Nafufill KM 250

Fire Resistant Structural Repair Mortar System

Nafufill KM 250

The complete repair programme

Polymer cement concretes (PCCs) have been used in the repair of reinforced concrete and pre-stressed concrete elements for over 20 years. Technical tasks are here not just limited to repairing surface-near structures: both structural strengthening, as well as fire-protection upgrading works for concrete load bearing structures, are part of the standard uses for concrete replacement systems.

In addition to standard repair principles other specialized methods, such as cathodic corrosion protection, are also used in this performance area.

The performance spectrum of Nafufill KM 250 not only covers but exceeds standard requirements. With this unique concrete replacement you can achieve a lasting repair for your concrete surfaces, the full restoration of load-bearing capability and full fire protection for the reinforced concrete structural element to be repaired.

Numerous test certifications, national and international approvals and certifications attest to Nafufill KM 250's high technical performance level and provide you with an absolute degree of security for the execution of a diverse range of repair measures.

Whether civil engineering, water structures, building construction or housing: Nafufill KM 250 means lasting security in concrete repairs.

Non-structural Repairs

Highly resistant long-term protection

Concrete structures exposed to the elements are subjected to a host of stresses (exposures). These frequently result in the corrosion of reinforcements and of the concrete itself in the areas that are close to the surface. The repair of such damaged areas then becomes unavoidable in order to ensure the overall durability of the concrete structure.

A professional planner usually determines whether the repair needs to be carried out, taking into account structural design considerations. If this is not a requirement, the objective of the repair will purely be to permanently protect the reinforcement from corrosion. To prove their suitability for the task the concrete replacement systems used in this application scenario must evidence their increased carbonation and freeze-thaw resistance.

