SECTION 02513 - STAINLESS STEEL REINFORCEMENT

Description

02513.00 Scope - *This section contains the requirements for stainless steel concrete* reinforcement bars and dowels.

Materials

02513.10 Deformed Bar Reinforcement - Deformed bar reinforcement shall conform to the requirements of ASTM A 615, with the exception of Section 6, Chemical Composition, Section 9, Mechanical Requirements, Section 12, Finish, and Section 20, Marking. The chemical composition, mechanical requirements and finish of reinforcement provided under this specification shall conform to the joint ASTM/SAE Uniform Numbering System (UNS) designation listed in Table 02513-1. Approved sources for stainless steel reinforcement are listed in Table 02513-2.

Table 02513-1
Approved Stainless Steel Alloys for Reinforcing Bars and Dowels

Common or Trade Name	Type 316 Low Carbon Nitrogen Added	Type 2205 Duplex	Nitronic 50
AISI Type	316LN	2205	XM-19
UNS Designation	S31653	S31803	S20910
Required Minimum Tensile Strength	**90 ksi**	**90 ksi**	**90 ksi**
Required Minimum 0.2% Offset Yield Strength	**60 ksi**	**60 ksi**	**60 ksi**
Required Minimum Elongation in 2 inches	25 %	25 %	25%
Required Condition	As Rolled	As Rolled	As Rolled
Required Finish	Deformed to ASTM A 615 rebar pattern, Descaled & white pickled	Deformed to ASTM A 615 rebar pattern, Descaled & white pickled	Deformed to ASTM A 615 rebar pattern, Descaled & white pickled

Table 02513-2
Approved Sources for Stainless Steel Reinforcing Bar and Dowels

Approved Source	Talley Metals Technology, Inc. P.O. Box 2498 Hartsville, SC 29551	Dunkirk Specialty Steel, LLC 88 Howard Ave. Dunkirk, NY 14048	Salit Specialty Rebar 3235 Lockport Rd. Niagara Falls, NY 14305
Telephone	800-334-8324 843-335-7540	800-916-9133 716-366-1000 Ext 323	877-299-1700 716-299-1990
Fax	843-335-5160	716-366-0478	716-299-1993
Contact	Sharon Brunson Inside Sales	Gary Zaffalon Product Manager	Kevin Cornell Manager
Approved to provide	316LN, 2205 duplex, Nitronic 50	316LN, 2205 duplex, Nitronic 50	316LN, 2205 duplex, Nitronic 50

02513.20 Mechanical Splices - Mechanical splices for reinforcing bars are systems which connect the bars without raising their temperature above 1300 °F.

- Provide mechanical splices which develop at least 90% of the specified minimum ultimate strength of the reinforcing bars in compression and in tension. Where bars of different sizes or strengths are connected, the governing strength shall be the strength of the smaller or weaker bar.

- The total slip of reinforcing bars within a splice sleeve shall not exceed 0.04 inch, measured between gauge points clear of the splice sleeve, when the reinforcing bars are loaded in tension to two-thirds of the specified minimum yield strength of the reinforcing bar.

- The splice sleeve and connection hardware shall be fabricated from stainless steel alloy type 2205, UNS designation S31803.

02513.50 Dowels - Dowels shall conform to the same requirements as Section 02513.10 and ASTM A 615, with the exception that Section 7, Requirements for Deformations, and Section 8, Measurement of Deformations, do not apply.

02513.60 Wire - Wire used to tie stainless steel reinforcement shall be fabricated from stainless steel alloy type 316L, UNS designation S31603, dead soft annealed, annealed at size. Wire size shall be 16 gauge (0.0625 inch diameter).

02513.70 Acceptance - Acceptance of reinforcement will be according to 00165.61 and this section. The contractor shall provide the following material documentation and samples, which will be the basis for acceptance, prior to placing any stainless steel reinforcing.

(a) Mill Certificate - The Certificate shall:

- Be from the supplying mill verifying that the stainless steel rebar provided has been sampled and tested and the test results meet the contract requirements, and

- Include a copy of the chemical analysis of the steel provided, with the UNS designation, the heat lot identification, and the source of the metal if obtained as ingots from another mill.

- Include a copy of tensile strength, yield strength, and elongation tests on each of the sizes (diameter) of stainless steel rebar or dowel provided.

- Include a completed Certificate of Materials Origin, Oregon Form 734-2126, documenting that the stainless steel dowels and reinforcing provided meets the Buy America Act. Only stainless steel originally melted within the United States will be accepted.

- Permit positive determination that the reinforcing provided is that which the test results cover.

