

(12-31-16) (4-11-17) (1-18) includes 9620101, 9620902

**SECTION 962**  
**STRUCTURAL STEEL AND MISCELLANEOUS**  
**METAL ITEMS (OTHER THAN ALUMINUM)**

**962-1 Structural Steel.**

**962-1.1 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. If the grade is not shown ~~in~~ 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:

Table 962-2.1 – Structural Steel Materials			
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, <u>B</u>	50 min	70 min
HPS 70W	P, <u>B</u>	70 min	85-110
<u>HPS100W</u> <del>{690}</del> (to 2-1/2 in or less) (over 2-1/2 in)	P, <u>B</u>	100 min <del>90 min</del>	<u>110-130 min</u> <del>130 min</del>
<u>HPS100W</u> <del>{690W}</del> (to 2-1/2 in) (over 2-1/2 in)	P, <u>B</u>	<del>100 min</del> 90 min	<del>130 min</del> <u>100-130 min</u>

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

**962-1.2 Testing:** 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, provide structural steel in accordance with ASTM A709 requirements for non-fracture and fracture critical tension components as directed by the Engineer.

**962-2 Steel Castings.**

**962-2.1 Carbon Steel Castings:** 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.

**962-2.2 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.

**962-3 Steel Forgings.**

Provide steel forgings from which pins, rollers, trunnions, shafts, gears, or other forged parts are fabricated that conform to ASTM A668. Unless otherwise specified in the Contract Documents, all forgings are to be Class C, D, F, or G.

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## **962-4 Iron Castings.**

**962-4.1 Gray Iron Castings:** Provide gray iron castings that conform to the requirements of ASTM A48. Unless otherwise specified in the Contract Documents, provide gratings, manhole covers and frames to Class 35B and machinery parts to Class 30. For manholes constructed within the area of vehicular traffic, the frames and gratings shall be machine ground so the irregularity of contact will be minimized and the grates will be rattle-proof.

**962-4.2 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.

**962-4.3 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.

## **962-5 Bolts, Nuts and Washers Not Designated as High-Strength.**

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.

## **962-6 High-Strength Bolts, Nuts, Washers and Direct-Tension-Indicator (DTI) Devices.**

Use high strength bolts, nuts, washers and DTI devices meeting the following requirements:

Bolts: [ASTM Grade A325](#) or [Grade A-490](#), Heavy Hex. Only use [ASTM Grade A490](#) high strength bolts with the approval of the Engineer.

Nuts: ASTM A-563, Heavy Hex. Select nuts in accordance with ASTM [A325 F3125](#) ([Subsection 3.2 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 [A325 F3125](#) ([Subsection 3.3 Table 1](#)). Use washers meeting the requirements of ASTM F844 only when approved by the Engineer.

Identifying Marks: in accordance with ASTM [A325 F3125 \(Table 1\)](#); [ASTM A490](#) 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).

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

**962-7 Anchor Rods and Bridge Bearing Materials.**

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.

**962-8 Miscellaneous Metal Items.**

Unless otherwise specified in the Contract Documents, provide the following specific materials.

**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.

**962-8.7 Field Splice Filler Materials:** Provide field splice filler materials in accordance with the Contract Documents. If unspecified and less than 3/16 inches thick provide ASTM A606 or ASTM A1011.

**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.

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## **962-9 Galvanizing.**

**962-9.1 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.

**962-9.2 Fasteners and Hardware:** When zinc coating is required in the Contract Documents, fasteners and hardware items shall be galvanized 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 [ASTM Grade](#) A490 bolts.
2. Mechanically galvanize [ASTM Grade](#) A3125 Type 1 bolts in accordance with ASTM B695, Class 505.
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.

## **962-10 Certifications and Verification.**

**962-10.1 General:** 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.

**962-10.4 Verification Samples:** Provide verification samples in accordance with Section 6.

## **962-11 Heat Treatments.**

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