



ITB WS 07-19 ADDENDUM 02

April 17, 2019

ARBENNIE PRITCHETT WRF RECLAIMED WATER EXPANSION PROJECT

****The Bid date and submission time have NOT changed****

The following changes, additions, and or deletions are hereby made a part of the Bidding Documents for the Bid # WS 07-19 as fully and completely as if the same were fully set forth therein:

TECHNICAL SPECIFICATIONS

- I. 03302- Cast-in-Place Concrete- Plant Tankage
 - 1) Section 03302- All
 - a. **ADD** - The attached Section 03302 shall be included in the Technical Specifications.

- II. 05700- Pre-Eng Aluminum Handrails Platforms Grating Systems
 - 1) Section 05700- All
 - a. **ADD** - The attached Section 05700 shall be included in the Technical Specifications.

- III. 07115- Bituminous Damproofing
 - 1) Section 07115- All
 - a. **ADD** - The attached Section 07115 shall be included in the Technical Specifications.

- IV. 07164- Concrete Tankage Waterproofing
 - 1) Section 07164- All
 - a. **ADD** - The attached Section 07164 shall be included in the Technical Specifications.

- V. 07921- Joint Sealants - Plant Tankage
 - 1) Section 07921- All
 - a. **ADD** - The attached Section 07921 shall be included in the Technical Specifications.

- VI. 15100 - Valves
 - 1) Section 15100, Part 2.4.A.1 AWWA Butterfly Valves for Clear Water Service
 - a. **REPLACE** - Entire Paragraph A.1 with the following: "Butterfly valves and operators up to 72-in diameter shall conform to AWWA C504, Class B, except as specified herein. Manufacturer shall submit an affidavit of compliance stating that valves have been manufactured and tested in accordance with AWWA C504 and specifically listing all exceptions. Valves

shall have a minimum 150 psi pressure rating or higher as noted on Drawings or in this Section and be manufactured by Dezurik; GA; Henry Pratt; M&H; Val-Matic or approved equal.”

TECHNICAL DRAWINGS

- I. Drawing S-1.1- Disinfection Basin Plan
 - 1) COATING AND WATERPROOFING NOTE
 - a. **REPLACE** - The referenced note section with the following: “APPLY CEMENTITIOUS & BITUMINOUS COATINGS TO TANKAGE PER SPECIFICATIONS 09902 & 07115 RESPECTIVELY. ALL TANKAGE CONCRETE SHALL CONTAIN CRYSTALLINE WATERPROOFING ADMIX AS PER SPECIFICATION 07164 INCLUDING FOUNDATION SLABS, WALLS, TOP SLABS, & BEAMS.”

**SECTION 03302
CAST-IN-PLACE CONCRETE - PLANT TANKAGE**

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section specifies cast-in place concrete, including formwork, reinforcement, concrete materials, mixture design, placement procedures, and finishes, for the following:
 - 1. Tankage Footings.
 - 2. Tankage Slabs on Grade.
 - 3. Tankage Suspended slabs.
 - 4. Tankage frame members.
 - 5. Tankage walls.

1.3 WATERTIGHTNESS TESTING FOR PLANT TANKAGE STRUCTURES

- A. All cast-in-place concrete tankage structures will be subject to watertightness testing in accordance with Section 01480-Watertightness Test for Plant Tankage Structures. Schedule all form stripping, curing, finishing, and backfilling of structures with this requirement. PLACE NO BACKFILL AGAINST TANKAGE STRUCTURES UNTIL TESTING HAS BEEN SATISFACTORILY APPROVED.

1.4 RELATED WORK

- A. Waterproofing of Concrete Tankage is included in Section 07164 - Concrete Tankage Waterproofing.
- B. Cementitious Finishes to be applied to the exposed plant tankage walls, including 12" below finished grade, and exposed slab edges and scheduled overhangs is included in Section 09981 - Cementitious Coatings.
- C. Bituminous Dampproofing to be applied to the below grade exterior of plant tankage, from 12" below finished grade and below, is included in Section 07115 - Bituminous Dampproofing.

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1.5 DEFINITIONS

- A. Cementitious Materials: Portland cement alone or in combination with one or more of the following: blended hydraulic cement, fly ash and other pozzolans, ground granulated blast-furnace slag, and silica fume; subject to compliance with requirements.
- B. Tankage Concrete: All footings, foundations, slabs-on-grade, suspended slabs, concrete toppings, frame members (columns, beams, pedestals) and walls associated with water, wastewater or solid waste processes. *Concrete for buildings and other site flatwork not associated with treatment, storage, or material conveyance related to processes but including the Filter support foundation and adjacent slabs on grade are specified in Section 03301.*

1.6 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Design Mixtures: For each concrete mixture. Submit alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.
- C. Steel Reinforcement Shop Drawings: Placing drawings that detail fabrication, bending, and placement. Include bar sizes, lengths, material, grade, bar schedules, stirrup spacing, bent bar diagrams, bar arrangement, splices and laps, mechanical connections, tie spacing, hoop spacing, and supports for concrete reinforcement.
- D. Formwork Shop Drawings: Prepared by or under the supervision of a qualified professional engineer detailing fabrication, assembly, and support of formwork. Drawings to be signed/sealed by PE registered in project state.
 - 1. Shoring and Reshoring: Indicate proposed schedule and sequence of stripping formwork, shoring removal, and installing and removing reshoring.
- E. Samples: For waterstops.
- F. Qualification Data: For Installer, manufacturer, and testing agency.
- G. Material Test Reports: For the following, from a qualified testing agency, indicating compliance with requirements:
 - 1. Aggregates. Include service record data indicating absence of deleterious expansion of concrete due to alkali aggregate reactivity.
- H. Material Certificates: For each of the following, signed by manufacturers:
 - 1. Cementitious materials.

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2. Admixtures.
3. Form materials and form-release agents.
4. Steel reinforcement and accessories.
5. Waterstops.
6. Bonding agents.
7. Adhesives.
8. Vapor retarders.
9. Repair materials.

- I. Field quality-control test reports.
- J. Minutes of preinstallation conference.

1.7 QUALITY ASSURANCE

- A. Installer Qualifications: A qualified installer who employs Project personnel qualified as ACI-certified Flatwork Technician and Finisher and a supervisor who is an ACI-certified Concrete Flatwork Technician.
- B. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94/C 94M requirements for production facilities and equipment.
 1. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities."
- C. Testing Agency Qualifications: An independent agency, acceptable to authorities having jurisdiction, qualified according to ASTM C 1077 and ASTM E 329 for testing indicated, as documented according to ASTM E 548.
 1. Personnel conducting field tests shall be qualified as ACI Concrete Field Testing Technician, Grade 1, according to ACI CP-01 or an equivalent certification program.
 2. Personnel performing laboratory tests shall be ACI-certified Concrete Strength Testing Technician and Concrete Laboratory Testing Technician - Grade I. Testing Agency laboratory supervisor shall be an ACI-certified Concrete Laboratory Testing Technician - Grade II.
- D. Source Limitations: Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant, obtain aggregate from one source, and obtain admixtures through one source from a single manufacturer.
- E. ACI Publications: Comply with the following unless modified by requirements in the Contract Documents:
 1. ACI 301, "Specification for Structural Concrete," Sections 1 through 5.
 2. ACI 117, "Specifications for Tolerances for Concrete Construction and Materials."

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- F. Concrete Testing Service: Engage a qualified independent testing agency to perform material evaluation tests and to design concrete mixtures.
- G. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Management and Coordination."
 - 1. Before submitting design mixtures, review concrete design mixture and examine procedures for ensuring quality of concrete materials. Require representatives of each entity directly concerned with cast-in-place concrete to attend, including the following:
 - a. Contractor's superintendent.
 - b. Independent testing agency responsible for concrete design mixtures.
 - c. Ready-mix concrete manufacturer.
 - d. Concrete subcontractor.
 - 2. Review special inspection and testing and inspecting agency procedures for field quality control, concrete finishes and finishing, cold- and hot-weather concreting procedures, curing procedures, construction contraction and isolation joints, and joint-filler strips, forms and form removal limitations, shoring and reshoring procedures, vapor-retarder installation, anchor rod and anchorage device installation tolerances, steel reinforcement installation, concrete repair procedures, and concrete protection.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Steel Reinforcement: Deliver, store, and handle steel reinforcement to prevent bending and damage.
- B. Waterstops: Store waterstops under cover to protect from moisture, sunlight, dirt, oil, and other contaminants.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
 - 1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products specified.
 - 2. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.

