

SECTION 03 22 00 – WELDED WIRE REINFORCEMENT FOR CONCRETE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. The Drawings and provisions of the General Conditions, Supplementary Conditions, and the Sections included under Division 1, General Requirements, are included as a part of this Section as though bound herein.

1.2 SUMMARY

- A. Work in this section comprises furnishings/installation of all welded wire reinforcement for cast-in-place concrete and precast concrete, including ties and supports.

1.3 QUALITY ASSURANCE

- A. Some products and execution are specified in this Section by reference to published specifications or standards from the following list:

American Association of State Highway and Transportation Officials	(AASHTO)
American Concrete Institute	(ACI)
American Railway Engineering and Maintenance-of-Way Association	(AREMA)
American Society for Testing and Materials	(ASTM)
American Welding Society	(AWS)
Concrete Reinforcing Steel Institute	(CRSI)
Precast/Prestressed Concrete Institute	(PCI)
Post-Tensioning institute	(PTI)
Wire Reinforcement Institute	(WRI)

- B. Recommendations of the Wire Reinforcement Institute (WRI) “Manual of Standard Practice”, “Bending Welded Wire Reinforcement”, and “WWR Design and Detailing Guide”, latest editions, are hereby made part of this specification to same extent as if written out herein in full, and shall be used in conjunction with other WRI recommendations for detailing/placing of welded wire reinforcement in concrete, unless otherwise specified or detailed.

- C. Current Editions of the following references shall apply to work of this Section:

Publications of the American Concrete Institute (ACI):

ACI 117	“Specification for Tolerances for Concrete Construction and Materials”
ACI 301	“Specification for Structural Concrete”
ACI 302.1	“Guide to Concrete Floor and Slab Construction”
ACI 315	“Guide to Presenting Reinforcing Steel Details”
ACI 318	“Building Code Requirements for Structural Concrete”
ACI 360	“Guide to Design of Slabs-on-Ground”

Publications of the Association of State highway and Transportation Officials (AASHTO):
“LRFD Bridge Design Specifications”

Publications of the American Railway Engineering and Maintenance-of-Way Association (AREMA):
“Manual of Railway Engineering”

Publications of the American Society for Testing and Materials (ASTM):
ASTM A884 “Standard Specification for Epoxy-Coated Steel Wire and Welded Wire Reinforcement”
ASTM A1022 “Standard Specification for Deformed and Plain Stainless Steel Wire and Welded Wire for Concrete Reinforcement”
ASTM A1060 “Standard Specification for Zinc-Coated (Galvanized) Steel Welded Wire Reinforcement, Plain and Deformed, for Concrete”
ASTM A1064 “Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete”

Publications of the American Welding Society (AWS):
AWS D1.4 “Structural Welding Code – Steel Reinforcing Bars”

Publications of the Concrete Reinforcing Steel Institute (CRSI):
“Manual of Standard Practice”
ETN-M-12-19 “Measuring Fabricated Steel Reinforcing Bars

Publications of the Precast/Prestressed Concrete Institute (PCI)
“PCI Design Handbook”

Publications of the Post-Tensioning Institute (PTI)
“Post-Tensioning Manual”

Publications of the Wire Reinforcement Institute (WRI)
WWR-400 “Bending Welded Wire Reinforcement”
WWR-500 “Manual of Standard Practice – Structural Welded Wire Reinforcement”
WWR-600 “Welded Wire Reinforcement Design and Detailing Guide”

1.4 SUBMITTALS

- A. Only shop drawings checked and stamped by contractor and fabricator indicating review for dimensional conformance and means and methods of construction will be accepted for review by the engineer of record.
- B. Submit for review to Engineer four (4) sets of shop drawings, consisting of plans showing size and layout of welded wire reinforcement mats. All individual welded wire reinforcement mat types shall be clearly illustrated to show wire size, spacing, and arrangement, and these mat types shall be labeled accordingly to correlate with positions indicated on the overall placement plans. All welded wire reinforcement splice lengths and bend geometries shall be clearly identified and detailed. Locations at which wires are permitted to be field cut must be clearly illustrated.

- C. The welded wire reinforcement shop drawings shall be made integral with the reinforcing bar shop drawings to result in a single, fully-coordinated and compatible project reinforcement submittal for review.
- D. For reinforcement applications originally detailed on the contract structural drawings to be reinforcing bars (rebar) but permitted by the engineer of record through pre-approval language thereon to be constructed with welded wire reinforcement substitutions, all relevant conversion calculations shall be included in the reinforcement shop drawing submittal for review and approval. Contractor shall present to the engineer of record the proposed extent to which welded wire reinforcement will be substituted for reinforcing bars (rebar), prior to the fabricator's proceeding with shop drawing submittal preparation.
- E. Certification documentation shall be submitted for welded wire reinforcement stating compliance with ASTM A1064 requirements. Information on weld strength, bend testing results, minimum measured yield strength and tensile strength, and reduction of area during tensile test (for plain wire only) shall be included in the certification documentation when required by ASTM A1064.
- F. When applicable, Special Requirements per ASTM A1064 Section 4 are identified on the contract structural drawings by the engineer of record, and shall be duly confirmed by the fabricator in the reinforcement submittal. Special requirements may include, but are not limited to, acceptability of oversteeling, identification of design-critical weld locations, and supplemental material property requirements for compatibility with design intent.
- G. Manufacturing or fabricating of any material prior to approval of shop drawings will be at Contractor's own risk. Shop drawings returned as only requiring corrections need not be resubmitted unless they are so noted, but four (4) sets of corrected shop drawings are to be furnished to the architect.
- H. Review of shop drawings by engineer of record is for general conformance with the design intent only. Contractor is responsible for dimensions, quantities, and coordination with other trades. Review does not authorize changes to contract requirements unless stated in separate letter or change order.

