CSI SPECIFICATIONS

Repair and Maintenance of Concrete

Concrete Leak Repair, Concrete Repair

Division 03 10 00

Note to Specifier: *This guide specification includes materials and installation procedures to make effective, waterproof repairs using the Krystol Leak Repair System. Successful installation of this systems will restore water tightness and prevent leakage through cracks, joints and holes in concrete. Repaired concrete will be more durable and better resist corrosion. The procedures are suitable for the repair of common concrete deficiencies such as cracks, spalls, honeycombs and faulty joints. The guide specification should be adapted to suit the needs and conditions of the project. The content may be included in Division 3 (03 01 00 Maintenance of Concrete).*

Part 1 General

1.1 Summary

A. This specification is intended to be read as a whole by all parties involved in the project. The general contractor is responsible to make clear to any subcontractors the scope of their work and coordinate work between different trades.

1.2 System Description

A. This specification describes the repair of cracks, joints, holes and other concrete defects using crystalline repair products to prevent leakage and increase durability for exterior horizontal and vertical surfaces of portland cement concrete.

B. The system consists of the following products:

1. Krystol Plug - Used to stop active leaks to allow permanent repairs to be completed.
2. Krystol Repair Grout - Used to make permanent, durable and waterproof repairs to concrete (i.e. cracks and honeycombs).
3. Krystol T1 - Penetrating Crystalline Surface Treatment - Used to add supplemental waterproofing over the repair site and along edges of the repair.

1.3 Related Sections

A. Section 07 16 16 Crystalline Waterproofing

B. Section 03 61 00 Cementitious Grouting

1.4 References

A. The following standards are applicable to this section:

1. ASTC 39 – Compressive strength
2. ASTM C1583 - Bond Strength by direct tension (Pull-off Method).
3. DIN 1048-5 – Water Permeability
4. USACE CRD C48 – Water Permeability
5. CAN/NSF/ANSI No. 61 – Drinking Water System Components

1.5 Quality Assurance

A. Manufacturing Qualifications: The manufacturer of the specified products shall follow a Factory Production Control system certified by agencies accredited to ISO 7065 - Conformity assessment - Requirements for bodies certifying products, processes and services.

B. Contractor Qualifications: The contractor must be qualified in the field of concrete repair with a successful track record of at least 5 years. The contractor will maintain qualified personal trained by a manufacturer's technical representative.

C. Store and apply materials in accordance with the product label and product SDS, or as required by local, state or federal authorities.

1.6 Delivery, Storage and Handling

A. All materials must be delivered in original, unopened containers with the manufacturer's name, label, and batch numbers. Remove damaged material from the site immediately.

B. Store materials off the ground and protect from rain, freezing or excessive temperature until ready to use.

1.7 Job Conditions

A. Do not apply below 4°C (40 °F), or if it is raining or snowing, or if such weather conditions are imminent.

1.8 Submittals

A. Submit copies of the manufacturer's literature, to include: Technical Data Sheet (TDS), Safety Data Sheet (SDS), Application Instructions (AI).

B. Qualification Statements

1. Written notice from installer confirming experience in similar repair work.
2. Submit letter of contractor training by manufacturer.

1.9 Warranty

A. Manufacturer's warranty: Provide written manufacturer's warranty against defects in materials and manufacturing for a period of 10 Years - Concrete Repair Products, beginning with the date of substantial completion of the work.

Part 2 Products

2.1 Manufacturer

A. Basis of Design

Kryton International Inc.
Toll Free: 1.800.268.8280
E-mail: info@kryton.com
Website: www.kryton.com

B. The following products manufactured by Kryton International Inc. conform to the requirements of this specification:

1. Krystol Plug (Product Code K-620)
2. Krystol Repair Grout (Product Code K-510)
3. Krystol T1 (Product Code K-210)

C. Substitutions: Not permitted.

2.2 General Requirements:

A. The concrete repair products shall be a blend of portland cement, specially graded, non-reactive aggregates, and additives designed to meet the requirements of this specification.

B. All materials shall be non-combustible, both before and after installation.

C. All materials must be supplied as a sealed, factory blended unit.

2.3 Performance Criteria

Note to Specifier: *Krystol T1 is available in Grey or White.*

A. Plug Compound

1. Appearance – dark grey powder
2. Working Time – 1 minutes (20°C/ 68°F, 50% RH)
3. Hardening Time – 2 minutes (20°C/ 68°F, 50% RH
4. Compressive strength (ASTM C109)
    1. > 40 MPa (5800 psi) at 7 days.