(b) Test Standards - Tests used to certify the stainless steel shall conform to:

- ASTM A276-97 Standard Specification for Stainless Steel Bars and Shapes.

- ASTM A370-97a *Standard Test Methods and Definitions for Mechanical Testing of* Steel Products.

- ASTM A380-96 Standard Practice for Cleaning, Descaling, and Passivation of Stainless Steel Parts, Equipment, and Systems.

- ASTM A555-97 Standard Specification for General Requirements for Stainless Steel Wire and Wire Rods.

- ASTM A751-96 Standard Test Methods, Practices, and Terminology for Chemical Analysis of Steel Products.

(c) Material Samples - The following will be provided to the Engineer:

- Three (3) each samples, **4 feet** in length, of each size (diameter) of reinforcing supplied from each heat lot.

SECTION 00533 - STAINLESS STEEL REINFORCEMENT FOR CONCRETE

This specification applies to stainless steel reinforcement to be placed in [redacted]

Description

00533.00 Scope - This work consists of furnishing and placing stainless steel reinforcement of the alloy type, properties and size shown or specified.

00533.05 Miscellaneous Metal - Minor stainless steel parts such as drains, bolts, concrete anchors, spacer blocks, expansion and bearing devices, access hole covers and frames, anchor bolts, inserts and similar miscellaneous metal, unless otherwise provided, shall be classified as reinforcement.

Materials

00533.10 General - Provide materials meeting the following requirements:

Reinforcement Bar	02513.10
Mechanical Splices	02513.20
Dowels	02513.50
Wire	02513.60

00533.11 Order Lists and Bending Diagrams - Before ordering material, submit all order lists and bending diagrams for review. Do not order material until such lists and bending diagrams have been reviewed. The review of order lists and bending diagrams by the Engineer shall in no way relieve the contractor of responsibility for the correctness of such lists and diagrams. Any expense incidental to the revision of material furnished according to such lists and diagrams to make it comply with the design drawings shall be borne by the Contractor.

00533.12 Fabrication - Cold bend reinforcement bars to the shapes shown. Make bends, tag, mark, and ship reinforcement bars according to the current edition of the "Manual of Standard Practice" by the Concrete Reinforcing Steel Institute.

Construction

00533.40 Protection of Material - Protect reinforcement at all times from damage. When placed in the work, it shall be free from dirt, detrimental scale, paint, oil and other foreign substances.

00533.41 Placing and Fastening - Place all reinforcement within the tolerances recommended in the "Manual of Standard Practice" by the Concrete Reinforcing Steel Institute. Hold reinforcement firmly during the placing and setting of concrete.

(a) Ties:

- Tie bars in top mats of footings and deck slabs at all intersections.

- Tie all other bars at all intersections except where spacing is less than [redacted] in each direction, then alternate intersections shall be tied.

- Tie stainless steel reinforcement **ONLY** with stainless steel tie wire meeting the requirements of Section 02513.60.

- Do **NOT** tie stainless steel reinforcement to mild steel reinforcement. Direct contact is not acceptable. When stainless steel reinforcing or dowels must be attached to mild steel reinforcing, use nylon, PVC or polyethylene spacers to maintain a minimum [redacted] clearance between the two metals and bind them with nylon cable ties. Where insufficient space exists to maintain this minimum, either the stainless or mild steel reinforcing may be sleeved with a continuous polyethylene or PVC tube extending at least [redacted] in each direction past the point of closest contact between the two dissimilar reinforcing bars.

(b) <u>Clearances</u>:

- Provide the same surface clearance for ties and splices that is shown or specified for the reinforcement.

- Maintain distance from the forms with non-metallic stays, precast concrete blocks, non-metallic ties, hangers, or other approved supports.

- Separate layers of bars with precast concrete blocks or by other equally suitable devices.

- Use precast concrete blocks with approved shape and dimensions and with the same or greater compressive strength as the concrete to be placed. All precast concrete blocks are to have tie wires cast into blocks to secure the blocks. Tie wire shall be stainless steel, meeting the *requirements of Section 02513.60.*

- Do not use pebbles, pieces of broken stone or brick, metal pipe or wooden blocks as bar supports or to separate layers of bars.

- Fabricate metal chairs and continuous metal supports from stainless steel conforming to the requirements of ASTM A 493, type 316, UNS number S31600, or type 316L, UNS number S31603.

- Legs of chairs shall be turned up a minimum of [redacted].

(c) <u>Approval</u>:

- After placing reinforcement in any member have it inspected and approved before placing concrete.

- Concrete placed in violation of this provision may be rejected and removal required.