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2.2 FORM-FACING MATERIALS

- A. Smooth-Formed Finished Concrete: Form-facing panels that will provide continuous, true, and smooth concrete surfaces. Furnish in largest practicable sizes to minimize number of joints. ALL VERTICAL WALL AND SLAB FACES AND HORIZONTAL SUSPENDED SLAB UNDERSIDES FOR TANKAGE WORK SHALL BE SMOOTH FORMED.
 - 1. Exterior-grade plywood panels, suitable for concrete forms, complying with DOC PS 1, and as follows:
 - a. High-density overlay, Class 1 or better.
- B. Rough-Formed Finished Concrete: Plywood, lumber, metal, or another approved material. Provide lumber dressed on at least two edges and one side for tight fit.
- C. Forms for Cylindrical Columns, Pedestals, and Supports: *(Not applicable to Project.)*
- D. Chamfer Strips: Wood, metal, PVC, or rubber strips, 3/4 by 3/4 inch, minimum.
- E. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces.
 - 1. Formulate form-release agent with rust inhibitor for steel form-facing materials.
- F. Form Ties: Factory-fabricated, removable or snap-off metal or glass-fiber-reinforced plastic form ties designed to resist lateral pressure of fresh concrete on forms and to prevent spalling of concrete on removal.
 - 1. Furnish units that will leave no corrodible metal closer than 1 inch to the plane of exposed concrete surface.
 - 2. Furnish ties that, when removed, will leave holes no larger than 1 inch in diameter in concrete surface.
 - 3. Furnish ties with integral water-barrier plates to walls indicated to receive dampproofing or waterproofing.

2.3 STEEL REINFORCEMENT

- A. Reinforcing Bars: ASTM A 615/A 615M, Grade 60, deformed.
- B. Steel Bar Mats: ASTM A 184/A 184M, fabricated from ASTM A 615/A 615M, Grade 60, deformed bars, assembled with clips.
- C. Plain-Steel Wire: ASTM A 82, as drawn.
- D. Plain-Steel Welded Wire Reinforcement: ASTM A 185, plain, fabricated from as-drawn steel wire into flat sheets.

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2.4 REINFORCEMENT ACCESSORIES

- A. Joint Dowel Bars: ASTM A 615/A 615M, Grade 60, plain-steel bars, cut bars true to length with ends square and free of burrs.
- B. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire reinforcement in place. Use plastic bar supports except use precast concrete 'bricks' for slabs on grade according to CRSI's "Manual of Standard Practice," of greater compressive strength than concrete and as follows:
 - 1. Do not use steel bar supports whether plastic coated or not.

2.5 CONCRETE MATERIALS

- A. Cementitious Material: Use the following cementitious materials, of the same type, brand, and source, throughout Project:
 - 1. Portland Cement: ASTM C 150, Type I, gray. Supplement with the following:
 - a. Fly Ash: ASTM C 618, Class F.
 - b. Ground Granulated Blast-Furnace Slag: ASTM C 989, Grade 100 or 120.
 - 2. Blended Hydraulic Cement: ASTM C 595, Type IS, portland blast-furnace slag cement.
- B. Silica Fume: ASTM C 1240, amorphous silica.
- C. Normal-Weight Aggregates: ASTM C 33, Class 3S coarse aggregate or better, graded. Provide aggregates from a single source with documented service record data of at least 10 years' satisfactory service in similar applications and service conditions using similar aggregates and cementitious materials.
 - 1. Maximum Coarse-Aggregate Size: 3/4 inch nominal.
 - 2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.
- D. Water: ASTM C 94/C 94M and potable.

2.6 ADMIXTURES

- A. Air-Entraining Admixture: ASTM C 260.
- B. Chemical Admixtures: Provide admixtures certified by manufacturer to be compatible with other admixtures and that will not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride. NOTE: USE OF CHEMICAL ADMIXTURES

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AS LISTED BELOW ARE AT THE DISCRETION OF THE CONTRACTOR AND IS TO BE EMPLOYED FOR WORKABILITY OF CONCRETE PLACEMENT.

1. Water-Reducing Admixture: ASTM C 494/C 494M, Type A.
2. Retarding Admixture: ASTM C 494/C 494M, Type B.
3. Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type D.
4. High-Range, Water-Reducing Admixture: ASTM C 494/C 494M, Type F.
5. High-Range, Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type G.
6. Plasticizing and Retarding Admixture: ASTM C 1017/C 1017M, Type II.

- C. Shrinkage Compensating Concrete Admixture Use: Construction plans indicate tankage slabs, walls and suspended slabs joints without the use of shrinkage compensating concrete admixtures. Alternate locations of joints may be shown per plans if the Contractor elects to use shrinkage compensating concrete admixtures in specific areas, if not shown then joint spacing may not exceed manufacturer's recommendations. The use of shrinkage compensating concrete admixture is not mandatory and all expenses associated with its use will be borne by the Contractor.

2.7 WATERSTOPS

- A. Flexible PVC Waterstops: CE CRD-C 572, with factory-installed metal eyelets, for embedding in concrete to prevent passage of fluids through joints. Factory fabricate corners, intersections, and directional changes.

1. Available Manufacturers:
 - a. Bometals, Inc.
 - b. Greenstreak.
 - c. Meadows, W. R., Inc.
 - d. Murphy, Paul Plastics Co.
 - e. Progress Unlimited, Inc.
 - f. Tamms Industries, Inc.
 - g. Vinylex Corp.
2. Profile: Ribbed with center bulb.
3. Dimensions: 6 inches by 3/8 inch thick; nontapered.

2.8 VAPOR RETARDERS

- A. (Not Applicable to Project)

2.9 CURING MATERIALS

- A. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.

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- B. Water: Potable.

2.10 RELATED MATERIALS

- A. Expansion- and Isolation-Joint-Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber or ASTM D 1752, cork or self-expanding cork.
- B. Bonding Agent: ASTM C 1059, Type II, non-redispersible, acrylic emulsion or styrene butadiene.
- C. Epoxy Bonding Adhesive: ASTM C 881, two-component epoxy resin, capable of humid curing and bonding to damp surfaces, of class suitable for application temperature and of grade to suit requirements, and as follows:
 - 1. Types IV and V, load bearing, for bonding hardened or freshly mixed concrete to hardened concrete.

2.11 REPAIR MATERIALS

- A. Repair Underlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/8 inch and that can be feathered at edges to match adjacent floor elevations.
 - 1. Cement Binder: ASTM C 150, portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.
 - 2. Primer: Product of underlayment manufacturer recommended for substrate, conditions, and application.
 - 3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch or coarse sand as recommended by underlayment manufacturer.
 - 4. Compressive Strength: Not less than 4100 psi at 28 days when tested according to ASTM C 109/C 109M.
- B. Repair Overlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/8 inch and that can be feathered at edges to match adjacent floor elevations.
 - 1. Cement Binder: ASTM C 150, portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.
 - 2. Primer: Product of topping manufacturer recommended for substrate, conditions, and application.
 - 3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch or coarse sand as recommended by topping manufacturer.
 - 4. Compressive Strength: Not less than 5000 psi at 28 days when tested according to ASTM C 109/C 109M.

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2.12 CONCRETE MIXTURES, GENERAL

- A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, according to ACI 301.
 - 1. Use a qualified independent testing agency for preparing and reporting proposed mixture designs based on laboratory trial mixtures.
- B. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than portland cement in concrete as follows:
 - 1. Fly Ash: 25 percent.
 - 2. Combined Fly Ash and Pozzolan: 25 percent.
 - 3. Ground Granulated Blast-Furnace Slag: 50 percent.
 - 4. Combined Fly Ash or Pozzolan and Ground Granulated Blast-Furnace Slag: 50 percent portland cement minimum, with fly ash or pozzolan not exceeding 25 percent.
 - 5. Silica Fume: 10 percent.
 - 6. Combined Fly Ash, Pozzolans, and Silica Fume: 35 percent with fly ash or pozzolans not exceeding 25 percent and silica fume not exceeding 10 percent.
 - 7. Combined Fly Ash or Pozzolans, Ground Granulated Blast-Furnace Slag, and Silica Fume: 50 percent with fly ash or pozzolans not exceeding 25 percent and silica fume not exceeding 10 percent.
- C. Limit water-soluble, chloride-ion content in hardened concrete to 0.06 percent by weight of cement.
- D. Admixtures: Use admixtures according to manufacturer's written instructions.
 - 1. Use water-reducing or plasticizing admixture in concrete, as required, for placement and workability.
 - 2. Use water-reducing and retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.
 - 3. Use water-reducing admixture in pumped concrete, concrete for heavy-use industrial slabs and parking structure slabs, concrete required to be watertight, and concrete with a water-cementitious materials ratio below 0.50.
- E. Shrinkage Compensating Concrete Admixture Use: Construction plans indicate tankage slabs, walls and suspended slabs joints without the use of shrinkage compensating concrete admixtures. Alternate locations of joints may be shown per plans if the Contractor elects to use shrinkage compensating concrete admixtures in specific areas, if not shown then joint spacing may not exceed manufacturer's recommendations. The use of shrinkage compensating concrete admixture is not mandatory and all expenses associated with its use will be borne by the Contractor.

