

Xypex Bio-San Admix CSI Format

Section 033000

1.01 SUMMARY

- A. **Section Includes:** Furnishing of all labor, materials, services, and equipment necessary for the supply and installation of antimicrobial crystalline additive to concrete as indicated on the drawings and as specified herein.
- B. **Related Sections:**
1. Section 031000 - Concrete Forming
 2. Section 032000 - Concrete Reinforcement
 3. Section 031516 - Concrete Construction Joints
 4. Section 033713 - Shotcrete
 5. Section 034000 - Precast Concrete
 6. Section 071616 - Crystalline Coatings
 7. Section 079000 - Joint Protection

1.02 REFERENCES

- A. **Applicable Standards:** The following standards are referenced herein.
1. American Society for Testing and Materials (ASTM)
 2. Army Corps of Engineers (CRD)
 3. American Concrete Institute (ACI)
 4. International Organization for Standardization (ISO)
 5. European Standards (EN)

1.03 SYSTEM DESCRIPTION

- A. **Antimicrobial Crystalline Waterproofing Additive:** Concrete protection and waterproofing system shall be of the antimicrobial crystalline type that chemically controls and permanently fixes both a non-soluble crystalline structure within the pores and capillary tracts of the concrete and bio-active mineral solids into the concrete matrix. This dual system additive causes the concrete to become sealed against the penetration of liquids from any direction and protects the concrete from deterioration due to harsh environmental conditions in wastewater applications. The product shall be of powder form and introduced to the mix during concrete production. The product shall be an EPA-registered integral concrete admixture for the prevention of microbial-induced corrosion (MIC) typically found in concrete tanks, pipes, manholes, and other structures/elements in sewage and drainage systems. The antimicrobial crystalline waterproofing additive shall have a Visual Detection System (VDS) to enable confirmation of the presence of the additive in hardened concrete.

1.04 SYSTEM PERFORMANCE REQUIREMENTS

- A. **Testing Requirements:** The antimicrobial crystalline waterproofing system shall have been tested in accordance with the following standards and conditions and as per the manufacturer's dosage range, and the testing results shall meet or exceed the performance requirements as specified herein.
- B. **Independent Laboratory:** Testing shall have been performed by an accredited independent laboratory, meeting the requirements of ASTM E 329, CCRL, CCIL, ISO 17025 or other applicable international standard for certification of testing laboratories.
- C. **Antimicrobial Effect:** Independent testing shall be performed according to ISO 22196 (Mod.) "Measurement of Antibacterial Activity on Plastics and other Non-Porous Surfaces". Treated and non-treated control concrete samples shall be tested and a definite antimicrobial effect shall be evidenced by a significant reduction in formation of *Thiobacillus Novellus* / *Starkeya Novella* bacteria on the treated samples versus the non-treated samples.
- D. **Concrete Corrosion Rate:** Treated and non-treated control concrete samples shall be tested in a live wastewater environment with high concentrations of H_2S . Treated samples shall show at least 9 times less mass loss after 10 years as compared to control samples.
- E. **Long-term Antimicrobial Action and Efficacy:** The antimicrobial admixture must show long-term antimicrobial action and efficacy as demonstrated by minimal bacterial concentration on the treated concrete after 10 years exposure to an elevated H_2S live wastewater environment.
- F. **Crystalline Formation:** Crystallizing capability of waterproofing system shall be evidenced by independent scanning electron microscope (SEM) photographs showing crystalline formations within the concrete matrix.
- G. **Permeability 1:** Independent testing shall be performed according to the U.S. Army Corps of Engineers CRD-C48 (Mod.) "Permeability of Concrete". Concrete samples shall be pressure tested to 150 psi (350-foot head of water) or 1.05 MPa (106 m head of water). After 5 days the untreated samples shall leak, and the treated samples shall exhibit no measurable leakage.
- H. **Permeability 2:** Independent testing shall be performed according to EN 12390-8. Treated samples shall be exposed to water with a pressure of 0.5 MPa for 72 hours. Treated samples must exhibit a reduction in permeability coefficient of at least 80% when compared to control concrete. Control samples must have a depth of penetration of at least 50 mm.
- I. **Sulfuric Acid Resistance:** Independent testing shall be performed to determine "Sulfuric Acid Resistance of Concrete Specimens." Treated concrete samples dosed at 3% shall be tested against untreated control samples. All samples shall be immersed in 7% sulfuric acid and weighed daily until a control sample reaches a mass loss of 50%. On final weighing, the percentage mass loss of the treated samples shall be significantly lower than the control samples.

