



Florida Department of Transportation

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SECRETARY

August 25, 2022

Khoa Nguyen
Director, Office of Technical Services
Federal Highway Administration
3500 Financial Plaza, Suite 400
Tallahassee, Florida 32312

Re: State Specifications Office
Section: **962**
Proposed Specification: **9620000 Structural Steel and Miscellaneous Metal Items (Other Than Aluminum).**

Dear Mr. Nguyen:

We are submitting, for your approval, two copies of the above referenced Supplemental Specification.

The changes are proposed by Tim McCullough from the State Materials Office to update the most current standards. Several standards have differing levels of quality. Good quality materials were provided to avoid material and maintenance issues. Several standards have varying requirements for certification, so the requirements were written to ensure the material order can be quickly and consistently checked for approval. This proposal is associated with the proposed revision to Section 700.

Please review and transmit your comments, if any, within two weeks. Comments should be sent via email to daniel.strickland@dot.state.fl.us.

If you have any questions relating to this specification change, please call me at 850-414-4130.

Sincerely,

Signature on file

Daniel Strickland, P.E.
State Specifications Engineer

DS/dh
Attachment

cc: Florida Transportation Builders' Assoc.
State Construction Engineer

STRUCTURAL STEEL AND MISCELLANEOUS METAL ITEMS (OTHER THAN ALUMINUM)

(REV ~~67-2713~~-22)

SECTION 962 is deleted and the following substituted:

962-1 General.

This Section covers the material and fabrication requirements for structural steel and miscellaneous metal components. All steel must be melted and manufactured in the United States and meet Section 6-5.2. All overhead cantilevers, monotubes, trusses and gantries, iron castings, steel gratings, fencing, field splices filler metals, and bridge components (including steel castings, steel forgings, and bearing material) supplied under this Specification shall be from producers currently on the Department's Production Facility Listing. Producers seeking inclusion on the Department's Production Facility Listing must meet the requirements of Section 105. Provide certifications that meet the applicable section and 962-12.

962-~~12~~ Structural Steel.

962-~~12.1~~ Structural Steel Materials: ~~Unless otherwise specified in the Contract Documents, provide structural steel for bolted or welded construction in accordance with Structural Steel for Bridges, ASTM A709~~ that meets the requirements of Table 962-1.1 and 962-1.2 when impact testing is specified. Grade HPS 70W shall not be substituted for Grade HPS 50W. Weathering steel shall not be substituted for non-weathering steel without Engineer approval.

~~Do not apply heat treatment unless approved by the Engineer. If the grade is not shown elsewhere in the Contract Documents, provide the grade as directed by the Engineer. All grades, as specified in the Contract Documents, are to conform to ASTM A709, as shown in Table 962-2.1 below: When galvanizing is specified, provide galvanizing in accordance with 962-11.1.~~

<u>Product</u>	<u>ASTM</u>	<u>Grade/Style</u>	<u>Reportable Properties</u>	<u>Supplementary Requirements</u>	
<u>Plate</u>	<u>A709</u>	<u>36</u>	<u>Composition, Yield Strength, Tensile Strength, Elongation, Killed.</u>	<u>None</u>	
		<u>50</u>		<u>Carbon Equivalency</u>	
		<u>50S</u>		<u>Heat-treating temperatures</u>	
		<u>50CR</u>			
		<u>50W</u>	<u>Composition, Yield Strength, Tensile Strength, Elongation, Killed, Fine Grain</u>	<u>Corrosion Resistance Index</u>	
		<u>HPS 50W</u>		<u>Corrosion Resistance Index,</u>	
		<u>HPS 70W</u>		<u>Heat Treatment Temperatures</u>	

ASTM A709 Grade	Product Form*	Yield Strength (ksi)	Tensile Strength (ksi)
36	P, S, B	36 min	58-80
50	P, S, B	50 min	65 min
50W	P, S, B	50 min	70 min
50S	S	50-65	65 min
HPS 50W	P, S, B	50 min	70 min
HPS 70W	P, B	70 min	85-110
HPS100W (-2-1/2 in or less)	P, B	100 min	110-130
HPS100W (over 2-1/2 in)	P, B	90 min	100-130

* P = plates, S = structural shapes, B = bars

962-12.2-Testing Impact Requirements: Structural steel subject to tensile stress for main load-carrying members shall meet the impact requirements listed in Table 962-2. Mill test reports shall identify average impact test values. Provide certifications that meet this section and 962-12. For structural steel subjected to tensile stress used for main load-carrying members or components (as defined in Section 460), meet the ASTM A709 impact test requirements for non-fracture and fracture critical tension components as specified in the Contract Documents. Meet the requirements for Zone 1 (Minimum Service Temperature 0°F).

If not specified elsewhere in the Contract Documents, For non-fracture and fracture critical tension components, provide structural steel in accordance with ASTM A709 requirements for non-fracture and fracture critical tension components as directed by the Engineer.

Product	ASTM	Grade	Zone	Minimum Average Energy (ft*lbf)	
				Non-Fracture Critical	Fracture Critical
Structural Steel	A709	36	1	15 at 70°F	25 at 70°F
		50		15 at 70°F (< 2.0"t) 20 at 70°F (> 2.0"t)	25 at 70°F (< 2.0"t) 30 at 70°F (> 2.0"t)
		50W			
		50S		15 at 70°F	25 at 70°F
		50CR		20 at 10°F (< 2.0"t) 25 at 50°F (> 2.0"t)	30 at 10°F (< 2.0"t) 35 at 50°F (> 2.0"t)
		HPS 50W		25 at -10°F	35 at -10°F
Structural Steel Tubing	A500	B, C, D	1	15 at 70°F	25 at 70°F
	A501	A, B			
	A847	Round, Square, Rectangle, Special			

Note: If yield >15 ksi above specified grade, test temperature must drop 15°F for each 10 ksi above grade.

962-23 Steel Castings.

Provide carbon steel and corrosion resistant castings in accordance with this section and Table 962-3.

962-23.1 Carbon Steel Castings: Perform heat treatments by annealing, normalizing, normalizing & tempering, or quenching & tempering after castings have been allowed to cool from the pouring temperature to below the transformation temperature range as regulated by the use of pyrometers. Class 1 castings shall be used if post-weld heat treatment is specified in the contract documents. Provide carbon steel castings that conform to the requirements of ASTM A27. Unless otherwise specified in the Contract Documents, all castings are to be Grade 65-35 or Grade 70-36.

962-23.2 Corrosion Resistant Steel Castings: Provide corrosion resistant Iron-Chromium or Iron-Chromium-Nickel castings that conform to the requirements of ASTM A743. Unless otherwise specified in the Contract Documents, all castings are to be Grade CA 15M. Perform heat treatments by air cooling and tempering; or annealing as defined in ASTM A743 Table 1.

<u>Table 962-3</u> <u>Requirements for Steel Castings</u>					
<u>Product</u>	<u>Standard</u>	<u>Grade</u>	<u>Class</u>	<u>Reportable Properties</u>	<u>Supplementary Requirements</u>
<u>Carbon Steel</u>	<u>ASTM A27</u>	<u>65-35,</u> <u>70-36</u>	<u>1, 2</u>	<u>Composition,</u> <u>Tensile,</u> <u>Class</u>	<u>None</u>
<u>Corrosion Resistant Steel</u>	<u>ASTM A743</u>	<u>CA 15M</u>	<u>All</u>	<u>Composition,</u> <u>Heat Treatment</u>	<u>S11, S12</u>
	<u>AASHTO M 163</u>				

962-34 Steel Forgings.

Provide carbon steel and alloy steel forgings from which pins, rollers, trunnions, shafts, gears, or other forged parts are fabricated in accordance with this section and Table 962-4. that conform to ASTM A668. Unless otherwise specified in the Contract Documents, all forgings are to be Class C, D, F, or G.

The manufacturer may elect to choose from any of the class specific heat treatments identified in the Table 962-4, provided that the controlling cross-sectional thickness meets mechanical property test requirements. Retreatment by re-austenitizing a lot is allowed up to three times when the mechanical properties have not been met. Re-testing of the mechanical properties is required on any lot subject to retreatment.

