

SECTION 03 10 00
CONCRETE FORMING AND ACCESSORIES

PART 1 GENERAL

1.01 REFERENCES

- A. The following is a list of standards which may be referenced in this section:
 - 1. American Concrete Institute (ACI):
 - a. 117, Specification for Tolerances for Concrete Construction and Materials.
 - a. 350.5, Specifications for Environmental Concrete Structures.
 - b. 350, Code Requirements for Environmental Engineering Concrete Structures.

1.02 DEFINITIONS

- A. Architectural Concrete: See definition in Section 03 30 00, Cast-in-Place Concrete.
- B. Defective Areas: See definition in Section 03 30 00, Cast-in-Place Concrete.
- C. Exposed Concrete: See definition in Section 03 30 00, Cast-in-Place Concrete.

1.03 DESIGN REQUIREMENTS

- A. Design formwork in accordance with ACI 350.5 and ACI 350 to provide concrete finishes specified in Section 03 30 00, Cast-in-Place Concrete.
- B. Unless otherwise specified, limit deflection of facing materials for concrete surfaces to comply with ACI 350.5. Limit deflection of facing materials to comply with tolerance limits established by Contract Documents and with tolerances required by equipment manufacturers. Coordinate tolerance requirements with equipment manufacturers.
- C. Form liner and concrete mixtures shall be compatible. Coordinate compatibility between form liner manufacturer and concrete producer.

1.04 SUBMITTALS

- A. Action Submittals:
 - 1. Shop Drawings:
 - a. Formwork drawings signed and sealed by a licensed professional engineer in the state of the Project.
 - b. Layout of panel joints, form liners, and tie-hole pattern.

2. Product Data:
 - a. Form release agent.
 - b. Form ties.
 - c. Products to be used for sealing tie holes.
 - d. Manufacturer's data for form liners.
3. Samples:
 - a. One each as follows:
 - 1) Form ties.
 - 2) Form liners.

B. Informational Submittals:

1. Statement of qualifications for formwork designer.
2. Statement of qualifications for form liner designer.
3. Statement of qualifications for form liner installer.

1.05 QUALITY ASSURANCE

A. Qualifications:

1. Formwork Designer: Formwork, falsework, and shoring design shall be designed by an engineer licensed in the state of Project.
2. Form liner designer shall have previous experience with design and installation of comparable form liners.
3. Form liner installer shall be approved by form liner manufacturer.

B. Mockup Panel: Construct as specified in Section 03 30 00, Cast-in-Place Concrete, for each form liner type.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Protect form liners from damage during delivery, storage, and handling.
- B. Store form liners in accordance with manufacturer's written instructions.

PART 2 PRODUCTS

2.01 FORM MATERIALS

A. Wall Forms and Underside of Slabs and Beams:

1. Materials: Plywood, hard plastic finished plywood, overlaid waterproof particle board, or steel in "new and undamaged" condition, of sufficient strength and surface smoothness to produce specified finish. Use plywood forms when using form liners. Plywood may be of lower finish grade when used in conjunction with form liners.

2. Where steel forms are used, treat steel surfaces to prevent rusting using products approved for use on steel forms.
- B. Column Forms:
1. Rectangular Columns: As specified for walls.
 2. Circular Columns: Fabricated steel or fiber-reinforced plastic with bolted sections or spirally wound laminated fiber form. Internally treat with release agent for full height of column.
- C. Form Liners:
1. Manufacturers and Products:
 - a. Sika; Architectural Concrete Formliners, Item # 342 (8-inch by 16-inch split face block).
 - b. Or equal.
 2. Physical Characteristics:
 - a. Material: Elastomeric, FRP, ABS, or PVC.
 - b. Manufacturing Tolerance: Overall dimensions within 0.125 inch at time of manufacture.
 3. Functional Characteristics: None.
 4. Performance Characteristics:
 - a. Controlled Permeability Form Liner:
 - 1) Consists of filter fabric bonded to backing grid with documented ability to improve concrete surface.
 - 2) Properties:
 - a) Maximum Pore Size: Less than 0.050 mm.
 - b) Water Retention Capacity: 1.30 liters per square meter without drainage, minimum.
 - c) Absorbency: 0.1 liter per square meter, maximum.
 - d) Compression: Less than 10 percent under a pressure of 200 kPa.
 - e) Tensile Strength at 5 Percent Elongation: 8 kN/square meter, minimum.
- D. Sandblasted Surface Forms: Medium-density overlay plywood for flat concrete surfaces to be sandblasted.
- E. Painted Surface Forms: High-density overlay plywood for flat concrete surfaces to be painted.
- F. All Other Forms: Materials as specified for wall forms.

