Renderoc LA

Single component free-flowing low alkali micro-concrete

Uses

The highly fluid nature of Renderoc LA obviates the need for compaction and vibration even where access to the repair zone is restricted or where reinforcement is congested. The product is ideal for the reinstatement of large, structural sections of concrete as well as for many smaller locations where difficulties of access make hand or trowel-applied mortars impractical. It is suitable for use where excellent chloride and carbon dioxide resistance is required or for repairs to concrete affected by alkali-silica reaction (ASR). Renderoc LA is alkaline in nature and will protect embedded steel reinforcement.

Advantages

- Dual expansion system compensates for shrinkage in the plastic and hardened states
- Low alkali content minimises risk of alkali-silica reaction
- Exceptional bond to concrete substrates without independent primer
- Suitable for placement by pumping or pouring techniques into restricted locations
- Self-compacting nature eliminates honeycombing and displaces air without vibration
- High strength and low permeability provide maximum protection against carbon dioxide and chlorides
- Pre-bagged to overcome site-batched variations — only the site addition of clean water is required
- Contains no chloride admixtures

Standards compliance

Renderoc LA conforms to the requirements of the UK Department of Transport Standard (BD27/86, Clause 4) 'Materials for the Repair of Concrete Highway Structures' and has been formulated to comply with the requirements of the DTp Specification for Highway Works, Clause 1704.6 Control of Alkali-Silica Reaction.

Description

Renderoc LA is supplied as a ready to use blend of dry powders which requires only the site addition of clean water to produce a free-flowing, shrinkage compensated micro-concrete suitable for large volume concrete repairs at nominal thicknesses in excess of 50 mm. The material is based on Portland cement, graded aggregates and additives which impart controlled expansion in both the plastic and hardened states while minimising water demand. Its low alkali content minimises the risk of alkali-silica reaction. The hardened product exhibits excellent thermal compatibility with concrete and outstanding water repellent properties. The aggregate grading is designed to aid uniform mixing and to eliminate segregation under pumping pressures. The low water requirement ensures fast strength gain and long-term durability.

Technical support

Fosroc offers a comprehensive range of high performance, high quality construction products. In addition, Fosroc offers a technical support service to specifiers, end-users and contractors, as well as on-site technical assistance in locations all over the world.

Design criteria

Renderoc LA is designed for large volume repairs typically in excess of 50 mm deep. The product can be applied in sections generally up to 150 mm thick although greater thicknesses may be achievable dependent on the configuration of the repair location and the volume of exposed reinforcing steel. Consult the local Fosroc office for further information.

Properties

The following results were obtained at a water:powder ratio of 0.133 and temperature of 20°C.

Test method	Typical result
Flow properties (UK Dept of Transport BD 27/86 Clause 4.6[b]):	750 mm within 10 secs
Setting time (BS 4550) — Initial set:	6 hours, 30 mins @ 20°C
Final set:	9 hours @ 20°C
Compressive strength (BS 1881 Pt 116 — restrained):	14 N/mm^2 @ 1 day 30 N/mm^2 @ 3 days 45 N/mm^2 @ 7 days 60 N/mm^2 @ 28 days
Water absorption ISAT (BS 1881 Pt 5: 1970) — 10 minutes:	0.0125 ml/m^2/sec
2 hours:	0.0013 ml/m^2/sec
Chloride diffusion (Taywood Method):	1.2 x 10^{-10} cm^2/sec
Carbon dioxide barrier — Equivalent thickness of concrete to Renderoc LA @ 50 mm (Taywood Method):	500 mm
Equivalent thickness of air to Renderoc LA @ 50 mm (Taywood Method):	140 metres
Coefficient of thermal expansion:	10 to 12 x 10^{-6}/°C
Modulus of elasticity (BS 1881 Pt 121: 1983 — cylinders cast under restraint and wet-cured):	33 kN/mm^2 @ 28 days
Bond strength (BS 6319 slant/shear — substrate presoaked, no bonding aid):	66 N/mm^2 @ 28 days
Alkali content:	The calculated equivalent sodium oxide content of Renderoc LA is approximately 2.9 kg/m^3
Fresh wet density:	Approximately 2270 kg/m^3 dependent on actual consistency used
Chemical resistance:	The low permeability of Renderoc LA severely retards chemical attack in aggressive environments. The cured micro-concrete is highly impermeable to acid gases, chloride ions, oxygen and water

