



European Technical Approval ETA-13/0417

English translation prepared by DIBt - Original version in German language

Handelsbezeichnung
Trade name

"Next SR03"

Zulassungsinhaber
Holder of approval

Buzzi Unicem Spa
Via L. Buzzi 6
15033 CASALE MONFERRATO
ITALIEN

Zulassungsgegenstand
und Verwendungszweck
*Generic type and use
of construction product*

Schnellerhärtender Zement auf Basis von Calciumaluminatsulfat
Rapid hardening calcium sulphoaluminate based cement

Geltungsdauer:
Validity: vom
from
bis
to

21 June 2013
21 June 2018

Herstellwerk
Manufacturing plant

Buzzi Unicem SpA
Trino (VC)
Italy

Diese Zulassung umfasst
This Approval contains

10 Seiten
10 pages

I LEGAL BASES AND GENERAL CONDITIONS

- 1 This European technical approval is issued by Deutsches Institut für Bautechnik in accordance with:

Council Directive 89/106/EEC of 21 December 1988 on the approximation of laws, regulations and administrative provisions of Member States relating to construction products¹, modified by Council Directive 93/68/EEC² and Regulation (EC) N° 1882/2003 of the European Parliament and of the Council³;

Gesetz über das In-Verkehr-Bringen von und den freien Warenverkehr mit Bauprodukten zur Umsetzung der Richtlinie 89/106/EWG des Rates vom 21. Dezember 1988 zur Angleichung der Rechts- und Verwaltungsvorschriften der Mitgliedstaaten über Bauprodukte und anderer Rechtsakte der Europäischen Gemeinschaften (Bauproduktengesetz - BauPG) vom 28. April 1998⁴, as amended by Article 2 of the law of 8 November 2011⁵;

Common Procedural Rules for Requesting, Preparing and the Granting of European technical approvals set out in the Annex to Commission Decision 94/23/EC⁶.
- 2 Deutsches Institut für Bautechnik is authorized to check whether the provisions of this European technical approval are met. Checking may take place in the manufacturing plant. Nevertheless, the responsibility for the conformity of the products to the European technical approval and for their fitness for the intended use remains with the holder of the European technical approval.
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- 6 The European technical approval is issued by the approval body in its official language. This version corresponds fully to the version circulated within EOTA. Translations into other languages have to be designated as such.

¹ Official Journal of the European Communities L 40, 11 February 1989, p. 12
² Official Journal of the European Communities L 220, 30 August 1993, p. 1
³ Official Journal of the European Union L 284, 31 October 2003, p. 25
⁴ *Bundesgesetzblatt Teil I* 1998, p. 812
⁵ *Bundesgesetzblatt Teil I* 2011, p. 2178
⁶ Official Journal of the European Communities L 17, 20 January 1994, p. 34

II SPECIFIC CONDITIONS OF THE EUROPEAN TECHNICAL APPROVAL

1 Definition of the product and intended use

1.1 Definition of the construction product

The rapid hardening calcium sulphotoaluminate based cement "Next SR03" referred to in this European technical approval is a special cement that is not covered by the European standard EN 197-1⁷. It is a hydraulic binder with rapid hardening properties.

This cement complies with the specifications of the standard EN 197-1⁷ except the following points:

- this cement contains as main constituent a calcium sulphotoaluminate clinker and
- the sulfate content of the cement, expressed as SO₃, is greater than 4 % by mass.

The calcium sulphotoaluminate clinker (CSAK) is made by sintering a precisely specified mixture of raw materials (raw meal, paste or slurry) containing elements, usually expressed as oxides, CaO, Al₂O₃, SiO₂, Fe₂O₃, SO₃ and small quantities of other materials.

The calcium sulphotoaluminate clinker is a hydraulic material which is composed mainly by C₄A₃S (Yeelimite).

The rapid hardening calcium sulphotoaluminate based cement "Next SR03" is characterized by a high early strength ≥ 10 MPa (6 h). The strength after 28 days is greater than 32,5 MPa.

The rapid hardening calcium sulphotoaluminate based cement "Next SR03" has a high resistance against sulfate attack on concrete.