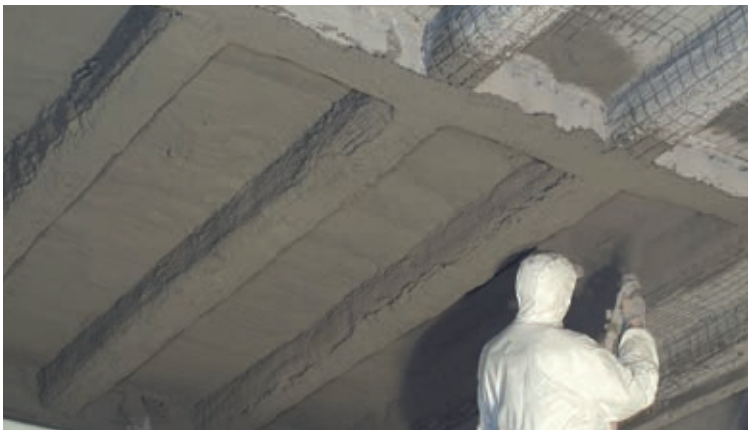
Above average results

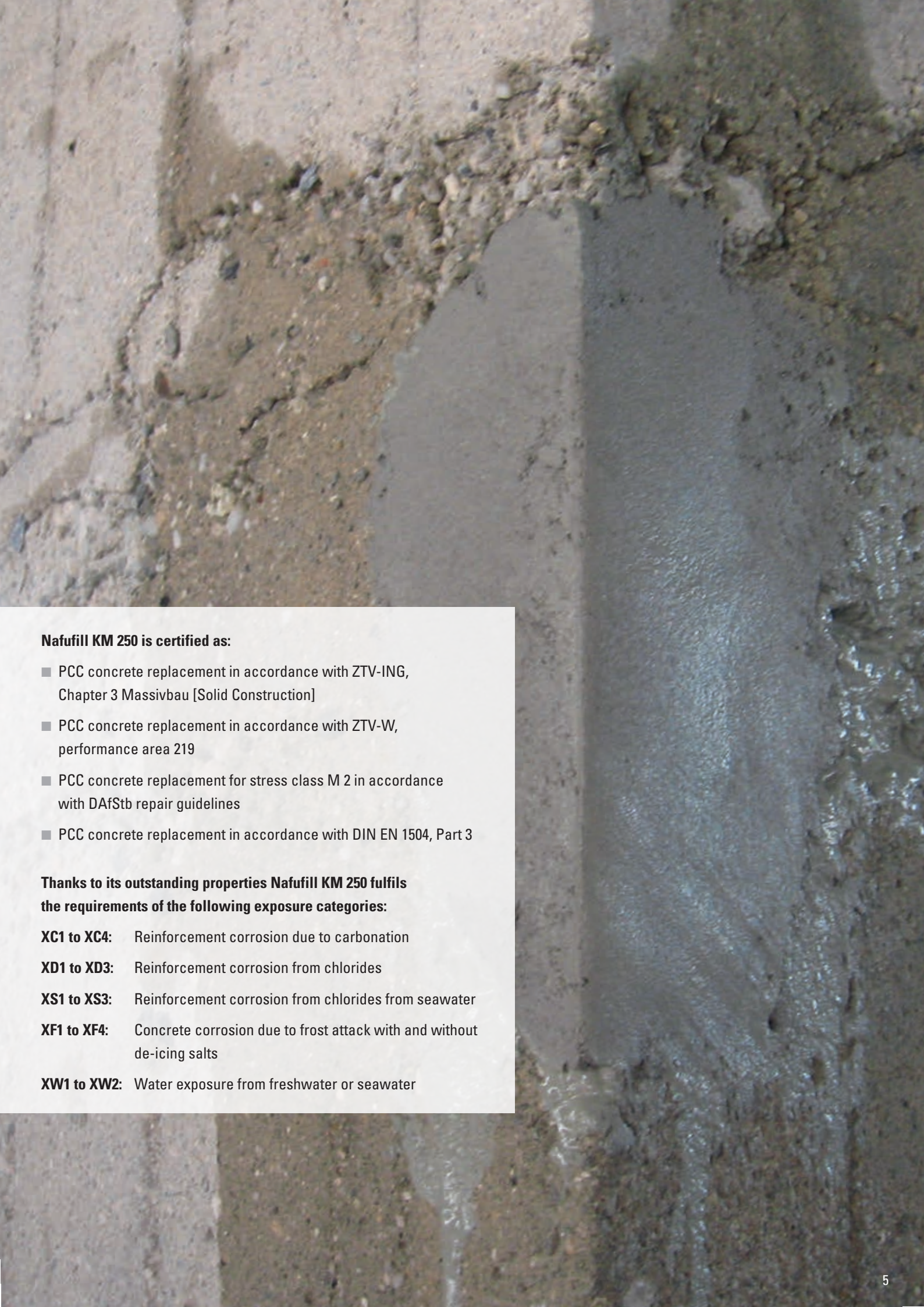
With an attested carbonation resistance of 0 mm and finding that Nafufill KM 250 shows no failure even after 400 alternating freeze-thaw stress test cycles, Nafufill KM 250 gives you optimal security for such load scenarios. The chloride migration coefficient of 2.53 x 10–12 m^2/s additionally highlights the high performance capability of Nafufill KM 250 protecting against chloride penetration.

Fast and powerful

The rapid strength development, low e-modulus, low shrinkage and its excellent bonding behaviour with the substrate are further technical characteristics of Nafufill KM 250 that assist in ensuring your repair measure has a lasting effect.

The fact that it can be sprayed on or applied by hand – even at a layer thickness of up to 100 mm – gives you extra flexibility as an added benefit.





Nafufill KM 250 is certified as:

- PCC concrete replacement in accordance with ZTV-ING, Chapter 3 Massivbau [Solid Construction]
- PCC concrete replacement in accordance with ZTV-W, performance area 219
- PCC concrete replacement for stress class M 2 in accordance with DAfStb repair guidelines
- PCC concrete replacement in accordance with DIN EN 1504, Part 3

Thanks to its outstanding properties Nafufill KM 250 fulfils the requirements of the following exposure categories:

XC1 to XC4:	Reinforcement corrosion due to carbonation
XD1 to XD3:	Reinforcement corrosion from chlorides
XS1 to XS3:	Reinforcement corrosion from chlorides from seawater
XF1 to XF4:	Concrete corrosion due to frost attack with and without de-icing salts
XW1 to XW2:	Water exposure from freshwater or seawater

Structural Strengthening

Added safety resulting from design calculations

A large area of application for Nafufill KM 250 is the structural strengthening of concrete support structures. Decisive for Nafufill KM 250 being used in this area are the product's outstanding test results in terms of creep behaviour, its structurally required high e-modulus, its bonding with the reinforcement and its increased adhesion with the existing concrete substrate.

