

DIVISION 3

SECTION 03100 – CONCRETE FORMWORK

PART 1 – GENERAL

1.01 Work Included

- A. Furnish labor, materials and equipment necessary for the complete construction of required formwork for cast-in-place concrete.
- B. Furnish and install anchor bolts, connectors, embedded plates, dovetail slots and anchors and other accessories required to be cast into concrete work.
- C. Furnish materials and equipment necessary to strip and remove formwork.
- D. Install embedded items furnished by other Sections.
- E. Related work specified elsewhere:
 - 1. Section 02220, Excavating, Filling and Grading.
 - 2. Section 02225, Structural Excavation, Backfilling and Compacting.
 - 3. Section 02515, Portland Cement Concrete Paving: Forming equipment.
 - 4. Section 02230, Drilled Piers: Concrete formwork for piers.
 - 5. Section 03300, Cast-in-Place Concrete.
 - 6. Section 07900, Sealants and Joint Fillers.

1.02 Quality Assurance

- A. General: Conform to the requirements and recommendations of ACI 301, "Specification for Structural Concrete in Buildings", and ACI 347, "Recommended Practice for Concrete Formwork", unless otherwise shown.
- B. Contractor shall be responsible for the design and engineering, construction and maintenance of formwork, as well as its adequacy and safety.
- C. Contractor shall design formwork for all loads and lateral pressures before and during placement of concrete. Maintain position and shape of formwork at all times. Provide positive means of adjustment for shores and forms which rest on compressible material.

1.03 Product Delivery, Storage and Handling

- A. Fiber Forms: Store prefabricated fiber forms on site horizontally if length requires, supported along the entire length of the form and elevated a minimum 4" off of ground, completely covered with waterproof membrane including ends, and not stacked over 5'-0" high. If stored vertically, the ends shall be covered with waterproof membrane and elevated a minimum 4" off of ground.

PART 2 – PRODUCTS

2.01 Formwork and Exposed Concrete

- A. Construct all formwork for exposed concrete surfaces with metal-framed/plywood-faced, metal or plastic panel-type materials to provide continuous, straight, smooth, solid exposed surfaces. Furnish in largest practicable sizes to minimize number of joints. Do not use any forms having defects on contact surfaces.
 - 1. Plywood forms will only be acceptable upon specific approval of the Owner Architect, and then only after visual inspection on the job site.

2. Plywood shall be sufficiently thick to withstand pressure of wet concrete without bow or deflection but shall not be less than 5/8" thick, complying with U.S. Product Standard PS-1, "B-B High Density Overlaid Concrete Form, Class 1 ", or "B-B Exterior Type DFPA Plyform, Class 1".
- B. Chamfer exposed external corners and edges, using chamfer strips accurately fabricated to produce uniform smooth lines and tight-edge joints.
 - C. Refer to the Drawings for locations where special joints may be required.
 - D. Arrangement for sheets or liner sheets shall be orderly and symmetrical. Form ties shall be spaced uniformly and aligned horizontally and vertically where locations are exposed to view in the completed project.

2.02 Formwork and Unexposed Concrete

- A. Form concrete which will be unexposed in finished structure with plywood, boards, metal or other acceptable material. Provide lumber that is dressed on at least two (2) edges and one (1) side for a tight fit.
 1. Below-Grade Pier Forms: Sonotube Fiber Form "An or equal, specified in paragraph 2.03 below.
- B. Earthen or trenched forms shall not be used for vertical formwork.

2.03 Round Tubular Fiber Forms

- A. General: Prefabricated round, one-piece tubular fiber forms for exposed, round cast in-place concrete columns, formed from multiple layers of high quality fiber, spirally wound and laminated with non-water sensitive adhesives.
- B. Finish:
 1. Coated form producing visible spiral seam, Sonotube Fiber Form "A" coated or equal.
- C. Size(s): Diameter and lengths as required to produce finished columns of the size(s) shown on the Drawings.
- D. Approved Manufacturers:
 1. Sonotube as manufactured by Sonoco Products Company, Hartsville, SC, (800) 532-8248, and represented locally by RW Specialties, Inc., Henderson, CO, (800) 332-6682.
 2. Manufacturers providing form materials of same type, function, quality and performance are acceptable.

2.04 Accessory Materials

- A. Premolded Joint Fillers: In joints caulked or sealed with silicone or thiokol-based compound, filler shall be non-bituminous, non-extruding, conforming to ASTM D1752. In all other joints, filler shall be bituminous type conforming to ASTM D1751. Filler shall be 1/2" thick, unless otherwise indicated.
 1. Non-Bituminous Filler: Sonoflex F by Sonneborne or equal.
- B. Premolded Fiberboard Joint Fillers (Bituminous-Type): Preformed rigid cane fiberboard material, impregnated with a durable asphaltic compound, conforming to AASHTO-M213. Fillers shall be 1/2" thick, unless otherwise indicated.
 1. Bituminous Filler: Flexcell by Celotex or approved equal.
- C. Bond Breaker: Where shown on the Drawings or required by the work, provide minimum two (2) layers 15-lb. non-bituminous felt bond breaker.

