

# STATE OF WISCONSIN



## STANDARD SPECIFICATIONS FOR HIGHWAY AND STRUCTURE CONSTRUCTION

2018 Edition

*Effective with December 2017 letting*

*The annotations, shown in boxed text, in this 2018 edition of the standard specifications identify substantive changes made since the 2017 edition. A brief explanation of each change is shown both in the table of contents and again adjacent to each revised passage. These annotations are not part of the contract.*

## Section 505 Steel Reinforcement

### 505.1 Description

- (1) This section describes furnishing and placing bar steel, high-strength bar steel or coated high-strength bar steel.

### 505.2 Materials

#### 505.2.1 General

- (1) Use deformed reinforcing bars unless the contract specifies otherwise.
- (2) Unless the plans show otherwise or the special provisions specify otherwise, use the deformed type for all bar steel, all high-strength bar steel, and all coated high-strength bar steel reinforcement. If plain, round steel reinforcement is specified, conform to ASTM A675, grade 80.
- (3) Use fabrication tolerances for straight and bent bars specified in Subsection 4.3, Tolerances, of the American Concrete Institute Committee 315, in the American Concrete Institute Detailing Manual.
- (4) Unless the contract specifies otherwise, submit a manufacturer's certified report of test or analysis showing the reinforcement conforms to the specifications to the engineer before incorporating the reinforcement into the work.

#### 505.2.2 Bar Steel Reinforcement

- (1) Conform to AASHTO M31.

#### 505.2.3 High-Strength Bar Steel Reinforcement

- (1) Conform to AASHTO M31, grade 60.

#### 505.2.4 Coated High-Strength Bar Steel Reinforcement

##### 505.2.4.1 General

- (1) Conform to AASHTO M31, grade 60. Ensure that the coating is applied in a CRSI certified epoxy coating plant. Bend bars that require bending before coating, unless the fabricator can bend the bar without damaging the coating.
- (2) Do not weld epoxy-coated reinforcement except as the plans show.

##### 505.2.4.2 Coating Material

- (1) Coat reinforcement according to ASTM A775 with a fusion-bonded powder from the department's APL. Provide written certification from the resin manufacturer that the coating material is the same formulation and quality as submitted to the department for prequalification testing.
- (2) Furnish a two-part epoxy resin that meets ASTM A775 for field repairs and patching.

##### 505.2.4.3 Surface Preparation

- (1) Ensure the bar surface is clean and free from rust, scale, oil, grease, and similar surface contamination, and slivers, scabs and other surface defects detrimental to proper coating.
- (2) Blast the surface to a near white No. 10 finish according to SSPC-SP 10. Provide an anchor pattern with blast profile maximum roughness depth readings within the range of 1.6 mils to 4.0 mils. Determine the readings according to NACE RP-287, using replica tape.
- (3) Remove all traces of grit and dust from the blasting before coating.
- (4) Apply the coating to the cleaned surface as soon as possible after cleaning and before visible oxidation of the surface occurs. The contractor shall not wait to apply the coating more than 8 hours after cleaning, unless the engineer directs otherwise.

##### 505.2.4.4 Coating Process

- (1) Apply the coating as an electrostatically charged dry powder sprayed onto the grounded steel bars using an electrostatic spray gun. The contractor may apply the powder to either a hot or a cold bar. Give the coated bar the thermal treatment the epoxy resin manufacturer recommends to provide a fully cured finished coating.
- (2) Cure, post-cure, or cure and post-cure the coating film to a fully cured condition. The coating applicator shall check a representative proportion of each production lot, using the method it finds most effective for measuring cure, to ensure the entire production lot of coating is fully cured.

##### 505.2.4.5 Test Bar Conditioning

- (1) Condition bars being tested for coating thickness, holidays (pinholes not visually discernible), coating adhesion, and abrasion resistance at a temperature range of 68 F to 86 F. If disputed, conduct tests at 73 F +/- 4 F and 50 +/- 5 percent relative humidity according to ASTM D3451 section 3.1.