Increased structural design security

Nafufill KM 250 counting towards structural strengthening brings many important advantages to any planning process of such repair works. In cases where portions of the concrete substance are damaged to such a degree that the remaining residual cross section of the concrete no longer fulfils the structural function, the use of Nafufill KM 250 is a reliable and cost-effective solution without the need to change the product: fast and reliable re-profiling and structural strengthening with a single product system, all in one.

Europe-wide approved quality

Numerous certifications attest Nafufill KM 250 its exceptional technical potential. In addition to certification under the German National Technical Approval, Nafufill KM 250 is also accredited in accordance with the German Committee on Reinforced Concrete (DAfStb) repair guideline for stress class M 3. In accordance with the European Standard DIN EN 1504 Part 3, Nafufill KM 250 is furthermore approved as a structural repair mortar, class R 4.

Bond behaviour of Nafufill KM 250 to reinforcement:

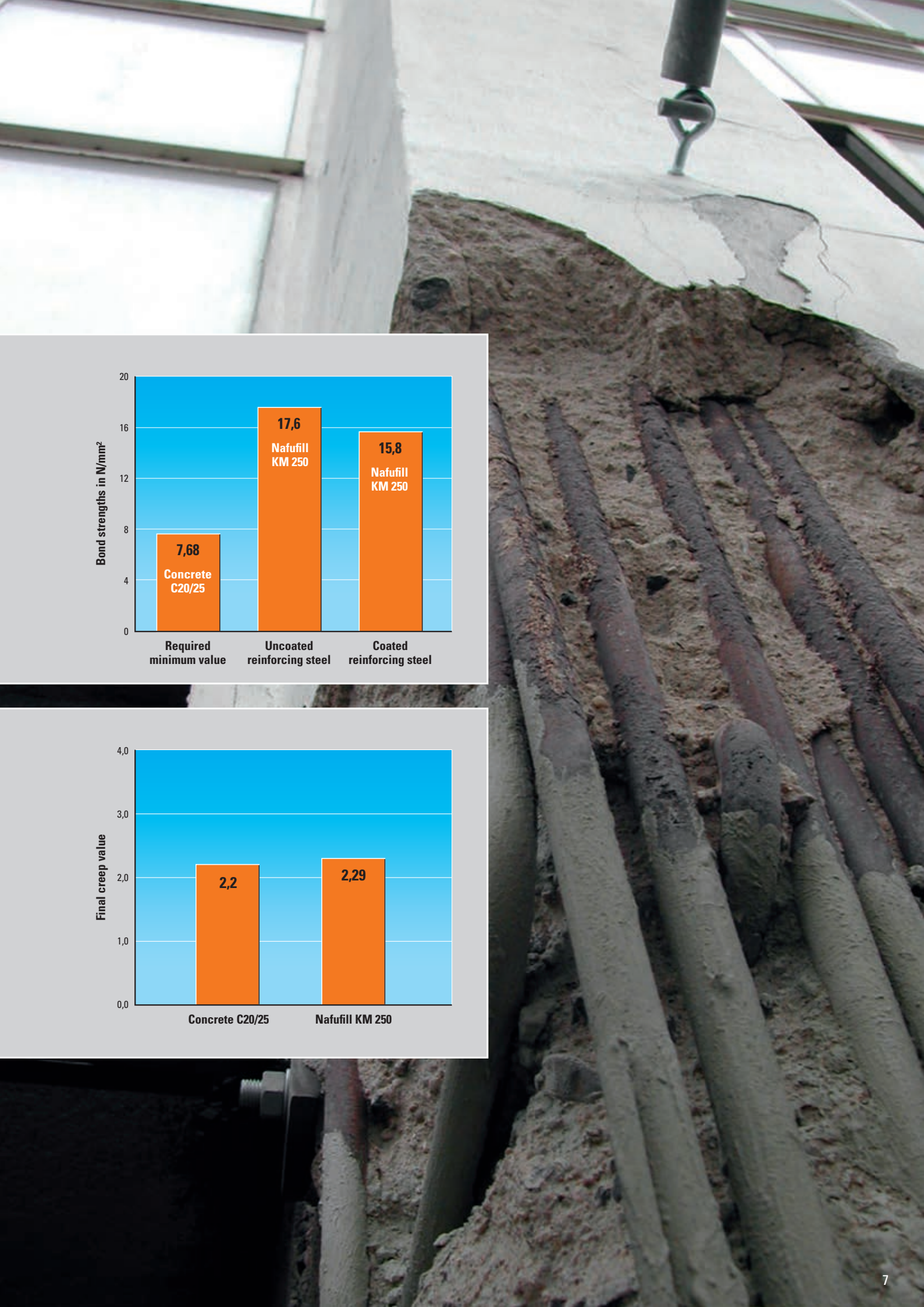
The bonding between existing reinforcement steel and new concrete replacement is described as bond strength. The higher the bond strength, the lower the failure probability of the concrete replacement in the bonding area.