- J. **Sulfate Resistance:** Independent testing shall be performed to determine "Sulfate Resistance of Concrete Specimens" treated with integral crystalline admixture. Treated and untreated samples shall be immersed in a concentrated sulfate solution for at least 4 months. On final weighing, the percentage mass loss of the treated samples shall be significantly lower than the control samples.
- K. **Compressive Strength:** Concrete samples containing the antimicrobial crystalline waterproofing additive shall be tested against an untreated control sample of the same mix. At 28 days, the treated samples shall exhibit equal or increased compressive strength over the control sample.
- L. **Visual Detection System (VDS):** The antimicrobial crystalline waterproofing additive shall include a Visual Detection System that enables confirmation that the concrete contains the crystalline admixture. The Visual Detection System will be composed of non-water-soluble particles and be detectable after the concrete has hardened and for a period of at least 6 months after casting.

1.05 SUBMITTALS

- A. **General:** Submit listed submittals in accordance with the conditions of the Contract and with Division 1 Submittal Procedures Section.
- B. **Product Data:** Submit product data, including the manufacturer's specifications, installation instructions, and general recommendations for concrete protection and waterproofing applications.
- C. **Test Reports:** Submit, for acceptance, complete test reports from approved independent testing facilities certifying that the antimicrobial crystalline waterproofing system conforms to the performance characteristics and testing requirements specified herein.
- D. **Manufacturer's Certification:** Provide documentation signed by the manufacturer or manufacturer's representative certifying that the materials to be installed comply with the requirements of this specification.

1.06 QUALITY ASSURANCE

- A. **Manufacturer Qualifications:** The manufacturer must be ISO 9001 registered and have no less than 10 years of experience in manufacturing crystalline waterproofing additives. The manufacturer must be capable of providing field service representation during the construction phase. Manufacturers who cannot provide ongoing field support or who cannot provide the performance test data specified herein will not be considered for the project.
- B. **Installer:** The ready-mix supplier and/or installer of the antimicrobial crystalline waterproofing additive shall be approved by the manufacturer or manufacturer's representative in writing.
- C. **Pre-Installation Conference:** Prior to the installation of the antimicrobial waterproofing system, hold a meeting with Architect/Engineer, owner's representative, concrete

supplier, concrete placer, and antimicrobial waterproofing manufacturer's representative to verify and review the following:

1. Project requirements for antimicrobial protection and waterproofing as set out in the Contract documents.
 2. The manufacturer's product data including mixing and installation instructions.
- D. **Technical Consultation:** The manufacturer's representative shall provide technical consultation on the antimicrobial protection and waterproofing applications and shall provide on-site support as needed.
- E. **Verification Testing / Visual Detection System Examination:** A concrete testing technician or other trained individuals shall provide verification testing that indicates that the Xypex additive has been dosed into the concrete, where required.

1.07 DELIVERY, STORAGE AND HANDLING

- A. **Ordering:** Comply with the manufacturer's ordering instructions and lead time requirements to avoid construction delays.
- B. **Delivery:** Deliver packaged waterproofing materials to the project site in the original undamaged containers, with the manufacturer's labels and seals intact.
- C. **Storage:** Store waterproofing materials in a dry, enclosed location at a minimum temperature of 45°F (7°C).

1.08 WARRANTY

- A. **Project Warranty:** Refer to the conditions of the Contract for project warranty provisions.
- B. **Manufacturer's Warranty:** The manufacturer shall provide a standard product warranty executed by an authorized company official.