<u>Table 962-4</u> <u>Requirements for Steel Forgings</u>				
<u>Product</u>	<u>Standard</u>	<u>Class</u>	<u>Reportable Properties</u>	<u>Supplementary Requirements</u>
<u>Steel Forgings</u>	<u>ASTM A668</u>	<u>C, D, F, G</u>	<u>Composition,</u> <u>Tensile, Yield,</u> <u>Elongation,</u> <u>Hardness</u>	<u>S7</u>
	<u>AASHTO</u> <u>M 102</u>			

962-45 Iron Castings.

Provide iron castings that conform to the requirements of this section and Table 962-5. Use producers listed on the Department's Production Facility Listing for galvanizing.

962-45.1 Gray Iron Castings: Provide gray iron castings that conform to the requirements of this section and Table 962-4. AASHTO HL-93 load testing may be substituted for tensile testing when specified in the contract documents. When Alternative G castings are specified, provide a composition that precludes the possibility of embrittlement during the normal thermal cycle of hot-dip galvanizing. AASHTO M105. For frames, grates, rings, and covers for inlets, manholes, and other structures placed in areas of vehicular traffic, conform to the requirements of AASHTO M306. Unless otherwise specified in the Contract Documents, provide gratings, manhole covers and frames to Class 35B and machinery parts to Class 30.

962-45.2 Ductile Iron Castings: Provide ductile iron castings that conform to the requirements of ASTM A536. Unless otherwise specified in the Contract Documents, provide castings to Grade 414-276-18. In addition to the specified test coupons, test specimens from parts integral with the castings, such as risers, are to be tested for castings with a mass more than 1,000 pounds to determine that the required quality is obtained in the castings in the finished condition. Perform full ferritizing anneal to remove carbides or stabilized pearlite. AASHTO HL-93 load testing may be substituted for tensile testing when specified in the contract documents.

962-54.3 Malleable Iron Castings: Provide malleable iron castings that conform to the requirements of ASTM A47. Unless otherwise specified in the Contract Documents, provide castings to Grade 24118. Perform heat treatments in the same production furnace and in the same cycles as the castings they represent. Produce a microstructure consisting of temper carbon nodules distributed through a ferritic matrix and free of excessive pearlite, massive carbides, and primary graphite. When critical sections of the production castings differ appreciably from that of the central portion, the time cycle for tempering may be altered from that of the production lot in order to obtain similar microstructures, or hardness, or both.

When Alternative G castings are specified, provide a composition that precludes the possibility of embrittlement during the normal thermal cycle of hot-dip galvanizing, or provide heat treatment that immunizes the casting against embrittlement during the normal thermal cycle of hot-dip galvanizing.

<u>Table 962-5</u> <u>Requirements for Iron Castings</u>				
<u>Product</u>	<u>Standard</u>	<u>Grade/Class</u>	<u>Reportable Properties</u>	<u>Supplementary Requirements</u>
<u>Gray Iron Traffic Service</u>	<u>AASHTO M 105 & AASHTO M 306</u>	<u>35B</u>	<u>Tensile*</u>	<u>None</u>
<u>Gray Iron Machinery</u>	<u>AASHTO M 105</u>	<u>30</u>	<u>Tensile</u>	<u>None</u>
<u>Ductile Iron</u>	<u>ASTM A536</u>	<u>60-40-18</u>	<u>Tensile*, Yield, Elongation, Heat Treatment</u>	<u>Additional Tensile test for castings > 1,000 lbs.</u>
<u>Malleable Iron</u>	<u>ASTM A47</u>	<u>30518 [24118]</u>	<u>Tensile, Yield, Elongation, Heat Treatment</u>	<u>None</u>

**AASHTO HL-93 may be substituted for tensile testing of vaned gratings, when specified in the contract.*

962-65 Bolts, Nuts and Washers Not Designated as High-Strength.

Provide bolts, nuts, and washers not designated as high strength meeting the requirements listed in this Section and Table 962-6. When galvanizing is specified in the contract documents, provide galvanizing in accordance with 962-11.3.1. Provide bolts that conform to the requirements of ASTM A307 or ASTM A449. Provide nuts that conform to the requirements of ASTM A563 and washers that conform to ASTM F436, unless specified as ordinary rough or machine bolts as approved by the Engineer. Washers provided to ASTM F844 and nuts to ASTM A194 may be used with the Engineer's approval.

Use double nuts, when ordinary rough or machine bolts are specified in the Contract Documents. Bolted assemblies shall be made of similar coating composition. When weathering material is used, provide the entire assembly in weathering steel. Bolts meeting the requirements of ASTM A193, washers meeting the requirements of ASTM F844 and nuts meeting the requirements of ASTM A194 or AASHTO M292 may be used with the Engineer's approval.

<u>Table 962-6</u> <u>Bolts, Nuts, and Washers Not Designated as High-Strength</u>				
<u>Product</u>	<u>Standard</u>	<u>Grade</u>	<u>Style</u>	<u>Reportable Properties</u>
<u>Bolts</u>	<u>ASTM A307</u>	<u>A, B</u>	<u>Heavy Hex, Threaded Rod</u>	<u>Size, Composition, Hardness, Tensile</u>
	<u>ASTM A449</u>	<u>1, 3</u>	<u>Hex, Threaded Stud</u>	<u>Size, Composition, Tensile, Proof Load, Hardness</u>

<u>Table 962-6</u> <u>Bolts, Nuts, and Washers Not Designated as High-Strength</u>				
<u>Product</u>	<u>Standard</u>	<u>Grade</u>	<u>Style</u>	<u>Reportable Properties</u>
	<u>ASTM F593</u>	<u>Group 2</u> <u>316 or 316L</u>	<u>Condition A</u> <u>CW1 or SH1</u>	<u>Alloy, Group, Condition</u>
	<u>ASTM A193*</u>	<u>B7, B16</u>	<u>Any</u>	<u>Size, Composition,</u> <u>Hardness, Heat</u> <u>Treatment, Macroetch</u> <u>results</u>
<u>Nuts</u>	<u>ASTM A563</u>	<u>A</u>	<u>Hex</u>	<u>Size, Composition, Proof</u> <u>Load, Hardness</u>
		<u>C, C3, DH,</u> <u>DH3</u>	<u>Heavy Hex</u>	
	<u>ASTM F594</u>	<u>Group 2</u> <u>316 or 316L</u>	<u>CW</u>	<u>Alloy, Group, Condition</u>
	<u>ASTM A194*</u>	<u>2, 2H</u>	<u>Hex, Heavy</u> <u>Hex</u>	<u>Composition, Hardness,</u> <u>Proof Load</u>
	<u>AASHTO</u> <u>M 292*</u>	<u>2, 2H</u>	<u>Hex, Heavy</u> <u>Hex</u>	<u>Size, Composition,</u> <u>Hardness, Heat</u> <u>Treatment, Macroetch</u> <u>results</u>
<u>Washers</u>	<u>ASTM F436</u>	<u>1, 3</u>	<u>Circular,</u> <u>Beveled,</u> <u>Clipped,</u> <u>Extra Thick</u>	<u>Size, Hardness</u>
	<u>N/A</u>	<u>316 or 316L</u>	<u>Any</u>	<u>Alloy, Size</u>
	<u>ASTM F844*</u>	<u>Plain</u>	<u>Round,</u> <u>Miscellaneous</u>	<u>Size</u>
	<u>ASTM A36</u>	<u>All</u>	<u>N/A</u>	<u>Killed, Thickness</u>
<u>Shims</u>	<u>ASTM A1011</u>	<u>Any</u>	<u>Any</u>	<u>None</u>
	<u>ASTM A109</u>	<u>Any</u>	<u>Any</u>	<u>None</u>
	<u>ASTM B36</u>	<u>Brass</u>	<u>Any</u>	<u>None</u>

962-76 High-Strength Bolts, Nuts, Washers and Direct-Tension-Indicator (DTI) Devices.