Results show that Nafufill KM 250 clearly exceeds the required minimum bond strength values. This ensures the lasting bond of Nafufill KM 250 with the reinforcement steel.

Creep behaviour of Nafufill KM 250:

The creep behaviour describes the negative length variations (compression) of the concrete/mortar when pressure is applied. The maximum permissible negative length variation is described by the final creep value. The closer the final creep value of the concrete replacement is to that of the concrete, the better the two different materials act together under load.

A comparison of the final creep value of Nafufill KM 250 with that of concrete shows that the former is optimally adjusted to the behaviour of concrete. A homogenous load bearing behaviour under full load is thus ensured.



Bond strengths in N/mm²
20
16
12
8
4
0
7,68
Concrete C20/25
17,6
Nafufill KM 250
15,8
Nafufill KM 250
Required minimum value
Uncoated reinforcing steel
Coated reinforcing steel

Final creep value
4,0
3,0
2,0
1,0
0,0
2,2
2,29
Concrete C20/25
Nafufill KM 250

Upgrading of the Fire Protection

Safety in industrial and commercial engineering and in housing construction

Fire protection may play an important part when it comes to repairing reinforced concrete elements. Especially for load-bearing and space-enclosing structural elements such as pillars, columns, beams, ceilings and walls, national and international regulations exist with regard to fire resistance: Structural building elements must meet fire resistance classes to fulfil its structural function in the case of fire.

If the reinforcement of such structural elements is exposed, the concrete repair must in addition to the protection against corrosion also restore the element's fire resistance. Depending on which part of a construction it is, fire resistance class F30, F60 or F90, must be taken into consideration.

