN 14651, *Test method for metallic fibre concrete — Measuring the flexural tensile strength (limit of proportionality (LOP), residual)*

EN 14889-1, *Fibres for concrete — Part 1: Steel fibres — Definitions, specifications and conformity*

EN 14889-2, *Fibres for concrete — Part 2: Polymer fibres — Definitions, specifications and conformity*

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

ISO 20290-1, *Aggregates for concrete — Test methods for mechanical and physical properties — Part 1: Determination of bulk density, particle density, particle mass-per-volume and water absorption*

3 Terms and definitions

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

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at https://www.electropedia.org/

3.1 Mix component

3.1.1 Admixtures

3.1.1.1
admixtures 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

[SOURCE: EN 934-2:2009+A1:2012, definition 3.2.1]

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 according to EN 934-2

Note 1 to entry: As defined and specified in EN 934-5:2007.

[SOURCE: EN 934-5:2007, definition 3.2.2]

3.1.1.2.2
non-alkaline sprayed concrete set accelerating admixture
sprayed concrete set accelerating admixture according to 3.1.1.2.1 with an alkali content (given as Na_2O equivalent) not exceeding 1 % by mass of the admixture

Note 1 to entry: Admixture made according to EN 934-5:2007.

[SOURCE: EN 934-5:2007, definition 3.2.3]

3.1.2
additions
finely divided mineral material used in concrete in order to improve certain properties or to achieve special properties

[SOURCE: EN 206:2013+A2:2021, definition 3.1.2.1]

3.1.3
cement
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

[SOURCE: EN 206:2013+A2:2021, definition 3.1.2.8]

3.1.4
aggregate
granular material used in construction, aggregate may be natural, manufactured or re-cycled

[SOURCE: EN 12620:2002+A1:2008, definition 3.1]

3.1.5 Fibres

3.1.5.1
steel fibres
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

[SOURCE: EN 14889-1:2006, definition 3.1]

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

[SOURCE: EN 14889-2:2006, definition 3.2]

3.2 Product

3.2.1 General

3.2.1.1
basic mix
mixture of cement, aggregates and any other constituents as fed into the spraying machine, excluding any component added at the nozzle

Note 1 to entry: The basic mix may be dry or wet.

Note 2 to entry: The basic mix may also contain:

— additions;

— admixtures;

— fibres;

— water.

3.2.1.2 Sprayed concrete with fibres

3.2.1.2.1
fibre reinforced sprayed concrete
sprayed concrete, including reinforcing fibres to improve certain properties of concrete

3.2.1.2.2
sprayed concrete with crack reducing fibres
sprayed concrete with fibres that reduce cracking in young sprayed concrete

3.2.1.2.3
sprayed concrete with fibres for fire resistance
sprayed concrete with fibres for improved fire resistance

3.2.1.3
fresh sprayed concrete
concrete prior to setting

3.2.1.4
rebound
part of material that, having been sprayed through the nozzle, does not adhere to the surface of application

3.2.1.5
reference sprayed concrete
sprayed concrete which does not contain admixtures for projection

Note 1 to entry: 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).

3.2.1.6
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

3.2.1.7
young sprayed concrete
sprayed concrete up to an age of 24 hours

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)

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 which need to be used shortly after mixing

3.2.3
wet mix
basic mix to be used in the wet process

3.3 Process

3.3.1 Dry spraying process

3.3.1.1
pre-wetting
adding water to dry mix before the nozzle, in order to reduce dust and improve mix quality

3.3.1.2
dry mix conveying
method of conveying a dry mix with or without pre-wetting where the necessary amount of additional water is added in the nozzle

3.3.2 Wet spraying process

3.3.2.1
dense flow conveying
pump conveying a wet mix to the nozzle, where it is pneumatically projected and compacted by adding high pressure air

3.3.2.2
thin flow conveying
conveying of the basic mix to the nozzle, through hoses or pipes with high pressure air, where the force of the transportation is used to project and compact the mix

3.3.3 General

3.3.3.1
nozzle
general term for the end of the conveying line, through which the mix is discharged

Note 1 to entry: 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.