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2.13 CONCRETE MIXTURES FOR PLANT TANKAGE ELEMENTS

- A. Tankage Footings: Proportion normal-weight concrete mixture as follows:
1. Minimum Compressive Strength: 5000 psi at 28 days.
 2. Maximum Water-Cementitious Materials Ratio: 0.45 .
 3. Slump Limit: 5 inches or 8 inches for concrete with verified slump of 3 to 5 inches before adding high-range water-reducing admixture or plasticizing admixture, plus or minus 1 inch.
 4. Air Content: 6 percent, plus or minus 1.5 percent at point of delivery for 3/4-inch nominal maximum aggregate size.
- B. Tankage Slabs-on-Grade: Proportion normal-weight concrete mixture as follows:
1. Minimum Compressive Strength: 5000 psi at 28 days.
 2. Minimum Cementitious Materials Content: 540 lb/cu. yd..
 3. Slump Limit: 5 inches or 8 inches for concrete with verified slump of 3 to 5 inches before adding high-range water-reducing admixture or plasticizing admixture, plus or minus 1 inch.
 4. Air Content: Do not allow air content of troweled finished floors to exceed 3 percent.
- C. Tankage suspended Slabs: Proportion normal-weight concrete mixture as follows:
1. Minimum Compressive Strength: 5000 psi at 28 days.
 2. Minimum Cementitious Materials Content: 540 lb/cu. yd..
 3. Slump Limit: 5 inches or 8 inches for concrete with verified slump of 3 to 5 inches before adding high-range water-reducing admixture or plasticizing admixture, plus or minus 1 inch.
 4. Air Content: Do not allow air content of troweled finished floors to exceed 3 percent.
- D. Tankage Concrete Toppings: *(Not applicable to project.)*
- E. Tankage Frame Members: Proportion normal-weight concrete mixture as follows:
1. Minimum Compressive Strength: 5000 psi at 28 days.
 2. Maximum Water-Cementitious Materials Ratio: 0.45.
 3. Slump Limit: 5 inches or 8 inches for concrete with verified slump of 3 to 5 inches before adding high-range water-reducing admixture or plasticizing admixture, plus or minus 1 inch.
 4. Air Content: 6 percent, plus or minus 1.5 percent at point of delivery for 3/4-inch nominal maximum aggregate size.
- F. Tankage Walls: Proportion normal-weight concrete mixture as follows:
1. Minimum Compressive Strength: 5000 psi at 28 days.
 2. Maximum Water-Cementitious Materials Ratio: 0.45.

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3. Slump Limit: 5 inches or 8 inches for concrete with verified slump of 3 to 5 inches before adding high-range water-reducing admixture or plasticizing admixture, plus or minus 1 inch.
4. Air Content: 6 percent, plus or minus 1.5 percent at point of delivery for 3/4-inch nominal maximum aggregate size.

2.14 FABRICATING REINFORCEMENT

- A. Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice."

2.15 CONCRETE MIXING

- A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94/C 94M and ASTM C 1116, and furnish batch ticket information.
 1. When air temperature is between 85 and 90 deg F, reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F, reduce mixing and delivery time to 60 minutes.

PART 3 - EXECUTION

3.1 FORMWORK

- A. Design, erect, shore, brace, and maintain formwork, according to ACI 301, to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until structure can support such loads.
- B. Construct formwork so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117.
- C. Limit concrete surface irregularities, designated by ACI 347R as abrupt or gradual, as follows:
 1. Class A, 1/8 inch for smooth-formed finished surfaces.
 2. Class B, 1/4 inch for rough-formed finished surfaces.
- D. Construct forms tight enough to prevent loss of concrete mortar.
- E. Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush or wrecking plates where stripping may damage cast concrete surfaces. Provide top forms for inclined surfaces steeper than 1.5 horizontal to 1 vertical.
 1. Install keyways, reglets, recesses, and the like, for easy removal.
 2. Do not use rust-stained steel form-facing material.

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- F. Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and slopes in finished concrete surfaces. Provide and secure units to support screed strips; use strike-off templates or compacting-type screeds.
- G. Provide temporary openings for cleanouts and inspection ports where interior area of formwork is inaccessible. Close openings with panels tightly fitted to forms and securely braced to prevent loss of concrete mortar. Locate temporary openings in forms at inconspicuous locations.
- H. Chamfer exterior corners and edges of permanently exposed concrete.
- I. Form openings, chases, offsets, sinkages, keyways, reglets, blocking, screeds, and bulkheads required in the Work. Determine sizes and locations from trades providing such items.
- J. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.
- K. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.
- L. Coat contact surfaces of forms with form-release agent, according to manufacturer's written instructions, before placing reinforcement.

3.2 EMBEDDED ITEMS

- A. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - 1. Install anchor rods, accurately located, to elevations required and complying with tolerances in Section 7.5 of AISC's "Code of Standard Practice for Steel Buildings and Bridges."

3.3 REMOVING AND REUSING FORMS

- A. General: Formwork for sides of beams, walls, columns, and similar parts of the Work that does not support weight of concrete may be removed after cumulatively curing at not less than 50 deg F for 24 hours after placing concrete, if concrete is hard enough to not be damaged by form-removal operations and curing and protection operations are maintained.
 - 1. Leave formwork for beam soffits, joists, slabs, and other structural elements that supports weight of concrete in place until concrete has achieved at least 70 percent of its 28-day design compressive strength.

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- B. Clean and repair surfaces of forms to be reused in the Work. Split, frayed, delaminated, or otherwise damaged form-facing material will not be acceptable for exposed surfaces. Apply new form-release agent.
- C. When forms are reused, clean surfaces, remove fins and laitance, and tighten to close joints. Align and secure joints to avoid offsets. Do not use patched forms for exposed concrete surfaces unless approved by Engineer.

3.4 SHORES AND RESHORES

- A. Comply with ACI 318 and ACI 301 for design, installation, and removal of shoring and reshoring.
- B. Plan sequence of removal of shores and reshore to avoid damage to concrete. Locate and provide adequate reshoring to support construction without excessive stress or deflection.

3.5 VAPOR RETARDERS

- A. *(Not applicable to project.)*

3.6 STEEL REINFORCEMENT

- A. General: Comply with CRSI's "Manual of Standard Practice" for placing reinforcement.
 - 1. Do not cut or puncture vapor retarder. Repair damage and reseal vapor retarder before placing concrete.
- B. Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials that would reduce bond to concrete.
- C. Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcement with bar supports to maintain minimum concrete cover. Do not tack weld crossing reinforcing bars.
- D. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.
- E. Install welded wire reinforcement in longest practicable lengths on bar supports spaced to minimize sagging. Lap edges and ends of adjoining sheets at least one mesh spacing. Offset laps of adjoining sheet widths to prevent continuous laps in either direction. Lace overlaps with wire.

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3.7 JOINTS

- A. General: Construct joints true to line with faces perpendicular to surface plane of concrete.
- B. Shrinkage Compensating Concrete Admixture Use: Construction plans indicate tankage slabs, walls and suspended slabs joints without the use of shrinkage compensating concrete admixtures. Alternate locations of joints may be shown per plans if the Contractor elects to use shrinkage compensating concrete admixtures in specific areas, if not shown then joint spacing may not exceed manufacturer's recommendations. The use of shrinkage compensating concrete admixture is not mandatory and all expenses associated with its use will be borne by the Contractor.
- C. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Engineer.
1. Place joints perpendicular to main reinforcement. Continue reinforcement across construction joints, unless otherwise indicated. Do not continue reinforcement through sides of strip placements of floors and slabs.
 2. Form keyed joints as indicated. Embed keys at least 1-1/2 inches into concrete.
 3. Locate joints for beams, slabs, joists, and girders in the middle third of spans. Offset joints in girders a minimum distance of twice the beam width from a beam-girder intersection.
 4. Locate horizontal joints in walls and columns at underside of floors, slabs, beams, and girders and at the top of footings or floor slabs.
 5. Space vertical joints in walls where indicated or as agreed upon by the Engineer following submittal of the Contractor's jointing plant. Locate joints where easiest for the doweling of continued reinforcing.
 6. Install waterstops per construction joint details.
 7. **Apply Xypex crystalline waterproofing to faces of construction joints. See waterproofing details.**
 8. Use a bonding agent at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
- D. Contraction Joints in Tankage Slabs-on-Grade:
1. Limit use of contraction joints in Tankage Slabs to planned Construction joints with continued reinforcing, waterstops, bonding agent and Xypex crystalline waterproofing.
- E. Expansion Joints in Tankage Slabs-on-Grade, Suspended Slabs or Vertical Walls: *(Not applicable to Project.)*
- F. Doweled Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or use dowel slip fit over one-half of dowel length to prevent concrete bonding to one side of joint.

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3.8 WATERSTOPS

- A. Flexible Waterstops: Install in construction joints and at other joints indicated to form a continuous diaphragm. Install in longest lengths practicable. Support and protect exposed waterstops during progress of the Work. Field fabricate joints in waterstops according to manufacturer's written instructions.

