Very
High
Durability
Repair &
Prevention
System

Certified Quality System since **FEBRUARY 1993**

From Project to Jobsite

BS 91 ANCORA A.R.C. MuCis®

RHEOPLASTIC SHRINKAGE-COMPENSATED POURING AND ANCHORING MORTAR WITH VERY HIGH CHEMICAL RESISTANCE. Contains MuCis® Multiple Corrosion Inhibiting Synergies

EN 1504-3 R4 NORMA EUROPEA

CE approved – Certificate n. 1305 - CPD - 0808
EN 1504-3 Class R4

Description

BS-91 ANCORA A.R.C. MuCis® is a ready-to-use mortar which after mixing with water is perfect for pouring. It cures to a high quality repair mortar with excellent adhesion, durability, impermeability and extremely high mechanical resistance, with virtually no shrinkage. The product does not contain metallic compounds and is formulated to achieve maximal resistance against chemical aggression. The multiple corrosion inhibitor MuCis® protects the reinforcement steel additionally against corrosion.

Advantages and characteristics

- Excellent durability to most chemicals aggressions and natural salts as CHLORIDES, NITRATES, SULPHATES in particular.
- Inhibits corrosion reactions of the reinforcement steel.
- The product is also suited for the injection into cavities in tunnels in construction, for consolidation of big cracks,…
- Resistance to repeated freezing and thawing, Resist penetration grease, oil,…
- High resistance to carbon dioxide penetration.
- Excellent pouring properties. It reaches and fills the finest and most difficult cracks and cavities, even for long distance consolidation.
- No bleeding or segregation
- Strong adhesion to various substrates, and to the reinforcement metal.
- No drying shrinkage or plastic shrinkage due to the compensation with special additives.
- Good resistance to water penetration, and permeable to water vapour.
- Exceptional mechanical strengths.

Fields of use

- All casting and pouring work in caissons and formworks where high structural qualities and high mechanical and chemical resistance are required.
- For structural reinforcement or repair with special anti-corrosion functionality due to the migration of inhibitor molecules by vapour tension to reach the reinforcement steel.
- Anchoring of beams in reinforced concrete or steel.
- Bedding and anchoring of all types of machinery
- Cavity filling, welding of joints and panelling, restoration of damaged structures, underpinning.
- Sealing of prefabricated items for structural continuity
- Soil consolidation and foundation strengthening with cables and pre-tensioned rods.

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Method of use

- Carefully remove all loose parts from the contact surfaces and anything which might adversely affect the normal hardening or adhesion of the BS 91 ANCORA MuCis® to the base concrete (oil, grease, dust, polystyrene, etc.).
- Wet the contact surfaces until thoroughly soaked: do this some hours before casting to ensure maximum saturation of suction porosity.
- Remove any excess surface or standing water with compressed air or sponge immediately before casting.
- Average amount of water needed for plastic mixes: 10-11 lt. for 100 Kg. of dry mixing.
- Average amount of water needed for fluid mixes: 12-13 lt. for 100 Kg. of dry mixing. In this case the mixture will be perfectly selflevelling and flowable.
- Add approximately the right amount of water to the cement-mixer before mixing, but slightly less than actually needed. Mix for 3-4 minutes (or, depending on the efficiency of the mix, until you have a smooth and uniform mix).
- For large cast volumes or thickness, we recommend adding 25% - 40% good quality washed quarts or fine gravel with size 2-6 mm or 2-12 mm depending on the cast area.
- Add enough of the remaining water to the mix to make it workable and mix for a further 2 minutes. The actual amount of water required will vary depending on the weather conditions.
- Start pouring by hand or pump from one corner. Gently vibrate or compact by hand to compact the cast in even the most awkward or intricate areas.
- When repairing severely chemically-damaged structures, we recommend that each individual area should be viewed by our engineering staff followed up by a specific technology and application report.
- Always make sure that you carry out all substratum filling work correctly:
  - do not cast where there are strong vibrations which could adversely affect the necessary adhesion to the concrete or steel
  - make sure that the sides of the lateral formwork is at least 10 cm higher than the edge of substratum so that you get the necessary head required for pouring.
  - seal each and every crack in the formwork, no matter how small, to prevent mortar leakage; pour the mortar continuously from one side only: check that any trapped air escapes using the special holes in the tile if necessary or by manually running bars across the underplate during and immediately after casting.

