

## SECTION 03210

## REINFORCING STEEL

## PART 1 GENERAL

## 1.1 SECTION INCLUDES

Structural concrete reinforcement and grouting of reinforcement dowel bars into hardened concrete.

## 1.2 UNIT PRICES

No separate payment will be made for reinforcing steel or grouting that is part of the Work as bid. Include payment in unit price for structural concrete.

## 1.3 SUBMITTALS

Conform to all provisions and sections in these specifications.

Shop Drawings:

1. Submit shop drawings detailing reinforcement fabrication, bar placement location, splices, spacing, bar designation, bar type, length, size, bending, number of bars, bar support type and other pertinent information, including dimensions. Provide sufficient detail for placement of reinforcement without use of Contract Drawings. Information shall correspond directly to data listed on bill of materials.
2. Use of reproductions of Contract Drawings by Contractor, Subcontractor, erector, fabricator or material supplier in preparation of shop drawings (or in lieu of preparation of shop drawings) signifies acceptance by that party of information shown thereon as correct, and acceptance of obligation to pay for any job expense, real or implied, arising due to errors that may occur thereon. Remove references to Design Engineer, including seals, when reproductions of Contract Drawings are used as shop drawings.
3. Detail shop drawings in accordance with ACI 315, Figure 6.
4. Submit shop drawings showing location of proposed additional construction joints as required under Section 03250 - Joints in Concrete Structures, and obtain approval of the Owner's Representative, prior to submitting reinforcing steel shop drawings.

Bill of Materials: Submit with shop drawings.

Product Data:

5. Mechanical Bar Splices: Submit manufacturer's technical literature, including specifications and installation instructions.

6. Epoxy grout proposed for anchoring reinforcing dowels to hardened concrete: Submit manufacturer's technical literature including recommended installation procedures.

Certificates:

7. Submit steel manufacturer's certificates of mill tests giving properties of steel proposed for use. List manufacturer's test number, heat number, chemical analysis, yield point, tensile strength and percentage of elongation. Identify proposed location of steel in work.
8. Foreign-manufactured reinforcing bars shall be tested for conformance to ASTM requirements by a certified independent testing laboratory located in United States. Certification from any other source is not acceptable. Submit test reports for review. Do not begin fabrication of reinforcement until material has been approved.

#### 1.4 HANDLING AND STORAGE

Store steel reinforcement above ground on platforms, skids or other supports. Protect reinforcing from mechanical injury, surface deterioration and formation of excessive, loose or flaky rust caused by exposure to weather. Protect epoxy-coated reinforcing from formation of any amount of rust.

#### 1.5 QUALITY ASSURANCE

Notify the Owner's Representative at least 48 hours before concrete placement so that reinforcement may be inspected, and errors corrected, without delaying Work.

### PART 2 PRODUCTS

#### 2.1 MATERIAL

Reinforcing Bars: Deformed bars conforming to ASTM A615, grade as indicated on Drawings, except column spirals and those shown on Drawings to be smooth bars. Where grade is not shown on Drawings, use Grade 60.

Smooth Bars: Where indicated on Drawings, use smooth bars conforming to ASTM A36; ASTM A615, Grade 60; or ASTM A675, Grade 70.

Column Spirals: Bars conforming to ASTM A615, Grade 60, or wire conforming to ASTM A82.

Epoxy-Coated Deformed Bars, Column Spirals and Smooth Bars: Conform to ASTM A775/A775M.

Welded Wire Fabric:

1. Welded Smooth Wire Fabric: Conform to ASTM A185.
2. Welded Deformed Wire Fabric: Conform to ASTM A497.

3. Provide wire size, type and spacing as shown. Where type is not shown on Drawings, use welded smooth wire fabric.

4. Furnish welded wire fabric in flat sheets only.

Tie Wire: 16-1/2 gage or heavier annealed steel wire. Use plastic-coated tie wire with epoxy-coated reinforcing steel.

Bar Supports: Provide chairs, riser bars, ties and other accessories made of plastic or metal, except as otherwise specified. Use bar supports and accessories of sizes required to provide required concrete cover. Where concrete surfaces are exposed to weather, water or wastewater, provide plastic accessories only; do not use galvanized or plastic-tipped metal in such locations. Provide metal bar supports and accessories rated Class 1 or 2 conforming to CRSI MSP-1 Manual of Standard Practice. Use epoxy-coated bar supports with epoxy-coated reinforcing bars.

