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This MANU-SPEC® utilizes the Construction Specifications Institute (CSI) *Project Resource Manual* (PRM), including *MasterFormat*™, *SectionFormat*™ and *PageFormat*™. A MANU-SPEC is a manufacturer-specific proprietary product specification using the proprietary method of specifying applicable to project specifications and master guide specifications. Optional text is indicated by brackets []; delete optional text in final copy of specification. Specifier Notes precede specification text; delete notes in final copy of specification. Trade/brand names with appropriate symbols typically are used in Specifier Notes; symbols are not used in specification text. Metric conversion, where used, is soft metric conversion.

This MANU-SPEC specifies concrete waterproofing by crystallization. These products are manufactured by ICS Penetron Intl. Ltd. Revise MANU-SPEC section number and title below to suit project requirements, specification practices and section content. Refer to CSI *MasterFormat* for other section numbers and titles.

SECTION 07 16 16 CRYSTALLINE WATERPROOFING

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes: This Section specifies integral capillary crystallization concrete waterproofing and repair systems for concrete surfaces and facilities.

1.02 RELATED SECTIONS

Specifier Note: Include in this Article only those sections that directly affect the work of this section. Do not include Division 00 or Division 01 sections since it is assumed that all technical sections are related to all project Division 00 and Division 01 sections to some degree.

- A. Section [03 01 30 - Maintenance of Cast-in-Place Concrete: Concrete repair] [_____].
- B. Section [03 01 30.71 - Rehabilitation of Cast-in-Place Concrete: Concrete repair] [_____].
- C. Section [03 30 00 - Cast-in-Place Concrete: Concrete slabs and walls] [_____].
- D. Section [03 35 00 - Concrete Finishing] [_____].

Specifier Note: Article below may be omitted when specifying manufacturer's proprietary products and recommended installation. Retain Reference Article when specifying products and installation by an industry reference standard. If retained, list standard(s) referenced in this section. Indicate issuing authority name, acronym, standard designation and title. Establish policy for indicating edition date of standard referenced. Conditions of the Contract or Section 01 42 19 - Reference Standards may establish the edition date of standards. This article does not require compliance with standard, but is merely a listing of references used. Article below should list only those industry standards referenced in this section. Retain only those reference standards to be used within the text of this Section. Add and delete as required for specific project.

1.03 REFERENCES

- A. ASTM International (ASTM):
 - 1. ASTM C109 Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-in. or [50-mm] Cube Specimens).
 - 2. ASTM C672/C627M Standard Test Method for Scaling Resistance of Concrete Surfaces Exposed to Deicing Chemicals.
- B. Environmental Protection Agency (EPA).

- C. New York State Department of Transportation (NY DOT):
 - 1. NY DOT Method 502-3P Freeze/Thaw Durability.
- D. National Sanitation Foundation International/American National Standards Institute (NSF/ANSI):
 - 1. NSF/ANSI 61 Drinking Water System Components - Health Effects.
- E. US Army Corps of Engineers (USACE):
 - 1. USACE CRD-C48-73 Method of Test for Water Permeability of Concrete.

Specifier Note: Article below includes submittal of relevant data to be furnished by Contractor before, during or after construction. Coordinate this article with Architect's and Contractor's duties and responsibilities in Conditions of the Contract and Section 01 33 00 - Submittal Procedures.

1.04 SUBMITTALS

- A. General: Submit listed submittals in accordance with Conditions of the Contract and Section [01 33 00 - Submittal Procedures] [_____].
- B. Product Data: Submit product data, including manufacturer's SPEC-DATA product sheet, for specified products.
 - 1. Material safety data sheets.
- C. Quality Assurance:
 - 1. Test Reports: Certified test reports showing compliance with specified performance characteristics and physical properties. Indicate VOCs during application [And curing].
 - 2. Certificates: Product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.
 - 3. Manufacturer's Instructions: Manufacturer's installation instructions.

Specifier Note: Coordinate paragraph below with Part 3 Field Quality Requirements Article. Retain or delete as applicable.

- D. Manufacturer's Field Reports: Manufacturer's field reports specified.
- E. Closeout Submittals:
 - 1. Warranty: Submit warranty documents specified.
 - 2. Operation and Maintenance Data: Submit operation and maintenance data for installed products in accordance with Section [01 78 00 - Closeout Submittals] [_____].

1.05 QUALITY ASSURANCE

- A. Qualifications:
 - 1. Installer experienced in performing work of this section who has specialized in installation of work similar to that required for this project.
 - 2. Manufacturer Qualifications: Manufacturer capable of providing field service representation during construction and approving application method.