Specification clauses

Steel reinforcement primer

Priming of the reinforcement shall not normally be necessary unless it is to remain exposed in an environment likely to perpetuate corrosion after preparation. When required the steel reinforcing primer shall be Nitoprime Zincrich an "active" single component zinc rich epoxy resin. It shall be fully compatible with the Renderoc system of concrete repair.

Where risk of incipient anode formation is a potential e.g. chloride contaminated concrete, extra protection to the repair area shall be provided by Renderoc Galvashield XP, a sacrificial metal, encapsulated by a highly alkaline cementitious mortar described in patent no. PCT/GB94/01224.

Fluid micro-concrete repair system

The fluid repair system (micro-concrete) shall be Renderoc LA, a single component, low-alkali cement-based blend of powders to which only the site-addition of clean water shall be permitted. The micro-concrete shall exhibit a 3-day compressive strength not less than 30 N/mm^2 and a 28-day compressive strength of 60 N/mm^2 (at 20°C). The sodium oxide content shall not exceed 3.0 kg/m^3. Chloride diffusion coefficient shall be not greater than 1.2 x 10^{-10} cm^2/sec (by the Taywood Method) and a 50 mm section of cured mortar shall provide a carbon dioxide barrier equivalent to not less than 500 mm concrete or 140 metres air (by the Taywood Method). The coefficient of thermal expansion shall be within the range of 10 to 12 x 10^{-6}/°C.

Application instructions

Preparation

The unrestrained surface area of the repair must be kept to a minimum. The formwork should be rigid and tight to prevent loss of material and have properly sealed faces to ensure that no water is absorbed from the repair material. The formwork should include drainage outlets for presoaking and, if beneath a soffit, provision for air-venting. Provision

must also be made for suitable access points to pour or pump the mixed micro-concrete into place.

Saw cut or cut back the extremities of the repair locations to a depth of at least 10 mm to avoid feather-edging and to provide a square edge. Break out the complete repair area to a minimum depth of 50 mm up to the sawn edge.

Clean the surface and remove any dust, unsound or contaminated material, plaster, oil, paint, grease, corrosion deposits or algae. Where breaking out is not required, roughen the surface and remove any laitance by light scabbling or abrasive-blasting.

Oil and grease deposits should be removed by steam cleaning, detergent scrubbing or the use of a proprietary degreaser. The effectiveness of decontamination should then be assessed by a pull-off test.

Expose fully any corroded steel in the repair area and remove all loose scale and corrosion deposits. Steel should be cleaned to a bright condition paying particular attention to the back of exposed steel bars. Abrasive-blasting is recommended for this process.

Where corrosion has occurred due to the presence of chlorides, the steel should be high-pressure washed with clean water immediately after abrasive-blasting to remove corrosion products from pits and imperfections within its surface.

Reinforcing steel priming

Priming of the steel reinforcement is not normally necessary unless it is to remain exposed in an environment likely to cause corrosion after preparation. When required apply one full coat of Nitoprime Zincrich and allow to dry before continuing. If any doubt exists about having achieved an unbroken coating, a second application should be made and, again, allowed to dry before continuing. Where the risk of incipient anode formation is a potential e.g. chloride contaminated concrete, extra protection to the repair area can be provided by Renderoc Galvashield XP, an embedded zinc anode.

Substrate priming

Several hours prior to placing, the prepared concrete substrates should be saturated by filling the prepared formwork with clean water. Immediately prior to the application of Renderoc LA, any excess water should be removed.

