SECTION 13 11 18 - POOL CONCRETE

PART 1 GENERAL

1.1 SECTION INCLUDES

A. This Section specifies cast-in-place pools and related structures, including formwork, reinforcement, concrete materials, mix design, placement procedures, and finishes.

B. Cast-in-place reinforced concrete shall be used for spray pad construction. This Section of the Specifications covers the furnishings of all labor, materials, tools , equipment, and the performance of all Work and services necessary or incidental to furnish and place all concrete necessary as shown on the Drawings and as specified, in accordance with the provisions of the Contract Documents, and completely coordinated with the Work of all other trades.

1.2 RELATED DOCUMENTS

A. Drawings and Contracting Requirements, including General and Supplementary Conditions and Division 01 - General Requirements, apply to this Section.

1.3 REFERENCES

A. The following latest edition reference specifications, guides and standards shall become part of this Specification as if herein written. If provisions conflict, the more stringent provisions shall apply.
   1. ACI-318 – Building Code Requirements for Reinforced Concrete
   2. ASTM C172 – Methods for Sampling Fresh Concrete
   3. ASTM C31 – Making and Curing Concrete Test Specimens in the Field
   4. ASTM C39 – Compressive Strength of Cylindrical Concrete Specimens
   5. ASTM C143 – Standard Method of Test for Slump of Portland Cement Concrete
   6. ASTM C231 – Standard Method of Test for Air Content of Freshly Mixed Concrete by the Pressure Method
   7. ASTM C260 – Specification for Air-Entraining Admixtures for Concrete
   8. ASTM C494 – Specification for Chemical Admixture for Concrete
   9. ASTM C618 – Specification for Fly Ash and Raw or Calcinated Natural Pozzolan for Use as a Mineral Admixture in Portland Cement Concrete
   10. ACI-304 – Recommended Practice for Measuring, Mixing, Transporting and Placing Concrete
   11. ACI-305 – Hot Weather Concreting
   12. ACI-306 – Recommended Practice for Cold Weather Concreting
   13. ACI-308 – Recommended
   14. CRD C-527 – Corps of Engineers Specifications for Polyvinylchloride Waterstop
   15. CRSI – Manual of Practice
   16. CRSI 63 – Recommended Practice for Placing Reinforcing Bars
   17. CRSI 65 – Recommended Practice for Placing Bar Supports, Specifications and Nomenclature

1.4 SUBMITTALS

A. Product Data: For each type of manufactured material and product indicated.

B. Design Mixes: For each concrete mix. Include alternate mix designs when characteristics of materials, project conditions, weather, test results, or other circumstances warrant adjustments. Indicate amounts of mix water to be withheld for later addition at Project site.

C. Steel Reinforcement Shop Drawings: Details of fabrication, bending, and placement, prepared according to ACI 315. Include material, grade, bar schedules, stirrup spacing, bent bar diagrams, arrangement, and supports of concrete reinforcement. Include special reinforcement required for openings through concrete structures.

D. Submit five copies of each to Architect/Engineer.

1.5 QUALITY ASSURANCE

A. Concrete Work: All concrete work in Division 13 11, including formwork and reinforcing, shall comply with applicable requirements of Division 13 11.

B. Qualifications of Pool Contractor
   1. Work of this Section shall be performed by a Contractor who has a proven record of competence and experience in the construction of similar facilities of this size and complexity for not less than 5 years. Contractors shall have an established record of reliability.

C. The following tests shall be performed during construction of the project. Refer to General Conditions and Division 01 for further requirements.
   1. Concrete
      a. Tests to measure slump, entrained air content and compressive strength shall be conducted by independent testing laboratory employed by the Owner.
         1) Provide minimum of four (4) test cylinders per 50 cubic yard or fraction thereof for each class of concrete poured each day. Comply with ACI-318, Subsection 4.3 (samples secured - ASTM C172, cylinders prepared and cured - ASTM C31, and tested - ASTM C39). Identify samples moist cure at 70 degrees F for five (5) days and ship samples to laboratory.
      b. Slump and Air Content Tests
         1) Perform on concrete from same batch as sampled for strength tests and whenever there is consistency of concrete. Slump tests shall be made in accordance with ASTM C143. Air content tests shall be made in accordance with ASTM C231. If measured slump or air content falls outside specified limits, check shall be made immediately on another portion of same sample. In event of second failure, concrete shall not be used in Work.
      c. Compliance
         1) Average of any three (3) consecutive strength tests for each class of concrete shall be equal to or greater than specified strength, and no individual test shall fall more than 500 psi below specified strength.
         2) When tests results are below specified requirements or when tests of field cured cylinders indicate deficiencies in protection and curing, Architect/Engineer may require additional tests in accordance with ACI-318, Subsection 4.3.
   2. Wet Mix Process Cylinder Sample
      a. Where automated wet mix equipment is used, shotcrete cylinders shall be taken from the mixer or ready-mix truck and tested in accordance with the requirements specified in this Section. Wet mix processes shall only be used with approved automated equipment.