Use Provide high-strength bolts, nuts, washers and DTI devices meeting the following requirements: in accordance with this Section and Table 962-7. High-strength bolts shall have identifying marks meeting ASTM F3125 Table 2 and ASTM A563. High-strength bolted assemblies shall be made of similar coating composition. When galvanizing is specified in the contract documents, provide galvanizing in accordance with 962-11.3.2. Bolts meeting the requirements of ASTM F3125 Grade A490, washers meeting the requirements of ASTM F844, and nuts meeting the requirements of ASTM A194 or AASHTO M 292 may be used with the Engineer's approval.

~~_____ Bolts: Grade A325 or Grade A490, Heavy Hex. Only use Grade A490 high strength bolts with the approval of the Engineer.~~

~~_____ Nuts: ASTM A563, Heavy Hex. Select nuts in accordance with ASTM F3125 (Table 1). If grade C, D or C3 nuts are selected, provide with a minimum Rockwell hardness of 89 HRB or a minimum Brinell hardness of 180 HB. Use nuts meeting the requirements of ASTM A194 only when approved by the Engineer.~~

~~_____ Washers: ASTM F436 and ASTM F3125 (Table 1). Use washers meeting the requirements of ASTM F844 only when approved by the Engineer.~~

~~_____ Identifying Marks: in accordance with ASTM F3125 (Table 1) and ASTM A563.~~

~~_____ DTI devices: meeting the requirements of ASTM F959. Furnish plain DTI devices for use with plain bolts if the finish coat of paint is applied after installation and testing of the DTI device and will cover the remaining gap. Otherwise, coat the DTI device in accordance with the manufacturer's recommendations.~~

~~_____ When the Contract Documents call for uncoated weathering steel in any component of the connected part, provide Type 3 bolts and washers, and nuts with weathering characteristics. If one side of the assembly is coated and the other exposed weathering steel, coat the fastener assembly on the coated side similarly (Such as the case for weathering steel tub girders coated on the inside only).~~

~~_____ Ensure that fastener assemblies are properly lubricated in accordance with ASTM A563 Supplementary Requirements S1 and S2.~~

<u>Table 962-7</u>					
<u>Requirements for High-Strength Steel Fastener Assemblies</u>					
<u>Products</u>	<u>Standard</u>	<u>Grade</u>	<u>Type/ Style</u>	<u>Reportable Properties</u>	<u>Supplementary Requirements</u>
<u>Bolts</u>	<u>ASTM F3125</u>	<u>A325</u>	<u>Heavy Hex</u>	<u>Size, Composition, Tensile, Proof Load, Hardness,</u>	<u>None</u>
		<u>A490*</u>		<u>Size, Composition, Tensile, Proof Load, Hardness, Magnetic Particle, Carburization/ Decarburization</u>	
	<u>ASTM A193</u>	<u>B7, B16</u>	<u>Any</u>	<u>Size, Composition, Hardness, Heat Treatment, Macroetch results</u>	
<u>Nuts</u>	<u>ASTM A563</u>	<u>DH, DH3</u>	<u>Heavy Hex</u>	<u>Size, Composition, Proof Load, Hardness</u>	<u>S1, S2 min. 89 HRB or 180 HB</u>
	<u>ASTM A194*</u>	<u>2H</u>	<u>Heavy Hex</u>	<u>Size, Composition, Hardness</u>	<u>Max HRC32</u>

<u>Table 962-7</u> <u>Requirements for High-Strength Steel Fastener Assemblies</u>					
<u>Products</u>	<u>Standard</u>	<u>Grade</u>	<u>Type/ Style</u>	<u>Reportable Properties</u>	<u>Supplementary Requirements</u>
	<u>AASHTO M 292*</u>	<u>2H</u>	<u>Heavy Hex</u>	<u>Size, Composition, Hardness, Heat Treatment, Macroetch results</u>	<u>Max HRC32</u>
<u>Washers</u>	<u>F436</u>	<u>Circular, Beveled, Clipped, Extra Thick</u>	<u>1, 3</u>	<u>Size, Hardness</u>	<u>None</u>
	<u>F844*</u>	<u>Round, Miscella neous</u>	<u>Plain</u>	<u>Size</u>	<u>None</u>
	<u>ASTM A709</u>	<u>36, 50</u>	<u>Any</u>	<u>Yield, Tensile, Elongation, Killed</u>	<u>None</u>
<u>DTI Devices</u>	<u>F959</u>	<u>A325</u>	<u>1</u>	<u>Size, Composition, Compression Load, Hardness</u>	<u>None</u>
			<u>3</u>	<u>Size, Composition, Compression Load, Hardness, Corrosion Resistance Index</u>	
<u>*Requires Engineer Approval.</u>					

962-~~8~~7 Anchor Rods and Bridge Bearing Materials.

962-8.1 Bearing and Masonry Plate: Meet the requirements of Table 962-8. Masonry plates and bearings shall be welded in accordance with AASHTO/AWS D1.5 Bridge Welding Code. When galvanizing is specified meet the requirements of 962-11.1. Use producers listed on the Department's Production Facility Listing for galvanizing.

~~Provide anchor rods, washers, masonry plates, bearings and other miscellaneous metal components that conform to the following requirements:~~

~~Provide anchor rods that conform to the requirements of ASTM F1554 unless the Engineer approves the use of anchor rods meeting the requirements of ASTM A307, with nuts that meet the requirements of ASTM A563, Hex Nuts, Heavy and with a finish consistent with the rod. Nuts meeting the requirements of ASTM A194 may be used only with the Engineer's approval.~~

~~Use washers meeting the requirements of ASTM F436, with a finish consistent with the rod. Washers meeting the requirements of ASTM A844 may be used only with the Engineer's approval.~~

<u>Table 962-8</u> <u>Requirements for Bearings and Masonry Plate</u>					
<u>Product</u>	<u>ASTM</u>	<u>Grade</u>	<u>Style</u>	<u>Reportable Properties</u>	<u>Supplementary Requirements</u>
<u>Plate</u>	<u>A709</u>	<u>50W</u>	<u>All</u>	<u>Yield, Tensile, Elongation, Killed, Fine Grain</u>	<u>Corrosion Resistance Index</u>
<u>Laminates</u>	<u>A240</u>	<u>316</u>	<u>Gage 16</u>	<u>Yield, Tensile, Elongation, Hardness</u>	<u>None</u>
	<u>A1011</u>	<u>36</u>	<u>HSLAS, Class 1</u>	<u>Designation, Style</u>	<u>None</u>
	<u>A36</u>	<u>All</u>	<u>All</u>	<u>Yield, Tensile, Elongation, Killed</u>	<u>None</u>

962-8.2 Anchor Rods and Bearing Hardware: Provide anchor rods and other bearing hardware in accordance with this section and Table 962-9. All fastening components shall be made of similar composition. When galvanizing is specified in the contract documents, provide galvanizing in accordance with Section 962-11.3.1. Anchor rods meeting the requirements of ASTM A307, washers meeting the requirements of ASTM F844, and nuts meeting the requirements of ASTM A194 may be used with the Engineer's approval.