3.9 CONCRETE PLACEMENT

- A. Before placing concrete, verify that installation of formwork, reinforcement, and embedded items is complete and that required inspections have been performed.
- B. Do not add water to concrete during delivery, at Project site, or during placement unless it is directly supervised and recorded by the Ready Mix Manufacturer Quality Control Director or Technician. Addition of water is at the responsibility of the Manufacturer and the General Contractor and will be documented.
- C. Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete will be placed on concrete that has hardened enough to cause seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as indicated. Deposit concrete to avoid segregation.
 1. Deposit concrete in horizontal layers of depth to not exceed formwork design pressures and in a manner to avoid inclined construction joints.
 2. Consolidate placed concrete with mechanical vibrating equipment according to ACI 301.
 3. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations to rapidly penetrate placed layer and at least 6 inches into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity. At each insertion, limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing mixture constituents to segregate.
 4. APPLY MECHANICAL VIBRATING EQUIPMENT TO THE EXTERIOR OF ALL FORMWORK TO ASSURE CONSOLIDATION OF CONCRETE AT THE FORMED FACE.
- D. Deposit and consolidate concrete for floors and slabs in a continuous operation, within limits of construction joints, until placement of a panel or section is complete.
 1. Consolidate concrete during placement operations so concrete is thoroughly worked around reinforcement and other embedded items and into corners.
 2. Maintain reinforcement in position on chairs during concrete placement.
 3. Screed slab surfaces with a straightedge and strike off to correct elevations.
 4. Slope surfaces uniformly to drains where required.

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5. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane, before excess bleedwater appears on the surface. Do not further disturb slab surfaces before starting finishing operations.
- E. Cold-Weather Placement: Comply with ACI 306.1 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.
1. When average high and low temperature is expected to fall below 40 deg F for three successive days, maintain delivered concrete mixture temperature within the temperature range required by ACI 301.
 2. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
 3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mixture designs.
- F. Hot-Weather Placement: Comply with ACI 301 and as follows:
1. Maintain concrete temperature below 90 deg F at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
 2. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade uniformly moist without standing water, soft spots, or dry areas.

3.10 FINISHING FORMED SURFACES

- A. Rough-Formed Finish: As-cast concrete texture imparted by form-facing material with tie holes and defects repaired and patched. Remove fins and other projections that exceed specified limits on formed-surface irregularities.
1. Apply to concrete surfaces not exposed to public view or containing liquid, specifically to the outside edges of foundations only.
- B. Smooth-Formed Finish: As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch tie holes and defects. Remove fins and other projections that exceed specified limits on formed-surface irregularities.
1. Apply to concrete surfaces to be covered with a coating or covering material applied directly to concrete.
 2. Apply to all formed vertical and formed horizontal concrete surfaces.
 3. "Defects" in the above paragraph include but are not limited to air bubbles and honeycomb. Refer to Paragraph 3.15 CONCRETE SURFACE REPAIRS for

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repairing formed surfaces. All air bubbles in the formed surface larger than 1/8" in size shall be filled as well as those areas of the formed surface which contain more than 10% air bubbles in any measured area.

4. Vibration of formwork is required for proper consolidation of concrete and lessening of air bubbles and honeycomb.

- C. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces, unless otherwise indicated.

3.11 FINISHING FLOORS AND SLABS

- A. General: Comply with ACI 302.1R recommendations for screeding, restraighening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.
- B. Float Finish: Consolidate surface with power-driven floats or by hand floating if area is small or inaccessible to power driven floats. Restraighten, cut down high spots, and fill low spots. Repeat float passes and restraighening until surface is left with a uniform, smooth, granular texture.
 1. Apply float finish to all horizontal unformed surfaces.
 2. Apply Xypex Dry Shake Waterproofing on those surfaces scheduled per plan in accordance with Section 07164 - Concrete Tankage Waterproofing.
- C. Broom Finish: Apply a broom finish to exterior concrete platforms, steps, and ramps, and elsewhere as indicated.
 1. Immediately after float finishing, slightly roughen trafficked surface by brooming with fiber-bristle broom perpendicular to main traffic route. Coordinate required final finish with Engineer before application.

3.12 MISCELLANEOUS CONCRETE ITEMS

- A. Filling In: Fill in holes and openings left in concrete structures, unless otherwise indicated, after work of other trades is in place. Mix, place, and cure concrete, as specified, to blend with in-place construction. Provide other miscellaneous concrete filling indicated or required to complete the Work.
- B. Curbs: Provide monolithic finish to interior curbs by stripping forms while concrete is still green and by steel-troweling surfaces to a hard, dense finish with corners, intersections, and terminations slightly rounded.
- C. Equipment Bases and Foundations: Provide machine and equipment bases and foundations as shown on Drawings. Set anchor bolts for machines and equipment at

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correct elevations, complying with diagrams or templates from manufacturer furnishing machines and equipment.

3.13 CONCRETE PROTECTING AND CURING

- A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and ACI 301 for hot-weather protection during curing.
- B. Formed Surfaces: Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces. If forms remain during curing period, moist cure after loosening forms. If removing forms before end of curing period, continue curing for the remainder of the curing period.
- C. Unformed Surfaces: Begin curing immediately after finishing concrete. Cure unformed surfaces, including floors and slabs, concrete floor toppings, and other surfaces.
- D. Cure concrete according to ACI 308.1, by one or a combination of the following methods:
 - 1. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches, and sealed by waterproof tape or adhesive. Cure for not less than seven days. Immediately repair any holes or tears during curing period using cover material and waterproof tape.

3.14 JOINT FILLING

- A. Prepare, clean, and install joint filler according to manufacturer's written instructions.
 - 1. Defer joint filling until concrete has aged at least one month(s). Do not fill joints until construction traffic has permanently ceased.
- B. Remove dirt, and debris from joints; leave contact faces of joint clean and dry.

3.15 CONCRETE SURFACE REPAIRS

- A. Defective Concrete: Repair and patch defective areas when approved by Engineer. Remove and replace concrete that cannot be repaired and patched to Engineer's approval.
- B. Patching Mortar: Mix dry-pack patching mortar, consisting of one part portland cement to two and one-half parts fine aggregate passing a No. 16 sieve, using only enough water for handling and placing.

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- C. Repairing Formed Surfaces: Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycombs, rock pockets, fins and other projections on the surface, and stains and other discolorations that cannot be removed by cleaning.
1. Immediately after form removal, cut out honeycombs, rock pockets, and voids more than 1/2 inch in any dimension in solid concrete, but not less than 1 inch in depth. Make edges of cuts perpendicular to concrete surface. Clean, dampen with water, and brush-coat holes and voids with bonding agent. Fill and compact with patching mortar before bonding agent has dried. Fill form-tie voids with patching mortar or cone plugs secured in place with bonding agent.
 2. Repair defects on surfaces exposed to view by blending white portland cement and standard portland cement so that, when dry, patching mortar will match surrounding color. Patch a test area at inconspicuous locations to verify mixture and color match before proceeding with patching. Compact mortar in place and strike off slightly higher than surrounding surface.
 3. Fill with repair materials all air bubbles on the formed surface greater than 1/8" in size, and those areas of the formed surface which contain more than 10% air bubbles in any measured area.
 4. Repair defects on concealed formed surfaces that affect concrete's durability and structural performance as determined by Engineer.
 5. Coordinate all repair work with manufacturer recommended use of Xypex products as specified in Section 07164 - Concrete Tankage Waterproofing.
- D. Repairing Unformed Surfaces: Test unformed surfaces, such as floors and slabs, for finish and verify surface tolerances specified for each surface. Correct low and high areas. Test surfaces sloped to drain for trueness of slope and smoothness; use a sloped template.
1. Repair finished surfaces containing defects. Surface defects include spalls, popouts, honeycombs, rock pockets, crazing and cracks in excess of 0.01 inch wide or that penetrate to reinforcement or completely through unreinforced sections regardless of width, and other objectionable conditions.
 2. After concrete has cured at least 14 days, correct high areas by grinding.
 3. Correct localized low areas during or immediately after completing surface finishing operations by cutting out low areas and replacing with patching mortar. Finish repaired areas to blend into adjacent concrete.
 4. Correct other low areas scheduled to receive floor coverings with a repair underlayment. Prepare, mix, and apply repair underlayment and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface. Feather edges to match adjacent floor elevations.
 5. Correct other low areas scheduled to remain exposed with a repair topping. Cut out low areas to ensure a minimum repair topping depth of 1/4 inch to match adjacent floor elevations. Prepare, mix, and apply repair topping and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface.
 6. Repair defective areas, except random cracks and single holes 1 inch or less in diameter, by cutting out and replacing with fresh concrete. Remove defective

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areas with clean, square cuts and expose steel reinforcement with at least a 3/4-inch clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding agent. Mix patching concrete of same materials and mixture as original concrete except without coarse aggregate. Place, compact, and finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.

7. Repair random cracks and single holes 1 inch or less in diameter with patching mortar. Groove top of cracks and cut out holes to sound concrete and clean off dust, dirt, and loose particles. Dampen cleaned concrete surfaces and apply bonding agent. Place patching mortar before bonding agent has dried. Compact patching mortar and finish to match adjacent concrete. Keep patched area continuously moist for at least 72 hours.
8. Coordinate all repair work with manufacturer recommended use of Xypex products as specified in Section 07164 - Concrete Tankage Waterproofing.

- E. Perform structural repairs of concrete, subject to Engineer's approval, using epoxy adhesive and patching mortar.
- F. Repair materials and installation not specified above may be used, subject to Engineer's approval.