After application, keep the mortar surface damp as soon as it sets or, at any time, prevent the water content from evaporating. This is especially important in hot, dry or windy conditions. We recommend the use of CURING COMPOUND UR-19. Furthermore, it is also possible to apply on the surface jute bags or wet rags covered, if necessary, by polythene sheets, maintaining the surface wet for some days.

Remarks Information according to 2003/53/CE
Storage : The product can be kept for at least 12 months if stored in dry and protected conditions, in the original packaging, between +5°C and + 35°C.

Do not use the content of open bags if there are lumps in the powder

Packaging 25 Kg bag

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COMPARISON PERFORMANCE REQUIREMENTS

	NORM EN 1504-3	BS 91 ANCORA A.R.C.

Performance characteristic	Reference substrate (EN 1766)	Test method	Requirements Strutturale Classe R4	Performances TYPICAL VALUES
Compressive strength	None	EN 12190	≥ 45 MPa (28 days)	90 MPa (28 days)
Chloride ion content	None	EN 1015-17	≤ 0,05%	≤ 0,03%
Adhesive bond (adhesion to concrete)	MC(0,40)	EN 1542	≥ 2,0 MPa	2,5 MPa
Restrained shrinkage/expansion	MC(0,40)	EN 12617-4	Bond strength after test ≥ 2,0 MPa	≥ 2,0 MPa
Carbonation resistance	None	EN 13295	d_k ≤ control concrete [MC(0,45)]	passed requirement
Elastic modulus	None	EN 13412	≥ 20.000 MPa (28 days)	32.000 MPa (28 days)
Thermal compatibility ✱ Part 1, freeze-thaw	MC(0,40)	EN 13687-1	Bond strength after 50 cycles ≥ 2,0 MPa	≥ 2,0 MPa
Thermal compatibility ✱ Part 2, Thunder shower	MC(0,40)	EN 13687-2	Bond strength after 30 cycles ≥ 2,0 MPa	≥ 2,0 MPa
Thermal compatibility ✱ Part 4, Dry cycling	MC(0,40)	EN 13687-4	Bond strength after 30 cycles ≥ 2,0 MPa	≥ 2,0 MPa
Coefficient of thermal expansion	None	EN 1770	Not required if tests ✱ are carried out, otherwise declared value	• passed tests ✱ • declared value = $15,1 \times 10^{-6}$ ($°K^{-1}$)
Capillary absorption	None	EN 13057	≤ 0,5 Kg $\cdot m^{-2} \cdot h^{-0,5}$	≤ 0,3 Kg $\cdot m^{-2} \cdot h^{-0,5}$

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Technical characteristic (typical values)

• Initial setting time :		approx 1 hour at 20°C
• Bleeding :		absent
• Compressive strength	N/mm^2	40 (1 d.) 90 (28 d.)
• Flexural strength	N/mm^2	5,5 (1 d.) 11 (28 d.)
• ELASTICITY MODULUS	N/mm^2	32.000 (28 d.)
• Adhesion to concrete	N/mm^2	2,5 (28 d.)
• Pull-out	N/mm^2	> 20 (28 d.)
• Carbonation in time	8 years mm 18 years mm 25 years mm	0,1 0,2 0,4
• Resist. to CO_2 penetration	µ	12.000
• Water vapour permeability coefficient	µ	55
• ① Res. FROST/THAW	gr/m²	4
• ② Permeab. to CHLORIDES	Coulomb	218
• Type of mortar		Mortar/micro-concrete/grout
• N. components		mono
• Advised layer thickness	mm	40÷300
• Application		in formwork
• Curing : wet		YES
• Curing : protected		SE
• Typical application		Anchor./ structural repair
• Setting time		Normal
• Hardening		Normal
• Shrinkage compensation		YES
• Consumption	Kg/litre	1,9
• Dosage		Also +40% gravel

1N/mm² = 1MPa = 10,19 Kg/cm²

* the formulation for this type of products can be also made with the addition of corrosion inhibitors and MuCis®.