<u>Table 962-9</u> <u>Requirements for Anchor Rods and Bearing Hardware</u>					
<u>Product</u>	<u>ASTM</u>	<u>Grade</u>	<u>Style</u>	<u>Reportable Properties</u>	<u>Supplementary Requirements</u>
<u>Bolts</u>	<u>F1554</u>	<u>36</u>	<u>Threaded Rod</u>	<u>Lot, Size, Tensile</u>	<u>None</u>
		<u>55</u>		<u>Lot, Size, Tensile, Carbon Equivalency</u>	<u>S1</u>
		<u>105</u>		<u>Lot, Size, Tensile, Carbon Equivalency</u>	<u>S3</u>
	<u>A307*</u>	<u>A, B</u>	<u>Threaded Rod</u>	<u>Size, Composition, Hardness, Tensile</u>	<u>S1</u>
<u>Nuts</u>	<u>A563</u>	<u>DH</u>	<u>Heavy Hex</u>	<u>Size, Composition, Proof Load, Hardness</u>	<u>None</u>
	<u>A194*</u>	<u>2H</u>	<u>Heavy Hex</u>	<u>Size, Composition, Hardness</u>	<u>None</u>
<u>Washers</u>	<u>F436</u>	<u>1, 3</u>	<u>Circular, Beveled, Clipped, Extra Thick</u>	<u>Size, Hardness</u>	<u>None</u>
	<u>F844*</u>	<u>Plain</u>	<u>Round, Miscellaneous</u>	<u>Size</u>	<u>None</u>
<u>Plate</u>	<u>A36</u>	<u>All</u>	<u>All</u>	<u>Yield, Tensile, Elongation, Killed</u>	<u>None</u>

<u>Table 962-9</u> <u>Requirements for Anchor Rods and Bearing Hardware</u>					
<u>Product</u>	<u>ASTM</u>	<u>Grade</u>	<u>Style</u>	<u>Reportable Properties</u>	<u>Supplementary Requirements</u>
<u>Shim</u>	<u>A653</u>	<u>All</u>	<u>Min. G30</u>	<u>Grade</u>	<u>None</u>
	<u>A1008</u> <u>A36</u>	<u>All</u>	<u>A153, F2329</u>	<u>None</u>	<u>None</u>
*Requires Engineers Approval.					

962-89 Overhead Signs.

Provide overhead sign materials in accordance with this section Table 962-2, and Table 962-10. When galvanizing is specified, meet the requirements of 962-11.1. Produce welds using E7018 electrode, in accordance with AWS D1.1 Structural welding Code.

<u>Table 962-10</u> <u>Requirements for Overhead Signs</u>					
<u>Product</u>	<u>Standard</u>	<u>Grade</u>	<u>Type/ Style</u>	<u>Reportable Properties</u>	<u>Supplementary Requirements</u>
<u>Upright Pipe</u>	<u>API 5L</u>	<u>X42R,</u> <u>X42N,</u> <u>X42M,</u> <u>X46N,</u> <u>X46M,</u> <u>X52N,</u> <u>X52M,</u> <u>X56N,</u> <u>X56M,</u> <u>X60N,</u> <u>X60M,</u> <u>X65M,</u> <u>X70M</u>	<u>PSL2</u>	<u>Killed, Fine Grain,</u> <u>Tensile, CVN Test</u>	<u>N/A</u>
	<u>A500</u>	<u>B, C</u>	<u>Round Structural</u>	<u>Composition, Yield,</u> <u>Tensile, Elongation</u>	<u>UT Seam Weld, (per API 5L) CVN Test per 962-2</u>
<u>Chords</u>	<u>A500</u>	<u>B, C</u>	<u>Round Structural</u>	<u>Composition, Yield,</u> <u>Tensile, Elongation</u>	<u>N/A</u>
<u>Plate, Angles & Handhole Frame</u>	<u>A709</u>	<u>50</u>	<u>Plates & Shapes</u>	<u>Composition, Yield,</u> <u>Tensile, Elongation</u>	<u>N/A</u>
	<u>A36</u>	<u>36</u>			<u>Yield > 50ksi</u>
<u>Poles</u>	<u>A1011</u>	<u>50, 55, 60, 65</u>	<u>Any</u>	<u>Designation, Grade</u>	<u>N/A</u>
	<u>A572</u>	<u>50, 55, 60, 65</u>	<u>1, 2, 3, 5</u>	<u>Composition,</u> <u>Tensile,</u> <u>Type, Killed</u>	<u>N/A</u>

<u>Table 962-10</u> <u>Requirements for Overhead Signs</u>					
<u>Product</u>	<u>Standard</u>	<u>Grade</u>	<u>Type/ Style</u>	<u>Reportable Properties</u>	<u>Supplementary Requirements</u>
	<u>A595</u>	<u>A, B</u>	<u>Any</u>	<u>Composition, Tensile, Type, Killed</u>	<u>N/A</u>

962-10.8 Miscellaneous Metal Items.

962-10.1 General: Unless otherwise specified in the cContract dDocuments, provide miscellaneous metal components in accordance with this section and Table 962-11, Table 962-12, Table 962-13, or Table 962-14. Structural tubing subject to tensile stresses, as defined in Section 460, shall meet Table 962-2.2 for tension components, Zone 1. Welding shall be done in accordance with the most current AWS D1.1 structural welding code. When galvanizing is specified in the contract documents, provide galvanizing in accordance with the contract documents.

Requirements for concrete reinforcement are contained in Section 931.

Requirements for steel guardrail are contained in Section 967.

the following specific materials.

<u>Table 962-11</u> <u>Requirements for Miscellaneous Metals</u>				
<u>Product</u>	<u>Standard</u>	<u>Grade</u>	<u>Type/ Style</u>	<u>Reportable Properties</u>
<u>Steel Sheet Piling</u>	<u>A328</u>	<u>All</u>	<u>Cold Rolled, Heat Treated</u>	<u>Composition, Tensile, Killed</u>
	<u>A572</u>	<u>42, 50, 55, 60, 65</u>	<u>1, 2, 3, 5</u>	<u>Composition, Tensile, Size, Killed</u>
	<u>A690</u>	<u>All</u>	<u>All</u>	<u>Composition, Tensile, Killed</u>
<u>Steel Pipe Piling</u>	<u>A252</u>	<u>3</u>	<u>All</u>	<u>Composition, Tensile, Size</u>
	<u>API 5L</u>	<u>X46, X52, X56, X60, X65, X70</u>	<u>PSL1 PSL2</u>	<u>Tensile Killed, Fine Grain, Tensile</u>
<u>Structural Tubing</u>	<u>A500</u>	<u>Round</u>	<u>B, C</u>	<u>Composition, Tensile, Flattening Test, Impact (Zone 1), Size</u>
		<u>Shaped</u>		<u>Composition, Tensile, Impact (Zone 1), Size</u>
	<u>A501</u>	<u>Square, Round, Rectangular, Special</u>	<u>A, B</u>	<u>Composition, Tensile, Impact (Zone 1), Size</u>
	<u>A847</u>	<u>Round</u>	<u>Welded, Seamless</u>	<u>Composition, Tensile, Flattening, Impact (Zone 1), Size</u>
		<u>Square, Rectangle, Special</u>	<u>Welded, Seamless</u>	<u>Composition, Tensile, Impact (Zone 1), Size</u>

<u>Table 962-11</u> <u>Requirements for Miscellaneous Metals</u>				
<u>Product</u>	<u>Standard</u>	<u>Grade</u>	<u>Type/ Style</u>	<u>Reportable Properties</u>
<u>Pipe Railing</u>	<u>A53</u>	<u>A, B</u>	<u>E, S</u>	<u>Composition, Mechanical Testing (Tensile, Bend, Flattening), Size</u>

~~962-8.1 Pipe Railings: Provide steel pipe conforming to the requirements of ASTM A53 for Standard Weight Pipe.~~

~~962-8.2 Steel Sheet Piling: Provide steel sheet piles conforming to the requirements of ASTM A328, ASTM A572 or ASTM A690.~~

~~962-8.3 Steel Sign Supports and Accessories: Provide steel members for sign supports that meet the material requirements specified in the Contract Documents.~~

~~962-8.4 Structural Tubing:~~

~~962-8.4.1 Materials: Provide steel structural tubing as one of the following: Cold formed, welded or seamless conforming to the requirements of ASTM A500, Grade B or C, coated in accordance with the Contract Documents;~~

~~Hot formed, welded or seamless tubing conforming to the requirements of ASTM A501, coated in accordance with the Contract Documents;~~

~~ASTM A847 when weathering characteristics are required; or~~

~~As indicated elsewhere in the Contract Documents.~~

~~962-8.4.2 Testing: Structural steel tubing subjected to tensile stresses used in main load carrying members or components (as defined in Section 460) shall meet the impact test requirements of ASTM A709 for non fracture and fracture critical tension components for Zone 1. Minimum Average energy shall be 15 ft lbf at 70°F (non fracture critical); or 25 ft lbf at 70°F (fracture critical).~~

