Section 4153. Miscellaneous Iron and Steel

4153.01 STEEL FORGINGS.

A. Meet the requirements of ASTM A 688/A 688M, Class C for forgings, from which pins, rollers, trunnions, or other forged parts 7 inches (175 mm) or more in diameter are made. Forgings of this class may also be used for production of pins and rollers smaller than 7 inches (175 mm) in diameter.

B. For forgings intended for welding, limit the maximum carbon content (product analysis) to 0.35%.

4153.02 COLD FINISHED STEEL.

A. Pins and rollers less than 7 inches (175 mm) in diameter may be made from cold finished steel meeting requirements of ASTM A 108, Grades 1016 to 1030 inclusive, with the additional requirement of Rockwell Hardness not less than B-80.

B. Steels which show Rockwell Hardness less than B-80 may be accepted provided they show an ultimate tensile strength not less than 66,000 psi (455 MPa) and a yield point no less than 33,000 psi (230 MPa).

4153.03 STEEL CASTINGS.

Meet the requirements of ASTM A 27/A 27M, Grade 65-35 (450-240), supplemented by the following provisions:

A. Quality of Work.
True to pattern in form and dimension, free from pouring faults, sponginess, cracks, blow holes, and other defects in positions affecting their strength and value for the service intended.

B. Blow Holes.
No blow holes exceeding 1/2 square inch (320 mm^2) in area or 1 inch (25 mm) in length. Total length of cavity cut by a straight line laid in any direction not to exceed 1 inch in 1 foot (25 mm in 300 mm).

C. Defects.
If the Engineer requires, suspend large castings and hammer all over. Ensure no cracks, flaws, or other defects appear after such treatment.

D. Unfilleted Corners.
No unfilleted angles or corners.

4153.04 IRON CASTINGS.

A. Either gray iron castings meeting requirements of ASTM A 48 or ductile (nodular) iron castings meeting requirements of ASTM A 536, as specified in the contract documents. Unless specified otherwise, comply with the following:
- Gray iron castings, bridge rockers, and shoes: meet the requirements of Class 35B.
- Ductile iron castings: meet the requirements of Grade 65-45-12.

B. Ensure castings are:
- Boldly filleted at angles, and arises are sharp and perfect.
- True to pattern in form and dimensions.
- Free from pouring faults, sponginess, cracks, blow holes, or other defects in positions affecting their strength for service intended.

C. With the Engineer's approval, minor defects may be welded by an approved process if:
- The depth is not greater than 5% of the thickness at the point of occurrence,
- The length is not greater than 25% of the thickness at the point of occurrence, and
- The defects do not impair the strength.

D. Castings which have been welded without the Engineer's permission may be rejected. Ensure frames and grates for drainage openings are straight and fit properly together so traffic will not cause them to rattle. Rough spots which prevent suitable fitting may be removed by grinding.

4153.05 WELDED STEEL PIPE.
Unless specified otherwise, standard weight black pipe meeting requirements of ASTM A 53, Grade B.

4153.06 BOLTS, NUTS, WASHERS AND FASTENERS.
Ensure bolts, nuts, and washers for bolted connections of steel structures comply with the type specified in the contract documents and meet the following requirements for the type designated:

A. Non-High Strength Bolts and Nuts.
Ensure the following:

1. Bolts and nuts meet the requirements of ASTM A 307, Class A, with full diameter body. Hexagonal bolt heads and nuts.

2. Threads meet the requirements of ANSI B1.1, Unified Coarse Thread Series, Class 1A and Class 1B fit.

3. Where galvanized fasteners are specified, zinc is applied by hot dipped galvanizing to meet the requirements of ASTM A 153. Fasteners may be mechanically galvanized to meet the requirements of ASTM B 695, Class 50 Type 1.

B. High Strength Fasteners.

1. Ensure the following:
a. High strength bolts, nuts, and washers meet the requirements of the appropriate ASTM Specifications as follows:

bolts	A 325
nuts	A 563 Grade DH3
washers	F 436

b. For galvanized high strength fasteners, the fasteners meet the requirements of ASTM B 695, Class 50 Type I.
c. For weathering steel, bolts are ASTM A 325 Type III, nuts are ASTM A 563 Grade DH3, and washers are ASTM F 436 Type III.

2. Furnish all high strength bolts, nuts and washers according to this specification, which includes:
- The appropriate ASTM Specifications,
- In certain instances, modifications of the requirements of ASTM Specifications, and
- In certain instances, additional requirements in excess of the ASTM Specification.

3. **NOTE:** ASTM A 490 bolts are specifically excluded from this specification.

