



**Oregon
Standard
Specifications
for Construction**



Volume 2

Unique 00530 - Stainless Steel Reinforcement (01-20-09)

(Use this Unique Specification when stainless steel reinforcement is required. Insert (cut & paste) the following subsections into the appropriate places in the boiler plate special provision SP530. Also insert (cut & paste) 02513 into the appropriate place near the end of the project special provisions.)

00530.10 General - Add the following to the end of the list:

Stainless Steel Dowels	02513.50
Stainless Steel Mechanical Splices.....	02513.20
Stainless Steel Reinforcement Bar.....	02513.10
Stainless Steel Tie Wire	02513.60

00530.14 Concrete Inserts - Add the following paragraph to the end of this subsection:

Where stainless steel inserts are specified, provide Type 316 stainless steel.

00530.30 Mechanical Splice Installers - In the paragraph that begins "Provide splice samples...", add the following sentence after the first sentence:

For stainless steel reinforcement, provide splice samples that meet the requirements of 02513.20.

00530.41(b) Ties and Supports - Add the following sentence to the bullet that begins "When precast concrete blocks are used...":

Provide tie wires meeting the requirements of 02513.60 for blocks supporting stainless steel reinforcement.

Add the following bullets to the end of the bullet list:

- Tie stainless steel reinforcement only with stainless steel tie wire meeting the requirements of 02513.60.
- Fabricate metal chairs and continuous metal supports in contact with stainless steel reinforcement from stainless steel conforming to the requirements of ASTM A 493, Type 316, UNS number S31600; or Type 316L, UNS number S31603.

- Do not tie stainless steel reinforcement to steel reinforcement. Direct contact is not acceptable. When stainless steel reinforcing or dowels must be near steel reinforcing, use nylon or polyethylene spacers to maintain a minimum 1 inch clearance between the two metals and bind them with nylon cable ties. Where insufficient space exists to maintain this minimum, either bar may be sleeved with a continuous polyethylene or nylon tube extending at least 1 inch in each direction past the point of closest contact between the two dissimilar bars.

(Replace the existing boiler plate special provision subsection .80(a) with the following subsection .80(a) when reinforcement is paid for on the lump sum basis. Delete what does not apply.)

00530.80(a) Lump Sum - Add the following to the end of this subsection:

The estimated quantity of reinforcement is:

Structure	Stainless Steel (Pound)	Quantity Uncoated (Pound)	Coated (Pound)
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The weight of miscellaneous metal, based on weights listed in 00530.80(b) and Project quantities, is included in the estimated quantity of stainless steel and uncoated reinforcement.

00530.80(b) Weight - In the paragraph that begins "The following assumed densities...", add the following to the list:

Stainless Steel - 500 pounds/cubic foot

(Select the appropriate unit of measurement. Delete the one that does not apply. If Pound is used, remove the parentheses.)

00530.90 Payment - Add the following pay item to the list of pay items:

(c) Stainless Steel Reinforcement.....Lump Sum (Pound)

Item (c) includes fabricating and placing stainless steel reinforcement as specified.

(Insert (cut& paste) this Section 02513 into the appropriate (Part 02000) place near the end of the project special provisions.)

SECTION 02513 - STAINLESS STEEL REINFORCEMENT

Section 02513, which is not a Standard Specification, is included in this Project by Special Provision.

Description

02513.00 Scope - This section includes the requirements for stainless steel reinforcement bars, dowels, and tie wire.

Materials

02513.10 Deformed Bar Reinforcement - Deformed bar reinforcement shall conform to the requirements of ASTM A 615 except Section 6, Chemical Composition; Section 9, Tensile Requirements; Section 12, Finish; and Section 20, Marking do not apply. The chemical composition, tensile requirements, and finish of reinforcement shall conform to the Uniform Numbering System for Metals and Alloys (UNS) designation listed in Table 02513-1.