1.2 Intended use

The rapid hardening calcium sulphotoaluminate based cement "Next SR03" is a cement for production of concrete, mortar, grouts and other mixes including in particular cast-in-situ and prefabricated structural concrete conforming to EN 206-1⁸ and other European standards for concrete elements⁹

The provisions made in this European technical approval are based on an assumed working life of concrete incorporating the rapid hardening calcium sulphotoaluminate based cement "Next SR03" of 50 years when installed in the works. These provisions are based upon the current state of the art and the available knowledge and experience.

When the rapid hardening calcium sulphotoaluminate based cement "Next SR03" is used in mortars and grouts, the assumed working life and assessment methods have been written based upon an assumed working life of mortars and grouts incorporating the rapid hardening calcium sulphotoaluminate based cement "Next SR03" for the intended use of a duration similar to the one of mortar and grout with a cement covered by EN 197-1.

⁷ EN 197-1 Cement - Part 1: Composition, specifications and conformity criteria for common cements

⁸ EN 206-1 Concrete – Part 1: Specification, production, performance and conformity

⁹ e. g. EN 490, EN 516, EN 1168, EN 1317, EN 1338, EN 1340, EN 1520, EN 1858, EN 1857, EN 1916, EN 1917, EN 13084, EN 12446, EN 12737, EN 13224, EN 15037, EN 14844, EN 12839, EN 14843, EN 13978, EN 12843, EN 12951, EN 13224, EN 13813, EN 13877, EN 14843, EN 14992, EN 15037, EN 15258, EN 15435, EN 15498

2 Characteristics of the product and methods of verification

2.1 Calcium sulfoaluminate content of the product

The calcium sulfoaluminate content in the rapid hardening calcium sulfoaluminate based cement "Next SR03", expressed as C_4A_3S , shall be determined from calcium sulfoaluminate content in the calcium sulfoaluminate clinker with XRD-analysis with Rietveld refinement and shall be (52 ± 5) % by mass.

2.2 Cement composition

The composition of the rapid hardening calcium sulfoaluminate based cement "Next SR03" shall be determined by an appropriate verification method and shall be

Calcium sulfoaluminate clinker (CSA-clinker)	(83 ± 7) % by mass
$CaSO_4$ (CS)	(17 ± 7) % by mass

2.3 Early strength ($3 \text{ h} \leq t \leq 8 \text{ h}$)

The early strength of the rapid hardening calcium sulfoaluminate based cement "Next SR03" shall be determined in accordance with EN 196-1 at t hours ($3 \leq t \leq 8$) and shall be declared.

2.4 Standard strength at 28 days

The standard strength of the rapid hardening calcium sulfoaluminate based cement "Next SR03" shall be determined in accordance with EN 196-1¹⁰ at 28 days and shall be declared. The declared value shall be at least 32,5 MPa.

2.5 Initial setting time

The initial setting time of the rapid hardening calcium sulfoaluminate based cement "Next SR03" shall be determined in accordance with EN 196-3¹¹ and shall be declared.

2.6 Soundness

The soundness of the rapid hardening calcium sulfoaluminate based cement "Next SR03" shall be determined in accordance with EN 196-3¹¹ and shall be not greater than 10 mm.

2.7 Sulfate content

The sulfate content, expressed as SO_3 , of the rapid hardening calcium sulfoaluminate based cement "Next SR03" shall be determined in accordance with EN 196-2¹² and shall be $(13,8 \pm 5,0)$ % by mass.

2.8 Chloride content

The chloride content of the rapid hardening calcium sulfoaluminate based cement "Next SR03" shall be determined in accordance with EN 196-2 and shall be not greater than 0,10 % by mass.

NOTE: If the Cl^- content is above 0,10 % by mass, the upper limit value shall be declared by the manufacturer.

¹⁰ EN 196-1 Methods of testing cement - Part 1: Determination of strength

¹¹ EN 196-3 Methods of testing cement - Part 3: Determination of setting time and soundness

¹² EN 196-2 Methods of testing cement - Part 2: Chemical analysis of cement

2.9 Density

The density of the rapid hardening calcium sulphoaluminate based cement "Next SR03" shall be determined according to EN 196-6¹³ and shall be declared. The declared value shall be at least 2,76 g/cm³. The density shall not vary by more than ± 0,20 g/cm³ from the declared value.