00533.42 Splicing:

(a) General:

- Furnish full length stainless steel reinforcing bars the specific length shown or the calculated length for those designated "full length", up to a length of at least [redacted].
- Splice bars with designated splice locations at those locations or fabricate full length.
- In the absence of other directions, including bars designated "continuous", furnish reinforcing bars to provide the minimum practical number of bars.
- Where splicing is permitted, unless shown otherwise:
  - Splice bars No. [redacted] and smaller, by lapping or by an approved mechanical splice.

(b) Lapped Splices - In lapped splices, place the bars in contact and fasten together according to 00533.41 with at least 3 ties per splice.

(c) Mechanical Splices:

(1) General - Provide mechanical splices using devices that lap or join bars end-to-end unless a mechanical butt splice is required, in which case they shall be joined end-to-end. All requirements for mechanical splices apply to mechanical butt splices. Furnish mechanical splice devices according to 02513.20.

- Perform mechanical splices according to procedures recommended by the manufacturer.
- Mechanical butt spliced reinforcing bars shall not deviate from the layout line by more than [redacted] over a [redacted] length of bar.
- Qualify mechanical splice procedures and technicians using them according to 00533.42(c-2) or 00533.42(c-3) as applicable.

(2) Qualifying Non-threaded Mechanical Splices - For approval of non-threaded mechanical splices, submit three samples for testing for each procedure to be used. A change of bar size for filled sleeve splices, or a change of position constitutes a change of procedure.

Qualify the technicians who will make filled sleeve splices by having them produce three samples for testing for each procedure they will perform. Make

these technician qualification samples in the presence of the Engineer without assistance of any kind, using the same materials, equipment, and procedures to be used on the project.

Technician qualification samples which meet the testing requirements will be accepted for product qualification.

(3) Qualifying Threaded Sleeve Mechanical Splices - For approval of threaded sleeve mechanical splices, whether tapered thread or non-tapered thread type, submit three qualification samples for each size of reinforcing bar to be spliced. Make samples using the same materials and installation method to be used on the project. The Engineer need not be present when the sample splice materials are prepared, but shall be present when they are assembled.

(4) Sampling and Testing:

a. General - Labor, material, and equipment for fabricating sample mechanical splices shall be furnished by the Contractor at the Contractor's expense. All sample splices will be tested by the Department at no cost to the Contractor.

b. Samples - All samples shall meet the requirements of 02513.20 and this subsection.

Make each sample for non-threaded mechanical splice from two equal-length, straight pieces of reinforcing bar joined by a splice and with a total assembled length of at least [redacted]. Make each sample for threaded sleeve mechanical splice using 2 threaded straight bars each at least [redacted] long. Mark each splice sleeve furnished with the heat treatment lot number.

c. Jobsite Quality Control - During the installation of mechanical splices:

- Submit one quality control sample for each 100 splices performed up to 500 splices; after which, submit one sample for each 500 splices. This sequence of testing will be required for each heat treatment lot used.

- Make non-threaded mechanical splice quality control samples at the jobsite in a manner similar to that used for the production splices.

- Fabricate threaded sleeve mechanical splice quality control samples on a random basis during the cutting of threads on the reinforcing bars and deliver to the Engineer at the jobsite with the material they represent.

- Complete the splice according to the manufacturer's recommendations.

- Quality control samples will be tested according to this Section. If any sample fails to meet the test criteria, the lot which it represents will be rejected until the sample's cause of failure has been determined. Materials from a rejected lot may be accepted if they are shown to be free of the cause of failure.

(5) Installation - Install splices in the presence of the Engineer. Splices made without the Engineer present will be rejected.

Do not place stirrups and other reinforcing bars between a mechanical splice sleeve and the surface of the concrete where this would impair the specified clearance. To comply, place additional reinforcement as necessary at the Contractor's expense.

00533.45 Substitutions - Substitute different size bars only with approval of the Engineer.

Measurement

00533.80 General - Reinforcement will be measured either on a [redacted] basis or on a lump sum basis. The special provisions will, in all cases, state the basis of measurement for payment applicable to the particular parts of work under the contract.

00533.81 [redacted] Basis - When measured on a [redacted] basis, reinforcement incorporated in the concrete will be measured in [redacted] based on the total computed [redacted] for the sizes and lengths of bars as shown or authorized.

For the purpose of computing weight of reinforcement, the following table will be used:

STAINLESS STEEL REINFORCEMENT BAR

Deformed Bar Designation Number	Nominal Diameter	Unit [redacted]
		

The weight of reinforcement in prestressed beams, slabs, piles and other items where the reinforcement is included in the contract price for the item will not be included in the pay quantities.

No allowance will be made for clips, wire, separators, wire chairs and other material used in fastening the reinforcing in place. If bars are substituted upon the Contractor's request and as a result more steel is used than specified, only the amount specified will be included in the pay quantities.