3.16 FIELD QUALITY CONTROL

- A. Testing and Inspecting: Engage a qualified testing agency to perform tests and to submit reports.
- B. Concrete Tests: Testing of composite samples of fresh concrete obtained according to ASTM C 172 shall be performed according to the following requirements:
 1. Testing Frequency: Obtain at least one composite sample for each 100 cu. yd. or fraction thereof of each concrete mixture placed each day.
 - a. When frequency of testing will provide fewer than five compressive-strength tests for each concrete mixture, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.
 2. Slump: ASTM C 143/C 143M; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture. Perform additional tests when concrete consistency appears to change.
 3. Air Content: ASTM C 231, pressure method, for normal-weight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
 4. Concrete Temperature: ASTM C 1064/C 1064M; one test hourly when air temperature is 40 deg F and below and when 80 deg F and above, and one test for each composite sample.

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5. Unit Weight: ASTM C 567, fresh unit weight of structural lightweight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
6. Compression Test Specimens: ASTM C 31/C 31M.
 - a. Cast and laboratory cure two sets of two standard cylinder specimens for each composite sample.
 - b. Cast and field cure two sets of two standard cylinder specimens for each composite sample.
7. Compressive-Strength Tests: ASTM C 39/C 39M; test one set of two laboratory-cured specimens at 7 days and one set of two specimens at 28 days.
 - a. Test one set of two field-cured specimens at 7 days and one set of two specimens at 28 days.
 - b. A compressive-strength test shall be the average compressive strength from a set of two specimens obtained from same composite sample and tested at age indicated.
8. When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, Contractor shall evaluate operations and provide corrective procedures for protecting and curing in-place concrete.
9. Strength of each concrete mixture will be satisfactory if every average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi.
10. Test results shall be reported in writing to Engineer, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mixture proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests.
11. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Engineer but will not be used as sole basis for approval or rejection of concrete.
12. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Engineer. Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42/C 42M or by other methods as directed by Engineer.
13. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
14. Correct deficiencies in the Work that test reports and inspections indicate do not comply with the Contract Documents.

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END OF SECTION

SECTION 05700
PRE-ENGINEERED ALUMINUM STAIRS, PLATFORMS, GRATING & RAILING
SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Structural Aluminum shapes and fabrications for elevated walkway framing and support.
 - 2. Aluminum pipe and tube handrails and railing systems.
 - 3. Aluminum bar gratings.
 - 4. Straight run, aluminum-framed stairs, landings and platforms.

1.3 PERFORMANCE REQUIREMENTS

- A. Control of Corrosion: Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.
- B. General: In engineering handrail and railing systems to withstand structural loads indicated, determine allowable design working stresses of materials based on the following:
 - 1. Aluminum: AA "Specifications for Aluminum Structures."
- C. Structural Performance of Stairs & Platforms: Engineer, fabricate, and install aluminum stairs & platforms to withstand the following structural loads without exceeding the allowable design working stress of the materials involved, including anchors and connections. Apply each load to produce the maximum stress in each component of aluminum members.
 - 1. Treads of Aluminum Stairs: Capable of withstanding a uniform load of 100 lbs per sq. ft. or a concentrated load of 300 lbs on an area of 4 sq. inches located in the center of the tread, whichever produces the greater stress.
 - 2. Platforms of Aluminum Stairs: Capable of withstanding a uniform load of 100 lbs per sq. ft.

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3. Stair Support Framing: Capable of withstanding stresses resulting from loads specified above as well as stresses resulting from railing system loads and other lateral loads.
- D. Structural Performance of Handrails and Railing Systems: Engineer, fabricate, and install handrails and railing systems to withstand the following structural loads without exceeding the allowable design working stress of the materials for handrails, railing systems, anchors, and connections. Apply each load to produce the maximum stress in each of the respective components comprising handrails and railing systems.
1. Top Rail of Guardrail Systems: Capable of withstanding the following loads applied as indicated:
 - a. Concentrated load of 200 lbf applied at any point and in any direction.
 - b. Uniform load of 50 lbf per linear foot applied horizontally and concurrently with uniform load of 100 lbf per linear foot applied vertically downward.
 - c. Concentrated and uniform loads above need not be assumed to act concurrently.
 2. Handrails Not Serving as Top Rails: Capable of withstanding the following loads applied as indicated:
 - a. Concentrated load of 200 lbf applied at any point and in any direction.
 - b. Uniform load of 50 lbf per linear foot applied in any direction.
 - c. Concentrated and uniform loads above need not be assumed to act concurrently.
- E. Thermal Movements in Handrail & Railing Systems: Allow for thermal movement resulting from the following maximum change (range) in ambient temperature in engineering, fabricating, and installing handrails and railing systems to prevent buckling, opening of joints, overstressing of components and connections, and other detrimental effects. Base engineering calculation on actual surface temperatures of materials due to both solar heat gain and nighttime sky heat loss.
1. Temperature Change (Range): 120 deg F ambient 180 deg F material surfaces.
- F. Structural Performance of Aluminum Bar Gratings: Engineer, fabricate, and install gratings to withstand the following structural loads without exceeding the allowable design working stress of the grating materials, anchors, and connections. Grating shall be capable of withstanding a uniform load of 200 lb. per sq. ft. with a maximum deflection of $\frac{1}{4}$ ".

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1.4 SUBMITTALS

- A. Product Data: For each product used in structural aluminum, including finishing materials and methods.
- B. Include Product Data for:
 - 1. Formed metal grating, manufacturer's clips and anchorage devices for gratings.
 - 2. Each kind of fitting, grout, anchoring cement, and paint products.
- C. Shop Drawings: Show fabrication and installation of structural aluminum. Include plans, elevations, component details, and attachments to other Work. Indicate materials and profiles of each structural aluminum member, fittings, joinery, finishes, fasteners, anchorages, and accessory items. Drawings shall be signed/sealed by PE registered in the project state.
 - 1. Include setting drawings, templates, and directions for installing anchor bolts and other anchorages.
 - 2. For installed gratings, platforms, stairs, handrails and railing systems indicated to comply with certain design loadings, include structural analysis data sealed and signed by the qualified professional engineer who was responsible for their preparation. Include all connection and anchorage design calculations. Include load tests and capacity information for proprietary fittings and connectors.
- D. Samples for Verification: If specifically required by Engineer after award of bid, submit each profile and pattern of fabricated metal and for each type of metal finish required, prepared on metal of same thickness and alloy indicated for the Work. If finishes involve normal color and texture variations, include sample sets, consisting of two or more units, showing the full range of variations expected.
 - 1. Include 6-inch-long samples of linear shapes.
- E. Welding Certificates: Copies of certificates for welding procedures and personnel.
- F. Qualification Data: For firms and persons specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects completed within the last 5-years at time of bid. List to include project names and addresses, scope of work, names and addresses of owners, and other information specified.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Arrange for installation of structural aluminum specified in this Section by the same firm that fabricated it.
- B. Fabricator Qualifications: A firm experienced in producing structural aluminum similar to that indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.

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- C. Engineer Qualifications: Professional engineer legally authorized to practice in the jurisdiction where Project is located and experienced in providing engineering services of the kind indicated for platforms, stairs, handrails and railing systems similar to this Project in material, design, and extent, and that have a record of successful in-service performance.
- D. Testing Agency Qualifications: An independent testing agency with the experience and capability to conduct the testing indicated, as documented according to ASTM E 548.
- E. Welding Standards: Qualify procedures and personnel according to the following:
 - 1. AWS D1.2, "Structural Welding Code--Aluminum."
- F. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Meetings."

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Store structural aluminum away from uncured concrete and masonry, and protected from soiling, and abrasion.

1.7 PROJECT CONDITIONS

- A. Field Measurements: Where structural aluminum is indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
 - 1. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabricating structural aluminum without field measurements. Coordinate other construction to ensure that actual dimensions correspond to established dimensions.

PART 2 - PRODUCTS

2.1 METALS

- A. General: Provide metals free from surface blemishes where exposed to view in finished unit. Exposed-to-view surfaces exhibiting pitting, seam marks, roller marks, stains, discolorations, or other imperfections on finished units are not acceptable.
- B. Aluminum: Alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated, and with not less than the strength and durability properties of alloy and temper designated below for each aluminum form required:

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1. Drawn Seamless Tubes: ASTM B 210, alloy 6061-T6.
2. Plate and Sheet: ASTM B 209, alloy 6061-T6.
3. Die and Hand Forgings: ASTM B 247, alloy 6061-T6.
4. Extruded Bars and Shapes: ASTM B 221, alloy 6061-T6
5. Extruded Pipe and Tubes: ASTM B 429, alloy 6061-T6.
6. Grating:
 - a. 6061-T6 for bearing bars of gratings and shapes.
 - b. 6061-T6 for grating cross bars.

2.2 MISCELLANEOUS MATERIALS

- A. Welding Electrodes and Filler Metal: Type and alloy of filler metal and electrodes as recommended by producer of metal to be welded, complying with applicable AWS specifications, and as required for color match, strength, and compatibility in fabricated items.
- B. Fasteners: Use stainless-steel fasteners, unless otherwise indicated. Do not use metals that are corrosive or incompatible with materials joined.
 1. Provide exposed fasteners for interconnecting structural aluminum components and for attaching them to other work, unless otherwise indicated.
- C. Cast-in-Place and Postinstalled Anchors: Anchors of type indicated below, fabricated from stainless-steel materials with capability to sustain, without failure, a load equal to four times the load imposed when installed in concrete as determined by testing per ASTM E 488 conducted by a qualified independent testing agency.
 1. Cast-in-place anchors.
 2. Chemical anchors.
 3. Expansion anchors.
- D. Nonshrink, Nonmetallic Grout: Premixed, factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107. Provide grout specifically recommended by manufacturer for exterior applications.
- E. Bituminous Paint: Cold-applied asphalt mastic complying with SSPC-Paint 12, except containing no asbestos fibers.