1.5 *DELIVERY, STORAGE, HANDLING*

- A. Reinforcing steel shall be delivered to Project Site properly tagged and bundled per ASTM A1064, and shall be ready to be placed.
- B. Reinforcing steel delivered to Project Site (and not immediately placed in forms), shall be protected from mud, excessive rust-producing conditions, oil, grease, or distortion. Reinforcing steel shall be stored off-ground on sufficient site storage dunnage to ensure protection from damage without compromise to fabricated shapes.
- C. Use all necessary precautions to maintain identification after bundles are broken. Traceability of welded wire reinforcement once on the project site is the sole responsibility of the contractor.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Reinforcing Steel: New, deformed and/or plain welded wire reinforcement mats, conforming to ASTM A1064, flat or bent. Welded wire reinforcement shall consist of electrical-resistance welded wires secured using controlled automatic welding equipment. Minimum yield strength of reinforcement shall be as indicated on the contract structural drawings.
- B. Accessories: Spacers, hangers, chairs, bar supports, stirrups, bolts, inserts, and/or anchors, conforming to all applicable requirements of appropriate ASTM Specification required for proper placement of reinforcing, is included in this section unless otherwise instructed by General Contractor and except anchor bolts specified in other sections. Spooled tie wire for securing mats to supports, where required, shall be black annealed steel wire of 16 gauge minimum or heavier.

2.2 FABRICATION

- A. Reinforcing steel shall be fabricated to shapes and dimensions indicated on the drawings, and in compliance with the applicable provisions of ASTM A1064, ACI 117, and ACI 318.
- B. Shear strength at all welded intersections shall be in strict accordance with the requirements of ASTM A1064, unless explicitly noted otherwise on the contract structural drawings.
- C. Wires shall be bent cold in the shop. No wires shall be bent or re-bent in the field unless specifically indicated on the contract structural drawings.
- D. Coated welded wire reinforcement shall not be field cut unless permitted by the engineer of record. Field cutting of coated reinforcement should be performed using hydraulic-powered or friction cutting tools to minimize damage to coating. Flame cutting of coated reinforcement is prohibited.
- E. Wires used for concrete reinforcement shall meet the following fabrication tolerances, unless otherwise more strictly superseded by reference standards noted in Section 1.3:

Sheared length:	± one inch
Stirrups and ties:	± one-quarter inch
All other bends:	± one inch

PART 3 – EXECUTION

3.1 GENERAL REQUIREMENTS FOR REINFORCING

- A. Reinforcing shall be free from scale, loose rust, mud, or incidental coatings which will reduce bond to concrete. Light surface rust not affecting the cross-sectional area of wire or its bond to concrete is acceptable.
- B. Wires with kinks or bends not shown on drawings shall not be placed. Heating of reinforcing for bending or straightening is prohibited.
- C. Minimum concrete cover for reinforcing shall be as shown on the contract structural drawings unless otherwise more strictly superseded by ACI 318 (for buildings), AASHTO (for bridges), or AREMA (for rail structures).
- D. Only machine-controlled electric-resistance welding complying with ASTM A1064 is permitted for attachment of wires used in the production of welded wire reinforcement sheets.

3.2 *PLACING REINFORCEMENT*

- A. Welded wire reinforcement mats shall be placed to the following cover tolerances:

Concrete cover to formed surfaces:	\pm one-quarter inch
Top wires in welded wire reinforcement mats in slabs-on-ground:	\pm one-quarter inch
Clearance to vertical formed surface:	\pm one-quarter inch
- B. Wire mats may be moved slightly to avoid interference with other reinforcing steel, conduits, or other embedded items. If wires are shifted more than one wire diameter or enough to exceed tolerances required, resulting arrangement of wires shall be subject to approval and/or supplementation by the engineer of record.
- C. Reinforcement shall be accurately placed as shown on the plans and firmly held in position during the placing and finishing operations. Reinforcement shall be lapped and tied around the perimeter (for flatwork or wall-type mats) and ends (for linear mats, ties, stirrups) to maintain proper positioning and alignment. Lap splices shall have a minimum of two (2) spooled wire ties per spliced length.
- D. For epoxy-coated wires, spool tie wire and metal clips shall be epoxy, plastic, or nylon-coated. For galvanized wires, spool tie wires and metal clips shall be plastic coated or galvanized.
- E. In foundations, support reinforcing with precast concrete blocks or non-metallic chairs and bolsters. Tie reinforcing securely to prevent displacement. If blocks are used they shall be thoroughly wetted prior to placement of concrete. For elements other than foundations, non-metallic chairs and bolsters shall be used.
- F. Reinforcing wires shall be supported and wired together to prevent displacement by construction loads, or by placement of concrete, beyond tolerances as set forth in this specification.
- G. Mats of reinforcing steel in slabs-on-grade shall be properly supported on chairs, bolsters, or other acceptable features, and shall be tied securely prior to placement of concrete.