1.6 SUBMITTALS

A. Submittals Required:
   1. Refer to General Conditions, Division 01, and Section 13 1101.
   2. Qualification Requirements
   3. Concrete Mix Design

4. Non-Shrink Grouts
5. PVC and Pre-formed Plastic Adhesive Waterstop
6. Expansion/Construction Joint Materials
7. Caulking

B. Shop Drawings Required:
1. Reinforcing Steel

C. Test Results:
1. Concrete Testing
2. Compaction

1.7 SUBSTITUTIONS

A. Refer to General Requirements and Division 01.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Refer to General Requirements and Division 01.

B. Deliver cementitious materials to work site in manufacturer's standard packages. Immediately upon delivery to work site, store in waterproof sheds. Sheds required shall be provided by the Pool Contractor. No cementitious or other material that has become caked or hardened will be permitted in the work.

1.9 WARRANTIES

A. Special 2-Year on Concrete Structure: The Pool Contractor shall guarantee for two (2) years repair of the concrete pool structure.

PART 2 PRODUCTS

2.1 CAST-IN-PLACE CONCRETE

A. Admixtures: Air Entraining: Refer to ASTM C260.

B. Concrete shall be ready-mixed conforming to ASTM C 94 and these Specifications. The use of non-agitating equipment will not be allowed.

C. Fine Aggregates: Conform to ASTM C 33. Materials finer than the 200 sieve shall not exceed 4 percent. Use only clean, sharp, natural sand.

D. Coarse Aggregate: Conform to ASTM C 33. Use only natural gravels, a combination of gravels and crushed gravels, crushed stone, or a combination of these materials containing no more than 15 percent flat or elongated particles (long dimension more than five times the short dimension). Materials finer than the 200 sieve shall not exceed 0.5 percent. Size of coarse aggregate shall be 3/4 inch on slabs and footings; 3/4 inch for walls. Approval of other aggregate gradations must be received in writing before use on the project.

E. Portland cement shall be Type I, conforming to ASTM C150

F. Slump range shall be 2 to 4 inches and the air entrainment between 6 percent plus or minus 1.5% by volume. The water-cement ratio shall not exceed 0.49 by weight and the minimum cement content shall be 564 pounds per cubic yard - 6 bag mix. Submit complete data on

the concrete mix for approval in conformance with the requirements of ASTM C 94, Alternate 2.

G. Minimum allowable 28-day compressive field strength shall be 4000 psi when cured and tested in conformance with ASTM C 31 and C 39.

2.2 FLY ASH

A. Fly Ash: Conform to ASTM C618. Limit the cement replacement to 20 percent by weight. Use Type C, Type F or pre-approved equal.

B. Ground Granulated last Surface Slag: Conform to ASTM C989. Limit the cement replacement to 20% by weight. Use Grade 120.

2.3 REINFORCING STEEL

A. Use deformed bars of sizes shown on the drawings conforming to ASTM A 615 Grade 60.

2.4 REINFORCEMENT ACCESSORIES

A. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire fabric in place. Manufacture bar supports according to CRSI's "Manual of Standard Practice" from steel wire, plastic, or precast concrete or fiber-reinforced concrete of greater compressive strength than concrete.

2.5 CONCRETE ADMIXTURES

A. Air-entraining admixture: Provide air-entraining admixture in all concrete. Admixture shall conform to ASTM C 260, except it shall be nontoxic after 30 days and shall contain no chlorides. Furnish manufacturer's compliance statement for these requirements to Architect/Engineer forty days prior to use.

B. Water-Reducing Admixture: All concrete shall contain a water-reducing admixture. The admixture shall conform to ASTM C 494, Type A or Type D; except it shall contain no chlorides, shall be nontoxic after 30 days, and shall be compatible with the air-entraining admixtures. The amount of admixture added to the concrete shall be in accordance with the manufacturer's recommendations. Furnish a compliance statement that the admixture used satisfies all requirements of this Specification to Architect/Engineer forty days prior to use.

2.6 PRE-MOLDED EXPANSION JOINT FILLER

A. Multicellular, closed cell, flexible polyethylene plastic foam as manufactured by Dow Chemical Co., Midland, MI. Ethafoam expanded polyethylene closed-cell foam, W.R. Meadows, Elgin, IL, Ceramar or a pre-approved equal.

2.7 WATERSTOP

A. Center bulb type, as shown on Drawings, extruded from an elastomeric plastic compound, the basic resin of which shall be polyvinyl chloride (PVC). The size shall be as shown. Specific gravity shall be approximately 1.37, and the Shore durometer Type A hardness approximately 80. No reclaimed PVC shall be used in the compound. Meet the performance requirements of CRD C-572.

