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Standard Guide for Waterproofing Repair of Concrete by Chemical Grout Crack Injection¹

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1. Scope

1.1 This guide describes the selection of materials, installation methods, and inspection required for sealing leaks at cracks in concrete building walls and slabs using chemical grout. The process discussed in this guide is a waterproofing repair in which voids in a concrete element are sealed with a reactive solution, installed by pressurized injection through drilled or surface-mounted ports.

1.2 This guide does not address the use of chemical grout for waterproofing by curtain grouting or injection into pre-placed permeable waterstop tubes. Injection of masonry elements presents additional factors beyond the scope of this guide. This guide does not address the use of injectable materials for structural repairs or for geotechnical applications such as soil stabilization.

1.3 The values stated in inch-pound units are to be regarded as standard. The values given in parentheses are mathematical conversions to SI units that are provided for information only and are not considered standard.

1.4 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety, health, and environmental practices and determine the applicability of regulatory limitations prior to use.*

1.5 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

¹ This guide is under the jurisdiction of ASTM Committee D08 on Roofing and Waterproofing and is the direct responsibility of Subcommittee D08.22 on Waterproofing and Dampproofing Systems.

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2. Referenced Documents

2.1 *ASTM Standards:*²

F2304 Practice for Sealing of Sewers Using Chemical Grouting

F2414 Practice for Sealing Sewer Manholes Using Chemical Grouting

F2454 Practice for Sealing Lateral Connections and lines from the mainline Sewer Systems by the Lateral Packer Method, Using Chemical Grouting

2.2 *International Concrete Repair Institute (ICRI):*³

Guideline No. 340.1 Guide for the Selection of Grouts to Control Leakage in Concrete Structures

2.3 *U.S. Army Corps of Engineers:*⁴

Manual No. 1110-1-3500 Chemical Grouting

2.4 *U.S. Department of the Interior, Bureau of Reclamation:*⁵

Leaking Crack Repair Using Chemical Grouts

3. Terminology

3.1 *Definitions of Terms Specific to This Standard:*

3.1.1 *acrylamide, n*—organic solid of white, odorless, acrylic resinous material available in flake-like crystals and in liquid form.

3.1.2 *acrylate, n*—a general term applied to various water-soluble acrylic resinous materials.

3.1.3 *acrylic resin, n*—a type of resin polymerized from acrylic acid, methacrylic acid, esters of these acids, or acrylonitrile.

² For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

³ Available from the International Concrete Repair Institute (ICRI), 10600 West Higgins Road, Suite 607, Rosemont, IL, 60018, www.icri.org.

⁴ Available from the U.S. Army Corps of Engineers, www.publications.usace.army.mil.

⁵ Available from U.S. Department of the Interior, Bureau of Reclamation, www.usbr.gov/research/projects.

3.1.4 *chemical grout, n*—injection repair media other than particulate or cementitious grout that may be multi-component, with or without additives, and based on either polyurethane resin or acrylic resin.

3.1.5 *cohesion, n*—the state in which the constituents of a mass of material are held together by chemical and physical forces.

3.1.6 *control agent, n*—substance added which controls the viscosity or flow properties of the material it is added to.

3.1.7 *curtain grouting, n*—injection of grout into a sub-surface formation in such a way as to create a barrier of grouted material transverse to the direction of the anticipated water flow. A grout curtain on the positive side of the leaking sub-grade element can be injected from the interior side of the element or from the exterior surface.

3.1.8 *epoxy, n*—a type of resin polymerized from epoxide groups.

3.1.9 *gel time, n*—time from the initial mixing of the resin with catalyst to gelation, also referred to as “set time.”

3.1.10 *hydrophilic, adj*—having a strong affinity for water. Hydrophilic grout will absorb water.

3.1.11 *hydrophobic, adj*—lacking affinity for water. Hydrophobic grout will repel water.

3.1.12 *injection port, n*—port through which materials are injected under pressure into the interior of a concrete element via attached mechanical pumping equipment. Injection ports may consist of a drilled hole fitted with a packer at the opening; or an attachment device mounted flush to the surface of, or directly into, a crack or other void.

3.1.13 *oakum, n*—loose hemp or jute fiber, sometimes treated with resin or grout.

3.1.14 *packer, n*—a tapered or expandable annular plug inserted into a drilled hole or crack in which grout or water is to be injected, which serves as an attachment for pumping equipment and includes a one-way valve fitting to prevent the return of the grout or water when material is not being injected.

3.1.15 *polyurethane resin, n*—any of various polymer resins containing the urethane radical.

4. Significance and Use

4.1 This guide is intended to be used in the selection and installation of chemical grout to seal leaks in concrete walls, floors, and ceilings. The procedure described in this guide focuses on the injection of through-wall cracks, but may be adapted to cold joints, control joints, voids associated with penetrations, and other voids contributing to water intrusion through concrete elements. This guide is intended to assist the building owner, owner’s representative, architect, engineer, contractor, or authorized inspector, or combinations thereof, during the selection, specification, or installation, or combinations thereof, of chemical grout for waterproofing repair.

4.2 Prior to attempting any repair, it is important for all parties to have a clear and mutual understanding of the limitations of the repair and the iterative nature of the process. Injection of chemical grout does not affect the source of a leak.

The repair obstructs the infiltration of water at a specific location only. The flow of water will be diverted elsewhere, and it is common for water to subsequently appear at a different location that was previously dry. A successful campaign at a given location can significantly reduce the amount of water infiltration, but may not fully prevent leakage. Given the nature of the materials and application technique, and depending on the conditions, the repairs should be periodically monitored and additional repair installations may be required.

4.3 This guide is applicable to installations at below-grade walls and slabs. At above-grade elements, temperature variation on a daily or seasonal basis may lead to significant or more frequent changes, or both, in the width of a crack or joint. The use of injected chemical grout may be appropriate for many above-grade applications, but this guide does not specifically address installation of grout in dynamic cracks or joints.

4.4 Cracks in below-grade walls may be a sign of structural distress. Prior to the injection of chemical grout, the overall conditions and context of the damage should be assessed to determine if a non-structural repair is appropriate.

4.5 This guide does not address repairs intended to provide a seal against air leakage or air infiltration.

4.6 Project-specific or environmental conditions such as existing construction, prior waterproofing installations, access, water volume or flow rate, water chemistry, temperature, humidity, and other factors may warrant the evaluation of curtain grouting as an alternative to crack injection.

4.7 Practices F2304, F2414, and F2454 describe materials and procedures related to the use of chemical grout to seal components of sewer systems. While the specific procedures differ from those described in this guide, the standards contain general information on chemical grouting materials and methods that may be of interest to those involved with waterproofing repair of building elements.

4.8 This guide does not address the use of particulate grouts or epoxy as an injection material.

5. Materials

5.1 General:

5.1.1 The intent of this section is to define the properties that a chemical grout should have to perform effectively in the intended application and under expected field conditions.

5.1.2 It is recognized that new and improved chemical grout materials will become available in the future. Sources, manufacturers, formulations, and product names of materials will change from time to time, and therefore specific manufacturers and product names are not provided.

5.2 Chemical Grout Characteristics:

5.2.1 The following are general characteristics that should be exhibited by the chemical grout.

5.2.2 The chemical grout should have documented satisfactory performance in similar usage as the intended conditions.

5.2.3 The chemical grout should have controllable reaction times.

5.2.4 The chemical grout should have resistance to the concentrations of chemicals found in the type(s) of water the