In exceptional circumstances, e.g. where a substrate/repair barrier is required, Nitobond EP bonding aid should be used. Contact the local Fosroc office for further information.

Mixing

Care should be taken to ensure that Renderoc LA is thoroughly mixed. A forced-action mixer is essential. Mixing in a suitably sized drum using an approved Renderoc Spiral Paddle in a slow speed (400/500 rpm) heavy-duty drill is acceptable. Free-fall mixers must not be used. Mixing of part bags should never be attempted.

It is essential that machine mixing capacity and labour availability is adequate to enable the placing operation to be carried out continuously. Measure 3.3 litres of drinking quality water and pour three-quarters into the mixer. With the machine in operation, add one full 25 kg bag of Renderoc LA and mix for 1 minute before adding the rest of the water. Mix for a further 2 to 3 minutes until a smooth even consistency is obtained. Note that powder must always be added to water. The quantities mixed may be scaled up as required.

When the drill and paddle mixing method is used, the complete 3.3 litres of water should be placed in the mixing drum. With the paddle rotating, add one full 25 kg bag of Renderoc LA and mix for 2 to 3 minutes until a smooth even consistency is obtained.

It is recommended that the mixed product be passed through a suitable coarse metal screen prior to placing or pumping to highlight any unmixed material.

Mixing warning

As with other ‘one pack’ repair mortars, Renderoc LA may exhibit satisfactory handling characteristics even though inadequately mixed. This will result in a significantly lower level of performance or possible failure. It is therefore essential that mixing instructions are strictly adhered to with particular emphasis on the quantity of water used and the time of the mixing operation.

Placing

The mixed material should be placed within 30 minutes of mixing in order to gain the full benefit of fluidity and of the expansion process. If placing by pump, standard concrete pumping practice should be followed. The pump and pipeline must be ‘grouted’ with a rich cement slurry or mortar, discharging the ‘grout’ as waste. Pumping should be commenced immediately after ‘grouting’ in this way.

Low temperature working

In cold conditions down to 5°C, the use of warm mixing water (up to 30°C) is advisable to accelerate strength development. Normal precautions for winter working with cementitious materials should then be adopted. The material should not be applied when the substrate and/or air temperature is 5°C and falling. At 5°C static temperature or at 5°C and rising, the application may proceed.

High temperature working

At ambient temperatures above 35°C, the material should be stored in the shade and cool water used for mixing.

Curing

The formwork should be left in place until the compressive strength of the Renderoc LA is 10 N/mm^2 or as otherwise specified by the Supervising Officer. Renderoc LA is a cement-based concrete reinstatement material. In common with all cementitious materials, Renderoc LA must be cured immediately after the formwork is stripped in accordance with good concrete practice. Immediately after striking the formwork, all exposed faces of the repair should be thoroughly soaked with clean water and then sprayed with a liquid curing membrane such as Concure WB. In fast drying conditions, supplementary curing with polythene sheeting taped down at the edges must be used. In cold conditions, the finished repair must be protected from freezing.

Overcoating with protective decorative finishes

Renderoc LA is extremely durable and will provide long term protection to the embedded steel reinforcement within the repaired locations. The surrounding parts of the structure will generally benefit from the application of a barrier/ decorative coating to limit the advance of chlorides and carbon dioxide, thus bringing them up to the same protective standard as the repair itself. Fosroc recommend the use of the Dekguard range of protective, anti-carbonation coatings. These products provide a decorative and uniform appearance as well as protecting areas of the structure which might otherwise be at risk from the environment. All traces of form-release oils and curing membranes must be removed prior to the application of Dekguard products. This is best achieved by light grit or sand-blasting.

Cleaning

Renderoc LA and Concure WB should be removed from tools, equipment and mixers with clean water immediately after use. Cured material can only be removed mechanically.

Equipment used with Nitoprime Zincrich and Nitobond EP should be cleaned with Fosroc Solvent 102.