4. The applicable ASTM test method specifications are as follows:
a. General.
1) ASTM F 606, Standard Test Methods for Determining the Mechanical Properties of Externally and Internally Threaded Fasteners, Washers and Rivets.
2) ASTM A 370, Standard Methods and Definitions of Mechanical Testing of Steel Products.
3) Article 7.2 of ASTM A 325 is changed to read as follows:
"Threads shall be the Unified Coarse Thread Series as specified in ANSI/ASME B1.1 and shall have Class 2A tolerances."
b. Specifications for Nuts.
1) ASTM A 563, Carbon and Alloy Steel Nuts.
2) Proof load tests (ASTM F 606 Paragraph 4.2) are required. Galvanizing, if required, completed prior to proof load testing. Minimum frequency of tests according to ASTM A 563 Paragraph 9.3.
c. Specifications for Bolts.
1) ASTM A 325, High Strength Bolts for Structural Steel Joints.

2) Proof load tests (ASTM F 606, Method 1), are required. Galvanizing, if required, completed prior to proof load testing. The minimum frequency of tests according to ASTM A 325 Paragraph 9.5.1.

3) In determining bolt length, calculate the grip as for a riveted joint. To compensate for thickness of the nut, one washer, and the bolt point, add the values shown under bolt size in Table 4153.06-1. If other than the preferred thickness of washer is used, adjust the necessary length to the next longer 1/4 inch (6 mm) increment.

Table 4153.06-1: Add to Grip

Bolt Size inches (mm)	1/2 (12.7)	5/8 (15.9)	3/4 (19.0)	7/8 (22.2)	1 (25.4)	1 1/8 (28.6)	1 1/4 (31.8)
Add to Grip inches (mm)	15/16 (24)	1 1/16 (27)	1 3/16 (30)	1 5/16 (33)	1 7/16 (36)	1 9/16 (40)	1 11/16 (43)

d. Specifications for Washers.

ASTM F 436, Specifications for Hardened Steel Washers.

e. Rotational-Capacity Certification Requirements.

The supplier's Rotational-Capacity Certification requirements are as follows:

1) Ensure the supplier subjects the fastener assembly (bolt, nut, and washer) to rotational-capacity tests prior to shipment to ensure compatibility of the fastener assembly, according to Materials I.M. 453.06B.

2) Ensure each combination of production lots (bolt, nut, and washer) has a unique Rotational-Capacity Lot number. Ensure this number is included on the certified test report and the shipping containers for bolts, nuts, and washers.

f. High Strength Fasteners.

Ensure high strength fasteners are manufactured to the following requirements:

1) **Bolts.**

a) Ensure bolts of diameters 1/2 inch to 1 inch (12.7 mm to 25.4 mm), inclusive, meet the following hardness requirements:

Table 4153.06-2: Hardness Number

	Minimum	**Maximum**
Brinell	248	311
Rockwell C	24	33

b) Black bolts shall be "oily" to the touch when installed. Clean and re-lubricate dry or rusted bolts prior to installation.

2) **Nuts.**

a) Grades 2H, DH, or DH3 and shall be "oily" to the touch when installed. Clean and re-lubricate dry or rusted nuts prior to installation.

b) Galvanized nuts: clean, dry, and lubricated as per ASTM A 563 Supplementary Requirements S1 and S2.

3) **Markings.**

a) Ensure bolts, nuts, and washers are marked with a symbol identifying the manufacturer as required by ASTM specifications.

b) Ensure the supplier includes with the certification documents the symbol and address of each manufacturer of bolts, nuts, and washers supplied for the project.

5. Unless specified otherwise, install all high strength bolts according to Article 2408.03, S, 5.

4153.07 HARDWARE FOR TIMBER STRUCTURES.

A. Bolts and Nuts.

1. Ensure all bolts used with timber structures have a full diameter body.

2. Ensure bolts and nuts meet the requirements of ASTM A 307, Grade A.

3. Bolt heads and nuts may be either square, hexagonal, or heavy hexagonal style. Ensure they meet the requirements of ASTM A 307 and ASTM A 563.

B. Washers.

1. Washers may be cast iron, malleable iron, or mild steel.

2. Flange bolts and flange nuts may be used in place of separate washers.

3. Ensure cast iron washers, flange bolts, and flange nuts have a diameter no less than 3.5 times the diameter of the bolt with which they are used.

4. Ensure Type A plain washers, before galvanizing, comply with the dimensions in ANSI B18.22.1.

C. Galvanizing.
Ensure all bolts, nuts, and washers are zinc coated to meet the requirements of ASTM A 153, Class D.

D. Nails.

1. Use round or oval galvanized wire nails meeting the requirements of FSS FF-N-105(2) and of the size designated.

2. Obtain the Engineer's approval for double pointed nails.

3. Ensure all nails holding floor plank, backing plank, or sway bracing are ring shanked prior to galvanizing.

4. Ensure the galvanized coating meets the requirements of ASTM A 153, Class D.

E. Lag Bolts.
Use lag bolts meeting the requirements of ANSI B18.2.1, galvanized according to ASTM A 153, Class D.

F. Floor Clips.
Use floor clips shown in the contract documents. When not shown, ensure they are galvanized metal, no thinner than 10 gage (3.4 mm), shaped to fit the flanges.