① Freeze and thaw resistance in the presence of salt. SIA 162 11/91 (< 600 gr/sm= very high freeze and thaw resistance)

② Chlorides permeability. FH WA RD/81 (100 ÷ 1000 COULOMB = very low chlorides permeability)

SE Depending on the applicative conditions (rain, sun, hot temperatures, humidity)

VHDRS Very High Durability Repair & Prevention Systems

VHDRC Very High Durability Reinforced Concretes

MuCis® Multiple Corrosion Inhibithing Synergies

AED Very High Deformation Energy

MECHANICAL STRENGTHS

Compressive strength and flexural strength can vary in function of the amount of water used for mixing, and thus also in relation with the specific consistency for each particular application.

	COMPRESSION N/mm^2	FLEXION N/mm^2
1 d.	35-52	4,5-6,0
3 d.	44-65	6,5-7,3
7 d.	54-73	7,8-9,1
28 d	70-92	8,0-11,8

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SHRINKAGE COMPENSATION

The formulation is calculated to compensate for the plastic and drying shrinkage by means of controlled expansion.

The expansion of BS-91 ANCORA A.R.C MuCis® according to ASTM C-878 or UNI 8147 is about 450-750 µ/m; the mayor part of this expansion occurs during the initial hardening of the product (24-48 h).

In function of the typical requirements for special applications, the expansion can be programmed « ad hoc »: taking into consideration variables as the absolute value of compressive strength, the strengths of the substrate, the percentage of reinforcement steel.

Dynamic elasticity modulus (with ultrasonic equipment)

After 7 days. from 28.000 to 34.000 N/mm^2

After 28 days. from 36.000 to 46.000 N/mm^2

Static elasticity modulus

With load gradient of 50 Kg/cm^2/sec., with prism of 100 x 100 x 200 mm, the modulus is calculated on the deformation by increasing load, 1 third of the load at break.

After 7 days. from 19.000 to 26.000 N/mm^2

After 28 days. from 26.000 to 32.000 N/mm^2

Please note: the variation between results is related to the difference in mechanical strengths due to different W/C ratio, respectively for plastic or fluid consistency.

ADHESION TO STEEL

Is determined to smooth steel, as well as to rebars with improved adhesion.

The adhesion to steel is determined by measuring the pull out resistance of the rebar, immersed in MuCis® BS-91 ANCORA A.R.C. after a normal curing period of 28 days.

The result, for mixes with different water content, vary from 3 -5 N/mm^2 for smooth rebars, and of 20 - 25 N/mm^2 for rebars with improved adhesion.

INFLUENCE OF THE TEMPERATURE

In case of high temperatures, apply the mortar as quickly as possible after mixing and keep the pouring surface protected with CURING COMPOUND UR 19 (and, if necessary, with wet cloths ever since the first phases after the pouring).

In case of rigid winter temperatures, it is essential to use warm mixing water: the optimal conditions of fluidity are obtained when temperatures, inside the mix, ≥ 15°C.

In case of temperatures < 0°C, in addition to using hot mixing water and materials at room temperatures, protect properly the exposed parts with polystyrene or other insulating material immediately after the casting.

Even in this case, it is recommended the surface aspersion with CURING COMPOUND UR 19 on the cast just levelled and immediately before the positioning of polystyrene.

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FROST RESISTANCE

When water turns into ice, there is a volume increase of about 9%, and creation of forces which can damage concrete.
The resistance of concrete to frost depends in general on many variables, as described in the fig.1 below.