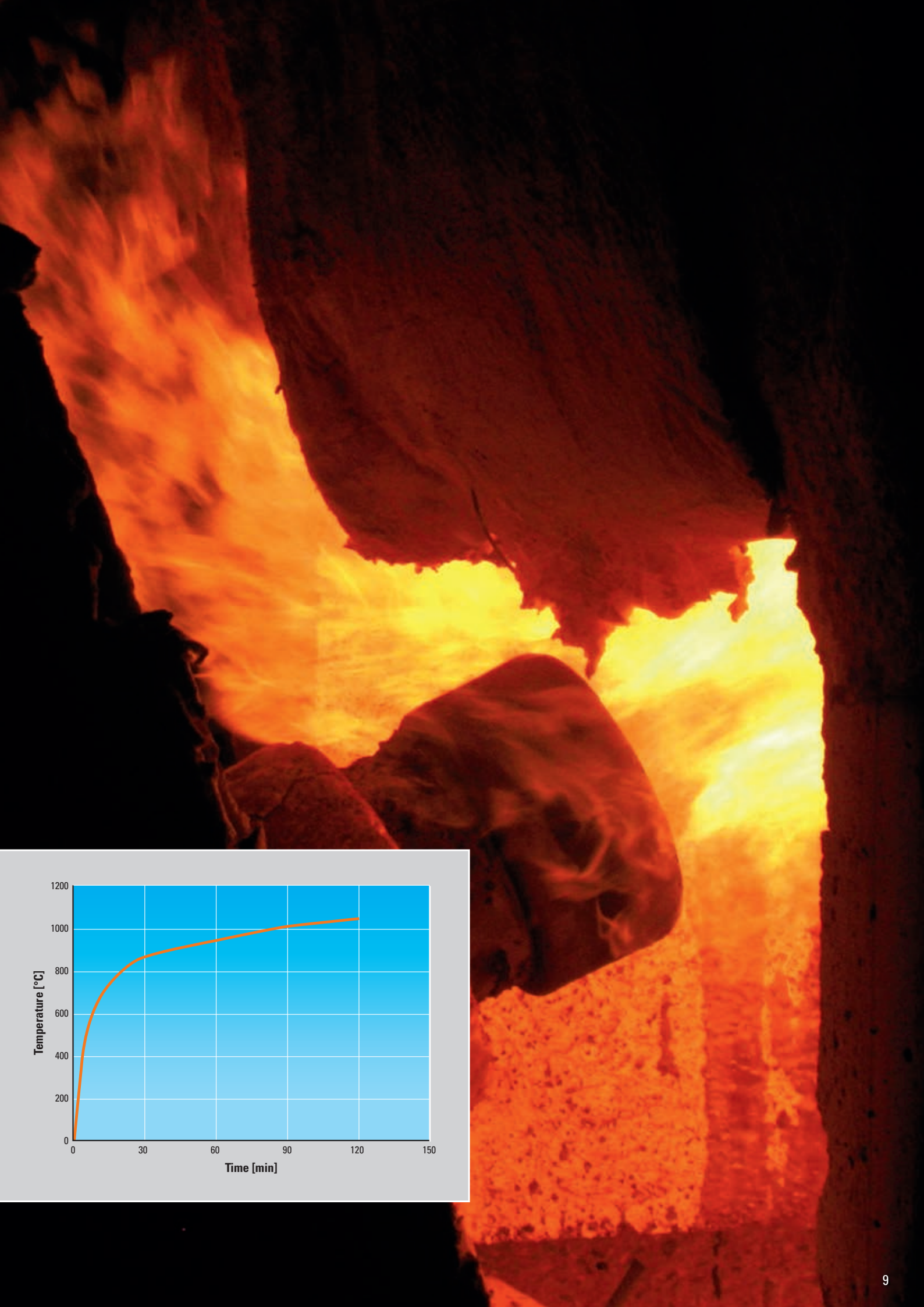
Fire resistance class F 120

Here, too, Nafufill KM 250 proves its technical class. Having gained fire resistance class F 120 the concrete replacement system far exceeds expectations. The classification "fire resistant" is far better than the standard requirement of being "non-flammable" in accordance with DIN 4102 Part 2. It comes without saying, possessing fire resistance class F 120 means Nafufill KM 250 already covers the requirements of the lower fire resistance classes of F 30, F 60 and F 90.

Thanks to its outstanding fire resistance Nafufill KM 250 can be used from a layer thickness of 10 mm – taking into consideration the necessary fire resistance class and the required total concrete cover of the concrete element to be repaired. It is no longer necessary to change to another product or to saddle up a separate fire protection system onto the process. This significantly simplifies such repair works.

To determine the fire resistance of a material EN 1363-1 stipulates a fire loading test in form of a temperature-time sequence.

This is based on the standard temperature curve (ETK) in accordance with ISO 834.


1200
1000
800
600
400
200
0
Temperature [°C]
0
30
60
90
120
150
Time [min]

Fire Protection in Tunnel Structures

Threefold certified fire resistance

It is not the proof of the fire resistance class alone, which is of most importance, when toughening the fire resistance in tunnel structures. Compared with structures in the areas of civil engineering, building construction or housing, tunnel structures must fulfil vastly higher requirements.

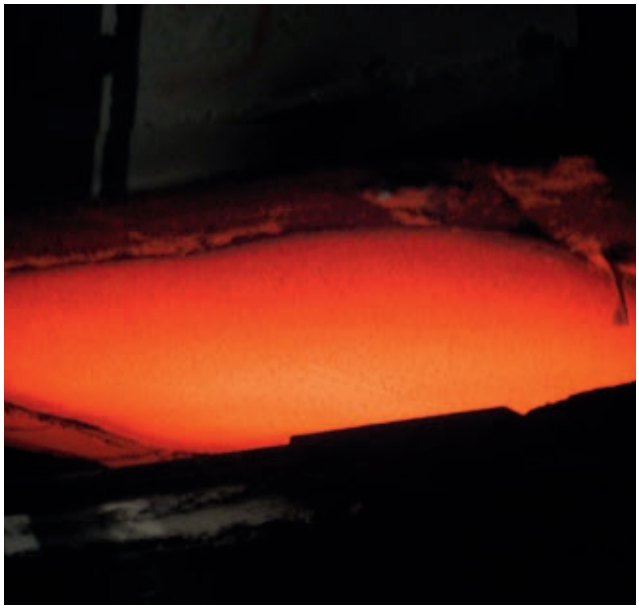
In terms of fire protection a tunnel is considered an enclosed space from which heat cannot dissipate easily. Depending on the material on fire, the fire loading and the resulting duration of the fire may vary heavily. In order to illustrate the various fire progress courses in more detail, a host of different tunnel fire curves have been defined all over the world.