2.10 Fineness (Blaine)

The fineness of the rapid hardening calcium sulphoaluminate based cement "Next SR03" shall be determined according to EN 196-6¹³ and shall be declared. The declared value shall be at least 5175 cm²/g. The fineness shall not vary by more than ± 500 cm²/g from the declared value.

2.11 Effect of high temperature on mortar hardened under standard conditions

To evaluate the effect of high temperature mortar with the rapid hardening calcium sulphoaluminate based cement "Next SR03" and with Portland cement CEM I according to EN 197-1⁷ as reference is preliminary hardened in climate with (20 ± 2)°C and more then 95 % relative humidity (climate 20/95). At an age of 28 days the specimens are subjected to high temperatures (40 °C and 60 °C). The development of strength is compared to the strength of the samples stored at (20 ± 2)°C when tested at the same age.

The compressive strength of mortar with the rapid hardening calcium sulphoaluminate based cement "Next SR03" at 20 °C, 40 °C and 60 °C is shown in **figure 1**.

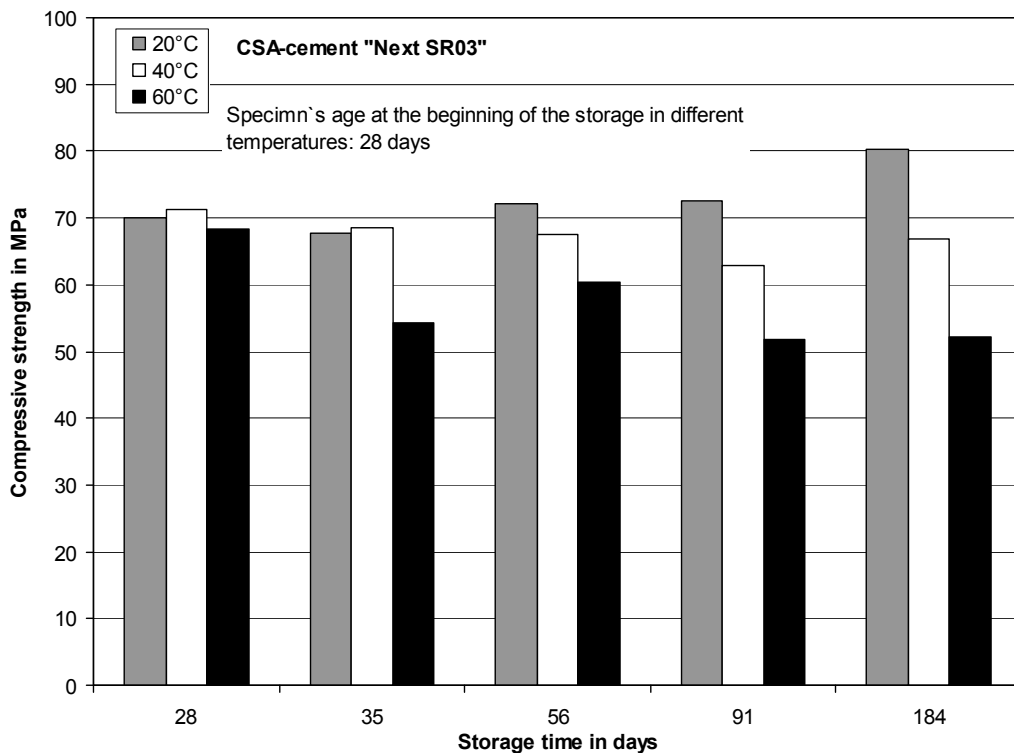


Figure 1: Compressive strength of mortar with rapid hardening calcium sulphoaluminate based cement "Next SR03" at 20°C, 40°C and 60°C

The compressive strength of mortar with CEM I 52,5 R acc. to EN 197-1⁷ at 20 °C, 40 °C and 60 °C is shown in **figure 2**.