PART 2 – PRODUCTS

2.01 MATERIALS

A. **Acceptable Manufacturer:**

Xypex Chemical Corporation
13731 Mayfield Place, Richmond, B.C., Canada V6V 2G9
Tel: 800 961.4477 or 604 273.5265 Fax: 604 270.0451
E-mail: info@xypex.com Website: www.xypex.com

Note: Acceptable manufacturers include all licensed manufacturing operations of Xypex Chemical Corporation.

B. **Proprietary Products:** Xypex antimicrobial crystalline waterproofing materials as follows:

1. Xypex Bio-San
2. Xypex Megamix II with Bio-San
3. Xypex Concentrate

C. **Submission of Substitutions or Alternate Products:**

1. No substitutions are permitted.
2. All requests for consideration of substitutions or equal products must be made to the Engineer of Record.
3. All costs associated with evaluating any requested substitutions or alternate products will be paid by the bidder making the request.

D. **Source Quality:** Obtain all proprietary antimicrobial crystalline waterproofing products from a single manufacturer.

2.02 DOSAGE

A. **General:** Xypex Bio-San should be added to the concrete mix at the time of batching.

B. **Dosage Rate:** Under normal conditions, the antimicrobial crystalline powder shall be added to the concrete mix at the following rates:

1. Xypex Bio-San 1% by weight of cementitious material content

PART 3 – EXECUTION

3.01 MANUFACTURER'S INSTRUCTIONS

- A. **Compliance:** Comply with the manufacturer's product data regarding installation, including technical bulletins, product catalogue, installation instructions, and product packaging labels.

3.02 PROJECT CONDITIONS

- A. **Crack Control:** All reinforcement shall be in accordance with applicable standards. Concrete elements shall be designed and constructed to minimize and control cracking.
- B. **Setting Time and Strength:** Xypex Bio-San is set neutral. Factors affecting the time of set can include the concrete mix design, dosage rate of the Bio-San, other admixtures, temperature of the concrete, and climatic conditions. Concrete containing Xypex Bio-San may develop higher ultimate strengths than plain concrete. Conduct trial mixes under project conditions to determine setting time and strength of the concrete. Consult with the manufacturer or manufacturer's representative regarding concrete mix design, project conditions, and proper dosage rate.
- C. **Weather Conditions:** For mixing, transporting, and placing concrete under conditions of high temperature or low temperature, follow the concrete practices such as those referred to in ACI 305R (Hot Weather Concreting) and ACI 306R (Cold Weather Concreting) or other applicable standards.

3.03 APPLICATION

- A. **General:** Xypex Bio-San is added to the concrete at the time of batching. Xypex Bio-San admixture shall be mixed into the concrete until homogeneous. Do not add dry Bio-San powder directly to wet mixed concrete as this could cause clumping and thorough dispersion may not occur.
- B. **Concrete Batching & Mixing:** Procedures for the addition of Xypex Bio-San will vary according to the type of batch plant operation and equipment.
 - 1. **Addition to Coarse Aggregate Belt:** Add Xypex Bio-San powder directly to the coarse aggregate conveyor belt manually or through a computer-controlled mass batching system. Account for worker health and safety issues relating to moving belts and wind-blown dust.
 - 2. **Addition to Ready-Mixed Truck at Plant:** Add Xypex Bio-San in bulk powder or soluble bag form to the drum of the ready-mix truck immediately prior to driving the truck under the batch plant. Then add the balance of the materials or the premixed concrete in accordance with standard concrete batching practices. Take measures to ensure that soluble bags are dispersed properly. Such measures can include a) adding the bags as far forward in the drum as possible, b) adding a small amount of batch water along with the bags, and c) spinning the drum prior to adding the remaining components. Avoid delays in adding other components and utilize high-speed mixing to ensure homogeneity of the mix. Where there may be insufficient

water for thorough dispersion of the bulk powder, mix the Bio-San powder with water to form a slurry and add it to the truck mixer drum prior to batching. Account for added water in the mix design and slump.