Nafufill KM 250 was able to attest its fire resistance three times over

In a total of 14 fire resistance tests carried out in the Hagerbach Test Gallery Nafufill KM 250 was able to impress and to confirm that this concrete replacement mortar fully complies with the requirements of a) the temperature time sequences (fire curves) as stipulated by ZTV-ING, Chapter 5, Tunnel Construction, b) with the EBA guideline (Federal Railway Authority) and c) with the TNO report 1998-CVB-R1161 "Fire Protection for Tunnels" by Rijkswaterstaat (RWS) (see diagram).

In all fire test trials two test requirements must be met: the temperature development in the load-bearing reinforcements must not exceed the stipulated thresholds and b) the concrete replacement system must remain undamaged. Nafufill KM 250 showed its powerful performance in this area as well. All temperature threshold values of < 300 °C, and < 250 °C respectively, at the reinforcements were clearly not reached. Neither chipping, nor loss of bonding of Nafufill KM 250 could be detected in any of the fire scenarios.

Test sample with Nafufill KM 250 after the fire test

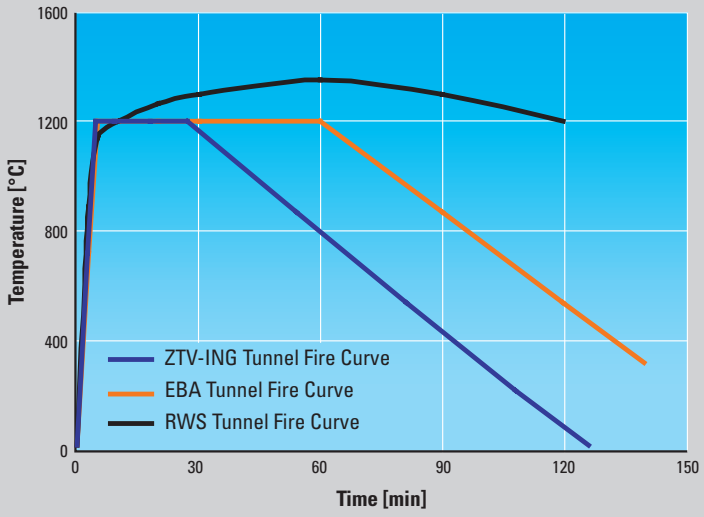


Fault-free, cooled down test sample with Nafufill KM 250

To measure the fire protection capacity of tunnels and to determine fire resistance different fire loadings in form of tunnel fire curves have been defined.

Three of the most demanding temperature time curves are:

- ZTV-ING, Chapter 5 Tunnel Construction
- EBA Guideline
- TNO Report by Rijkswaterstaat (RWS)



Cathodic Corrosion Protection

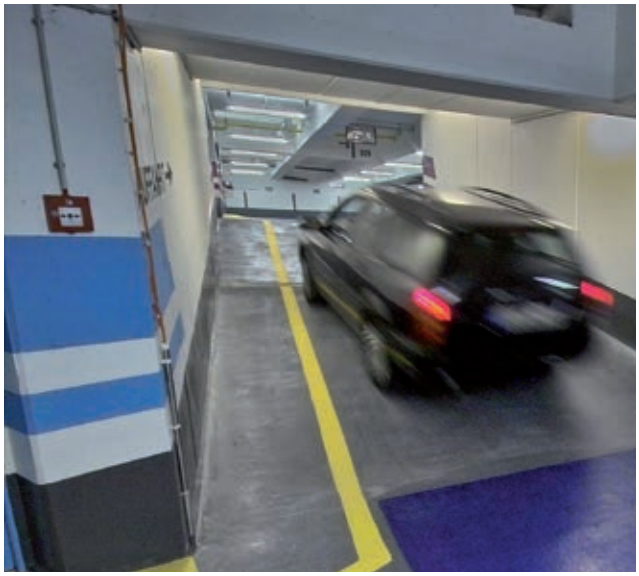
Repair and anode embedding mortar

At concrete elements subjected to heavy chloride loading "cathodic corrosion protection" (CCP) is increasingly used as the repair method of choice as it is more cost-effective. The main application areas for such repairs are multi-storey car parks and bridges.