~~962-8.5 Steel for Concrete Reinforcement: Requirements for concrete reinforcement are contained in Section 931.~~

~~962-8.6 Steel Guardrail: Requirements for steel guardrail are contained in Section 967.~~

~~962-108.27 Field Splice Filler Materials: Provide field splice filler materials in accordance with the cContract dDocuments. If unspecified and less than 3/16 inches thick filler splice materials in accordance with this section and Table 962-12. Filler plates may also meet the appropriate grades specified in 962-2. When galvanized plate is specified, use producers listed on the Department's Production Facility Listing for galvanizing. provide ASTM A606 or ASTM A1011.~~

<u>Table 962-12</u> <u>Requirements for Field Splice Filler Materials</u>				
<u>Product</u>	<u>Standard</u>	<u>Grade</u>	<u>Type/ Style</u>	<u>Reportable Properties</u>
<u>Filler Sheet</u>	<u>A1011</u>	<u>50</u>	<u>HSLAS, Class 1</u>	<u>Designation, Grade</u>

~~962-10.3 Fencing Material: Provide fencing materials in accordance with this section and Table 962-13. When galvanizing is specified, provide galvanizing in accordance with the~~

contract documents. Use producers listed on the Department’s Production Facility Listing for Coated Steel Fencing.

<u>Table 962-13</u> <u>Material Requirements for Fencing</u>				
<u>Product</u>	<u>Standard</u>	<u>Grade / Type</u>	<u>Style</u>	<u>Reportable Properties</u>
<u>Fabric</u>	<u>A116</u>	<u>60</u>	<u>No. 9</u>	<u>Breaking Strength,</u> <u>Coating Weight</u>
		<u>175</u>	<u>No. 12-1/2</u>	
	<u>A584</u>	<u>175</u>	<u>No. 12-1/2</u>	
	<u>M181</u>	<u>1, 2, 4</u>	<u>No. 9</u>	
	<u>A392</u>	<u>All</u>	<u>No. 9</u>	
	<u>A491</u>	<u>All</u>	<u>No. 9</u>	
<u>F668</u>	<u>All</u>	<u>No. 9</u>		
<u>Posts</u>	<u>A702</u>	<u>50</u>	<u>Carbon, Rail</u>	<u>Tensile or Hardness</u>
<u>Pipe, Tube</u>	<u>A53</u>	<u>A, B</u>	<u>E, F, S</u>	<u>Grade, Finish</u>
	<u>F1083</u>	<u>Schedule 40</u>	<u>High Strength</u>	<u>Schedule</u>
	<u>F1043</u>	<u>1C</u>	<u>All</u>	<u>Group, Coating,</u> <u>Type</u>
	<u>1A</u>	<u>High strength</u>		
<u>Beam</u>	<u>A36</u>	<u>36</u>	<u>All Shapes</u>	<u>Grade, Killed</u>
	<u>A572</u>	<u>42</u>		
	<u>A992</u>	<u>50</u>		
<u>Sheets</u>	<u>A1011</u>	<u>36, 45, 50</u>	<u>HSLAS, HSLAS-F,</u> <u>SS</u>	<u>Designation, Style</u>

~~962-8.8 Steel Pipe Piling: Provide seamless, or longitudinal or helical welded pipe conforming to the requirements of API 5L Grade L320, X46 or higher, or ASTM A252 Grade 3. Provide longitudinal or helical welded pipe with only complete joint penetration (CJP) welds conforming to the requirements of API 5L or AWS D1.1.~~

~~962-108.49 Steel Grates: Provide steel grating in accordance with this section and Table 962-14. When vaned gratings are specified, AASHTO HL-93 load testing may be substituted for tensile testing when specified in the contract documents. When Alternate G is specified, provide galvanizing in accordance with 962-11.1. Grade 50 steel per ASTM A242/A242 M, A572/A572 M or A588/A588 M for grates. Galvanize grates in accordance with 962-9 when “Alt. G” grates are specified in the Plans.~~

~~Use producers listed on the Department’s Production Facility Listing for galvanizing.~~

<u>Table 962-14</u> <u>Requirements for Steel Grating</u>				
<u>Product</u>	<u>Standard</u>	<u>Grade</u>	<u>Type/ Style</u>	<u>Reportable Properties</u>
<u>Steel Grating</u>	<u>A242</u>	<u>50</u>	<u>1</u>	<u>Composition, Tensile*, Killed</u>
	<u>A572</u>		<u>1, 2, 3, 5</u>	<u>Composition, Tensile*, Size, Killed</u>
	<u>A588</u>		<u>A, B, K</u>	<u>Composition, Tensile*, Fine Grain</u>
	<u>A1011</u>	<u>Any</u>	<u>SS, HSLAS, HSLAS-F</u>	<u>Designation, Style</u>

* AASHTO HL-93 may be substituted for tensile testing for vaned gratings when specified.

962-~~119~~ Galvanizing.

962-~~119~~.1 Plates, Structural Shapes, Bars, and Strip: When galvanizing is specified in the Contract Documents for ferrous metal products, ~~other than fasteners and hardware items,~~ provide galvanizing in accordance with the requirements of ASTM A123, ~~Specifications for Zinc (Hot Dip Galvanized) Coatings on Iron and Steel Products~~ Zinc composition shall meet “Intermediate Grade” in accordance with ASTM B6. Use galvanizers listed on the Department’s Production Facility Listing for hot-dip galvanizing.

<u>Table 962-15</u> <u>Requirements for Galvanizing Bath Composition</u>			
<u>Product</u>	<u>Zinc (Zn)</u>	<u>Lead (Pb)</u>	<u>Tin (Sn)</u>
<u>Galvanizing Bath</u>	<u>≥ 99.00%</u>	<u>≤ 0.50%</u>	<u>≤ 0.10%</u>

962-11.2 Castings: When Alternative G castings are specified in the contract documents, provide galvanizing in accordance with the requirements of ASTM A123. Zinc composition shall meet 962-11.1.

962-~~119~~.~~32~~ Fasteners and Hardware:

962-11.3.1 Fasteners and Hardware Designated Not High-Strength: When zinc coating is required in the ~~cContract dDocuments,~~ ~~fasteners and hardware items shall be galvanized~~ provide galvanizing of stell or malleable iron in accordance with the requirements of ASTM A153, ~~Specification for Zinc Coating (Hot Dip) on Iron and Steel Hardware, except for high strength fasteners as noted below:~~

- ~~1. Do not galvanize Grade A490 bolts.~~
- ~~2. Mechanically galvanize Grade A3125 Type 1 bolts in accordance with ASTM B695, Class 55.~~
- ~~3. For all anchor rods and hardware treat the coated rods, nuts and washers with chromate after coating in a water solution containing 0.2% sodium dichromate 3 ounces/10 gallons. Coat the bolt, nut and washer used in the fastener assembly by the same zinc process, and submit a test report on the zinc coating thickness.~~
- ~~4. For anchor rods fabricated from material having a yield strength greater than 80,000 psi, apply an electroplated zinc coating SC 3, Type II in accordance with ASTM B633.~~

~~962-9.3 Qualifications of Galvanizer: Use galvanizers listed on the Department's Production Facility Listing. Producers seeking inclusion shall meet the requirements of Section 105.~~

962-11.3.2 Fasteners and Hardware Designated as High-Strength: When zinc coating is required in the Contract Documents, provide galvanizing in accordance with Table 962-16. Coating of ASTM F3125, A490 bolts is prohibited. Bake all hot dipped or electroplated bolt, rod, or bar with a tensile strength greater than or equal to 150 ksi to remove any residual hydrogen.