Specifier Note: Paragraph below should list obligations for compliance with specific code requirements particular to this section. General statements to comply with a particular code are typically addressed in Conditions of the Contract and Section 01 41 00 - Regulatory Requirements. Repetitive statements should be avoided. Current data on building code requirements and product compliance may be obtained from manufacturer's technical support specialists.

Specifier Note: Specify regulatory requirements related to potable water and foodstuffs that ensure materials and systems are approved by the U.S. Environmental Protection Agency (EPA) or the National Sanitation Foundation International (NSF).

- B. Regulatory Requirements: In accordance with Section [01 41 00 - Regulatory Requirements] [_____]. Provide crystalline waterproofing that complies with requirements as follows:
 - 1. NSF/ANSI 61 Drinking Water System Components - Health Effects.
 - 2. USACE CRD-C48-73 Standard Test Method for Water Permeability of Concrete.

3. Environmental Protection Agency (EPA).

- C. Preinstallation Meetings: Conduct preinstallation meeting to verify project requirements, manufacturer's installation instructions and manufacturer's warranty requirements. Comply with Section [01 31 19 - Project Meetings] [_____].

1.06 DELIVERY, STORAGE & HANDLING

- A. General: Comply with Section [01 61 00 - Common Product Requirements] [_____].
- B. Ordering: Comply with manufacturer's ordering instructions and lead time requirements to avoid construction delays.
- C. Delivery:
 - 1. Deliver materials in manufacturer's original, unopened, undamaged containers with identification labels intact.
- D. Storage and Protection:
 - 1. Store materials protected from exposure to harmful weather conditions and at temperatures recommended by manufacturer.
 - 2. Dry store waterproofing products at [45 degrees F (7.2 degrees C)] [_____] minimum temperature.
- E. Handling: Ensure workers wear rubber gloves when handling raw materials.
- F. Waste Management and Disposal:

Specifier Note: Environment: The disposal of packaging waste into landfill site demonstrates an inefficient use of natural resources and consumes valuable landfill space. Specifying appropriate packaging and construction waste management and disposal procedures may contribute to points required for LEED® construction project certification.

- 1. Separate waste materials for [reuse] [and] [recycling] [_____] in accordance with Section [01 74 19 - Construction Waste Management and Disposal] [_____].
- 2. Remove from site and dispose of packaging materials at appropriate recycling facilities.
- 3. Collect and separate for disposal [paper] [plastic] [polystyrene] [corrugated cardboard] [_____] packaging material [in appropriate onsite bins] [_____] for recycling.

1.07 PROJECT CONDITIONS

- A. Installation Location: Apply materials when substrate temperatures are above [40 degrees F (4 degrees C)] [_____].

1.08 SEQUENCING

- A. Sequence with Other Work: Comply with crystalline waterproofing manufacturer's written recommendations for sequencing construction operations after waterproofing applications. Sequence operations to avoid detrimental performance of waterproofing application.

Specifier Note: Coordinate article below with Conditions of the Contract and with Section 01 78 36 - Warranties.

1.09 WARRANTY

- A. Project Warranty: Refer to Conditions of the Contract and Section [01 78 36 - Warranties] [_____] for project warranty provisions.
- B. Manufacturer's Warranty: Submit, for Owner's acceptance, manufacturer's standard warranty document executed by authorized company official. Manufacturer's warranty is in addition to, and not a limitation of, other rights Owner may have under Contract Documents.

Specifier Note: Coordinate article below with manufacturer's warranty requirements.

- C. Warranty: Commencing on Date of Shipment.

PART 2 PRODUCTS

Specifier Note: Retain article below for proprietary method specification. Add product attributes, performance characteristics, material standards and descriptions as applicable. Use of such phrases as "or equal" or "or approved equal" or similar phrases may cause ambiguity in specifications. Such phrases require verification (procedural, legal and regulatory) and assignment of responsibility for determining "or equal" products.

2.01 FACILITY CRYSTALLINE WATERPROOFING

- A. Manufacturer: ICS Penetron Intl. Ltd.
 - 1. Contact: 45 Research Way, Suite 203, East Setauket, NY 11733-6401; Telephone: (631) 941-9700; Fax: (631) 941-9777; Email: info@penetron.com; website: www.penetron.com.
- B. Proprietary Products/Systems.
 - 1. Crystalline waterproofing system for both positive and negative side waterproofing applications.
 - a. Portland cement, quartz, special grade sand and activating chemicals.