- H. Maintain metal reinforcing securely and accurately in place until concrete is placed.
- I. Use bar bolsters on side-forms for concrete walls and piers.
- J. Any and all disturbances of reinforcement from any cause whatsoever shall be corrected fully prior to placement of concrete. Damaged wire supports and spacers shall be repaired, or shall be removed and replaced.
- K. Wires shall not be bent after being embedded in hardened concrete, unless indicated on the drawings.
- L. Where welded intersections are not relied upon for tension development or tension lap splicing of wires, the welded deformed wire reinforcement shall be manufactured with overhang lengths sufficient to achieve the minimum lap splice defined on the drawings without "stacking" of the mats, to be not less than 12 inches. Installed mats and associated laps shall all be coplanar. Mats shall be extended across supporting beams and walls where applicable. Where mats abut perimeter terminations of the slab such that the wire parallel to and nearest the edge exceeds 4 inches clear, loose deformed wire or deformed bar of equivalent or greater size and strength shall be added at 2 inches clear cover.

3.3 *SURFACE REPAIR OF REINFORCEMENT*

- A. Epoxy-coated reinforcement in accordance with ASTM A884 – in addition to the requirements of ASTM D3963, all visible damage (i.e. scratches, nicks, cracks) to the epoxy coating of the reinforcement, caused during shipment, storage, or placement, shall be repaired by the contractor on the jobsite with approved patching materials. Ends of reinforcement that have been sheared, sawn, or cut by other means shall be coated with approved patching material. Patching of damaged areas shall be performed in accordance with the patching material manufacturer's written instructions. Any damaged surface area (prior to repair with approved patching material) shall not exceed 10% of the total mat surface area, unless otherwise directed by the engineer of record. Should this limit be exceeded the mat shall be removed and replaced with an acceptable mat. All patching material shall be fully cured prior to placing concrete. The patching material shall be compatible with the epoxy coating, inert in concrete, and suitable for repairs in the field. The patching material shall be prequalified, as required for the coating material and shall either be identified on the container as meeting the requirements of Annex A1 of ASTM D3963 - or shall be accompanied by a Materials Certificate certifying that the material meets or exceeds the requirements of said Annex A1.
- B. Galvanized reinforcement in accordance with ASTM A1060 - All visible damage (i.e., scratches, nicks, cracks) to the galvanized coating of the reinforcement, caused during shipment, storage or placement shall be repaired by the contractor on the jobsite in accordance with appropriate ASTM specifications. Ends of reinforcement that have been sheared, sawed, or cut by other means shall be coated. Field coating of damaged areas shall be performed in accordance with the coating manufacturer's recommendations. Zinc coating shall conform to contract specifications and shall be applied to achieve a dry film equal to or

exceeding that designated in the contract documents. All touchup paint shall be cured fully prior to placing concrete.

3.4 *WELD REPAIR OF REINFORCEMENT*

- A. Selective manual welding of wire intersections under plant-controlled conditions shall be carried out by a duly-certified welder using compatible processes and materials.
- B. Selective manual welding shall not result in a reduction to strength or ductility of the wire, nor the shear strength of welded intersections.
- C. Selective manual welding shall be limited to no more than 5% of the total welded intersections on a single welded wire reinforcement mat.
- D. Manual welding of welded wire reinforcement mats on the jobsite is prohibited.

3.5 *SPLICES OF REINFORCING*

- A. Splices and offsets in reinforcing shall not be made at points of maximum stress.
- B. Splices shall be approved. Splices shall provide sufficient lap to transfer required stress. Stagger splices of adjacent wires wherever possible. Refer to lap splice schedules on the structural drawings.
- C. Character and design of each splice shall conform to requirements of ACI 318 (for buildings), AASHTO (for bridges), or AREMA (for rail structures), with lengths not less than those identified on the contract structural drawings.
- D. For welded plain wire reinforcement, splices must contain intentionally-positioned welded intersections with the lap splice region itself, as identified on the contract structural drawings.

3.6 *FIELD QUALITY CONTROL*

- A. Owner's representative shall be given advanced notice of not less than 24 hours prior to placing concrete to allow for review of reinforcing steel.
- B. Owner's representative shall be given notice required hereinbefore, and shall be given opportunity to review (for correction) placement of reinforcing steel before placing of concrete. Any concrete placed without approval of Owner's representative will be subject to rejection.

- C. Inspection of placement of reinforcing in a section will be made only after placement is complete for that section to be cast.
- D. Such inspections shall not relieve the Contractor of his responsibility to provide work in accordance with the requirements of the Contract Documents. Such inspections are for the purposes of minimizing errors in the field work.

END OF SECTION 03 22 00