B. Waterstop shall have a constant thickness from the edge of the bulb to the outside edge. All waterstops shall have a number of parallel ribs or protrusions on each side of the center of

the strip. Corrugated type or tapered waterstops are not acceptable. The minimum weight per foot for waterstop shall be 1.62 pounds for 3/8-inch by 6-inch and 2.30 pounds for 3/8-inch by 9-inch.

C. Manufacturers and suppliers who have provided samples meeting the specified geometry and who have the specified waterstop readily available are listed below. A wire loop waterstop meeting the geometry requirements as listed below may be used by the Contractor, at his option, as an alternate to those listed. Waterstops that do not contain the wire loops are not acceptable. Other products shall not be used without prior review and acceptance by the Architect/Engineer.
   1. Vinylex Corporation, 2636 Byington-Solway Road, Knoxville, Tennessee 37921-0887, phone: (615) 690-2211 or fax: (615) 691-6273; Catalog No. RB6-38H for the 6-inch by 3/8-inch and Catalog No. RB9-38H for the 9-inch by 3/8-inch.
   2. Greenstreak Plastic Products, P.O. Box 7139, St. Louis, Missouri 63177, phone: (314) 225-9400 or fax: (314) 225-9854. These products are also distributed by the Burke Company, San Mateo, California. Style 732 for the 6-inch by 3/8-inch and Style 735 for the 9-inch by 3/8-inch.
   3. Synko-Flex waterstop, where specifically called out on the drawings, shall be Synko-Flex Preformed Plastic Adhesive Waterstop with Synko-Flex primer or equal. Manufacturer: Henry Company, 800-486-1278. Products containing Bentonite clay or hydrophilic materials are prohibited.

2.8 NON-SHRINK GROUT

A. Upcon High Flow, the Upco Company, Cleveland, Ohio; Master Flow 713, The Master Builder Company, Cleveland, Ohio; Crystex, L & M Construction Chemicals, Inc., Omaha, Nebraska.

2.9 GUN GRADE SEALANTS

A. Two part polysulfide certified by Manufacturer as suitable for use in pools including submerged locations. “Deck-O-Seal” as manufactured by W.R. Meadows or equal. Color shall be white.

PART 3 EXECUTION

3.1 CAST-IN-PLACE CONCRETE

A. Concrete shall be agitated by at least 70 revolutions of the mixing drum but not by more than 270 revolutions. Concrete shall be placed within 1-1/2 hours after the cement has been added to the mix.

B. Provide concrete blocks of same strength as the concrete mix to support reinforcing bars. Do not use broken concrete, brick or stone.

3.2 WATERSTOP

A. Split formwork is generally required for slab-to-slab, slab-to-wall and wall-to-wall joints where ribbed style waterstops are used. The centerline of the waterstop should be aligned with the center of the joint. The split form shall firmly hold the waterstop in position to prevent misalignment of waterstop during concrete placement. Secure waterstop with hog rings prior to concrete placement. Loop tie wires through the hog ring and tie off to adjacent reinforcing steel to prevent displacement of the waterstop during concrete placement. Fasteners through the body of the waterstop are not permitted.

B. Lapping of the waterstop is not permitted. PVC waterstop may be butt spliced in the field with Teflon coated, thermostatically controlled splicing iron. Direct exposure to a flame is not permitted. Factory fabricated fittings are recommended for ells, tees and crosses.

C. Thoroughly consolidate the concrete around the waterstop to prevent voids or honeycombing next to the waterstop. Maintain adequate clearance between reinforcing steel and the waterstop. Typical clearance should be twice the maximum aggregate size. Maintain continuity of the entire waterstop system. Properly store PVC waterstops prior to installation to prevent UV degradation

3.3 FORMWORK

A. Forms: Materials shall produce tight forms and an acceptable finish.

B. Form Ties: Constructed so that the tie remains embedded in the wall, except for a removable portion at each end. Form ties shall have conical or spherical type inserts. Inserts shall be fixed so that they remain in contact with forming material, and shall be constructed so that no metal is within 1 inch of the concrete surface when the forms, inserts and tie ends are removed. Wire ties will not be permitted. Ties shall withstand all pressures and limit deflection of forms to acceptable limits. Flat bar ties for panel forms shall have plastic or rubber inserts having a minimum depth of 1 inch and sufficient dimensions to permit proper patching of the tie hole.

3.4 WORKMANSHIP

A. Forms: Construct forms accurately to dimensions and elevations required and to be strong and unyielding. Construct forms with tight joints to prevent the escape of mortar and to avoid the formation of fins. Brace as required to prevent distortion during concrete placement.