B. Fiber Reinforced Crystalline Concrete Repair Grout

1. Color - Concrete Grey
2. Working time (20°C / 68°F, 50% RH) - 30 minutes
3. Hardening time (20°C / 68°F, 50% RH) - 1 hour
4. Hydrostatic head resistance - USACE CRD-C48, 140 m (460 feet)
5. Compressive Strength (ASTM C109)
    1. 16 MPa (2300 psi) @ 1 day
    2. 38 MPa (5500psi) @ 3 days
    3. 45 MPa (6500 psi) @ 7 days
    4. 49 MPa (7100psi) @ 28 days
    5. 52 MPa (7500psi) @ 56 days
6. Pull-off Strength (ASTM C1583) - 2.8 MPa (400 psi)

C. Crystalline Waterproofing and Protective Coating

1. Appearance <Grey> <White>
2. VOC content – Zero (0 g/L)
3. Working Time – 30 min (20°C / 68°F, 50% RH)
4. Hardening Time – 5 hours (20°C / 68°F, 50% RH)
5. Hydrostatic head resistance – 140 m (460 feet)
6. Crack Sealing – up to 0.5mm (0.02 inches)
7. Pull off strength – (ASTM D4541) – 3.1 MPa (450 psi)
8. Water Permeability – DIN 1048-5 – reduced 75-85%
9. Water Permeability – USACE CRD C48 – reduced 90%
10. Integral Protection:
    1. Crystal growth verified microscopically 100 mm (4 inches) away from the coated surface.
    2. Water penetration - DIN 1048-5 – reduced 51% when tested after removal of the crystalline surface coating.
11. Sulfate Resistance – No loss of strength after 21 cycles in high sulfate solution.
12. Chloride Ion Penetration – reduced 94.6% at a depth of 15 mm (0.5 inches) after 90-day ponding with 10% calcium chloride.
13. Water Absorption – BS 1881: Part 2 – Negligible – “Too impermeable to be sensitive to a longer-term test.”

14. Shape of Crystal - Manufacturer must present independent evidence of waterproofing crystals using both optical imaging and scanning electronic microscope (SEM) to verify waterproofing crystals are needle shaped
15. Potable Water – Certified to CAN/NSF/ANSI No 61.

Part 3 Execution

Note to Specifier: *Detailed installation information is given in Kryton Application Instructions # 5.12 (Leak Repair) and 5.32 (Penetrations). The contractor must read those instructions before performing the work.*

3.1 Surface Preparation

A. Prepare the repair area:

1. Cracks or Joints - Chisel or cut the full length of the crack or joint to provide a rectangular-shaped chase that is 40 mm (1.5 inch) deep x 25 mm (1 inch) wide.
    1. Wall-Slab Joints - Angle the chase so it intersects the joint, removing some concrete from both the wall and the slab.
2. Tie holes, rock-pockets, honeycombs - Chisel out defective areas to sound concrete. Rout out the defect to a uniform depth. Leave edges square, do not featheredge.
3. Where reinforcing is encountered, mechanically clean the steel to remove contaminates and rust.
4. For repairs that will be finished with Krystol T1 coating, prepare the surrounding concrete to ICRI CSP <1-3> by high pressure water blasting (minimum 3,000 psi), scarifying, shot blasting or sand blasting to remove loose concrete and surface contaminates at least 150 mm <6 inches> on either side of the repair.

B. Thoroughly rinse the repair area with water to remove all dust and silt.

3.2 Surface Saturation

A. All concrete surfaces that receive repair materials must be in a Saturated Surface-Dry (SSD) condition. The concrete must be completely saturated with water, but all surface water must be removed before installing repair materials. Rewet the surface as needed to maintain SSD conditions during installation.

3.3 Installation – Concrete Repair - Plug Active Leaks

A. Krystol Plug – Mix to a suitable putty consistency – approximately 4 parts powder to 1 part clean water by volume. Mix only the amount of material that can be installed within one minute.

1. Install 13 mm (0.5 inches) of Krystol Plug and hold in place until it hardens. Do not overfill.
2. Install Krystol Plug along the full length/area of the leaking defect until all leakage has stopped.
3. Wire brush the sides/perimeter of the area to remove excess Plug and rinse with water to expose clean, sound concrete to allow bonding of Krystol Repair Grout.
4. Ensure a minimum depth of 25 mm remains to install Krystol Repair Grout.