2.3 FABRICATION, GENERAL

- A. Form structural aluminum to required shapes and sizes, with true curves, lines, and angles. Provide components in sizes and profiles indicated, but not less than that needed to comply with requirements indicated for structural performance.

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- B. Provide necessary rebates, lugs, and brackets to assemble units and to attach to other work. Drill and tap for required fasteners, unless otherwise indicated.
- C. Form exposed work true to line and level with accurate angles and surfaces and straight sharp edges.
- D. Shear and punch metals cleanly and accurately.
- E. Remove sharp or rough areas on exposed surfaces.
- F. Ease exposed edges to a radius of approximately 1/32 inch, unless otherwise indicated. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.
- G. Comply with AWS for recommended practices in shop welding and brazing. Provide welds and brazes behind finished surfaces without distorting or discoloring exposed side. Clean exposed welded and brazed joints of all flux, and dress all exposed and contact surfaces.
- H. Mill joints to a tight, hairline fit. Cope or miter corner joints. Form joints exposed to weather to exclude water penetration.
- I. Provide castings that are sound and free of warp, cracks, blowholes, or other defects that impair strength or appearance. Grind, wire brush, sandblast, and buff castings to remove seams, gate marks, casting flash, and other casting marks.
- J. Finish exposed surfaces to smooth, sharp, well-defined lines and areas.
- K. Shop Assembly: Assemble items in the shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation. Use connections that maintain structural value of joined pieces.

2.4 FRAMED STAIRS

- A. General: Construct stairs to conform to sizes and arrangements indicated. Join pieces together by welding, unless otherwise indicated. Provide complete stair assemblies, including metal framing, hangers, columns, handrails, railing systems, newels, balusters, struts, clips, brackets, bearing plates, or other components necessary for the support of stairs and platforms, and as required to anchor and contain the stairs on the supporting structure.
 - 1. NAAMM Stair Standard: Comply with "Recommended Voluntary Minimum Standards for Fixed Metal Stairs" in NAAMM "Metal Stair Manual" for class of stair designated, except where more stringent requirements are indicated.
 - a. Commercial class, unless otherwise indicated.

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2. Fabricate treads and platforms of exterior stairs to accommodate slopes to drain in finished traffic surfaces.
- B. Stair Framing: Fabricate stringers of structural aluminum channels, plates, or a combination thereof, as indicated. Provide closures for exposed ends of stringers. Construct platforms of structural aluminum channel headers and miscellaneous framing members as indicated. Bolt or weld headers to stringers; and bolt or weld newels and framing members to stringers and headers. If using bolts, fabricate and join so bolts are not exposed on finish surfaces.
1. Floor Grating Treads and Platforms: Provide patterns, spacing and bar sizes indicated; fabricate to comply with ANSI/NAAMM MBG 531" Metal Bar Grating Manual".
 2. Fabricate treads from swage-locked aluminum I-bar grating with 1 1/2-by-3/16-inch bearing bars at 11/16 inch o.c. and cross bars at 4 inches o.c., NAAMM designation: P-11-4 (11/2 x 3/16) Aluminum.
 3. Surface: Non-slip striated I-bar.
- C. Fabricate grating treads with aluminum plate nosing and with aluminum angle or aluminum plate carrier at each end for stringer connections. Secure treads to stringers.
- D. Fabricate grating platforms with nosing matching that on grating treads at all landings.
- E. Provide toe plates at open-sided edges of grating platform. Secure grating to platform frame with welds.

2.5 PIPE HANDRAILS AND RAILING SYSTEMS

- A. General: Fabricate pipe handrails and railing systems to comply with requirements indicated for design, dimensions, details, finish, and member sizes, including wall thickness of pipe, post spacings, and anchorage, but not less than that required to support structural loads.
- B. Interconnect railing and handrail members by butt-welding or welding with internal connectors, at fabricator's option, unless otherwise indicated.
1. At tee and cross intersections, cope ends of intersecting members to fit contour of pipe to which end is joined, and weld all around.
- C. Form changes in direction of handrails and rails as follows:
1. As detailed.
 2. By welding in prefabricated flush elbow fittings.
 3. By radius bends of radius indicated.
 4. By flush radius bends.
 5. By bending.
 6. By any method indicated above, applicable to change of direction involved.

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- D. Form simple and compound curves by bending pipe in jigs to produce uniform curvature for each repetitive configuration required; maintain cylindrical cross section of pipe throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of pipe.
- E. Close exposed ends of pipe by welding 3/16-inch-thick aluminum plate in place or with prefabricated fittings, except where clearance of end of pipe and adjoining wall surface is 1/4 inch or less.
- F. Fabricate newels of aluminum tubing and provide newel caps of pressed aluminum as shown.
- G. Brackets, Flanges, Fittings, and Anchors: Provide wall brackets, end closures, flanges, miscellaneous fittings, and anchors for interconnections of pipe and attachment of handrails and railing systems to other work. Furnish inserts and other anchorage devices for connecting handrails and railing systems to concrete or masonry work.
 - 1. Connect railing posts to stair framing by direct welding, unless otherwise indicated.
- H. Fillers: Provide aluminum sheet or plate fillers of thickness and size indicated or required to support structural loads of handrails where needed to transfer wall bracket loads through wall finishes to structural supports. Size fillers to suit wall finish thicknesses. Size fillers to produce adequate bearing to prevent bracket rotation and overstressing of substrate.

2.6 METAL BAR GRATINGS

- A. General: Produce metal bar gratings of description indicated per NAAMM marking system that comply with the following:
 - 1. Metal Bar Grating Standard: "Guide Specifications for Metal Bar Grating" published in ANSI/NAAMM MBG 531 "Metal Bar Grating Manual."
- B. Fabricate swage-locked rectangular bar aluminum gratings to comply with requirements indicated below:
 - 1. I-shaped bars with swaged cross bars spaced on 4" centers. Bearing bars shall be spaced on 11/16" centers.
- C. Traffic Surface for Aluminum Bar Gratings: As follows:
 - 1. Striated non-slip I-bar.
- D. Aluminum Finish: As follows:
 - 1. Mill.

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- E. Fabricate removable grating sections with banding bars attached by welding to entire perimeter of each section. Include anchors and fasteners of type indicated, or if not indicated, as recommended by manufacturer, for attachment to supports.
1. Provide not less than 4 flange blocks for each section of aluminum I-bar grating, with block designed to fit over lower flange of I-shaped bearing bars.
 2. Furnish threaded bolts with nuts and washers for each clip required.
 - a. Available Product: Subject to compliance with requirements, a product that may be incorporated in the Work is Grate-Fast by Struct-Fast Inc.
- F. Fabricate cutouts in grating sections for penetrations indicated. Arrange cutouts to permit grating removal without disturbing items penetrating gratings.
1. Edge band openings in grating that interrupt 4 or more bearing bars with bars of same size and material as bearing bars.
 2. Do not notch bearing bars at supports to maintain elevation.
 3. Cutouts for circular obstructions shall be at least 2" larger than obstruction.
- G. Available Manufacturers: Subject to compliance with requirements, manufacturers offering metal bar gratings that may be incorporated in the Work include, but are not limited to, the following:
1. IKG Borden.
 2. Klemp Corp.
 3. McNichols Co.
 4. Ohio Gratings, Inc.
 5. Thompson Fabricating.
 6. Tru-weld, Inc.

2.7 FINISHES, GENERAL

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Protect mechanical finishes on exposed surfaces from damage by applying a strip-pable, temporary protective covering before shipping.
- C. Provide structural aluminum members in mill finish with one shop coat bitumastic where aluminum contacts concrete.
- D. Provide Aluminum Pipe & Tube Railings with Class II, Clear Anodic Finish: AA-M12C22A41 (Mechanical Finish: nonspecular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class II, clear coating 0.01 mil or thicker) complying with AAMA 611.

