1. Section 033000   
   Cast-in-Place Concrete
   1. PART 1  GENERAL
      1. Related Requirements
         1. Section 032000 - Concrete Reinforcing.
         2. Section 033511 - Concrete Floor Finishes:  Densifiers, hardeners, applied coatings, and polishing.
         3. Section 079200 - Joint Sealants:  Products and installation for sealants and joint fillers for saw cut joints and isolation joints in slabs.
      2. Price and Payment Procedures
         1. Cast-in-place concrete work will be paid for by the unit price method.
         2. See Section 012200 - Unit Prices for additional unit price requirements.
         3. Concrete - ​Slab-on-Grade​:  Includes formwork​​, reinforcement​​, concrete, placement accessories, consolidating and leveling, troweling, and curing.  Measurement by:
            1. Cubic yard.
         4. Concrete - Vertical in Forms:  Includes formwork​​, reinforcement​​, concrete, placement accessories, consolidating, and curing.  Measurement by:
            1. Cubic yard.
         5. Concrete - Miscellaneous Locations:  Includes formwork​​, reinforcement​​, concrete, placement accessories, consolidating, and curing.  Measurement by:
            1. Cubic yard.
         6. Concrete - Grouting:  Includes preparation of substrate, grout, placement, consolidating, troweling, and curing.  Measurement by the cubic yard.
         7. Construction Joint Devices:  Includes component,  accessories, and installation. Measurement by the linear foot.
      3. Reference Standards
         1. ACI CODE-318 - Building Code Requirements for Structural Concrete and Commentary; 2019 (Reapproved 2022).
         2. ACI PRC-211.1 - Selecting Proportions for Normal-Density and High Density-Concrete - Guide; 2022.
         3. ACI PRC-302.1 - Guide to Concrete Floor and Slab Construction; 2015.
         4. ACI PRC-304 - Guide for Measuring, Mixing, Transporting, and Placing Concrete; 2000 (Reapproved 2009).
         5. ACI PRC-305 - Guide to Hot Weather Concreting; 2020.
         6. ACI PRC-306 - Guide to Cold Weather Concreting; 2016.
         7. ACI PRC-308 - Guide to External Curing of Concrete; 2016.
         8. ACI SPEC-301 - Specifications for Concrete Construction; 2020.
         9. ASTM E1643 - Standard Practice for Selection, Design, Installation, and Inspection of Water Vapor Retarders Used in Contact with Earth or Granular Fill Under Concrete Slabs; 2018a.
         10. ASTM E1745 - Standard Specification for Plastic Water Vapor Retarders Used in Contact with Soil or Granular Fill under Concrete Slabs; 2017 (Reapproved 2023).
      4. Submittals
         1. See Section 013000 - Administrative Requirements for submittal procedures.
         2. Samples:  Submit samples of underslab vapor retarder to be used.
         3. Test Reports:  Submit report for each test or series of tests specified.
         4. Project Record Documents:  Accurately record actual locations of embedded utilities and components that will be concealed from view upon completion of concrete work.
         5. Warranty:  Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.
      5. Quality Assurance
         1. Perform work of this section in accordance with ACI SPEC-301 and ACI CODE-318.
         2. Follow recommendations of ACI PRC-305 when concreting during hot weather.
         3. Follow recommendations of ACI PRC-306 when concreting during cold weather.
   2. PART 2  PRODUCTS
      1. Formwork
         1. Form Materials:  Contractor's choice of standard products with sufficient strength to withstand hydrostatic head without distortion in excess of permitted tolerances.
            1. Form Facing for Exposed Finish Concrete:  Contractor's choice of materials that will provide smooth, stain-free final appearance.
            2. Earth Cuts:  Do not use earth cuts as forms for vertical surfaces.  Natural rock formations that maintain a stable vertical edge may be used as side forms.