- D. Column Isolation Joints: Joints around columns may be formed with minimum 30# nonbituminous building felt left in place with neatly trimmed top edge or approved joint filler material.
- E. Keyways: Provide nominal 1-1/2" deep keyways in all construction joints in walls, slabs and joints between walls and slabs, unless otherwise shown.
- F. Form Ties: Provide factory-fabricated break-back, removable, or snap-type form ties designed to prevent spalling concrete surfaces on removal and which will leave no metal within 1/2" of concrete surface. Use stainless steel, plastic-coated or hot-dipped galvanized at exposed concrete with cone-shaped tie heads, manufactured by Dayton, Gates, Heckman, Richmond or approved equal.
- G. Release Agent: Provide commercial formulated synthetic resin or oil-type form coating compounds that will not bond with or adversely affect concrete surfaces and will not impair subsequent finish treatment of surfaces, manufactured by Protex Pro-Coat, Euclid Eucoslip, J & P Tex-Mastic or approved equal.
 - 1. Contractor shall ensure that release agent is compatible with the finish requirements of concrete to be exposed to view.
- H. Metal Inserts: Provide adjustable wedge inserts of malleable cast iron complete with bolts, nuts, washers, 3/4" bolt size, unless otherwise shown, manufactured by Hohmann and Barnard, Gateway, Dayton or approved equal.
- I. Embedded Dovetail Anchor Slots and Anchors: Refer to Section 03250, Concrete Accessories.
- J. Embedded Plates, Sleeves and Anchor Bolts: Miscellaneous embedded items furnished by other Sections. Refer to the appropriate Section(s) in these Specifications.

PART 3 – EXECUTION

3.01 Preparation

- A. Site preparation and compaction of existing and/or imported fill materials shall be in accordance with the requirements of the Soils Investigation Report and Section 02225. If the foundation structure design shown on the Drawings and/or specified will not strictly conform to this requirement, advise Owner/Architect/Engineer before proceeding with work of this Section.
- B. Expansion, Construction and Other Joints: Properly layout work and make necessary preparations for construction of specified joints in cast-in-place concrete work.
 - 1. Take special care to provide joints to allow for removal of sections of concrete foundations, walls or flatwork for future construction where shown on the Drawings.
- C. Ensure that connector plates, sleeves, dovetail anchor slots and other concrete accessories embedded in concrete are properly located, aligned and secured prior to placing concrete.

3.02 Fabrication

- A. Construct forms complying with ACI 347 to the exact sizes, shapes, lines and dimensions as shown on the Drawings and as required to obtain accurate alignment, location, grades, level and plumb work in finished structures. Use selected material to obtain the required finishes. Concrete tolerances shall be as specified in Section 03300.
- B. Construct formwork to be readily removable without impact, shock or damage to cast in-place concrete surfaces and adjacent materials.
- C. Provide formwork sufficiently tight to prevent leakage of cement paste during concrete placement. Solidly butt all joints and provide backup materials at joints as may be required to prevent leakage. Ensure that formwork is properly braced and tied.

- D. Provide openings in forms as required to accommodate other work. Accurately place and securely support all items required to be built into the forms. Size and locations of openings, recesses, chases and other built-in items shall be obtained from the Contractor or the trades involved.

3.03 Preparation of Form Surfaces

- A. Prior to each use, coat contact surfaces of forms with release agent prior to placement of reinforcement, in accordance with the manufacturer's recommendations. Do not allow excess coating material to accumulate in forms or to come into contact with concrete surfaces against which fresh concrete will be placed.
- B. Do not apply form release agent where concrete surfaces will receive special finishes or applied coverings which are affected by agent. Refer to Section 03300 for required concrete finishes.
- C. Ensure that all debris and frost has been removed from forms before placing concrete.
- D. Clean, repair and recoat surfaces of forms that are to be reused. Split, frayed, delaminated or otherwise damaged form facing materials will not be acceptable.
- E. When forms are extended for successive concrete placement, thoroughly clean surfaces, remove fins and tighten forms to close all joints. Align and secure all joints to avoid offsets.

3.04 Erection of Round, Tubular Fiber Forms

- A. General: Erect, brace and maintain prefabricated fiber forms in accordance with the manufacturer's written instructions and recommendations.
- B. Provide fiber forms in continuous, one-piece lengths for all project applications.
- C. Ensure that cages of reinforcing steel have been properly fabricated and tied, inspected and approved before installing fiber forms.
- D. Drop fiber forms over reinforcing steel cage either manually, with block and tackle, or by crane, depending upon sizes and lengths.
- E. Take all necessary precautions to prevent damaging the interior surfaces of the forms.
- F. Brace fiber forms as recommended by the manufacturer and as required by job conditions before, during and after concrete placement.

3.05 Removal of Formwork

- A. Formwork not supporting weight of concrete such as sides of grade beams, walls and similar parts of work may be removed 48 hours after placing concrete, providing concrete is sufficiently hard to not be damaged by removal operations and providing that curing and protection operations are maintained. Refer to specific requirements for hot- and cold- weather concreting in Section 03300.
- B. Formwork for beam soffits, slabs and other parts that support the weight of concrete shall remain in place at least 14 days and until concrete has reached its specified 28-day strength.
- C. Whenever formwork is removed during the curing period, cure exposed concrete as specified in Section 03300.
- D. Prefabricated Fiber Forms: Remove forms as soon as possible after concrete has set. This is to generally occur between 24 and 48 hours, but not exceeding 5 days, in strict accordance with the manufacturer's written instructions and recommendations. Take all necessary precautions not to mar concrete surfaces.
- E. Prefabricated Fiber Forms: Forms for unexposed, below-grade piers need not be removed. Trim excess form material flush with top of pier, or finish grade for exterior locations.
- F. Contractor shall verify required tolerances specified in Section 03300 immediately after removal of forms.

- G. Carefully remove fins or other minor surface defects from concrete to remain exposed in the final construction, and leave surfaces prepared for sealers, paint, skim coats or other finishes. Repair minor imperfections as specified in Section 03300.

END OF SECTION