2.02 ACCESSORIES

A. Form Release Agent:

1. Manufacturers and Products: Not for surfaces exposed to potable water.
 - a. BASF, Shakopee, MN; MBT MasterFinish RL 211.
 - b. Or equal.
2. Physical Characteristics:
 - a. Ready-to-use water based material formulated to reduce or eliminate surface imperfections.
 - b. Contain no mineral oil or organic solvents.
3. Functional Characteristics: None.
4. Performance Characteristics:
 - a. Shall not bond with, stain, or adversely affect concrete surfaces.
 - b. Shall not impair subsequent treatments of concrete surfaces when applied to forms or formliners.

B. Rustication Grooves and Beveled Edge Corner Strips: Nonabsorbent material, compatible with form surface, fully sealed on all sides prohibiting loss of paste or water between the two surfaces.

C. Form Snap-Ties:

1. Material: Steel.
2. Spreader Inserts:
 - a. Conical or spherical type.
 - b. Design to maintain positive contact with forming material.
 - c. Furnish units that will leave no metal closer than 1.5 inches to concrete surface when forms, inserts, and tie ends are removed.
3. Wire ties not permitted.
4. Flat bar ties for panel forms; furnish plastic or rubber inserts with minimum 1.5-inch depth and sufficient dimensions to permit patching of tie hole.

D. Form Snap-Ties with Water Stop:

1. For water-holding structures, basements, pipe galleries, and accessible spaces below finish grade, furnish one of the following:
 - a. Integral steel water stop 0.103-inch thick and 0.625-inch diameter tightly and continuously welded to tie.
 - b. Polychloroprene water stop 3/16-inch thick and 15/16-inch diameter whose center hole is one-half diameter of tie, or molded plastic water stop of comparable size.
 - c. Orient water stop perpendicular to tie and symmetrical about center of tie.
 - d. Design ties to prevent rotation or disturbance of center portion of tie during removal of ends and to prevent water leaking along tie.

E. Through-Bolts:

1. At Contractor's option, may be used as alternate to form snap-tie or form snap-tie with water stop.
2. Tapered minimum 1 inch diameter at smallest end.
3. Elastic Vinyl Plug for Through-Bolt Tie Holes:
 - a. Manufacturers and Products:
 - 1) Dayton Superior, Miamisburg, OH; A58 Sure Plug.
 - 2) Or equal.
 - b. Physical Characteristics: None.
 - c. Functional Characteristics: None.
 - d. Performance Characteristics: Design and size of plug to allow insertion with tool to enable plug to elongate and return to original length and diameter upon removal; forms watertight seal.

PART 3 EXECUTION

3.01 FORM SURFACE PREPARATION

- A. Prior to coating surface, thoroughly clean form surfaces that will be in contact with concrete or that have been in contact with previously cast concrete, dirt, and other surface contaminants.
- B. Exposed Wood Forms in Contact with Concrete: Apply form release agent as recommended by manufacturer.
- C. Steel Forms: Apply form release agent as soon as they are cleaned to prevent discoloration of concrete from rust.
- D. Form Liner Forms:
 1. Prepare forms as recommended by manufacturer.
 2. Provide liners in full sheets and locate seams as shown on approved Shop Drawings.
 3. Anchor liners to formwork as recommended by liner manufacturer.
 4. Clean form liner after each use and use only form release agents approved by form liner manufacturer.

3.02 ERECTION

- A. General: In accordance with ACI 301, unless otherwise specified.
- B. Beveled Edges (Chamfer):
 1. Form 3/4-inch bevels at concrete edges, unless otherwise shown.

2. Where beveled edges on existing adjacent structures are other than 3/4 inch, obtain Contracting Officer's approval of size prior to placement of beveled edge.

C. Wall Forms:

1. Do not reuse forms with damaged surfaces.
2. Locate form ties and joints in uninterrupted uniform pattern.
3. Inspect form surfaces prior to installation to ensure conformance with specified tolerances.