B. Placing reinforcing steel: Place reinforcing steel in conformance with the information on the Contract Drawings and CRSI Recommended Practice for Placing Reinforcing Bars, except as modified herein. Minimum length of splices shall be as shown in table on Contract Drawings. Tie splices with 18-gauge annealed wire as specified in the referenced CRSI standard.

C. Placing concrete:
   1. Prior to placing concrete, remove water from excavation and all debris and foreign material from forms. Check the reinforcing steel for proper placement and correct any discrepancies.
   2. Place concrete as soon as possible after leaving mixer, without segregation or loss of ingredients, without splashing forms or steel above, and in layers not over 2 feet deep. The vertical drop to final placement shall not exceed 6 feet. Placement shall conform to the requirements of ACI 318, except as modified herein.
   3. Do not place concrete when the ambient temperature is below 40 degrees F and falling without special protection. Any concrete damaged by freezing shall be removed and replaced at no additional cost to the Owner.
   4. Compaction: Apply approved vibrator at points spaced not farther apart than vibrator's effective radius. Apply close enough to forms to vibrate surface effectively but not damage form surfaces. Vibrate until concrete becomes uniformly plastic. Vibrator must penetrate the fresh placed concrete and into the previous layer of fresh concrete below.

3.5 CONSTRUCTION JOINTS/EXPANSION JOINTS

A. Caulk all expansion joints with gun grade sealant.

3.6 FINISHING

A. Screed surfaces of floor slabs and tops of exposed walls to true level planes. After the initial water has been absorbed, float and trowel with steel trowel. Provide light broom finish.

B. Do not absorb wet spots with neat cement. Pool floors shall not vary from level or true plane more than 1/4 inch in 10 feet when measured with a straightedge.

3.7 FORM REMOVAL

A. Remove after concrete has set sufficiently to carry the dead load and construction load it has to sustain. Remove forms with care to prevent scarring and damaging the surface.

3.8 PROTECTION AND CURING

A. Protect fresh concrete from direct rays of the sun, drying winds and wash by rain. The method of water curing shall be the responsibility of the Contractor; however, the method used shall guarantee that all concrete surfaces remain wet to the touch, (free moisture present), at all times during the cure period.

B. Wet cure shall be used conforming to ACI 308. Keep concrete slabs and wall continuously wet for a 7-day period. Intermittent wetting is not acceptable. Any product used shall be compatible with finish bond requirements.

3.9 PROTECTION OF ADJACENT SURFACES

A. Contractor shall take every possible precaution to protect adjacent concrete surfaces, equipment, etc., from being damaged by overshooting concrete. Overshot concrete and rebound materials deposited shall be removed at the Contractor's expense.

3.10 FINISHING FORMED SURFACES

A. Areas not subject to water: Cut out all honeycombed and defective areas. Cut edges perpendicular to surface at least 1 inch deep, no feather edge allowed, and patch. Using bonding agent fill holes flush with cement mortar composed of 1 part cement and 2 parts sand. Rub surface with wood float and burlap. Keep patches damp for a minimum of seven days. Fill all form tie holes in same manner.

B. Areas subject to water: Cut out all honeycombed and defective areas, cut edges perpendicular to surface at least 1 inch deep, no featheredge allowed, soak area to be patched for 24 hours, then allow surface to drain free of standing water, then patch with color matched non-shrink grout:

C. The grout used shall be cured as recommended by grout manufacturer.

3.11 EXPANSION JOINTS (IF REQUIRED)

A. The pre-molded expansion joint filler shall be of sufficient width to completely fill the joint. Filler shall be accurately cut to butt tightly against the waterstop and the side forms.

B. At locations where joint sealant is to be applied, the pre-molded joint filler shall be precut to the required depth.

C. Cavities for joint sealant shall be formed with either precut, pre-molded joint filler or smooth, accurately shaped material that can be removed.

D. Concrete shall be thoroughly vibrated along the joint form to produce a dense, smooth surface. Surface irregularities along the joint sealant cavity, due to improper concrete consolidation or faulty form removal, shall be repaired with an approved compound compatible with the joint sealant in a manner that is satisfactory to the sealant manufacturer.

E. Installation of Cellular Neoprene: Install in joint accurately as shown. Attach to concrete with a bonding agent approved in writing by the joint sealant and joint filler manufacturer for compatibility.

F. All joints require gun grade sealant.

3.12 CONSTRUCTION JOINTS

A. Locate as shown on the Contract Drawings. All construction joints require sealants.

3.13 PLACING REINFORCING STEEL

A. Place reinforcing steel in conformance with the information on the drawings and CRSI 63 and CRSI, except as modified herein. Minimum length of splices shall be as shown in table on drawings. Tie splices with 18-gauge annealed wire as specified in the referenced CRSI standard. All tie wires shall be “made tight” for electrical bonding purposes, as required by NEC, Article 680.

END OF SECTION