PRE-ENGINEERED ALUMINUM STAIRS, PLATFORMS, GRATING & RAILING SYS.**PART 3 - EXECUTION****3.1 INSTALLATION, GENERAL**

- A. Provide anchorage devices and fasteners where necessary for securing structural aluminum to in-place construction.
- B. Perform cutting, drilling, and fitting required to install structural aluminum. Set products accurately in location, alignment, and elevation; measured from established lines and levels. Provide temporary bracing or anchors in formwork for items to be built into concrete, masonry, or similar construction.
- C. Fit exposed connections accurately together to form tight, hairline joints or, where indicated, with uniform reveals and spaces for sealants and joint fillers. Where cutting, welding, and grinding are required for proper shop fitting and jointing of structural aluminum, restore finishes to eliminate any evidence of such corrective work.
- D. Do not cut or abrade finishes that cannot be completely restored in the field. Return items with such finishes to the shop for required alterations, followed by complete refinishing, or provide new units as required.
- E. Restore protective coverings that have been damaged during shipment or installation. Remove protective coverings only when there is no possibility of damage from other work yet to be performed at same location.
 - 1. Retain protective coverings intact; remove coverings simultaneously from similarly finished items to preclude nonuniform oxidation and discoloration.
- F. Field Welding: Field welding is strongly discouraged and must be approved in writing by Engineer of Record prior to commencing work. Comply with applicable AWS specification for procedures of manual shielded metal arc welding, for appearance and quality of welds, and for methods used in correcting welding work. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Grind exposed welded joints smooth and restore finish to match finish of adjacent surfaces.
- G. Corrosion Protection: Coat concealed surfaces of aluminum that will be in contact with grout, concrete or dissimilar metals with a heavy coat of bituminous paint.

3.2 INSTALLING ALUMINUM PIPE RAILINGS AND HANDRAILS

- A. Adjust handrails and railing systems prior to anchoring to ensure matching alignment at abutting joints. Space posts at spacing indicated or, if not indicated, as required by design loadings. Plumb posts in each direction. Secure posts and railing ends as follows:
 - 1. Anchor handrail ends by side connectors to aluminum framing.

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2. Surface mount posts to top of concrete slabs and walls where possible. Maintain adequate edge distance to prevent conflict with edge of beam/slab reinforcing.
3. Face or surface mount posts to aluminum I-beams or channels.
4. Do not core concrete walls/slabs. Do not embed aluminum posts in concrete.

3.3 INSTALLING METAL BAR GRATINGS

- A. General: Install gratings to comply with recommendations of NAAMM grating standard referenced under Part 2 that apply to grating types and bar sizes indicated, including installation clearances and standard anchoring details.
- B. Secure removable units to supporting members with type and size of clips and fasteners indicated, or, if not indicated, as recommended by grating manufacturer for type of installation conditions shown.
- C. Secure non-removable units to supporting members by welding where both materials are the same; otherwise, fasten by bolting as indicated above.

3.4 FIELD QUALITY CONTROL

- A. Testing Agency: Upon Engineer's review of substantially erected structure, if certain deficiencies are suspected then contractor will engage a qualified independent testing and inspecting agency, approved by the Engineer to perform field tests and inspections and to prepare test reports. An example of items to be tested would include but is not limited to welded and bolted connections.
- B. Testing agency will report test results promptly and in writing to Contractor and Engineer.

3.5 CLEANING

- A. At the time of Substantial completion clean all aluminum and stainless steel by hand washing thoroughly with clean water and soap and rinsing with clean water.

3.6 PROTECTION

- A. Protect finishes of structural aluminum from damage during construction period with temporary protective coverings approved by structural aluminum fabricator. Remove protective covering at the time of Substantial Completion.
- B. Restore finishes damaged during installation and construction period so no evidence remains of correction work. Return items that cannot be refinished in the field to the shop; make required alterations and refinish entire unit, or provide new units.

PRE-ENGINEERED ALUMINUM STAIRS, PLATFORMS, GRATING & RAILING SYS.

END OF SECTION

**SECTION 07115
BITUMINOUS DAMPPROOFING**

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Cold-applied, emulsified-asphalt dampproofing.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated. Include recommendations for method of application, primer, number of coats, coverage or thickness, and protection course.
- B. Material Certificates: For each product, signed by manufacturers.

1.4 QUALITY ASSURANCE

- A. Source Limitations: Obtain primary dampproofing materials and primers through one source from a single manufacturer. Provide secondary materials recommended by manufacturer of primary materials.

1.5 PROJECT CONDITIONS

- A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit dampproofing to be performed according to manufacturers' written instructions.
- B. Ventilation: Provide adequate ventilation during application of dampproofing in enclosed spaces. Maintain ventilation until dampproofing has cured.

PART 2 - PRODUCTS**2.1 COLD-APPLIED, EMULSIFIED-ASPHALT DAMPPROOFING**

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. ChemMasters Corp.
 - 2. Degussa Building Systems; Sonneborn Brand Products.
 - 3. Gardner Gibson, Inc.
 - 4. Henry Company.
 - 5. Karnak Corporation.
 - 6. Koppers Inc.
 - 7. Malarkey Roofing Products.
 - 8. Meadows, W. R., Inc.
 - 9. Tamms Industries, Inc.
- B. Brush and Spray Coats: ASTM D 1227, Type III, Class 1.
- C. VOC Content: 0.25 lb/gal. or less.

2.2 PROTECTION COURSE

- A. Protection Course, Roll-Roofing Type: Smooth-surfaced roll roofing complying with ASTM D 6380, Class S, Type III.

2.3 MISCELLANEOUS MATERIALS

- A. Emulsified-Asphalt Primer: ASTM D 1227, Type III, Class 1, except diluted with water as recommended by manufacturer.
- B. Asphalt-Coated Glass Fabric: ASTM D 1668, Type I.

PART 3 - EXECUTION**3.1 EXAMINATION**

- A. Examine substrates, with Installer present, for compliance with requirements for surface smoothness and other conditions affecting performance of work.

BITUMINOUS DAMPROOFING

1. Proceed with dampproofing application only after substrate construction and penetrating work have been completed and unsatisfactory conditions have been corrected.
2. Test for surface moisture according to ASTM D 4263.

3.2 PREPARATION

- A. Protection of Other Work: Mask or otherwise protect adjoining exposed surfaces from being stained, spotted, or coated with dampproofing. Prevent dampproofing materials from entering and clogging weep holes and drains.
- B. Clean substrates of projections and substances detrimental to work; fill voids, seal joints, and apply bond breakers if any, as recommended by prime material manufacturer.

3.3 APPLICATION, GENERAL

- A. Comply with manufacturer's written recommendations unless more stringent requirements are indicated or required by Project conditions to ensure satisfactory performance of dampproofing.
 1. Apply additional coats if recommended by manufacturer or if required to achieve coverages indicated.
 2. Allow each coat of dampproofing to cure six hours before applying subsequent coats.
 3. Allow 48 hours drying time prior to backfilling.
- B. Apply dampproofing to Concrete Plant Tankage Exterior Walls.
 1. Apply from 12" below finished-grade line to top of footing, extend over top of footing, and down a minimum of 6 inches over outside face of footing.
 2. Extend 12 inches onto intersecting walls and footings, but do not extend onto surfaces exposed to view when Project is completed.
 3. Tankage walls above grade and to a depth 12" below grade will receive a cementitious coating, do not apply dampproofing in these areas.

3.4 COLD-APPLIED, EMULSIFIED-ASPHALT DAMPPROOFING

- A. On Concrete Plant Tankage Exterior Walls and Foundations: Apply 2 brush or spray coats at not less than 1.5 gal./100 sq. ft. for first coat and 1 gal./100 sq. ft.

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for second coat, 1 fibered brush or spray coat at not less than 3 gal./100 sq. ft., or 1 trowel coat at not less than 4 gal./100 sq. ft..

3.5 INSTALLATION OF PROTECTION COURSE

- A. Install protection course over completed-and-cured dampproofing. Comply with dampproofing material manufacturer's written recommendations for attaching protection course.
 - 1. Support protection course with spot application of adhesive of type recommended by protection course manufacturer over cured coating.
 - 2. Install protection course on same day of installation of dampproofing (while coating is tacky) to ensure adhesion.

3.6 CLEANING

- A. Remove dampproofing materials from surfaces not intended to receive dampproofing.

END OF SECTION

SECTION 07164 CONCRETE TANKAGE WATERPROOFING

PART 1: GENERAL

1.01 SUMMARY

- A. This section covers the requirements for crystalline cementitious waterproofing.
- B. Related Specifications:
 - 1. Division 3 - Concrete Work
 - 2. Division 7 - Joint Sealers
 - 3. Division 9 - Paints and Coatings

1.02 REFERENCES

- A. American Society for Testing and Materials (ASTM)
- B. Army Corp. of Engineers (CRD)
- C. American Concrete Institute (ACI) Reference 308

1.03 SYSTEM DESCRIPTION

- A. The concrete waterproofing admixture shall be of the cementitious crystalline type that chemically controls and permanently fixes a non-soluble crystalline structure throughout the capillary voids of the concrete.
- B. The design shall include the use of the crystalline waterproofing repair materials that generate a non-soluble crystalline formation in the concrete.

1.04 SYSTEM PERFORMANCE REQUIREMENTS

- A. Testing Requirements: Crystalline waterproofing system shall have been tested in accordance with the following standards and conditions, 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 or other applicable international standard for certification of testing laboratories. Testing laboratory shall have obtained all control and treated concrete samples.
- C. Crystalline Formation: Crystallizing capability of waterproofing system shall be evidenced by independent SEM (Scanning Electron Microscope) photographs showing crystalline formations within the concrete matrix.

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- D. Permeability 1: Independent testing shall be performed according to a 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.
- E. 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.
- F. 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.
- G. 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.
- H. Compressive Strength: Concrete samples containing the 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.
- I. Potable Water Approval: Waterproof material shall have a current, valid approval certificate from NSF (NSF 61), DWI, or other recognized certification agency.