Product	ASTM	Grade	Type/Style	Coating Finish
Bolts	F3125	A325	1	ASTM B695, Class 55 ASTM F2329
		A490	All	Do Not Galvanize
Anchor Rods	F3125	A325	1	ASTM B633 SC 3, Type II
		A490	All	Do Not Galvanize
Anchor Rods	F1554	105	All	ASTM B633 SC 3, Type II
Nuts	A563	A, C, D, C3, DH, DH3	Hex, Heavy Hex	ASTM B695 Class 55 ASTM F2329
	A194	1, 2	All	
Washers	F436	Circular, Beveled, Clipped, Extra Thick	1	
	F844	Round, Miscellaneous	A	
DTI Devices	F959	A325	1	

962-120 Certifications and Verification.

962-120.1 General: Provide certifications for steel directly from the Mill. Mill certifications shall show compliance to the specification and include the reportable properties and supplementary requirements from the applicable sections listed above.

When secondary processing, or testing has occurred, in addition to the mill certificate, provide a certified mill analysis signed by a quality control representative that show compliance with and the test results of the applicable sections listed above.

When material meeting "Buy America" is specified, the mill certification or certified mill analysis shall identify that the included material meets the Source of Supply-Steel requirements in Section 6. ~~Supply a certified mill analysis to the Engineer for all metal materials to be used in fabrication, including but not limited to plates, bars, shapes, and fasteners in accordance with their respective ASTM or AASHTO specification. Show or attach the full and complete designation of the project for which the materials are intended for use and specifically cross-identify each furnished piece to the order material.~~

~~Material meeting equivalent AASHTO and ASTM specifications may be supplied under either specification. Provide materials in accordance with the latest edition of the specifications shown below, as approved by the Engineer.~~

~~**962-10.2 Conformance:** The certified mill analysis will indicate that the material is in conformance with the applicable material specification and will include actual values from required tests. Check the certified mill analysis against the appropriate specification to ensure that materials conform to Contract Documents.~~

~~**962-10.3 Certified Mill Analysis Source:** The certified mill analysis must originate from the producer of the material and not from a supplier. Material from stock may only be accepted if it can be positively identified and the appropriate documentation is submitted.~~

~~962-11 Heat Treatments:~~

~~Provide procedures and perform heat treatments in accordance with Section 460.~~

STRUCTURAL STEEL AND MISCELLANEOUS METAL ITEMS (OTHER THAN ALUMINUM)

(REV 7-13-22)

SECTION 962 is deleted and the following substituted:

962-1 General.

This Section covers the material and fabrication requirements for structural steel and miscellaneous metal components. All steel must be melted and manufactured in the United States and meet Section 6-5.2. All overhead cantilevers, monotubes, trusses and gantries, iron castings, steel gratings, fencing, field splices filler metals, and bridge components (including steel castings, steel forgings, and bearing material) supplied under this Specification shall be from producers currently on the Department's Production Facility Listing. Producers seeking inclusion on the Department's Production Facility Listing must meet the requirements of Section 105. Provide certifications that meet the applicable section and 962-12.

962-2 Structural Steel.

962-2.1 Structural Steel Materials: Provide structural steel for bolted or welded construction that meets the requirements of Table 962-1.1 and 962-1.2 when impact testing is specified. Grade HPS 70W shall not be substituted for Grade HPS 50W. Weathering steel shall not be substituted for non-weathering steel without Engineer approval.

Do not apply heat treatment unless approved by the Engineer. When galvanizing is specified, provide galvanizing in accordance with 962-11.1.

Product	ASTM	Grade/Style	Reportable Properties	Supplementary Requirements
Plate	A709	36	Composition, Yield Strength,	None
		50		

		50S	Tensile Strength, Elongation, Killed	Carbon Equivalency
		50CR		Heat-treating temperatures
		50W	Composition, Yield Strength, Tensile Strength, Elongation, Killed, Fine Grain	Corrosion Resistance Index
		HPS 50W		Corrosion Resistance Index, Heat Treatment Temperatures
		HPS 70W		

962-2.2 Impact Requirements: Structural steel subject to tensile stress for main load-carrying members shall meet the impact requirements listed in Table 962-2. Mill test reports shall identify average impact test values. Provide certifications that meet this section and 962-12.

For non-fracture and fracture critical tension components, provide structural steel in accordance with ASTM A709.

Table 962-2 Requirements for Impact Testing Structural Steel					
Product	ASTM	Grade	Zone	Minimum Average Energy (ft*lbf)	
				Non-Fracture Critical	Fracture Critical
Structural Steel	A709	36	1	15 at 70°F	25 at 70°F
		50 50W 50S		15 at 70°F (≤ 2.0"t) 20 at 70°F (> 2.0"t)	25 at 70°F (≤ 2.0"t) 30 at 70°F (> 2.0"t)
		50CR		15 at 70°F	25 at 70°F
		HPS 50W		20 at 10°F (≤ 2.0"t) 25 at 50°F (> 2.0"t)	30 at 10°F (≤ 2.0"t) 35 at 50°F (> 2.0"t)
		HPS 70W		25 at -10°F	35 at -10°F
Structural Steel Tubing	A500	B, C, D		15 at 70°F	25 at 70°F
	A501	A, B			
	A847	Round, Square, Rectangle, Special			

Note: If yield ≥ 15 ksi above specified grade, test temperature must drop 15°F for each 10 ksi above grade.

962-3 Steel Castings.

Provide carbon steel and corrosion resistant castings in accordance with this section and Table 962-3.

962-3.1 Carbon Steel Castings: Perform heat treatments by annealing, normalizing, normalizing & tempering, or quenching & tempering after castings have been allowed to cool from the pouring temperature to below the transformation temperature range as regulated by the

use of pyrometers. Class 1 castings shall be used if post-weld heat treatment is specified in the contract documents.

962-3.2 Corrosion Resistant Steel Castings:

Perform heat treatments by air cooling and tempering; or annealing as defined in ASTM A743 Table 1.

Table 962-3 Requirements for Steel Castings					
Product	Standard	Grade	Class	Reportable Properties	Supplementary Requirements
Carbon Steel	ASTM A27	65-35, 70-36	1, 2	Composition, Tensile, Class	None
Corrosion Resistant Steel	ASTM A743	CA 15M	All	Composition, Heat Treatment	S11, S12
	AASHTO M 163				

962-4 Steel Forgings.

Provide carbon steel and alloy steel forgings from which pins, rollers, trunnions, shafts, gears, or other forged parts are fabricated in accordance with this section and Table 962-4.

The manufacturer may elect to choose from any of the class specific heat treatments identified in the Table 962-4, provided that the controlling cross-sectional thickness meets mechanical property test requirements. Retreatment by re-austenitizing a lot is allowed up to three times when the mechanical properties have not been met. Re-testing of the mechanical properties is required on any lot subject to retreatment.

Table 962-4 Requirements for Steel Forgings				
Product	Standard	Class	Reportable Properties	Supplementary Requirements
Steel Forgings	ASTM A668	C, D, F, G	Composition, Tensile, Yield, Elongation, Hardness	S7
	AASHTO M 102			

962-5 Iron Castings.

Provide iron castings that conform to the requirements of this section and Table 962-5. Use producers listed on the Department's Production Facility Listing for galvanizing.

962-5.1 Gray Iron Castings: Provide gray iron castings that conform to the requirements of this section and Table 962-4. AASHTO HL-93 load testing may be substituted for tensile testing when specified in the contract documents. When Alternative G castings are specified, provide a composition that precludes the possibility of embrittlement during the normal thermal cycle of hot-dip galvanizing.

962-5.2 Ductile Iron Castings: Perform full ferritizing anneal to remove carbides or stabilized pearlite. AASHTO HL-93 load testing may be substituted for tensile testing when specified in the contract documents.

962-5.3 Malleable Iron Castings: Perform heat treatments in the same production furnace and in the same cycles as the castings they represent. Produce a microstructure consisting of temper carbon nodules distributed through a ferritic matrix and free of excessive pearlite, massive carbides, and primary graphite. When critical sections of the production castings differ appreciably from that of the central portion, the time cycle for tempering may be altered from that of the production lot in order to obtain similar microstructures, or hardness, or both.

When Alternative G castings are specified, provide a composition that precludes the possibility of embrittlement during the normal thermal cycle of hot-dip galvanizing, or provide heat treatment that immunizes the casting against embrittlement during the normal thermal cycle of hot-dip galvanizing.