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

UNS Designation	S31653		S31803		S20910	
AISI Type	316LN		2205		XM-19	
Common or Trade Name	Type 316 Low Carbon Nitrogen Added		Type 2205 Duplex		Nitronic 50	
Required Condition	As Rolled		As Rolled		As Rolled	
Required Finish	Deformed to ASTM A 615 rebar pattern, descaled and white pickled		Deformed to ASTM A 615 rebar pattern, descaled and white pickled		Deformed to ASTM A 615 rebar pattern, descaled and white pickled	
Grade	60	75	60	75	60	75
Minimum Tensile Strength (ksi)	90	95	90	95	90	95
Minimum Yield Strength (ksi)	60	75	60	75	60	75
Minimum Elongation in 2 inches (%)	25	20	25	20	25	20

02513.20 Mechanical Splices - Mechanical splices for reinforcing bars are systems which connect the bars without raising their temperature above 1,300 °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 0.040 inch, measured between gauge points clear of the splice sleeve, when the reinforcing bars are loaded in tension to 67% 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 requirements of 02513.10 with the additional exception that Section 7, Requirements for Deformations and Section 8, Measurement of Deformations of ASTM A 615 do not apply.

02513.60 Tie Wire - Tie wire used to tie stainless steel reinforcement shall be 16 gauge wire fabricated from stainless steel alloy Type 316L, UNS designation S31603, dead soft annealed, annealed at size.

02513.70 Acceptance - Stainless steel reinforcement will be accepted according to 00165.35, this Section, and the following before placing stainless steel reinforcement:

(a) Test Standards - Use the following ASTM tests to certify the stainless steel reinforcement:

- ASTM A 276 - Standard Specification for Stainless Steel Bars and Shapes.
- ASTM A 370 - Standard Test Methods and Definitions for Mechanical Testing of Steel Products.
- ASTM A 380 - Standard Practice for Cleaning, Descaling, and Passivation of Stainless Steel Parts, Equipment, and Systems.
- ASTM A 555 - Standard Specification for General Requirements for Stainless Steel Wire and Wire Rods.
- ASTM A 751 - Standard Test Methods, Practices, and Terminology for Chemical Analysis of Steel Products.

(b) Material Samples - Provide three, 4 foot long samples from each heat lot of each size of reinforcement to be used on the Project.

Section 00530 - Steel Reinforcement for Concrete

Description

00530.00 Scope - This work consists of furnishing and placing steel reinforcement of the grade, type and size shown or specified.

Materials

00530.10 General - Provide materials meeting the following requirements:

Dowels	02510.50
Epoxy coating	02510.11
Galvanized coating	02510.30
Mechanical splices	02510.20
Reinforcement bar	02510.10
Welded wire fabric	02510.40
Wire	02510.60

00530.11 Order Lists and Bending Diagrams - Before ordering material, submit all order lists according to 00150.37 and bending diagrams according to 00150.35(b-2) 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.

Order lists and bending diagrams for reinforcement affected by stressing system in prestressing beams or post-tensioning systems such as anchorage design and duct placement will not be reviewed before the stressing system is reviewed.

00530.12 Fabrication - Cold bend reinforcement bars to the shapes shown. Make bends, tag, mark and ship reinforcement bars according to the current edition of the Concrete Reinforcing Steel Institute's "Manual of Standard Practice".

00530.13 Miscellaneous Metal - Minor metal 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.

Standard steel pipe attached to or used in conjunction with bridge deck drains or catch basins shall be classified as reinforcement.

Labor

00530.30 Mechanical Splice Installers - Construct mechanical splices using personnel qualified as follows:

Each installer, before installing any mechanical splices, shall provide three completed samples meeting the requirements of 02510.20, of each type, size and lot to be used. Thereafter, each installer shall provide one sample for every 100 splices of each type, size and lot. These qualification samples shall be made in the presence of the Engineer, by the installer seeking qualification, unassisted, using the same materials, equipment and procedures to be used on the Project.

00530.40

Construction

00530.40 Protection of Material - Protect reinforcement at all times from damage. When placed in the work, it shall be free from dirt, detrimental rust or scale, paint, oil and other foreign substances.