Slabs on Grade: Provide chairs with sheet metal bases or provide precast concrete bar supports 3 inches wide, 6 inches long, and thick enough to allow required cover. Embed tie wires in 3-inch by 6-inch side.

Mechanical Bar Splices:

5. Conform to ACI 318; use where indicated on Drawings.

a. Compression splices shall develop ultimate stress of reinforcing bar.

b. Tension splices shall develop 125 percent of minimum yield point stress of reinforcing bar.

6. Regardless of chemical composition of steel, any heat effect shall not adversely affect performance of reinforcing bar.

Welded Splices:

7. Provide welded splices where shown and where approved by the Owner's Representative. Welded splices of reinforcing steel shall develop a tensile strength exceeding 125 percent of the yield strength of the reinforcing bars connected.

8. Provide materials for welded splices conforming to AWS D1.4.

Epoxy Grout: High-strength rigid epoxy adhesive, conforming to ASTM C881, Type IV, manufactured for purpose of anchoring dowels into hardened concrete and the moisture condition, application temperature and orientation of the hole to be filled. Unless otherwise shown, depth of embedment shall be as required to develop the full tensile strength (125 percent of yield strength) of dowel, but not less than 12 diameters.

## 2.2 FABRICATION

Bending: Fabricate bars to shapes indicated on Drawings by cold bending. Bends shall conform to minimum bend diameters specified in ACI 318. Do not straighten or rebend bars. Fabricate epoxy-coated reinforcing steel to required shapes in a manner that will not damage epoxy coating. Repair any damaged epoxy coating with patching material conforming to Item 4.4 of ASTM A775/A775M.

Splices:

1. Locate splices as indicated on Drawings. Do not locate splices at other locations without approval of the Owner's Representative. Use minimum number of splices located at points of minimum stress. Stagger splices in adjacent bars.
2. Length of lap splices: As shown on Drawings.
3. Prepare ends of bars at mechanical splices in accordance with splice manufacturer's requirements.

Construction Joints: Unless otherwise shown, continue reinforcing through construction joints.

Bar Fabrication Tolerances: Conform to tolerances listed in ACI 315, Figures 4 and 5.

Standard Hooks: Conform to the requirements of ACI 318.

Marking: Clearly mark bars with waterproof tags showing number of bars, size, mark, length and yield strength. Mark steel with same designation as member in which it occurs.

## PART 3 EXECUTION

### 3.1 PREPARATION

Clean reinforcement of scale, loose or flaky rust and other foreign material, including oil, mud or coating that will reduce bond to concrete.

### 3.2 INSTALLATION

Placement Tolerances: Place reinforcement within tolerances of Table 03210A at the end of this Section. Bend tie wire away from forms to maintain the specified concrete coverage.

Interferences: Maintain 2-inch clearance from embedded items. Where reinforcing interferes with location of other reinforcing steel, conduit or embedded items, bars may be moved within specified tolerances or one bar diameter, whichever is greater. Where greater movement of bars is required to avoid interference, notify the Owner's Representative. Do not cut reinforcement to install inserts, conduit, mechanical openings or other items without approval of the Owner's Representative.

Concrete Cover: Provide clear cover measured from reinforcement to face of concrete as listed in Table 03210B at the end of this Section, unless otherwise indicated on Drawings.

Placement in Forms: Use spacers, chairs, wire ties and other accessory items necessary to assemble, space and support reinforcing properly. Provide accessories of sufficient number, size and strength to prevent deflection or displacement of reinforcement due to construction loads or concrete placement. Use appropriate accessories to position and support bolts, anchors and other embedded items. Tie reinforcing bars at each intersection, and to accessories. Blocking reinforcement with concrete or masonry is prohibited.

Placement for Concrete on Ground: Support bar and wire reinforcement on chairs spaced at approximately 3 feet on centers each way. Use minimum of one support for each 9 square feet. Tie supports to reinforcing bars and wires.

Vertical Reinforcement in Columns: Offset vertical bars by at least one bar diameter at splices. Provide accurate templates for column dowels to ensure proper placement.

Splices:

1. Do not splice bars, except at locations indicated on Drawings or reviewed shop drawings, without approval of the Owner's Representative.
2. Lap Splices: Unless otherwise shown or noted, Class B, conforming to ACI 318-89, Section 12.15.1. Tie securely with wire prior to concrete placement, to prevent displacement of splices during concrete placement.
3. Mechanical Bar Splices: Use only where indicated on Drawings or approved by the Owner's Representative. Install in accordance with manufacturer's instructions.
  - a. Couplers located at a joint face shall be of a type which can be set either flush or recessed from the face as shown. Seal couplers prior to concrete placement to completely eliminate concrete or cement paste from entering.
  - b. Couplers intended for future connections: Recess 1/2 inch minimum from concrete surface. After concrete is placed, plug coupler and fill recess with sealant to prevent contact with water or other corrosive materials.
  - c. Unless noted otherwise, match mechanical coupler spacing and capacity to that shown for the adjacent reinforcing.