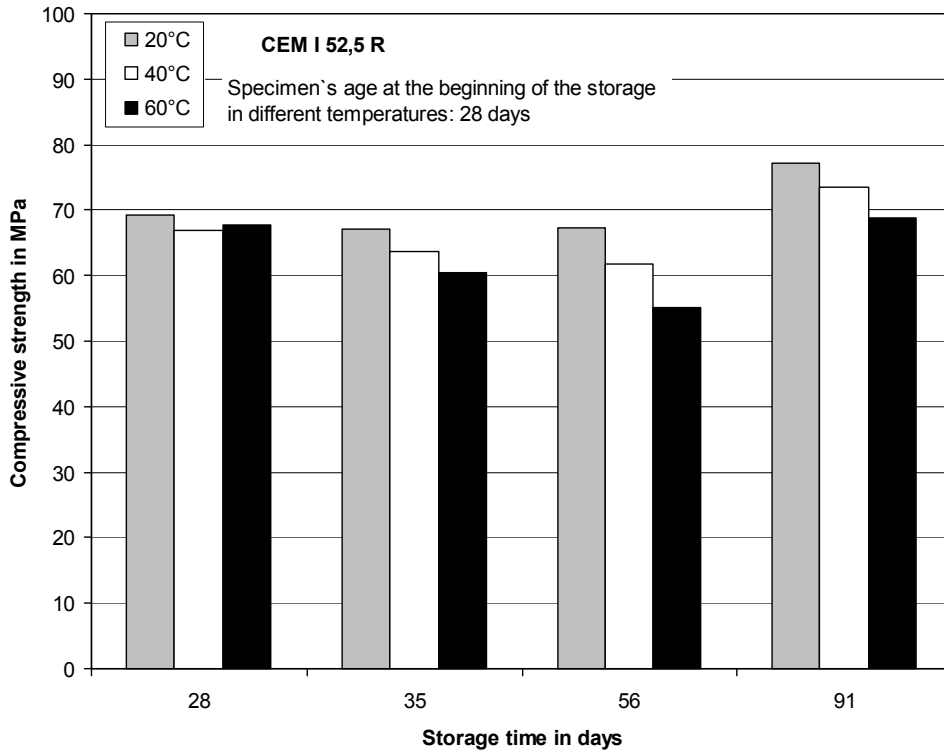


Figure 2: Compressive strength of mortar with CEM I 52,5 R at 20°C, 40°C and 60°C

2.12 Shrinkage

No performance determined.

2.13 Sulfate resistance

The rapid hardening calcium sulphoaluminate based cement "Next SR03" shows a comparable sulfate resistance like a blast furnace cement CEM III/B-SR according to EN 197-1⁷.

The sulfate resistance was determined with the flat prism method.

The test specimens were made of mortar according to EN 196-1¹⁰ with rapid hardening calcium sulphoaluminate based cement "Next SR03" and with two reference cements (CEM I 42,5 R-SR 3 and CEM III/B 42,5 N-LH/SR according to EN 197-1⁷) according to the flat prism method.

24 flat prism from each mortar with the dimensions 10 mm x 40 mm x 160 mm (12 prisms with and 12 prisms without pins) were made in accordance with EN 196-1¹⁰ and were compacted on the vibrating table.

The prisms were stored for 2 days in the mould at 20 °C and a relative air humidity of > 95 % r.H..

After demoulding the prisms were pre-stored until an age of 14 days, on edge, standing on granting in a saturated Ca(OH)₂-solution at 20 °C.

At an age of 14 days, a series of 3 flat prisms with measuring pins and 3 flat prisms without measuring pins were stored on edge, standing on gratings in a 4,4 % Na₂SO₄-solution at 5 °C and 20 °C. One series each of 3 flat prisms with measuring pins and 3 flat prisms without measuring pins were stored on edge, standing on gratings (reference storage 5 °C) in a saturated Ca(OH)₂ solution at 5 °C. The other two series of 3 flat prisms each remained stored in saturated Ca(OH)₂ solution at 20 °C (reference storage 20 °C).

The length and the dynamic modulus of elasticity of the flat prisms stored in 4,4 % Na₂SO₄-solution and in saturated Ca(OH)₂ solution were measured after 0, 14, 28, 56, 90 and 180 days.