3.4 Installation – Concrete Repair – Fill with Grout

A. Krystol Repair Grout - Mix to a non-sag putty consistency (approximately 4.5 parts of powder to 1-part clean water by volume) using a margin trowel or a drill with a grout mixing paddle.

1. Firmly install Krystol Repair Grout into the prepared repair area so that it is flush with the surface. Do not leave any voids.
2. For repairs with minimum width and depth of 50 mm (2 in.) or larger, Krystol Repair Grout may be extended with 10 mm (3/8 in.) pea gravel. Use clean, non-reactive, well-graded gravel complying with ASTM C33. Mix 4 parts grout powder: 2 parts gravel, and up to 1 part water to make a low-slump, cohesive mix. Perform trial batches to confirm workability, as aggregate properties can vary.

3.5 Installation - Concrete Protection and Waterproofing – Krystol T1:

A. Krystol T1 – Mix to a thick but spreadable consistency (approximately 3.5 parts powder to 1-part clean water by volume) using a margin trowel or a drill with a grout mixing paddle.

1. Verify surface is Saturated Surface Dry (SSD).
2. Brush or spray Krystol T1 evenly over the repair and 150 mm <6 inches> on either side to a typical coating thickness of 1-1.5 mm <0.04-0.06 inches.>. As supplied, the consumption rate of Krystol T1 powder will be <1.2 – 1.6> kg/m^2 (<2.2 – 3.0 lb/yd^2>).
    1. Brush Application - Apply by with a masonry brush using a circular motion to press the coating into low spots. Finish with a lighter pressure to achieve the target coverage and a uniform finish.
    2. Spray Application – Spray evenly over the surface at the specified coverage. Low impact spray equipment will require back brushing to ensure adequate contact between the coating and the concrete. Consult spray equipment manufacturer regarding methods and attachments.

3.6 Protection and Curing

A. Krystol Repair Grout - Protect fresh grout from rapid drying or freezing for at least 24 hours. Cover with tarps or poly if necessary. Protect the fresh grout from rain until it has fully hardened, and do not apply curing water if the grout has not hardened. Begin wet curing once Krystol Repair Grout has hardened (1-2 hours under most conditions). Wet cure by ensuring the grout remains saturated with water by using hoses and sprinklers, saturated coverings or impermeable coverings. Maintain these curing conditions for at least 72 hours or until Krystol T1 is applied.

B. Krystol T1 - Protect the freshly applied Krystol coating with tarps or plastic to prevent water loss due to evaporation while it hardens. Leave an air space between freshly applied coating and the protective covering until the coating has set to the touch. Wet curing should begin as soon as the Krystol coating has hardened and will not be damaged by the curing water, usually 6-24 hours depending on temperature. Keep protective coverings in place during the curing period to retain moisture. Apply more curing water if the coating dries out during the curing period. Wet cure for a minimum of 72 hours.

3.7 Clean Up

A. Concrete repair materials - Uncured repair materials can be cleaned from tools with water. Cured repair materials must be removed mechanically.

B. Sealer – clean tools and equipment immediately with soap and water.

C. Leave finished work area in a neat, orderly and clean condition.

3.8 Field Quality Control

Note to Specifier: *Only include this section if special field inspection services are required.*

A. Provide free access to Work and cooperate with appointed firm.

B. Do not conceal installed waterproofing treatment before review by Consultant [and waterproofing manufacturer's representative].

C. If leaks are discovered, verify with manufacturer whether time period for self-sealing properties of the treated concrete has been exceeded. Make repairs as recommended by the manufacturer and repeat test until no leaks are observed.

3.9 Protection of Finished Work

A. Protect completed work from damage after application.

B. Do not backfill for at least thirty six hours (36) after completion of repairs.

C. If backfilling within 7 days, use damp backfill material.

3.10 Schedules

Note to Specifier: *Specify products, type of repair and location to suite project.*

A. Provide crystalline waterproofing repairs in the following locations

1. Elevator pits [sump pits, escalator pits]
2. Tunnels, underground vaults, dry wells and manholes
3. Water tanks, clarifier tanks, digester sections, reservoirs and wet wells
4. Planters, fountains, pools
5. Electrical Room
6. Mechanical Room
7. Common Parking Area <P1> <P2> <P3>
8. Retaining walls, sea walls

END OF SECTION