3. **Addition to Central Mixer:** Load the Xypex Bio-San in bulk powder form or in soluble bags along with the other components. Mix in accordance with the standard batching practices to ensure thorough dispersion and a homogeneous mixture. Account for worker safety issues when accessing the equipment.
4. **Precast Batch Plant - Pan Type Mixer:** Add Xypex Admix to the mixer with or immediately after other ingredients, then mix until homogenous. The total concrete mix shall be blended using standard practices.

Note 1: While it is preferable to install the Xypex Admix at the batch plant, when necessary, a slurry mixture containing the Admix can be added on site to the ready-mix truck. To create a slurry, mix 5 parts Admix powder to 3 parts water by volume (i.e., a water-to-powder ratio of 0.67 by mass). Following addition to the drum, mix the concrete for a minimum of 5 minutes on high speed or until thoroughly dispersed. Account for added water in the mix design and slump.

Note 2: Consult with a local Xypex Technical Services Representative concerning additional procedures for addition and mixing.

- C. **Construction and Cold Joints:** In addition to specified waterstops, apply one coat of Xypex Concentrate slurry at a rate of 2 lb./sq. yd. (1 kg/m²) to joint surfaces between concrete pours. Moisten the surfaces prior to the slurry application. Apply the slurry and keep it moist for 12 hours then allow the slurry to set or dry. Where joint surfaces are not accessible prior to pouring new concrete, contact a Xypex Technical Services Representative for assistance.

Note: The inclusion, type, and position of waterstops are at the discretion of the designer. Expanding waterstops may be placed on Xypex after it has dried or before the Xypex slurry application. The Xypex slurry may only be applied over a waterstop if approved by a waterstop manufacturer.

- D. **Xypex Sealing Strips:** Where hydrostatic conditions exist, sealing strips shall also be applied at construction joints by filling grooves that are created along the joints. Dimensions of the grooves shall be 1 inch (25 mm) wide and 1.5 inches (37 mm) deep. If grooves have not been pre-formed, then chip grooves to those dimensions. Fill the grooves as follows:
1. Apply a slurry coat of Xypex Concentrate to slot in accordance with the manufacturer's instructions or recommendations.
 2. While the slurry coat is still tacky, fill the slot with Xypex Concentrate Dry-Pac.
 3. Compact it tightly using a pneumatic packer or a hammer and block so that the compacted material fills half the depth of the slot.
 4. Fill the remainder of the slot with Xypex Megamix II with Bio-San.

- E. **Form Tie Holes:** Form tie holes shall be waterproofed as follows:

1. Prepare the tie hole to create a straight sided void with a profile of at least ICRI CSP-3. For through-element tie holes, such as those created by taper ties, the prepared void shall be at least 5" (125 mm) deep. For cone ties, the void shall be to the bottom of the cone.
2. For through-element tie holes, create a solid plug of material at the bottom of the profiled hole using Xypex Patch'n Plug, leaving at least 4" (100 mm) of empty tie hole from the top of the plug to the surface of the concrete element.
3. Apply a coat of Xypex Concentrate slurry at a rate of 1.5 lb./sq. yd. (0.8 kg/m²) to the inside of the tie hole.
4. Fill and compact the tie hole with Xypex Concentrate Dry-Pac so that the level of the compacted material is approximately ¾" (20 mm) below the surface of the concrete.
5. Fill the remainder of the hole with Xypex Megamix II with Bio-San.

F. **Repair of Defects:** Concrete defects shall be repaired generally as follows:

1. Cracks and Faulty Construction Joints:

- a. Chip out cracks, faulty construction joints, and other defects to a depth of 1.5 inches (37 mm) and a width of one inch (25 mm). A "V"-shaped slot is not acceptable. The slot may be saw cut instead of chipped but ensure that the slot is dovetailed or otherwise shaped such that there will be mechanical interlocking of materials placed into the slot at a later stage.
- b. Clean the slot of debris and dust. Soak the area with water and remove any excess surface water. Apply a slurry coat of Xypex Concentrate at the rate of 1.5 lb./sq. yd. (0.8 kg/m²) to the slot.
- c. While the slurry coat is still tacky, fill the cavity with Dry-Pac. Compress it tightly into the cavity using a pneumatic packer or a block and hammer so the compacted material fills half the depth of the cavity.
- d. Fill the remainder of the slot with Xypex Megamix II with Bio-San.