The elongation of the flat prisms was calculated as mean value from 3 specimens. The difference in elongation between the sulfate storage and the reference storage was calculated as expansion of length.

Additionally the test specimens were examined visual after each test date.

After a testing period of 180 days the specimens show no expansion damages, cracks or flaking based on formation of thaumasite.

The rapid hardening calcium sulphoaluminate based cement "Next SR03" fulfils the following requirements for the sulfate testing:

20 °C-Storage

- after 90 days: max. expansion difference 0,5 mm/m
- after 180 days: max. expansion difference 0,8 mm/m
- Visual examination of the specimens after 180 day storage in 4,4 % Na₂SO₄-solution:
The specimens show no cracks or flaking.

5 °C-Storage

- after 90 days: max. expansion difference 0,5 mm/m
- Visual examination of the specimens after 180 day storage in 4,4 % Na₂SO₄-solution:
The specimens show no cracks or flaking.

2.14 Resistance to chloride penetration

The resistance to chloride penetration of concrete with the rapid hardening calcium sulphoaluminate based cement "Next SR03" and with Portland cement CEM I according to EN 197-1 as reference was determined by the non-steady-state migration experiments – chloride migration coefficient D_{mig} . The tests were carried out on concrete with a cement content of 300 kg/m³ and a w/c-ratio of 0,50.

The chloride migration coefficient D_{mig} of the rapid hardening calcium sulphoaluminate based cement "Next SR03" at an age of 97 days is greater than $25 \cdot 10^{-12}$ m²/s. Therefore the chloride migration coefficient (D_{mig}) shall be declared.

2.15 Freeze-thaw resistance (without de-icing agent)

The freeze-thaw resistance (without de-icing agent) of concrete with the rapid hardening calcium sulphoaluminate based cement "Next SR03" was determined according to CEN/TS 12390-9¹⁴ ("cube procedure"). The test was carried out on concrete with a cement content of 300 kg/m³ and a w/c-ratio of 0,60. After 100 freeze-thaw cycles the scaling was less than 10 % by mass.

3 Evaluation and attestation of conformity and CE marking

3.1 System of attestation of conformity

According to the communication of the European Commission¹⁵ system 1+ of the attestation of conformity applies.

This system of attestation of conformity is defined as follows:

System 1+: Certification of the conformity of the product by an approved certification body on the basis of:

- (a) Tasks for the manufacturer:
 - (1) factory production control;
 - (2) further testing of samples taken at the factory by the manufacturer in accordance with a prescribed test plan;
- (b) Tasks for the approved body:
 - (3) initial type-testing of the product;
 - (4) initial inspection of factory and of factory production control;
 - (5) continuous surveillance, assessment and approval of factory production control;
 - (6) audit-testing of samples taken at the factory.

Note: Approved bodies are also referred to as "notified bodies".

3.2 Responsibilities

3.2.1 Tasks for the manufacturer

3.2.1.1 Factory production control

The manufacturer shall exercise permanent internal control of production. 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, including records of results performed. This production control system shall insure that the product is in conformity with this European technical approval.

The manufacturer may only use initial materials stated in the technical documentation of this European technical approval.

The factory production control shall be in accordance with the control plan which is part of the technical documentation of this European technical approval. The control plan is laid down in the context of the factory production control system operated by the manufacturer and deposited with Deutsches Institut für Bautechnik.¹⁶

The results of factory production control shall be recorded and evaluated in accordance with the provisions of the control plan.

3.2.1.2 Other tasks for the manufacturer

The manufacturer shall, on the basis of a contract, involve a body which is approved for the tasks referred to in section 3.1 in the field of rapid hardening calcium sulphoaluminate based cement in order to undertake the actions laid down in section 3.2.2. For this purpose, the control plan referred to in sections 3.2.1.1 and 3.2.2 shall be handed over by the manufacturer to the approved body involved.

¹⁵ Letter of the European Commission of 22/01/2009 to EOTA

¹⁶ The control plan is a confidential part of the European technical approval and only handed over to the approved body involved in the procedure of attestation of conformity. See section 3.2.2.