Specifier Note: Specify ICS Penetron Intl. Ltd. Penetron Integral Capillary Waterproofing System for waterproofing on vertical, sloped or horizontal concrete surfaces. The material may be applied by brush or spray to either surface regardless of whether the surface is with or against the water pressure.

- b. Acceptable Material: ICS Penetron Intl. Ltd. Penetron.
- 2. Crystalline waterproofing and hardener system for horizontal concrete surfaces.
 - a. Dry shake chemical treatment consisting of Portland cement, active proprietary chemicals, crushed and graded synthetic aggregate hardener: To [ASTM C672/C627M] [_____].
 - b. Permeability: To [USACE CRD C48] [_____], maximum allowable penetration [3/64 inch (1.2 mm)] [_____] after [5] [_____] days.

Specifier Note: Specify ICS Penetron Intl. Ltd. Penetron Plus, Integral Capillary Waterproofing System for waterproofing on new horizontal concrete surfaces where greater resistance to impact and abrasion is required. Coordinate with Section 03 30 00 - Cast-in-Place Concrete.

- c. Acceptable Material: ICS Penetron Intl. Ltd. Penetron Plus.
- 3. Integral crystalline waterproofing and sealing mortaring system for repairing and sealing existing concrete.
 - a. Mortar: Portland cement, treated quartz sand and active chemicals resistant to water pressure.
 - b. Compressive strength at 28 days [6900 psi (47 MPa)] [_____] to [ASTM C109] [_____].
 - c. Freeze/Thaw Durability: To [NY DOT Method 502-3P] [_____].

Specifier Note: Specify ICS Penetron Intl. Ltd. Penecrete Mortar for sealing and repair of existing concrete surfaces.

- d. Acceptable Material: ICS Penetron Intl. Ltd. Penecrete Mortar.
- 4. Plugging mortar for repair of cracks and leaks in concrete: Ready-mixed, rapid setting, integral crystalline, cementitious waterstop mortaring compound capable of stopping water leaks and ingress of moisture to [ASTM C109] [_____].
 - a. Permeability: To [USACE CRD C48] [_____], maximum allowable penetration [3/64 inch (1.2 mm)] [_____] after [5] [_____] days.
 - b. Freeze/Thaw: To [NY DOT Method 502-3P] [_____].

Specifier Note: Specify ICS Penetron Intl. Ltd. Peneplug for repair of leaks and cracks. Peneplug can be used underwater or as a dry powder for repairing leaks.

- c. Acceptable Material: ICS Penetron Intl. Ltd. Peneplug rapid setting mortar.
- 5. Spray-Applied Liquid Sealer: For repair of minor cracks [1/25 inch (1.02 mm)] [_____] maximum.

Specifier Note: Specify ICS Penetron Intl. Ltd. Peneseal Pro to prevent the penetration of water into concrete and to repair minor cracks. When sprayed onto a clean concrete surface, Peneseal Pro will form a subsurface moisture barrier.

- a. Acceptable Material: ICS Penetron Intl. Ltd. Peneseal Pro.

2.02 SOURCE QUALITY CONTROL

- A. Ensure waterproofing materials are from single manufacturer.
- B. Acceptable Materials: ICS Penetron Intl. Ltd. Penetron Integral Capillary Waterproofing System.

Specifier Note: Edit Paragraph below to suit project requirements. If substitutions are permitted, edit text below. Add text to refer to Section 01 25 13 - Product Substitution Procedures.

2.03 PRODUCT SUBSTITUTIONS

- A. Substitutions: [In accordance with Section 01 25 13 - Product Substitution Procedures] [_____] [No substitutions permitted].

PART 3 EXECUTION

3.01 MANUFACTURER'S INSTRUCTIONS

Specifier Note: Article below is an addition to the CSI *SectionFormat* and a supplement to MANU-SPEC. Revise article below to suit project requirements and specifier's practice.

- A. Compliance: Comply with manufacturer's written data, including product technical bulletins, product catalog installation instructions, product carton installation instructions and ICS Penetron Intl. Ltd. SPEC-DATA.

3.02 EXAMINATION

- A. Site Verification of Conditions:
 1. Verify that conditions of substrates previously installed under other sections are acceptable for product installation in accordance with manufacturer's instructions prior to application of waterproofing system.