- (2) Overlap the sheets of welded steel wire fabric to maintain uniform strength, and securely fasten at the ends and edges. Ensure the edge lap is at least one mesh wide.

#### **505.3.3.2 Lapped Splices**

- (1) Ensure that lapped splices conform to plan requirements, are placed in contact with each other, and wired together to hold the bars in position for the full length of the splice.

#### **505.3.3.3 Welded Splices**

- (1) The contractor may weld uncoated reinforcement only if the plans show welded splices or the engineer approves welded splices in writing. Do not splice epoxy-coated reinforcement by welding. Use welded butt splices conforming to the AWS D 1.4, Structural Welding Code - Reinforcing Steel. Use electrodes conforming to AWS D 1.5 and submit electrode acceptance reports according to AWS D 1.5.
- (2) Use AWS D 1.4 certified welders to perform all welding. If welder certification tests are required, a department-approved independent testing agency shall perform the testing. The engineer may require qualification tests according to AWS D 1.4.
- (3) Test 4 percent of the total number of splices per each bar size, but not less than 4 splices. For both qualification samples and production splices, conform to AWS radiographic methods and provide test results prepared by an inspector qualified under AWS to perform radiographic interpretation.

#### **505.3.3.4 Bar Couplers**

##### **505.3.3.4.1 General**

- (1) Provide threaded bar couplers unless the engineer approves an alternate coupler system in writing as allowed under 505.3.3.4.3.
- (2) If splicing epoxy-coated bars, clean and coat couplers and exposed threads with epoxy. Couplers may be coated with epoxy before or after installation. Use epoxy that is compatible with the touchup epoxy used on coated reinforcing bars.

##### **505.3.3.4.2 Threaded Bar Couplers**

- (1) Ensure that the threaded bar coupler material is capable of developing 125 percent of the yield strength of the bar being spliced. Provide a manufacturer-certified report of tests, based on a minimum of 3 tests, showing the threaded bar coupler capacity.

##### **505.3.3.4.3 Alternate Bar Coupler System**

- (1) Do not install alternate bar coupler systems before department proof testing and without the engineer's written approval. Provide 3 sample splices to the department for testing. Conform to the manufacturer's installation instructions and provide a copy of those instructions to the engineer.

#### **505.3.4 Placing and Fastening**

- (1) Place steel reinforcement precisely in the position the plans show and hold firmly during the concrete placing and setting by using spacer strips, stays, recycled plastic chairs, metal chairs, or other engineer-approved devices or supports. The contractor may use recycled plastic supports for a bottom layer of steel reinforcement which in turn supports upper layers on continuous bar chairs; but do not use individual plastic chairs to directly support upper layers. Unless the contract provides otherwise, use coated high-strength bar steel reinforcement in the top layer of reinforcement in the concrete deck.
- (2) Make metal chairs from stainless steel, steel that is zinc coated or epoxy coated after fabrication, or from uncoated steel with engineer-approved plastic tipped legs, or with at least 1/2 inch of the bottom of the legs hot dip zinc coated or plastic-coated. Furnish epoxy-coated metal chairs or recycled plastic chairs to support coated high-strength bar steel reinforcement, subject to the plastic chair restriction stated above. The epoxy coating thickness shall conform to 505.2.4.6.
- (3) Use recycled plastic chairs manufactured from recycled plastic obtained from post consumer products. Ensure they are chemically inert in concrete and are molded in a shape that does not restrict concrete flow and consolidation around and under the chairs.
- (4) For recycled plastic chairs conform to the following requirements within a temperature range of 20 F to 150 F:

PROPERTY	VALUE	ASTM TEST
Minimum shear strength	5000 psi	<u>ASTM D732</u>
Minimum compressive strength	10,000 psi	<u>ASTM D695</u>
Maximum water absorption	0.1 percent	<u>ASTM D570</u>

- (5) Support bar steel reinforcement in the concrete decks and slab spans as follows:
  1. For all decks and slab spans, support bottom transverse bars with continuous bar chairs spaced 4 foot on centers or closer. Support the ends of the bars with a line of chairs near each deck or slab edge.