Limitations

Renderoc LA should not be used when the temperature is below 5°C and falling. Do not mix part bags. The product should not be used to reinstate horizontal areas where the surface would remain unrestrained during cure. It should not be exposed to moving water during application. If any doubts arise concerning temperature, application or substrate conditions, consult the local Fosroc office.

Estimating

Supply

Renderoc LA:	25 kg bags
Nitoprime Zincrich:	1 litre cans
Nitobond EP:	4.5 kg packs
Concure WB:	200 litre drums
Fosroc Solvent 102:	5 litre cans

Coverage and yield

Renderoc LA:	Approximately 12.0 litres / 25 kg bag
Nitoprime Zincrich:	7.4 m^2/litre
Nitobond EP:	10 to 11.5 m^2/pack
Concure WB:	3.5 to 5 m^2/litre

Notes: the coverage figures for liquid products are theoretical — due to wastage factors and the variety and nature of possible substrates, practical coverage figures will be reduced.

Storage

Shelf life

All products have a shelf life of 12 months if kept in a dry store in the original, unopened bags or packs.

Storage conditions

Store in dry conditions in the original, unopened bags or packs. If stored at high temperatures and/or high humidity conditions the shelf life may be reduced to 4 to 6 months. Concure WB should be protected from frost.

Nitoprime Zincrich should be stored in accordance with the Highly Flammable Liquids and Liquefied Petroleum Gases Regulations 1972.

Precautions

Health and safety

Renderoc LA contains cement powders which, when mixed or become damp, release alkalis which can be harmful to the skin. During use, avoid inhalation of dust and contact

with skin and eyes. Wear suitable protective clothing, gloves, eye protection and respiratory protective equipment. The use of barrier creams provide additional skin protection. In case of contact with skin, rinse with plenty of clean water, then cleanse with soap and water. In case of contact with eyes, rinse immediately with plenty of clean water and seek medical advice. If swallowed, seek medical attention immediately — **do not** induce vomiting.

Nitoprime Zincrich, Nitobond EP and Fosroc Solvent 102 should not come into contact with skin or eyes, or be swallowed. Ensure adequate ventilation and avoid inhalation of vapours. Some people are sensitive to resins, hardeners and solvents. Wear suitable protective clothing, gloves and eye protection. If working in confined areas, suitable respiratory protective equipment must be used. The use of barrier creams provide additional skin protection. In case of contact with skin, rinse with plenty of clean water, then cleanse with soap and water. In case of skin contact with Nitoprime Zincrich and Nitobond EP, remove immediately with resin removing cream followed by washing with soap and water. Do not use solvent. In case of contact with eyes, rinse immediately with plenty of clean water and seek medical advice. If swallowed, seek medical attention immediately — **do not** induce vomiting.

Fire

Renderoc LA, Nitobond EP and Concure WB are non-flammable.

Nitoprime Zincrich and Fosroc Solvent 102 are flammable. Keep away from sources of ignition. No Smoking. In the event of fire, extinguish with CO_2 or foam. Do not use a water jet.

Flash points

Nitoprime Zincrich:	16°C
Fosroc Solvent 102:	33°C

Additional information

Fosroc manufactures a wide range of products specifically designed for the repair and refurbishment of damaged reinforced concrete. This includes hand-placed and spray grade repair mortars, fluid micro-concretes, chemical-resistant epoxy mortars and a comprehensive package of protective coatings. In addition, a wide range of complementary products is available. This includes joint sealants, waterproofing membranes, grouting, anchoring and specialised flooring materials.

Fosroc have also produced several educational training videos which provide more detail about the mechanisms which cause corrosion within reinforced concrete structures and the solutions which are available to arrest or retard these destructive mechanisms. Further information is available from the publication: ‘Concrete Repair And Protection — The Systematic Approach’, available in seven language formats.

For further information about products, training videos or publications, contact the local Fosroc office.

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Important note