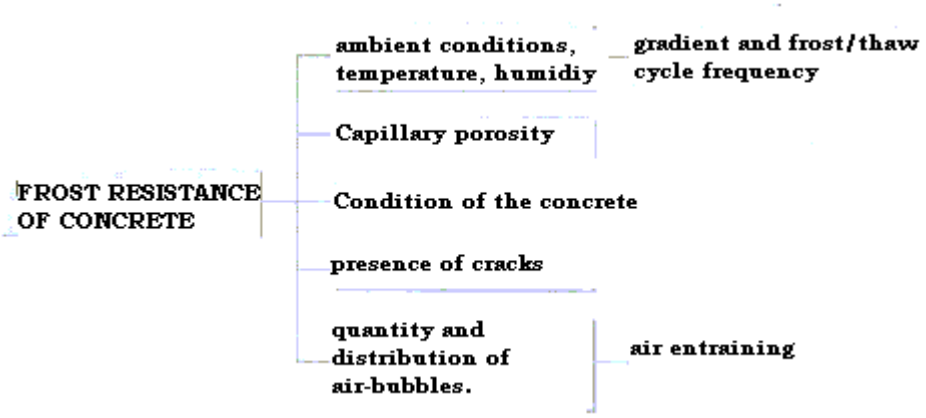

Fig. 1: Factors that influence the frost resistance of concrete.

BS-91 ANCORA A.R.C MuCis® has a very high resistance to frost/thaw cycling, related to the very low porosity. In particular the frost/thaw cycling in presence of salt (STANDARD SIA 162/1 -1991) only revealed a decrease in weight by scaling of only 4,16 gr/m² after 30 cycles, while the standard states that a loss of ≤ 600 gr/m² is labelled as ' very high resistance' .

Test of frost resistance in presence of salt (STANDARD SIA 162/1-1991, Test n° 9)					
BS 91 ANCORA A.R.C. MuCis®					
Scaling in g after			Total scaling in g	Total surface (m^2)	Specific scaling (g/m^2) Δm_{30}
10 cycles	20 cycles	30 cycles			
0	0	0	0,045	0,0108	4,16
0	0	0,05			

(surface of the specimen : internal part polystyrene)
Criteria of evaluation : $\Delta m_{30} \leq 600$ g/m² = high frost resistance
$\Delta m_{30} \leq 3.800$ g/m² = low frost resistance

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WATER PERMEABILITY AND POROSITY

Upon hardening of the cement paste, fundamentally two types of porosity can be found, which both influence directly and very significantly the properties of the product in general :

- Capillary porosity : formation of cavities spread in the total volume of the mortar, with variable dimensions of about 10^{-2} to 10^{-4} mm, and which have an impact on the mechanical resistance, the modulus of elasticity, and the frost/thaw cycle resistance if the concrete.
- The gel porosity: very small, variable pores of dimension of about 10^{-5} to 10^{-6} mm which take about 28% of the gel volume and which impact the shrinkage and the plasticity of the concrete.

The capillary porosity increases significantly with increasing W/C ratio and decrease progressively in time with increasing degree of hydratation of the cement
The permeability for water is in relation with the capillary porosity; the level of hydratation and the W/C ratio (see fig. 2.)