Product	Standard	Grade/Class	Reportable Properties	Supplementary Requirements
Gray Iron Traffic Service	AASHTO M 105 & AASHTO M 306	35B	Tensile*	None
Gray Iron Machinery	AASHTO M 105	30	Tensile	None
Ductile Iron	ASTM A536	60-40-18	Tensile*, Yield, Elongation, Heat Treatment	Additional Tensile test for castings > 1,000 lbs.
Malleable Iron	ASTM A47	30518 [24118]	Tensile, Yield, Elongation, Heat Treatment	None

*AASHTO HL-93 may be substituted for tensile testing of vaned gratings, when specified in the contract.

962-6 Bolts, Nuts and Washers Not Designated as High-Strength.

Provide bolts, nuts, and washers not designated as high strength meeting the requirements listed in this Section and Table 962-6. When galvanizing is specified in the contract documents, provide galvanizing in accordance with 962-11.3.1.

Use double nuts, when ordinary rough or machine bolts are specified in the Contract Documents. Bolted assemblies shall be made of similar coating composition. When weathering material is used, provide the entire assembly in weathering steel. Bolts meeting the requirements of ASTM A193, washers meeting the requirements of ASTM F844 and nuts meeting the requirements of ASTM A194 or AASHTO M292 may be used with the Engineer's approval.

Table 962-6 Bolts, Nuts, and Washers Not Designated as High-Strength				
Product	Standard	Grade	Style	Reportable Properties
Bolts	ASTM A307	A, B	Heavy Hex, Threaded Rod	Size, Composition, Hardness, Tensile
	ASTM A449	1, 3	Hex, Threaded Stud	Size, Composition, Tensile, Proof Load, Hardness
	ASTM F593	Group 2 316 or 316L	Condition A CW1 or SH1	Alloy, Group, Condition
	ASTM A193*	B7, B16	Any	Size, Composition, Hardness, Heat Treatment, Macroetch results
Nuts	ASTM A563	A	Hex	Size, Composition, Proof Load, Hardness
		C, C3, DH, DH3	Heavy Hex	
	ASTM F594	Group 2 316 or 316L	CW	Alloy, Group, Condition
	ASTM A194*	2, 2H	Hex, Heavy Hex	Composition, Hardness, Proof Load
	AASHTO M 292*	2, 2H	Hex, Heavy Hex	Size, Composition, Hardness, Heat Treatment, Macroetch results
Washers	ASTM F436	1, 3	Circular, Beveled, Clipped, Extra Thick	Size, Hardness
	N/A	316 or 316L	Any	Alloy, Size
	ASTM F844*	Plain	Round, Miscellaneous	Size
	ASTM A36	All	N/A	Killed, Thickness
Shims	ASTM A1011	Any	Any	None
	ASTM A109	Any	Any	None
	ASTM B36	Brass	Any	None

962-7 High-Strength Bolts, Nuts, Washers and Direct-Tension-Indicator (DTI) Devices.

Provide high-strength bolts, nuts, washers and DTI devices in accordance with this Section and Table 962-7. High-strength bolts shall have identifying marks meeting ASTM F3125 Table 2 and ASTM A563. High-strength bolted assemblies shall be made of similar coating composition. When galvanizing is specified in the contract documents, provide galvanizing in accordance with 962-11.3.2. Bolts meeting the requirements of ASTM F3125 Grade A490, washers meeting the requirements of ASTM F844, and nuts meeting the requirements of ASTM A194 or AASHTO M 292 may be used with the Engineer's approval.

Table 962-7 Requirements for High-Strength Steel Fastener Assemblies					
Products	Standard	Grade	Type/ Style	Reportable Properties	Supplementary Requirements
Bolts	ASTM F3125	A325	Heavy Hex	Size, Composition, Tensile, Proof Load, Hardness,	None
		A490*		Size, Composition, Tensile, Proof Load, Hardness, Magnetic Particle, Carburization/ Decarburization	
	ASTM A193	B7, B16	Any	Size, Composition, Hardness, Heat Treatment, Macroetch results	S5
Nuts	ASTM A563	DH, DH3	Heavy Hex	Size, Composition, Proof Load, Hardness	S1, S2 min. 89 HRB or 180 HB
	ASTM A194*	2H	Heavy Hex	Size, Composition, Hardness	Max HRC32
	AASHTO M 292*	2H	Heavy Hex	Size, Composition, Hardness, Heat Treatment, Macroetch results	Max HRC32
Washers	F436	Circular, Beveled, Clipped, Extra Thick	1, 3	Size, Hardness	None
	F844*	Round, Miscella neous	Plain	Size	None

Table 962-7 Requirements for High-Strength Steel Fastener Assemblies					
Products	Standard	Grade	Type/ Style	Reportable Properties	Supplementary Requirements
	ASTM A709	36, 50	Any	Yield, Tensile, Elongation, Killed	None
DTI Devices	F959	A325	1	Size, Composition, Compression Load, Hardness	None
			3	Size, Composition, Compression Load, Hardness, Corrosion Resistance Index	
*Requires Engineer Approval.					

962-8 Anchor Rods and Bridge Bearing Materials.

962-8.1 Bearing and Masonry Plate: Meet the requirements of Table 962-8. Masonry plates and bearings shall be welded in accordance with AASHTO/AWS D1.5 Bridge Welding Code. When galvanizing is specified meet the requirements of 962-11.1. Use producers listed on the Department’s Production Facility Listing for galvanizing.

Table 962-8 Requirements for Bearings and Masonry Plate					
Product	ASTM	Grade	Style	Reportable Properties	Supplementary Requirements
Plate	A709	50W	All	Yield, Tensile, Elongation, Killed, Fine Grain	Corrosion Resistance Index
Laminates	A240	316	Gage 16	Yield, Tensile, Elongation, Hardness	None
	A1011	36	HSLAS, Class 1	Designation, Style	None
	A36	All	All	Yield, Tensile, Elongation, Killed	None

962-8.2 Anchor Rods and Bearing Hardware: Provide anchor rods and other bearing hardware in accordance with this section and Table 962-9. All fastening components shall be made of similar composition. When galvanizing is specified in the contract documents, provide galvanizing in accordance with Section 962-11.3.1. Anchor rods meeting the requirements of ASTM A307, washers meeting the requirements of ASTM F844, and nuts meeting the requirements of ASTM A194 may be used with the Engineer’s approval.

Table 962-9 Requirements for Anchor Rods and Bearing Hardware					
Product	ASTM	Grade	Style	Reportable Properties	Supplementary Requirements
Bolts	F1554	36	Threaded Rod	Lot, Size, Tensile	None
		55		Lot, Size, Tensile, Carbon Equivalency	S1
		105		Lot, Size, Tensile, Carbon Equivalency	S3
	A307*	A, B	Threaded Rod	Size, Composition, Hardness, Tensile	S1
Nuts	A563	DH	Heavy Hex	Size, Composition, Proof Load, Hardness	None
	A194*	2H	Heavy Hex	Size, Composition, Hardness	None
Washers	F436	1, 3	Circular, Beveled, Clipped, Extra Thick	Size, Hardness	None
	F844*	Plain	Round, Miscellaneous	Size	None
Plate	A36	All	All	Yield, Tensile, Elongation, Killed	None
Shim	A653	All	Min. G30	Grade	None
	A1008 A36	All	A153, F2329	None	None

*Requires Engineers Approval.

962-9 Overhead Signs.

Provide overhead sign materials in accordance with this section Table 962-2, and Table 962-10. When galvanizing is specified, meet the requirements of 962-11.1. Produce welds using E7018 electrode, in accordance with AWS D1.1 Structural welding Code.