2. **Rock Pockets, Honeycombing, or Other Defective Concrete:** All areas of poor concrete consolidation (honeycomb or rock pockets) shall be repaired. It is recommended that Xypex Megamix II with Bio-San or ready-mixed concrete dosed with Xypex Bio-San C500 be used for infill concrete.

Note: Where there is active water-flow, contact a Xypex Technical Services Representative for assistance.

3.04 PLACING

A. **Concrete Placement:** Concrete placement shall be in accordance with ACI 309R: Guide for Consolidation of Concrete or other applicable standard. Special attention shall be given to consolidation at joints, penetrations, and other potential leakage locations.

3.05 CURING

- A. **General:** Concrete containing Xypex Bio-San shall be moist cured in accordance with ACI 308, "Standard Practice for Curing Concrete" or other applicable standard.
- B. **Curing Compounds:** Curing compounds are not recommended for use over Xypex Bio-San treated concrete. Where required, only curing agents proven to dissipate and not interfere with the antimicrobial protection may be used. Contact a Xypex Technical Services Representative where required.

3.06 PROTECTION

- A. **Protection:** Protect installed product and finished surfaces from damage during construction.

3.07 FIELD QUALITY CONTROL

- A. **Verification of the Inclusion of Xypex:** A concrete testing technician or other trained individuals shall examine the concrete surfaces on the construction site for VDS, typically within 28 days after placing or stripping. Alternately perform VDS evaluation on routine QC tests specimens (cubes or cylinders) cast on the construction site at the time they are stripped in the concrete laboratory.
- B. **Examination for Defects:** Do not conceal Xypex treated concrete before it has been observed by the Architect/Engineer, manufacturer's representative, or other designated entities. The concrete shall be examined for structural defects such as honeycombing, rock pockets, tie holes, faulty construction joints, cold joints, and cracks larger than 0.02" (0.5 mm). Such defects shall be repaired in accordance with the manufacturer's repair procedures as noted above.
- C. **Testing for Tanks and Foundation Works**
 - 1. **Testing:** Fill tanks or, for foundation works, shut off the dewatering system as soon as practical so that the structure shall be exposed to its normal service conditions. Examine for leaks. For structures that will be dry until a specific event (eg: interior located containment basin), the concrete elements should be fully saturated several times over a period of several weeks to encourage crystal development to occur.
 - 2. **Monitoring:**
 - a. Actively leaking cracks and joints shall be left to self-heal for as long as practical. Depending on job site and ambient conditions, crack healing can be expected to take several days to weeks.
 - b. Any crack or joints that do not heal in the allowable time frame shall be repaired.
 - c. Moving cracks shall be repaired using polyurethane injection or other appropriate method.
 - 3. **Repair:** Use Xypex repair procedures to seal any static crack or joint that does not self-heal. See Method Statements (www.xypex.com/technical/statements) or contact a Xypex Technical Services Representative for appropriate repair procedures.

Note: Lower temperatures will extend the times for crystalline development.

3.08 INTERACTION WITH OTHER MATERIALS

- A. **Backfilling:** Normal backfilling procedures may be used after the concrete has been cured.
- B. **Paint, Epoxy, Grout, Cement Parge Coat, Plaster, or Stucco:** Xypex Bio-San provides protection when bacteria are in direct contact with Bio-San treated concrete. Bio-San treated concrete shall not be covered or coated on any surface desired to have protection from microbial induced corrosion.
- C. **Responsibility to Ensure Compatibility:** Xypex Bio-San products are compatible with most admixtures used in the production of quality concrete, including air-entraining admixture. However, Xypex Chemical Corporation makes no representations or warranties regarding the compatibility of Xypex Bio-San products with other additives or admixtures. It shall be the responsibility of the concrete contractor to take whatever measures are necessary, including testing, to ensure compatibility of the Xypex Bio-San with other additives or admixtures being used in the concrete mix.

End of Section 033000