3.03 PREPARATION

- A. Ensure surfaces are clean and free of laitance, dirt, film, paint, coatings and other foreign matter harmful to performance of waterproofing materials.
- B. Ensure surface has open capillary system to provide tooth and suction for crystalline waterproofing material.
 1. Where concrete surfaces are too smooth, as determined by manufacturer's representative, [acid etch] [sandblast] [waterblast] [_____] as recommended by waterproofing manufacturer.
- C. Rout out defects, cracks, faulty construction joints, honeycombing and other defects to sound concrete, and repair in accordance with waterproofing manufacturer's repair procedures manual.
- D. Finish new horizontal surfaces to receive crystalline waterproofing treatment using [rough wood float] [broom] [_____].
- E. Ensure surfaces to receive crystalline waterproofing system are properly watered.
 1. Ensure watered surfaces are damp but not wet prior to application of crystalline waterproofing system.

3.04 REPAIR OF SURFACE DEFECTS

- A. Ensure workers wear rubber gloves when handling cementitious crystalline waterproofing products.
- B. Form Tie Holes, Construction Joints, Cracks:
 1. Chip defective areas in "U" shaped slot [3/4 inch x 1 inch (19.1 x 25.4 mm)] [_____] wide and minimum [1 inch (25.4 mm)] [_____] deep.
 2. Clean slot, wet-saturate with water and remove surface water.
 3. Apply slurry coat of integral crystalline waterproofing and sealing mortar at rate of [1.5 lb/yd² (0.8 kg/m²)] [_____] to slot.
 4. Allow slurry to reach initial set as recommended in accordance with manufacturer's written instructions.

Specifier Note: If crack is still leaking at time of repair, use a rapid setting, plugging mortar rather than a sealing mortar.

- 5. Fill cavity with [waterproofing and sealing mortar in consistency of mortar] [plugging mortar] flush with surface.
- 6. Compress tightly into cavity using [pneumatic packer] [hammer and blocks] [_____].
- C. Repair of Leaks:
 1. Chip defective areas in "U" shaped slot [3/4 inch x 1 inch (19.1 x 25.4 mm)] [_____] wide and minimum [1 inch (25.4 mm)] [_____] deep.
 2. Mix rapid setting, cementitious, crystalline waterstopping mortar in a ratio of [2.5 lb (1 kg)] [_____] mortar to [8 fl oz (236.6 ml)] [_____] water to form mortar into a dry pack consistency.

3. Form mortar into wedge shape of size to fit defective area slot.
 4. Pack mortar wedge tightly into defective area and hold in place [for [30] [_____] seconds minimum] [until leak has stopped].
 5. Apply as much pressure as possible by hand and tap in place using [pneumatic packer] [hammer and blocks] [_____] .
 6. Remove excess material and coat with integral cementitious waterproofing material using [spray] [stiff bristle brush] [_____] application.
- D. Rock Pockets, Honeycombing or Other Defective Concrete:
1. Rout out defective areas to sound concrete.
 2. Remove loose material and saturate with water.
 3. Remove surface water and apply one slurry coat of waterproofing admixture.
 4. After slurry has set but while still "green," fill cavity to surface with plugging mortar.
- E. Coves, Sealing Strips, Expansion and Control Joints:
1. Prepare concrete joint surfaces by application of one coat of integral crystalline cementitious ready-mixed waterproofing and sealing mortar in slurry form.
 2. Apply waterproofing and sealing mortar in consistency of mortar, flush with surface while slurry coat is still green, but after slurry coat has reached initial set.
 3. Coves: Trowel-apply and pack Portland cement fortified admixture into cove shape.
 4. Sealing Strips: Fill preformed grooves, [3/4 inch (19.1 mm)] [_____] wide and minimum [1 inch (25.4 mm)] [_____] deep, located at construction joints with waterproofing and sealing mortar.
 - a. Compact tightly using [pneumatic packer] [hammer and blocks] [_____] .

Specifier Note: Treat expansion joints as a special condition and seek direction from a design professional. Contact the manufacturer's technical representative for advice on the best way to treat expansion and control joints on the project when using their products.

5. Expansion and Control Joints: Treat expansion joints as a special condition as directed by [Engineer] [_____] .

3.05 INSTALLATION

Specifier Note: Coordinate installation in accordance with the manufacturer's written installation details and instructions.

- A. Perform concrete work in accordance with Section [03 30 00 - Cast-in-Place Concrete] [_____] .
- B. Coordinate concrete repairs with Section [03 01 30 - Maintenance of Cast-in-Place Concrete] [_____] , and with Section [03 01 30.71 - Rehabilitation of Cast-in-Place Concrete] [_____] .
- C. Wetting Concrete: Saturate surfaces to be treated with clean water in order to enhance crystallization formation process within concrete.
 1. Remove excess surface water before application of waterproofing treatment.