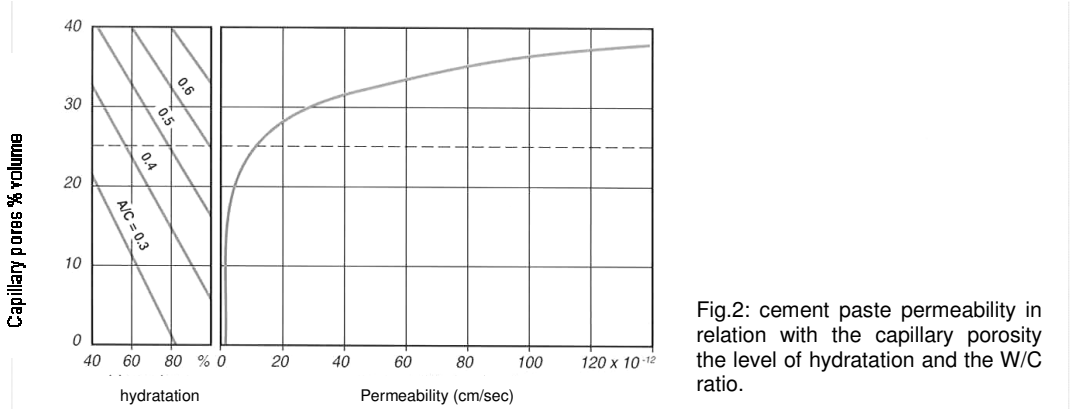

Fig.2: cement paste permeability in relation with the capillary porosity the level of hydratation and the W/C ratio.

BS-91 ANCORA A.R.C. MuCis®, thanks to the very low W/C ratio, and the speed of hydratation of the binder particles, assumes already very quickly permeability coefficients of less than 1 x 10^{-12}.
Tests with the mercury-porosity meter and at very high pressure, indicate so small dimensions and low quantity of pores to achieve the impermeability of our water based product.
The reduced permeability make the product also particular resistant to varies types of CHEMICAL AGGRESSIONS, which are know to be destructive for cement based products.

RESISTANCE TO DYNAMIC STRESSES AND TO FATIGUE

The high mechanical strengths and the particular elastic deformability under load, make BS-91 ANCORA A.R.C. MuCis® very resistant to fatigue and severe dynamic movements, repetitive in time. In the case of applications of very severe, repetitive solicitations, it is advisable to use BS-110 CORAZZA.

PERMEABILITY AND RESISTANCE TO CHLORIDES

The test performed according the normative FHWA/RD81 indices a value in Coulomb of 218, quantified in the norm as suited for concrete slabs when in the range between minimum 100 and maximum of 1000 Coulomb.
Note that values below 100 Coulomb can only be obtained with polymer impregnated concrete (P.I.C.)

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CONCRETE PERMEABILITY TO CHLORIDES
(Rapid method according to FHWA/RD-81)

BS-91 ANCORA A.R.C. MuCis®

Interpretation of results			
	high	permeability	> 4000 Coulomb
	moderate		2000/4000 C
	low		1000/2000 C
x	***very low**		**100/1000 C**
	negligible		< 100 C
Measurement : $C=_0\int^t A \cdot dt = 218$ (Coulomb)			

*Requirement for road borders

ACCELERATED CARBONATION TEST PERFORMED ON SAMPLES OF BS-91 ANCORA A.R.C. MuCis® CONCRETE

Samples of 10x10x8 cm are stored in climate area with 20°C, 65 % of relative humidity, and a concentration of 90% in CO_2.
After 4,9 and 25 days of storage in this atmosphere, each sample is cut in two parts and subjected to the phenolphthalein test.
The not carbonated concrete becomes a red/violet colour, while on carbonated surfaces, no colour appears.
Interpretation of results :
4 days of conservation as described, correspond to about 30 years of service.
9 days of conservation as described, correspond to about 70 years of service
25 days of conservation as described, correspond to about 180 years of service

The results obtained with the mortar of BS-91 ANCORA A.R.C.MuCis® indicate as average value, a carbonation depth of 2,5 mm after 70 years of exposure to the atmosphere.

Safety indications Read carefully the safety indications on the packaging, or consult the relevant Material Safety Data Sheet of this product.

The above information is based on our best experiences and lab results and on results of the application of the product in various fields. Tecnochem Italiana is not responsible for negative performances due to not proper use of the product or for defects due to elements not connected with the quality of the product included wrong storage.
Technical characteristic in this technical data sheet are up-to-dated periodically .Revision date of this technical data sheet is indicated below. Changes of this data sheet can be found in our web-site www.tecnochem.it where you can find the same technical data sheet updated in real time.

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