Table 962-10 Requirements for Overhead Signs					
Product	Standard	Grade	Type/ Style	Reportable Properties	Supplementary Requirements
Upright Pipe	API 5L	X42R, X42N, X42M, X46N, X46M, X52N, X52M,	PSL2	Killed, Fine Grain, Tensile, CVN Test	N/A

Table 962-10 Requirements for Overhead Signs					
Product	Standard	Grade	Type/ Style	Reportable Properties	Supplementary Requirements
		X56N, X56M, X60N, X60M, X65M, X70M			
	A500	B, C	Round Structural	Composition, Yield, Tensile, Elongation	UT Seam Weld, (per API 5L) CVN Test per 962-2
Chords	A500	B, C	Round Structural	Composition, Yield, Tensile, Elongation	N/A
Plate, Angles & Handhole Frame	A709	50	Plates & Shapes	Composition, Yield, Tensile, Elongation	N/A
	A36	36			Yield > 50ksi
Poles	A1011	50, 55, 60, 65	Any	Designation, Grade	N/A
	A572	50, 55, 60, 65	1, 2, 3, 5	Composition, Tensile, Type, Killed	N/A
	A595	A, B	Any	Composition, Tensile, Type, Killed	N/A

962-10 Miscellaneous Metal Items.

962-10.1 General: Unless otherwise specified in the contract documents, provide miscellaneous metal components in accordance with this section and Table 962-11, Table 962-12, Table 962-13, or Table 962-14. Structural tubing subject to tensile stresses, as defined in Section 460, shall meet Table 962-2.2 for tension components, Zone 1. Welding shall be done in accordance with the most current AWS D1.1 structural welding code. When galvanizing is specified in the contract documents, provide galvanizing in accordance with the contract documents.

Requirements for concrete reinforcement are contained in Section 931.

Requirements for steel guardrail are contained in Section 967.

Table 962-11 Requirements for Miscellaneous Metals				
Product	Standard	Grade	Type/ Style	Reportable Properties
Steel Sheet Piling	A328	All	Cold Rolled, Heat Treated	Composition, Tensile, Killed

Table 962-11 Requirements for Miscellaneous Metals				
Product	Standard	Grade	Type/ Style	Reportable Properties
	A572	42, 50, 55, 60, 65	1, 2, 3, 5	Composition, Tensile, Size, Killed
	A690	All	All	Composition, Tensile, Killed
Steel Pipe Piling	A252	3	All	Composition, Tensile, Size
	API 5L	X46, X52, X56, X60, X65, X70	PSL1	Tensile
			PSL2	Killed, Fine Grain, Tensile
Structural Tubing	A500	Round	B, C	Composition, Tensile, Flattening Test, Impact (Zone 1), Size
		Shaped		Composition, Tensile, Impact (Zone 1), Size
	A501	Square, Round, Rectangular, Special	A, B	Composition, Tensile, Impact (Zone 1), Size
	A847	Round	Welded, Seamless	Composition, Tensile, Flattening, Impact (Zone 1), Size
		Square, Rectangle, Special	Welded, Seamless	Composition, Tensile, Impact (Zone 1), Size
	Pipe Railing	A53	A, B	E, S

962-10.2 Field Splice Filler Materials: Provide field splice filler materials in accordance with the contract documents. If unspecified and less than 3/16 inches thick filler splice materials in accordance with this section and Table 962-12. Filler plates may also meet the appropriate grades specified in 962-2. When galvanized plate is specified, use producers listed on the Department’s Production Facility Listing for galvanizing.

Table 962-12 Requirements for Field Splice Filler Materials				
Product	Standard	Grade	Type/ Style	Reportable Properties
Filler Sheet	A1011	50	HSLAS, Class 1	Designation, Grade

962-10.3 Fencing Material: Provide fencing materials in accordance with this section and Table 962-13. When galvanizing is specified, provide galvanizing in accordance with the contract documents. Use producers listed on the Department’s Production Facility Listing for Coated Steel Fencing.

Table 962-13 Material Requirements for Fencing				
Product	Standard	Grade / Type	Style	Reportable Properties
Fabric	A116	60	No. 9	Breaking Strength, Coating Weight
		175	No. 12-1/2	
	A584	175	No. 12-1/2	
	M181	1, 2, 4	No. 9	
	A392	All	No. 9	
	A491	All	No. 9	
	F668	All	No. 9	
Posts	A702	50	Carbon, Rail	Tensile or Hardness
Pipe, Tube	A53	A, B	E, F, S	Grade, Finish
	F1083	Schedule 40	High Strength	Schedule
	F1043	1C	All	Group, Coating, Type
		1A	High strength	
Beam	A36	36	All Shapes	Grade, Killed
	A572	42		
	A992	50		
Sheets	A1011	36, 45, 50	HSLAS, HSLAS-F, SS	Designation, Style

962-10.4 Steel Grates: Provide steel grating in accordance with this section and Table 962-14. When vaned gratings are specified, AASHTO HL-93 load testing may be substituted for tensile testing when specified in the contract documents. When Alternate G is specified, provide galvanizing in accordance with 962-11.1.

Use producers listed on the Department's Production Facility Listing for galvanizing.

Table 962-14 Requirements for Steel Grating				
Product	Standard	Grade	Type/ Style	Reportable Properties
Steel Grating	A242	50	1	Composition, Tensile*, Killed
	A572		1, 2, 3, 5	Composition, Tensile*, Size, Killed
	A588		A, B, K	Composition, Tensile*, Fine Grain
	A1011	Any	SS, HSLAS, HSLAS-F	Designation, Style

* AASHTO HL-93 may be substituted for tensile testing for vaned gratings when specified.

962-11 Galvanizing.

962-11.1 Plates, Structural Shapes, Bars, and Strip: When galvanizing is specified in the Contract Documents for ferrous metal products, provide galvanizing in accordance with the requirements of ASTM A123, Zinc composition shall meet “Intermediate Grade” in accordance with ASTM B6. Use galvanizers listed on the Department’s Production Facility Listing for hot-dip galvanizing.

Table 962-15 Requirements for Galvanizing Bath Composition			
Product	Zinc (Zn)	Lead (Pb)	Tin (Sn)
Galvanizing Bath	≥ 99.00%	≤ 0.50%	≤ 0.10%

962-11.2 Castings: When Alternative G castings are specified in the contract documents, provide galvanizing in accordance with the requirements of ASTM A123. Zinc composition shall meet 962-11.1.

962-11.3 Fasteners and Hardware:

962-11.3.1 Fasteners and Hardware Designated Not High-Strength: When zinc coating is required in the contract documents provide galvanizing of steel or malleable iron in accordance with the requirements of ASTM A153.

962-11.3.2 Fasteners and Hardware Designated as High-Strength: When zinc coating is required in the Contract Documents, provide galvanizing in accordance with Table 962-16. Coating of ASTM F3125, A490 bolts is prohibited. Bake all hot dipped or electroplated bolt, rod, or bar with a tensile strength greater than or equal to 150 ksi to remove any residual hydrogen.

Table 962-16 Coating Requirements for Fastener and Hardware Designated as High-Strength				
Product	ASTM	Grade	Type/Style	Coating Finish
Bolts	F3125	A325	1	ASTM B695, Class 55 ASTM F2329
		A490	All	Do Not Galvanize
Anchor Rods	F3125	A325	1	ASTM B633 SC 3, Type II
		A490	All	Do Not Galvanize
Anchor Rods	F1554	105	All	ASTM B633 SC 3, Type II
Nuts	A563	A, C, D, C3, DH, DH3	Hex, Heavy Hex	ASTM B695 Class 55 ASTM F2329
	A194	1, 2	All	
Washers	F436	Circular, Beveled, Clipped, Extra Thick	1	
	F844	Round, Miscellaneous	A	
DTI Devices	F959	A325	1	

962-12 Certifications and Verification.

962-12.1 General: Provide certifications for steel directly from the Mill. Mill certifications shall show compliance to the specification and include the reportable properties and supplementary requirements from the applicable sections listed above.

When secondary processing, or testing has occurred, in addition to the mill certificate, provide a certified mill analysis signed by a quality control representative that show compliance with and the test results of the applicable sections listed above.

When material meeting “Buy America” is specified, the mill certification or certified mill analysis shall identify that the included material meets the Source of Supply-Steel requirements in Section 6.