Specifier Note: For new construction, use the surface-applied integral crystalline waterproofing (Penetron as manufactured by ICS Penetron Intl. Ltd.). Material can be spray-applied as a liquid, brushed on as a slurry or dry sprinkled and troweled on.

- D. Waterproofing New Construction: Apply integral crystalline waterproofing admixture in accordance with Section [03 05 01 - Admixture Work Results for Concrete] [_____] .
1. Apply integral crystalline waterproofing treatment uniformly with [spray nozzle] [or] [semi-stiff bristle brush] as follows:
 - a. Surface Application on Non-Horizontal Surfaces: [Spray on] [Brush on] at coverage rate [1.25 - 1.5 lb/yd² (0.68 - 0.81 kg/m²)] [_____] [Recommended by manufacturer].
 - b. Horizontal Construction Slabs: [Brush on as slurry] [Dry sprinkle and trowel on] at coverage rate [2 lb/yd² (1.1 kg/m²)] [_____] [Recommended by manufacturer].
 - c. Construction Joints: [Brush on as slurry] [Dry sprinkle and trowel on] at coverage rate [3 lb/yd² (1.6 kg/m²)] [_____] [Recommended by manufacturer] immediately prior to next [lift] [bay] of concrete.

d. Water Retaining Structure Internal Walls:

- 1) One coat application: [Spray on] [Brush on] at coverage rate [2.5 - 3 lb/yd² (1.4 - 1.6 kg/m²)] [_____]
[Recommended by manufacturer].
- 2) Two coat application: [Spray on] [Brush on] each coat at coverage rate [1.25 - 1.5 lb/yd² (0.68 - 0.81 kg/m²)]
[_____] [Recommended by manufacturer].
- 3) Use light, pre-watering between coats when rapid drying conditions occur.
- 4) Ensure surface is damp, not wet, for second coat.

- E. Dry Shake Chemical Mixture Application for Horizontal Slabs: Apply waterproofing powder to fresh horizontal concrete surfaces. Incorporate powder into surface during concrete finishing process. Finish concrete surfaces in accordance with Section [03 35 00 - Concrete Finishing] [_____].

Specifier Note: Check with manufacturer's technical representative for dry shake chemical mixture application rate that best suits the project requirements.

1. Dry shake chemical mixture application rate: [1 lb/yd² (0.542 kg/m²)] [_____].

Specifier Note: Proper curing of waterproofing treatment is essential in order to prevent premature evaporation of moisture from the concrete substrate and to aid in the hardening of the cementitious coating.

3.06 CURING

- A. Perform concrete curing in accordance with Section [03 39 00 - Concrete Curing] [_____].
1. Cure waterproofing treatment using [misty fog spray of clean water] [_____] after waterproofing coating has hardened.
 2. Avoid damaging coating with spray operation.
 - a. Spray waterproofing treated surface [3] [_____] times each day for [2] [3] [_____] days.
 3. In hot climates, as determined by waterproofing treatment manufacturer, spray waterproofing treated surfaces at intervals recommended by manufacturer's technical representative.
 4. During curing period, protect treated surfaces from rainfall, frost and puddling of water.

Specifier Note: Include the following Article for reservoirs, tanks and other liquid holding structures.

5. Concrete Liquid Structures: Cure waterproofing treated concrete surface of structures that hold liquids for [3] [_____] days minimum before filling structure with liquid.

3.07 FIELD QUALITY CONTROL

Specifier Note: Use the following Articles when manufacturer's field services are desired to verify the quality of the installed components. Establish the number and duration of periodic site visits required by the Manufacturer and specify below. Consult with the Manufacturer for services required. Delete if field services are not required.

- A. Have manufacturer of products supplied under this section review work involved in handling, installation, application and protection of product[s], and submit written report in acceptable format to verify compliance of work.
- B. Manufacturer's Field Services: Have manufacturer's technical representative schedule site visits to review work as follows:
 1. After delivery and storage of products.
 2. When preparatory work for work of this Section is complete, but before installation begins.
 3. [Weekly] [2 times] [_____] during progress of work [at [25%] and [60%]] [_____] of completion.
 4. Upon completion of work, after cleaning is completed.

3.08 PROTECTION

Specifier Note: Coordinate the following Article with Section 01 76 00 - Protecting Installed Construction.

- A. Protect installed product from damage during construction in accordance with Section [01 76 00 - Protecting Installed Construction] [_____].

3.09 FINAL CLEANING

- A. Perform cleanup in accordance with Section [01 74 00 - Cleaning and Waste Management] [_____].
- B. Upon completion, remove surplus materials, rubbish, tools and equipment.

END OF SECTION