00530.41 Placing and Fastening - Place all reinforcement within the tolerances recommended in the Concrete Reinforcing Steel Institute's "Manual of Standard Practice". Hold reinforcement firmly during the placing and setting of concrete.

(a) Fabric - If fabric reinforcement is shipped in rolls, straighten it into flat sheets before placing.

(b) Ties - Keep reinforcement properly positioned during placement of concrete according to the following:

- 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 300 mm (1 foot) in each direction; in that case tie alternate intersections.
- Use nonmetallic-coated ties to tie coated reinforcement to coated reinforcement or uncoated reinforcement.
- Precast concrete blocks that support coated reinforcement shall have nonmetallic coated ties.

(c) Clearances:

- Provide the same surface clearance for ties and splices that is shown or specified for the reinforcement.
- Maintain distance from the forms with stays, precast concrete blocks, ties, hangers, or other approved supports.
- Separate layers of bars with precast concrete blocks or by other 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.
- Do not use pebbles, pieces of broken stone or brick, metal pipe or wooden blocks as bar supports or to separate layers of bars.
- Use stainless steel metal chairs conforming to the requirements of ASTM A 493, Type 430 when the legs of the chair will be on an exposed surface.
- Legs of chairs shall be turned up a minimum of 3 mm (1/8 inch).

(d) Approval - 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.

00530.42 Splicing:

(a) General - Furnish full length reinforcing bars the specific length shown or the calculated length for those designated "full length".

If specific locations are designated for splices, make splices only at those locations, or use full-length bars.

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. 36 (No. 11) and smaller by lapping, or with an approved mechanical splice
- Splice bars No. 43 (No. 14) and larger with an approved mechanical butt splice

(b) Lapped Splices - In lapped splices, place the bars in contact and fasten together according to 00530.41 with at least three ties per splice.

The length of lapped splices for coated reinforcement shall be longer than for uncoated reinforcement as shown.

(c) Mechanical Splices:

(1) General - Construct mechanical splices according to 02510.20 and the manufacturer's recommended procedures. Use devices that join bars end-to-end if a butt splice is specified; otherwise bars may be lapped or joined end-to-end. All requirements for mechanical splices apply to mechanical butt splices.

Mechanical butt-spliced reinforcing bars shall not deviate from the layout line by more than 6 mm (1/4 inch) over a 1 m (3 foot) length of bar.

When approved, dowels may be replaced by reinforcing bars with threaded sleeve mechanical splice couplers imbedded in the portion of concrete placed first and threaded reinforcing bars inserted in the couplers after forms are removed. Construct assemblies that develop 135% of the specified minimum yield strength of the dowels shown or specified. Construct reinforcing bars that have effective splice or development lengths equal to the replaced dowels.

Qualify mechanical splice procedures according to 00530.42(c-2) or 00530.42(c-3) as applicable, and qualify technicians according to 00530.30.

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

Technician qualification samples that 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 - Furnish labor, material and equipment for fabricating sample mechanical splices at Contractor's expense. All sample splices will be tested by the Agency at no cost to the Contractor.

b. Samples - All samples shall meet the requirements of 02510.20 and this subsection.

00530.42(c)

c. Testing - Construct test splices in the presence of the Engineer. Construct test splices with two equal lengths of straight reinforcing bar so that the total length of the assembled sample is not less than 1200 mm (48 inches). Mark each splice sleeve with the heat treatment lot number.

d. 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 cause of failure has been determined. Materials from a rejected lot may be accepted if they are shown to be free of the condition which caused the 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 it would impair the specified clearance. Instead, place additional reinforcement as necessary at the Contractor's expense.

Coat mechanical splices of epoxy coated reinforcing bars after installation, according to AASHTO M 284 for patching damaged epoxy coatings.

Where pre-coating is required, pre-coat splices with an approved coating.

Following installation on projects within 40 km (50 miles), by air, of the Pacific Ocean, coat exposed areas of bare steel with heat shrink tubing from Section 2510.11 of the QPL. On all other projects, coat exposed areas of bare steel with heat shrink tubing or epoxy patching material from Section 2510.11 of the QPL.