            3. Form Ties:  Cone snap type that will leave no metal within 1-1/2 inches of concrete surface.
      2. Reinforcement Materials
         1. Refer to Structural Drawings
      3. Concrete Materials
         1. Refer to Structural Drawings
      4. Admixtures
         1. Refer to Structural Drawings
      5. Accessory Materials
         1. Underslab Vapor Retarder:
            1. Sheet Material:  ASTM E1745, Class A; stated by manufacturer as suitable for installation in contact with soil or granular fill under concrete slabs.  Single-ply polyethylene is prohibited.
            2. Accessory Products:  Vapor retarder manufacturer's recommended tape, adhesive, mastic, prefabricated boots, etc., for sealing seams and penetrations.
      6. Bonding and Jointing Products
         1. Slab Isolation Joint Filler:  1/2-inch thick, height equal to slab thickness, with removable top section forming 1/2-inch deep sealant pocket after removal.
      7. Concrete Mix Design
         1. Refer to Structural Drawings
         2. Admixtures:  Add acceptable admixtures as recommended in ACI PRC-211.1 and at rates recommended or required by manufacturer.
   3. PART 3  EXECUTION
      1. Preparation
         1. Formwork:  Comply with requirements of ACI SPEC-301. Design and fabricate forms to support all applied loads until concrete is cured and for easy removal without damage to concrete.
         2. Interior Slabs on Grade:  Install vapor retarder under interior slabs on grade.  Comply with ASTM E1643.  Lap joints minimum 6 inches.  Seal joints, seams and penetrations watertight with manufacturer's recommended products and follow manufacturer's written instructions.  Repair damaged vapor retarder before covering.
      2. Placing Concrete
         1. Place concrete in accordance with ACI PRC-304.
         2. Place concrete for floor slabs in accordance with ACI PRC-302.1.
         3. Finish floors level and flat, unless otherwise indicated, within the tolerances specified below.
      3. Slab Jointing
         1. Locate joints as indicated on drawings.
         2. Anchor joint fillers and devices to prevent movement during concrete placement.
         3. Isolation Joints:  Use preformed joint filler with removable top section for joint sealant, total height equal to thickness of slab, set flush with top of slab.
      4. Floor Flatness and Levelness Tolerances
         1. Maximum Variation of Surface Flatness:
            1. Exposed Concrete Floors:  1/4 inch in 10 feet.
            2. Under Seamless Resilient Flooring:  1/4 inch in 10 feet.
            3. Under Carpeting:  1/4 inch in 10 feet.
         2. Correct the slab surface if tolerances are less than specified.
         3. Correct defects by grinding or by removal and replacement of the defective work.  Areas requiring corrective work will be identified.  Re-measure corrected areas by the same process.
      5. Concrete Finishing
         1. Concrete Slabs:  Finish to requirements of ACI PRC-302.1 and as follows:
            1. Surfaces to Receive Thin Floor Coverings:  "Steel trowel" as described in ACI PRC-302.1; thin floor coverings include carpeting, resilient flooring, seamless flooring, resinous matrix terrazzo, thin set quarry tile, and thin set ceramic tile.
            2. Decorative Exposed Surfaces:  Trowel as described in ACI PRC-302.1; take measures necessary to avoid black-burnish marks; decorative exposed surfaces include surfaces to be stained or dyed, pigmented concrete, surfaces to receive liquid hardeners, surfaces to receive dry-shake hardeners, surfaces to be polished, and all other exposed slab surfaces.
      6. Curing and Protection
         1. Comply with requirements of ACI PRC-308. Immediately after placement, protect concrete from premature drying, excessively hot or cold temperatures, and mechanical injury.
         2. Maintain concrete with minimal moisture loss at relatively constant temperature for period necessary for hydration of cement and hardening of concrete.
         3. Surfaces Not in Contact with Forms:
            1. Initial Curing:  Start as soon as free water has disappeared and before surface is dry.  Keep continuously moist for not less than three days by water ponding, water-saturated sand, water-fog spray, or saturated burlap.
            2. Final Curing:  Begin after initial curing but before surface is dry.
      7. Defective Concrete
2. END OF SECTION

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