1.05 SUBMITTALS

- A. General: Submit listed submittals in accordance with conditions of the Contract and with Division 1 Submittal Procedures Section.
- B. Product Data: Submit product data, including manufacturer's specifications, installation instructions, and general recommendations for waterproofing applications.
- C. Test Reports: Submit, for acceptance, complete test reports from approved independent testing laboratories certifying that waterproofing system conforms to performance characteristics and testing requirements specified herein.

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- D. **Manufacturer's Certification:** Provide document signed by 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:** Manufacturer to be ISO 9001 registered, and to have no less than 10 years experience in manufacturing the crystalline waterproofing additive for the required work. Manufacturer must be capable of providing field service representation during 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:** Ready-mix supplier and/or installer of crystalline waterproofing additive shall be approved by the manufacturer or manufacturer's representative in writing.
- C. **Pre-Installation Conference:** Prior to installation of waterproofing system, conduct meeting with Architect/Engineer, owner's representative, concrete supplier, concrete placer and waterproofing manufacturer's representative to verify and review the following:
 - 1. Project requirements for waterproofing as set out in Contract Documents.
 - 2. Manufacturer's product data including mixing and installation instructions.
- D. **Technical Consultation:** The waterproofing manufacturer's representative shall provide technical consultation on waterproofing applications and shall provide on-site support as needed.

1.07 STORAGE, DELIVERY AND HANDLING

- A. Store manufacturer's sealed and labeled material containers in dry, protected environment off the ground at a minimum of 45 degs. F.

1.08 SCHEDULING

- A. Coordinate with Section 03302 Cast-In-Place Concrete.

1.09 WARRANTY

- A. **Manufacturer's Warranty:** Manufacturer shall provide standard product warranty executed by authorized company official. Term of warranty shall be ten (10) years from Date of Substantial Completion.
- B. **Applicator's Warranty:** Applicator or General Contractor shall warrant the waterproofing installation against defects caused by faulty workmanship or materials for a period of ten (10) years from Date of Substantial Completion. The warranty will

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cover the surfaces treated (such as but not limited to form hole repairs, surface defect repairs, etc.) and will bind the applicator to repair, at his expense, any and all leaks through the treated surfaces which are not due to structural weaknesses or other causes beyond applicator's control such as fire, earthquake, tornado and hurricane. The warranty shall read as follows:

1. Warranty: The applicator warrants that, upon completion of the work, surfaces treated with cementitious crystalline waterproofing will be and will remain free from water leakage resulting from defective workmanship or materials for a period of ten (10) years from Date of Substantial Completion. In the event that water leakage occurs within the warranty period from such causes, the applicator shall, at his sole expense, repair, replace or otherwise correct such defective workmanship or materials. Applicator shall not be liable for consequential damages and applicator's liability shall be limited to repair, replacement or correcting of defective workmanship or materials. Applicator shall have no responsibility with respect to water leakage or other defects caused by structural failure or movement of the structure, or any other causes beyond Applicator's control.

PART 2: PRODUCTS**2.01 MANUFACTURERS**

- A. Xypex Chemical Corporation, Richmond, B.C., Canada. Technical information may be obtained from the following:

SteelCon Coating Systems, Inc.
2100 3rd Avenue South
Irondale, Alabama 35210
Phone: 205-951-2086
Fax: 205-951-2089

- B. Equivalent materials as approved by the engineer 14 days prior to acceptance of bids.

2.02 MATERIALS

- A. Xypex Admix C-500.

2.03 MIXES

- A. Xypex Admix C-500 shall be added to the mix at a rate of 3% by weight of Portland cement.

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- B. For enhanced chemical protection, consult with the manufacturer or an authorized Xypex representative to determine appropriate addition rate.

PART 3: EXECUTION**3.01 MANUFACTURER'S INSTRUCTIONS**

- A. Compliance: Comply with 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: Some delay of set may occur when using Xypex Admix products. The amount of set delay will depend upon the concrete mix design, the particular Admix product used, dosage rate of the Admix, temperature of the concrete and climatic conditions. Concrete containing a Xypex Admix product 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 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 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 Admix C-500 must be added to the concrete at the time of batching. It is recommended that the Admix powder be added first to the rock and sand and blended thoroughly for 2 - 3 minutes before adding cement and water.
- B. Concrete Batching & Mixing:
 - 1. Blend total concrete mix using normal practices to ensure formation of homogeneous mixture.
 - 2. For ready-mix batch plants the Xypex Admix C-500 can be evenly distributed on a plant conveyor belt carrying the rock and sand, or the dry powder Admix can be added to the truck first and then 30 - 50% of the required water for the concrete batch is dispensed along with 300 - 500 pounds of aggregate and mixed thoroughly for 2 - 3 minutes. The rest of the materials are then added to the truck and mixed for at least 5 minutes.

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- 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 surfaces prior to slurry application. Apply slurry and keep moist for 12 hours then allow slurry to set or dry. Where joint surfaces are not accessible prior to pouring new concrete, contact Xypex Technical Services Representative for assistance.
- D. Form Tie Holes: Form tie holes shall be waterproofed in accordance with manufacturer's technical literature including relevant Method Statements (www.xypex.com/technical/statements). Procedures are generally 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 ties holes such as those created by taper ties the prepared void is to be at least 5" (125 mm) deep. For cone ties the void is to be to the bottom of the cone.
 2. Clean and profile the area to a 6 inch (150 mm) diameter around the tie hole to an ICRI CSP-3 profile.
 3. 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.
 4. 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 and to a 12" (300 mm) diameter area around the hole.
 5. Fill and compact the tie hole with Xypex Concentrate Dry-Pac.
 6. Wet Dry-Pac surface lightly with water, then apply a slurry coat of Xypex Concentrate at a coverage rate of 1.5 - 2 lb./sq. yd. (0.8 - 1 kg/m²) over the repaired area to a 12" (300 mm) diameter area around the filled void.
- F. Repair of Defects: Concrete defects shall be repaired in accordance with manufacturer's technical literature including relevant Method Statements (www.xypex.com/technical/statements). Procedures are 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 interlock of materials placed into the slot at a later stage.
 - b. Clean slot of debris and dust. Soak area with water and remove 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 slurry coat is still tacky, fill cavity with Dry-Pac. Compress tightly into cavity using pneumatic packer or block and hammer.
 - d. Wet Dry-Pac surface lightly with water, then apply a slurry coat of Xypex Concentrate at a coverage rate of 1.5 - 2 lb./sq. yd. (0.8 - 1 kg/m²) over the repaired area to 6" (150 mm) on either side of slot.
 2. Rock Pockets, Honeycombing or other defective concrete: All areas of poor concrete consolidation (honeycomb or rock pockets) shall be repaired.

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Note: Where there is active water-flow see Method Statements or contact EOR and Xypex Technical Services Representative for assistance.

G. Placement of concrete shall be in accordance with the Section 03302

3.04 CURING

A. Concrete that contains Xypex Admix C-500 must be cured as per "Standard for Curing Concrete" (ACI 308)

B. Normal backfilling procedures may be used after concrete has cured as specified.

3.05 INTERACTION WITH OTHER MATERIALS

A. Backfilling: Normal backfilling procedures may be used after concrete has been cured.

B. Paint, Epoxy, Grout, Cement Parge Coat, Plaster or Stucco: Xypex Admix treatment of concrete does not adversely affect the bond of subsequently applied materials. Follow surface preparation and other relevant directions of the coating or parge material manufacturer.

C. Responsibility to Ensure Compatibility: Xypex Admix products are compatible with most admixtures used in the production of quality concrete. However, Xypex Chemical Corporation makes no representations or warranties regarding such compatibility of Xypex Admix 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 Admix with other additives or admixtures being used in the concrete mix, and it shall be the responsibility of the installer of the surface-applied material that is to be applied over the Xypex treated concrete to take whatever measures are necessary, including testing, to ensure acceptance by or adhesion to the Xypex treated concrete.

3.06 FIELD QUALITY CONTROL

A. Observation: Do not conceal Xypex treated concrete before it has been observed by Architect/Engineer, waterproofing manufacturer's representative or other designated entities.

B. Examination for Defects: Concrete shall be examined for structural defects such as honeycombing, rock pockets, tie holes, faulty construction joints, cold joints and cracks larger than 1/64" (0.4 mm). Such defects to be repaired in accordance with manufacturer's repair procedures as noted above and in accordance with Project Concrete Specification - 03302.

C. Flood Testing (Coordinate with Section 01480 - Watertightness Test for Plant Tankage Structures):

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1. Perform flood test on completed waterproofing installation before placement of other construction.
2. Plug or dam drains and fill area with water to a depth of two inches (50 mm) or to within 0.5 inch (12.5 mm) of top of waterproofing treatment.
3. Let water stand for 24 hours.
4. If leaks are discovered, make repairs and repeat test until no leaks are observed.

3.07 CLEANING AND PROTECTION

- A. Cleaning: Clean spillage and soiling from adjacent surfaces using appropriate cleaning agents and procedures.
- B. Protect installed product and finished surfaces from damage during construction.

END OF SECTION