

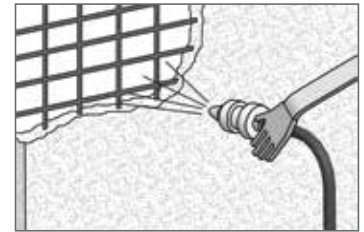
Krytol Internal Membrane™ (KIM®)

Instructions for Shotcrete Inspector

DESCRIPTION

Krytol Internal Membrane (KIM) is a chemical admixture in powder form used to create waterproof concrete. KIM is used in place of externally applied surface membranes to protect against moisture transmission, chemical attack, and corrosion of reinforcing steel.

IMPORTANT: Follow the guidelines of ACI 506R Guide to Shotcrete. You are making a waterproof membrane out of the concrete. This is different from traditional construction where the concrete just forms the structure. The KIM concrete you are placing will be the only barrier to water penetration. This means that common defects found in typical concrete cannot be tolerated. Poor consolidation, unplanned cold joints, cracks, penetrations, contaminations, etc. will all result in a leaking structure. To avoid leakage and to achieve success, you must follow the critical instructions outlined in this document.



PREPARATION FOR SHOTCRETING

- All equipment shall be appropriate and suitable for dry-mix or wet-mix shotcrete, as applicable, in accordance with the requirements of ACI 506.2.
- Shotcrete forms must be braced to avoid excessive vibration and must be designed to allow for the escape of compressed air and rebound.
- Inspect reinforcing steel, anchors, mesh and embedments to ensure they are properly placed and secured so they do not vibrate or otherwise move during shotcrete placement. Ensure that sufficient clearances have been provided, and that reinforcing steel is free of grease, oil, loose rust and other coatings that may impair bond with the shotcrete.
- If possible, the clearance around exposed bar should be three times the maximum aggregate particle in the shotcrete mix.
- If the design allows, lapping of the reinforcing splices should be avoided. Lapped bars should be spaced apart at least three times the diameter of the largest bar at the splice.
- Ensure that tie wires are cut to prevent loose ends from interfering with the encapsulation of reinforcement.
- Ensure that all pipes and other penetrations are in place and prepared according to Application Instruction 4.17 — Waterproofing Tie Holes and Pipe Penetrations.
- Ensure there are no unintended penetrations through the shotcrete element such as excess rebar, tie wires, etc. that could provide a migration path for water.
- Ensure that the Krytol® Waterstop System has been applied to all existing concrete/shotcrete surfaces (refer to Cold Joints and Construction Joints section below).
- Ensure that earth, rock, concrete and masonry surfaces, as applicable, are prepared in accordance with ACI 506.2. All surfaces to be shot must be brought to a saturated-surface-dry (SSD) condition immediately prior to shotcrete application.
- Ensure that free standing water is drained away from shotcrete operations.
- Ensure that shotcrete is not placed during rainy or windy weather.

SHOTCRETE SUPPLY

- Inspect the ready-mix shotcrete batch ticket to verify that the correct shotcrete mixture has been supplied with KIM added at the specified addition rate.
- Ensure that the shotcrete air content and slump are in the specified range prior to discharge into the shotcrete pump.
- Slump: Add a mid or high range water reducer (superplasticizer) as necessary to achieve the required slump. Only add water with the approval of the shotcrete supplier's quality control technician. Record all water additions on the batch ticket and do not exceed the specified water-cement ratio (max 0.40 for shotcrete).
- Air Content: Add additional air-entraining admixture as necessary to achieve the required air content.