When laps are made for splices for the convenience of the Contractor, the extra reinforcement will not be included in the pay quantities.

00533.82 Lump Sum Basis - The lump sum basis of measurement will be in effect without further measurement unless plan changes are ordered. The special provisions will show an estimate of quantities for the sole purpose of providing a basis for adjustment of payment in the event changes in the work are ordered. Estimated quantities shown are approximate only and it will be the bidders' responsibility to determine the actual quantities required.

The estimated quantity of stainless steel reinforcement to be paid for on the lump sum basis is as follows:

Structure	Quantity ([redacted])
(Cast-in-Place Members) Bridge No. [redacted]	[redacted]

The estimate shown in the special provisions is made on a reasonable interpretation of the plans. The [redacted] of reinforcement in prestressed beams, slabs, piles and other items where the reinforcement is included in the contract price for the item will not be included. The bidder's responsibility to determine the actual quantity required according to 00120.15 is not waived. If no changes are made in the work, payment will be made at the lump sum contract amount.

If changes are ordered, the adjustment will apply only to those quantities involved in the plans change and will be as determined by the Engineer.

Payment

00533.90 General - Payment for reinforcement measured on the [redacted] basis according to 00533.81 or on the lump sum basis according to 00533.82 will be made at the applicable contract price for one of the pay items listed below as given in the bid schedule. Payment for reinforcement will be made when the reinforcement is incorporated into the concrete. Payment for quantities involved in plan changes will be made according to 00195.20.

	Pay Item	Unit of Measurement
(a)	Stainless Steel Reinforcement	Lump Sum

Payment for item (a) will be payment in full for furnishing, fabricating and placing stainless steel reinforcement as specified.

Materials

02513.10 Deformed Bar Reinforcement - Deformed bar reinforcement shall conform to the requirements of ASTM A 615, with the exception of Section 6, Chemical Composition, Section 9, Mechanical Requirements, Section 12, Finish, and Section 20, Marking. The chemical composition, mechanical requirements and finish of reinforcement provided under this specification shall conform to the joint ASTM/SAE Uniform Numbering System (UNS) designation listed in Table 02513-1. Approved sources for stainless steel reinforcement are listed in Table 02513-2.

Table 02513-1
Approved Stainless Steel Alloys for Reinforcing Bars and Dowels

Common or Trade Name	Type 316 Low Carbon Nitrogen Added	Type 2205 Duplex	Nitronic 50
AISI Type	316LN	2205	XM-19
UNS Designation	S31653	S31803	S20910
Required Minimum Tensile Strength	95 ksi	95 ksi	95 ksi
Required Minimum 0.2% Offset Yield Strength	75 ksi	75 ksi	75 ksi
Required Minimum Elongation in 2 inches	20 %	20%	20%
Required Condition	As Rolled	As Rolled	As Rolled
Required Finish	Deformed to ASTM A 615 rebar pattern, Descaled & white pickled	Deformed to ASTM A 615 rebar pattern, Descaled & white pickled	Deformed to ASTM A 615 rebar pattern, Descaled & white pickled

(a) Mill Certificate - The Certificate shall:

- Be from the supplying mill verifying that the stainless steel rebar provided has been sampled and tested and the test results meet the contract requirements, and
- Include a copy of the chemical analysis of the steel provided, with the UNS designation, the heat lot identification, and the source of the metal if obtained as ingots from another mill.
- Include a copy of tensile strength, yield strength, and elongation tests on each of the sizes (diameter) of stainless steel rebar or dowel provided.
- Include a completed Certificate of Materials Origin, Oregon Form 734-2126, documenting that the stainless steel dowels and reinforcing provided meets the Buy America Act. Only stainless steel originally melted within the United States will be accepted.
- Permit positive determination that the reinforcing provided is that which the test results cover.

(b) Test Standards - Tests used to certify the stainless steel shall conform to:

- ASTM A276-97 Standard Specification for Stainless Steel Bars and Shapes.
- ASTM A370-97a Standard Test Methods and Definitions for Mechanical Testing of Steel Products.
- ASTM A380-96 Standard Practice for Cleaning, Descaling, and Passivation of Stainless Steel Parts, Equipment, and Systems.
- ASTM A555-97 Standard Specification for General Requirements for Stainless Steel Wire and Wire Rods.
- ASTM A751-96 Standard Test Methods, Practices, and Terminology for Chemical Analysis of Steel Products.

(c) Material Samples - The following will be provided to the Engineer:

- Three (3) each samples, 4 feet in length, of each size (diameter) of reinforcing supplied from each heat lot.