3.2.2 Tasks for the approved bodies

The approved body shall perform the

- initial type-testing of the product,
- initial inspection of factory and of factory production control,
- continuous surveillance, assessment and approval of factory production control,
- audit-testing of samples taken at the factory

in accordance with the provisions laid down in the control plan.

The approved body shall retain the essential points of its actions referred to above and state the results obtained and conclusions drawn in a written report.

The approved certification body involved by the manufacturer shall issue an EC certificate of conformity of the product stating the conformity with the provisions of this European technical approval.

In cases where the provisions of the European technical approval and its control plan are no longer fulfilled the certification body shall withdraw the certificate of conformity and inform Deutsches Institut für Bautechnik without delay.

3.3 CE marking

The CE marking shall be affixed on the packages and the accompanying commercial documents, e.g. the EC declaration of conformity respectively. The letters "CE" shall be followed by the identification number of the approved certification body and be accompanied by the following additional information:

- the name and address of the producer (legal entity responsible for the manufacture),
- the last two digits of the year in which the CE marking was affixed,
- the number of the EC certificate of conformity for the product,
- the number of the European technical approval: ETA-13/0417
- the designation of the product: "Next SR03"
- intended use: "Rapid hardening calcium sulphoaluminate based cement for use in concrete, mortar, grouts and other mixes"
- the declared value of the early strength ($f_{3 \leq t \leq 8h}$)
- the declared value of the standard strength (f_{28d})
- if so, the content of organic additives is between > 0,2 and 1,0 %, the content of organic additives in % by mass
- if so, the limit of chloride in % by mass¹⁷

- Shrinkage: NPD

- Sulfate resistance

Flat prism method (S_{FPM})

S_{FPM} : pass

- Chloride penetration

Chloride migration coefficient (D_{mig})

D_{mig} : declared value

- Freeze-thaw resistance (without de-icing agent)

Cube-procedure (FT_{Cube})

FT_{Cube} : pass

¹⁷

Only where the rapid hardening calcium sulphoaluminate based cement "Next SR03" is produced to meet a chloride content limit different to the value specified in Table 3 of EN 197-1.

4 Assumptions under which the fitness of the product for the intended use was favourably assessed

4.1 Manufacturing

The rapid hardening calcium sulphoaluminate based cement "Next SR03" is manufactured from calcium sulphoaluminate clinker (CSA-clinker), calcium sulphate (CaSO_4), minor additional constituents and citric acid to control setting in the plant of Buzzi Unicem SpA, Trino, Italy. Grinding is carried out separately with subsequent mixing. The sources of the constituents are deposited with Deutsches Institut für Bautechnik.

The European technical approval is issued for the product on the basis of agreed data/information, deposited with Deutsches Institut für Bautechnik, which identifies the product that has been assessed and judged. Changes to the product or production process, which could result in this deposited data/information being incorrect, should be notified to Deutsches Institut für Bautechnik before the changes are introduced. Deutsches Institut für Bautechnik will decide whether or not such changes affect the approval and consequently the validity of the CE marking on the basis of the approval and if so whether further assessment or alterations to the approval shall be necessary.

4.2 Application

The rapid hardening calcium sulphoaluminate based cement "Next SR03" is intended to be used for preparation of concrete, mortar, grouts and other mixes for construction and for the manufacturing of construction products⁹.

Especially rapid hardening calcium sulphoaluminate based cement "Next SR03" is characterized by an evidently high resistance against sulfate attack on concrete.

Heat treatment must not be applied to concrete containing the rapid hardening calcium sulphoaluminate based cement "Next SR03".

5 Indications to the manufacturer for packaging, transport and storage

In the production plant the rapid hardening calcium sulphoaluminate based cement "Next SR03" shall be stored in silos.

Packaging, transport, storage of the rapid hardening calcium sulphoaluminate based cement "Next SR03" shall be the same as for common cements according to EN 197-1⁷.

The manufacturer shall ensure that the requirements given in sections 1, 2 and 4 are made known to those involved. This can be implemented by, for example, handing over copies of the appropriate sections of the European technical approval.

Andreas Kummerow
p.p. Head of Department

beglaubigt:
Schröder