D. Forms Supporting Form Liners:

1. Construct to structurally withstand deflection, movement, leakage, high hydraulic pressures resulting from rapid filling and heavy-high frequency vibration.
2. Lay out form joints and ties in uniform pattern, unless otherwise shown.

E. Form Liner Installation:

1. Protect form liners from extended exposure to sunlight and from high surface temperatures during installation.
2. Handle, cut, and install form liners in accordance with form liner manufacturer's instructions and recommendations.
3. Place form liners with level and square, unless otherwise noted and in accordance with specified patterns and joints.
4. Maintain required concrete cover between form liner and steel reinforcement.

F. Curb, Sidewalk, and Driveway Forms:

1. Provide standard steel or wood forms.
2. Set forms to true lines and grades, and securely stake in position.

G. Form Tolerances:

1. Provide forms in accordance with ACI 117 and ACI 318, and the following tolerances for finishes specified:
 - a. See the Schedule of Concrete Finishes in Section 03 30 00, Cast-in-Place Concrete, for beam, column, and wall types related to required form tolerances.
 - b. Wall Tolerances:
 - 1) Straight Vertical or Horizontal Wall Surface: Flat planes within tolerance specified.

- 2) Wall Type W-A:
 - a) Plumb within 1/4 inch in 10 feet or within 1 inch from top to bottom for walls over 40 feet high.
 - b) Depressions in Wall Surface: Maximum 5/16 inch when 10-foot straightedge is placed on high points in all directions.
- 3) Wall Type W-B:
 - a) Plumb within 1/8 inch in 10 feet or within 1/2 inch from top to bottom for walls over 40 feet high.
 - b) Depressions in Wall Surface: Maximum 1/8 inch when 10-foot straightedge is placed on high points in all directions.
- 4) Thickness: Maximum 1/4 inch minus or 1/2 inch plus from dimension shown.
- 5) Form Offset: Between adjacent pieces of formwork, facing material shall not exceed 1/4 inch.
- c. Beams and Columns Tolerances:
 - 1) Exposed Straight Horizontal and Vertical Surfaces: Flat planes within tolerances specified.
 - 2) Lateral Alignment:
 - a) Centerlines shall be within plus or minus 1/2 inch from dimensions shown.
 - b) At intersections, centerlines shall intersect within plus or minus 1/2 inch of dimensions shown.
 - 3) Beam Type B-A:
 - a) Physical Dimensions: Maximum 1/4 inch minus or 1/2 inch plus from dimension shown.
 - b) Elevations: Within plus or minus 1/2 inch, except where tops of beams become part of finished slab. In this case refer to slab tolerances.
 - 4) Column Type C-A:
 - a) Physical Dimensions: Maximum 1/4 inch minus or 1/2 inch plus from dimension shown.
 - b) Plumb within 1/4 inch in 10 feet in all directions with maximum 1/2 inch out-of-plumb at top with respect to bottom.

3.03 FORM REMOVAL

- A. Nonsupporting forms, sides of beams, walls, columns, and similar parts of Work, may be removed after cumulatively curing at not less than 50 degrees F for 24 hours from time of concrete placement if:
 1. Concrete is sufficiently hard so as not to sustain damage by form removal operations.
 2. Curing and protection operations are maintained.

- B. Elevated Structural Slabs or Beams: In accordance with ACI 318, Chapter 6, and at such time as concrete has reached compressive strength equal to 80 percent of specified 28-day compressive strength as determined by test cylinders.
- C. Forms with Form Liners: Remove formwork in accordance with form liner manufacturer's recommendations. Use consistent form liner removal timing to avoid variations in concrete color. Avoid damaging formed profiles.
- D. Form Ties: Remove conical inserts or through bolts and plug holes as specified in Section 03 30 00, Cast-in-Place Concrete.

3.04 MANUFACTURER'S SERVICES

- A. Provide form liner manufacturer's representative at Site for installation assistance, and inspection.

3.05 FIELD QUALITY ASSURANCE AND QUALITY CONTROL

- A. Contractor-Furnished Quality Assurance, in accordance with IBC Chapter 17 requirements, is provided in Statement of Special Inspections Plan in Section 01 40 00, Quality Requirements and in and Section 01 45 33, Special Inspection, Observation, and Testing. Contractor responsibilities and related information are included in Section 01 45 33, Special Inspection, Observation, and Testing.
- B. Contractor-Furnished Quality Control: Inspection and testing as required in Section 01 40 00, Quality Requirements.

END OF SECTION