SHOTCRETE APPLICATION

- Verify that shotcrete nozzlemen have been prequalified to shoot on the project:
 - All nozzlemen must be ACI certified in the correct category (wet-mix vertical, wet-mix overhead, dry-mix vertical or dry-mix overhead).
 - The nozzlemen should have passed prequalification job-specific mock-up tests.
- Monitor the shotcrete application to establish that the nozzlemen are using proper application procedures as recommended in ACI 506R Guide to Shotcrete. In particular:
 - Ensure the nozzlemen completely encase reinforcing steel by shooting with sufficient velocity and plasticity so material flows around and behind the reinforcement.
 - Ensure the front face of reinforcement remains clean during encasement, and that an air lance is used to remove overspray and rebound prior to shotcrete placement. Rebound must not be salvaged for later use.
 - Ensure sufficient shotcrete cover is applied over reinforcement as required by project specifications, and that tie wire ends do not protrude through the shotcrete cover.
 - Shotcrete Joints: Unless otherwise specified, ensure that unfinished work does not stand more than 30 minutes unless cold joints are provided for. If the use of accelerating admixtures causes shotcrete to harden in less than 30 minutes, cold joints must be provided for at shorter intervals (refer to Cold Joints and Construction Joints section below).
- If defects are observed during shooting, get the contractor to stop and cut out the defects while the shotcrete is still plastic and reshoot the affected area. Defects include:
 - Entrapped rebound and overspray
 - Voids of incomplete consolidation, including shadows behind rebar
 - Sloughs, delamination, plastic shrinkage cracks, etc.

COLD JOINTS AND CONSTRUCTION JOINTS

- Ensure the Krystol Waterstop System (consisting of Krystol Waterstop Grout™ and Krystol Waterstop Treatment™) is applied to all preplanned construction joints at the end of a shift using one of the following procedures:
 - Application Instruction 4.21 — Waterproofing Horizontal & Vertical Construction Joints for Shotcrete — External Grout Method
 - Application Instruction 4.11 — Waterproofing Horizontal Construction Joints — Internal Grout Method.
- Ensure that all pipes and other penetrations are prepared to receive the Krystol Waterstop System as described in Application Instruction 4.17 — Waterproofing Tie Holes and Pipe Penetrations.
- Ensure proper surface preparation prior to installing the Krystol Waterstop System or placing the next layer of shotcrete.
 - Plastic Shotcrete: Broom or trim by trowel to the specified angle.
 - Hardened Shotcrete: Use a high pressure water blast to remove sheen, overspray, dust, curing agents or other materials detrimental to good bonding.
- Ensure all surfaces to receive the Krystol Waterstop System or additional shotcrete are dampened to a saturated-surface-dry (SSD) condition to ensure adequate bonding.

IMPORTANT: Unintended cold joints may develop long lift breaks during bench gunning if the previous layer of shotcrete hardens before the next layer is placed. This is common during hot weather or when using highly accelerated mixes. Inspect all lift breaks as described in Application Instruction 4.22 — Waterproofing Unintended Cold Joints (Shotcrete), and apply a coating of Krystol Waterstop Treatment before shooting the next layer if the previous layer has already hardened.

CURING AND PROTECTION

- Ensure that fresh shotcrete is protected from rain, wind, direct sunlight and freezing temperatures. Prevent premature drying by using fogging/misting equipment or other suitable protective measures.
- Ensure that all shotcrete is cured in accordance with ACI 308.1 guidelines immediately after final finishing.
- Wet curing for a minimum of 5 to 7 days is recommended.
- If wet curing is not possible, use a curing compound conforming to ASTM C309. Note that for rough textured shotcrete surfaces, curing compounds are often applied at twice the amount used for cast-in-place concrete to account for the greater surface area.
- Alert the manufacturer immediately of any concerns.

APPLICATION INSTRUCTION

(Formally known as Application Instruction 108)

Concrete Waterproofing Admixture

1.22

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SMART CONCRETE®

INSPECTION OF FINISHED WORK:

- Hardened shotcrete should be sounded with a hammer to locate hollow-sounding areas resulting from rebound pockets or lack of bond.
- Hollow-sounding areas, voids, sags and other defects should be carefully cut out and replaced following the procedures for cold joints.

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