00530.43 Splicing Welded Wire Fabric - Overlap sheets of welded wire fabric as shown or provide edge and end laps not less than one mesh in width. Securely fasten sheets at the ends and edges according to 00530.41.

00530.45 Substitutions - Substitute different size bars only if approved.

00530.48 Protect Epoxy Coated Rebar - Inspect coated bars before placement for damage to coating. Patch all visual defects in the coating with a prequalified patching material according to AASHTO M 284 before installation. Clean areas to be patched to remove all surface contaminants and damaged coating. Promptly treat cleaned areas according to the resin manufacturer's recommendations and before detrimental oxidation occurs. Where rust is present, remove it by blast cleaning or power tool cleaning methods immediately before applying the patching material. Clean and

roughen the metal before applying patching material. Feather the patching material 50 mm to 75 mm (2 - 3 inches), or as recommended by the manufacturer, into the undamaged coated areas. Apply patching material to a thickness greater than 200 μm (8 mils). Cover coated bars with an opaque material during storage, to protect them from exposure to sunlight and saline mist. Clean bars exposed to saline mist with a high pressure washer (10 MPa (1,500 pounds/square inch) pressure, with a fan pattern, 17 L/min (4.5 gallons/minute) capacity) just prior to placing concrete. Move bars to or from storage carefully, according to 02510.11(c) to minimize damage to the coating. Total exposure time, while in storage or in place, is not to exceed three months.

Clean visual damage found after placement as specified above. Keep repairs to installed bars to a minimum.

Measurement

00530.80 General - Reinforcement will be measured either on a mass (weight) basis or on a lump sum basis. The Special Provisions will state the basis of measurement for payment applicable to the particular parts of work under the Contract.

00530.81 Mass (Weight) Basis - When measured on a mass (weight) basis, reinforcement incorporated in the concrete will be measured in kg, based on the total computed mass (weight) for the sizes and lengths of bars as shown or authorized.

The following assumed densities will be used as a basis for computing the theoretical mass (weight) of miscellaneous metal:

Steel	7842 kg/m ³ (0.2833 pounds/cubic inch)
Copper	8858 kg/m ³ (0.32 pounds/cubic inch)
Cast Iron	7197 kg/m ³ (0.26 pounds/cubic inch)

The mass (weight) of mesh will be computed from the theoretical mass (weight) of plain wire. If the mass per m² (weight per square foot) is shown, that mass (weight) will be used.

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

Steel Reinforcement Bar

METRIC			ENGLISH		
Deformed Bar Designation Number	Nominal Diameter (mm)	Nominal Mass (kg/m)	Deformed Bar Designation Number	Nominal Diameter (inch)	Nominal Weight (lb/in ²)
10	9.5	0.560	3	0.375	0.376
13	12.7	0.994	4	0.500	0.668
16	15.9	1.552	5	0.625	1.043
19	19.1	2.235	6	0.750	1.502
22	22.2	3.042	7	0.875	2.044
25	25.4	3.973	8	1.000	2.670
29	28.7	5.060	9	1.128	3.400
32	32.3	6.404	10	1.270	4.303
36	35.8	7.907	11	1.410	5.313
43	43.0	11.38	14	1.690	7.650
57	57.3	20.24	18	2.260	13.600

The mass (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.

00530.81

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 at 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.

00530.82 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 is the Contractor's responsibility to determine the actual quantities required.

The estimate shown in the Special Provisions is made on a reasonable interpretation of the plans. The mass (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. If no changes are made in the work, payment will be made at the lump sum Contract price.

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

Payment

00530.90 General - Payment for reinforcement measured on the mass (weight) basis according to 00530.81 or on the lump sum basis according to 00530.82 will be made at the applicable Contract price for one of the pay items listed below as given in the Schedule of Items. 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) Reinforcement.....	Lump Sum or kg (Pound)
(b) Coated Reinforcement	Lump Sum or kg (Pound)

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

Payment for item (b) will be payment in full for furnishing and placing epoxy coated reinforcement as specified.