Construction Joints: Place reinforcing continuous through construction joints, unless noted otherwise.

Welded Wire Fabric: Install wire fabric in as long lengths as practicable. Unless otherwise indicated on Drawings, lap adjoining pieces at least 6 inches or one full mesh plus 2 inches, whichever is larger. Lace splices with wire. Do not make end laps midway between supporting beams, or directly over beams of continuous

structures. Offset end laps in adjacent widths to prevent continuous laps. Conform to WRI - Manual of Standard Practice for Welded Wire Fabric.

Field Bending: Shape reinforcing bent during construction operations to conform to Drawings. Bars shall be cold-bent; do not heat bars. Closely inspect reinforcing for breaks. When reinforcing is damaged, replace, Cadweld, or otherwise repair, as directed by the Owner's Representative. Do not bend reinforcement after it is embedded in concrete.

Epoxy-coated Reinforcing Steel: Install in accordance with Paragraph 3.02J, Field Bending, and in a manner that will not damage epoxy coating. Repair damaged epoxy coating with patching material as specified in Paragraph 2.02A, Bending.

Field Cutting: Cut reinforcing bars by shearing or sawing. Do not cut bars with cutting torch.

Welding of reinforcing bars is prohibited, except where shown on Drawings.

### 3.3 GROUTING OF REINFORCING AND DOWEL BARS

Use epoxy grout for anchoring reinforcing and dowel steel to existing concrete in accordance with epoxy manufacturer's instructions. Drill hole not more than 1/4 inch larger than steel bar diameter (including height of deformations for deformed bars) in existing concrete. Just before installation of steel, blow hole clean of all debris using compressed air. Partially fill hole with epoxy, using enough epoxy so when steel bar is inserted, epoxy grout will completely fill hole around bar. Dip end of steel bar in epoxy and twist bar while inserting into partially filled hole.

TABLE 03210A

## REINFORCEMENT PLACEMENT TOLERANCES

PLACEMENT	TOLERANCE IN INCHES
Clear Distance - To formed soffit: To other formed surfaces: Minimum spacing between bars	 -1/4 ±1/4 -1/4
Clear distance from unformed surface to top reinforcement - Members 8 inches deep or less: Members more than 8 inches deep but less than 24 inches deep: Members 24 inches deep or greater: Uniform spacing of bars (but the required number of bars shall not be reduced): Uniform spacing of stirrups and ties (but the required number of stirrups and ties shall not be reduced):	 ±1/4 -1/4, +1/2 -1/4, +1 ±1 ±1
Longitudinal locations of bends and ends of reinforcement - General: Discontinuous ends of members: Length of bar laps:	 ±1 ±1/2 -1
Embedded length - For bar sizes No. 3 through 11: For bar sizes No. 14 and 18:	 -1 -2

TABLE 03210B  
 MINIMUM CONCRETE COVER FOR REINFORCEMENT

SURFACE	MINIMUM COVER IN INCHES
Slabs and Joists - Top and bottom bars for dry conditions - No. 14 and No. 18 bars: No. 11 bars and smaller:	   1-1/2  1
Formed concrete surfaces exposed to earth, water or weather; over, or in contact with, sewage; and for bottoms bearing on work mat, or slabs supporting earth cover - No. 5 bars and smaller: No. 6 through No. 18 bars:	   1-1/2  2
Beams and Columns - For dry conditions - Stirrups, spirals and ties: Principal reinforcement: Exposed to earth, water, sewage or weather - Stirrups and ties: Principal reinforcement:	   1-1/2  2   2  2-1/2
Walls -	

For dry conditions -	
No. 11 bars and smaller:	1
No. 14 and No. 18 bars:	1-1/2
Formed concrete surfaces exposed to earth, water, sewage or weather, or in contact with ground -	
Circular tanks with ring tension:	2
All others:	2
Footings and Base Slabs -	
At formed surfaces and bottoms bearing on concrete work mat:	2
At unformed surfaces and bottoms in contact with earth:	3
Over top of piles:	2
Top of footings – same as slabs	

END OF SECTION