The anode systems commonly used to carry out Cathodic corrosion protection are strips or meshes of activated titanium anodes which are applied to the surface of the reinforced concrete to be protected. Embedding these titanium anodes helps with the attachment to the substrate and to create an electrolytically conducting system between anode, structural concrete and reinforcement. In vertical surfaces these anode systems are covered with cement-based spray mortars and shotcrete.

Nafufill KM 250 as an electrolytically conducting repair and anode embedding mortar offers optimal material properties and application characteristics for cathodic corrosion protection. The product can be used to repair isolated damaged spots or to embed the titanium anodes. In these scenarios application of Nafufill KM 250 extends to vertical, horizontal and overhead areas.

Countless international projects are testimony to Nafufill KM 250 reliably and successfully meeting all the requirements of current guidelines for the CCP of reinforced concrete structures.



As a certified and approved product in accordance with EN 12696 Nafufill KM 250 fulfils everything that's asked of an anode embedding mortar:

- Producing electrolytical conductivity between anode, concrete and reinforcement
- Fixing the anode to the concrete's surface
- Producing a fully closed, visually flawless surface once repair works are completed
- Compatibility with titanium strips and meshes

Certified Safety

Internationally tried-and-tested quality

Nafufill KM 250 was specially developed to meet with the various requirements of concrete repair. The concrete replacement system has stood its ground internationally since 1998, having for all these years been used all over the world covering the breadth of its extensive performance spectrum.

The properties of Nafufill KM 250 are attested by countless test certifications that have currency across Europe. Nafufill KM 250's hallmark in this respect is that it not only fulfils the respective standards, but instead tends to exceed these by some distance. Giving you maximum security when tackling your daily challenges posed by concrete repairs.

PCC Concrete Replacement – suitable for spray and application by hand

- in accordance with ZTV-ING, Chapter 3 Solid Construction, section 4 (Repair of Traffic Structures)
- in accordance with ZTV-W, performance area 219 (Repair of Water Structures)
- in accordance with DAfStb repair guideline, concrete replacement for stress class M 2

Structural Strengthening PCC

- in accordance with German Committee on Reinforced Concrete (DAfStb) repair guideline, stress class M 3

Non-flammable PCC concrete replacement

- in accordance with DIN EN 13501 Part 1, Building Material Class A1

Fire-resistant PCC concrete replacement

- in accordance with standard temperature time curve (ETK) of DIN 4102 Part 2, Fire Resistance Class F 120

Fire-resistant in accordance with temperature time curves

- of ZTV-ING, Part 5, Sections 1+2
- of EBA guideline
- of TNO Report 1998-CVB-R1161 by Rijkswaterstaat (RWS Curve)

Certified according to DIN EN 1504, Part 3/Part 9

- for principles 3, 4 and 7 and for methods 3.1, 3.3, 4.4, 7.1 and 7.2

Repair and anode embedding mortar

- in accordance with EN 12696 for the repair principle "Cathodic corrosion protection of steel in concrete"

Suitable for use in exposure classes to EN 206

- XC 1-4, XF 1-4, XW 1-2, XD 1-3 and XS 1-3

Nafufill KM 250

The premium mortar for concrete repairs

- Non-flammable in accordance with DIN EN 13501 Part 1, grouped as building material class A1
- Fire-resistant in accordance with DIN 4102 Part 2, grouped as fire resistance class F 120
- Structural strengthening in accordance with DAfStb Concrete Repair Guideline, grouped as exposure class M 3
- Fire-resistant in accordance with tunnel fire curves of ZTV-ING, of the EBA guideline and the TNO Report by the Rijkswaterstaat (RWS)
- Certified in accordance with the European standard of DIN EN 1504 Part 3, graded as mortar class R 4

Information

Request an information pack now – by post, fax or email!

I would like you to …

☐ …send me further information on Nafufill KM 250.

☐ …call me!

☐ …show me how Nafufill KM 250 works in practice!
Please contact me to arrange an appointment.

Company: _____

Name: _____

Address: _____

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Phone: _____

Email: _____

MC-Bauchemie Müller GmbH & Co. KG
Protection Technologies
Am Kruppwald 1-8
46238 Bottrop
Germany

Phone: +49 2041 101-10
Fax: +49 2041 101-188

protection-technologies@mc-bauchemie.com
www.mc-bauchemie.com

Scan for contact details
Protection Technologies

akut 130757 EN