

Kiewit Infrastructure West Co.
Klamath River Renewal Project
Technical Specifications

05 12 00 STRUCTURAL STEEL

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REVISION INDEX

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SECTION 05 12 00 – STRUCTURAL STEEL

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section applies to the supply, fabrication and installation of structural steel items including but not limited to the following:
 - 1. Fabrication and installation of structural steel items including miscellaneous metalwork.
 - 2. Fabrication and installation of steel pipe for water conveyance including miter bends, reducers, manholes, ring-girders, ring-girder bases, seepage rings or puddle flanges, stiffener rings, thrust collars and grout holes.
 - 3. Fabrication and erection of steel tunnel lining.

1.2 RELATED SECTION

- A. 31 71 00 – Tunnel Construction

1.3 REFERENCE STANDARDS

- A. American Institute of Steel Construction, Inc. (AISC):
 - 1. AISC 303 – Code of Standard Practice for Steel Buildings and Bridges.
 - 2. AISC 325 – Steel Construction Manual.
 - 3. AISC 326 – Detailing for Steel Construction.
- B. American Welding Society (AWS):
 - 1. AWS A2.4 – Standard Symbols for Welding, Brazing, and Non-destructive Examination.
 - 2. AWS D1.1 – Structural Welding Code - Steel.
 - 3. AWS B2.1 Standard for Welding Procedure and Performance Qualifications Welding Handbook.
- C. ASTM International (ASTM):
 - 1. ASTM A36 – Standard Specification for Carbon Structural Steel.

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2. ASTM A123 – Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
 3. ASTM A563 – Standard Specification for Carbon and Alloy Steel Nuts.
 4. ASTM F436 – Standard Specification for Hardened Steel Washers Inch and Metric Dimensions.
 5. ASTM F3125 – Standard Specification for High Strength Structural Bolts and Assemblies, Steel and Alloy Steel, Heat Treated, Inch Dimensions 120 ksi and 150 ksi Minimum Tensile Strength, and Metric Dimensions 830 MPa and 1,040 MPa Minimum Tensile Strength.
- D. American Society of Mechanical Engineers (ASME) - Boiler and Pressure Vessel Code (BPVC):
1. Section VIII - Rules for Construction of Pressure Vessels, Division 1.
 2. Section IX - Welding, Brazing, and Fusing Qualifications.
- E. American Water Works Association (AWWA):
1. AWWA C206 - Field Welding of Steel Water Pipe.
 2. AWWA C207 - Steel Pipe Flanges for Waterworks Service—Sizes 4 In. Through 144 In.
 3. AWWA C208 - Dimensions for Fabricated Steel Water Pipe Fittings.
- F. Steel Structures Painting Council (SSPC):
1. SSPC-SP-6 – Surface Preparation Standards.

1.4 SUBMITTALS

- A. Items listed in this section are to be submitted to the Engineer for information prior to the start of any Works, unless noted otherwise.
- B. Identify structural steel by specification, type and grade and heat number. Submit for review and approval mill analysis certificates for each heat number indicating the following:
1. Chemical and physical properties of steel used in this work.
- C. Submit for review and approval shop drawings: in accordance with AISC 303, AISC 325, AISC 326, AWS A2.4 showing sections and profiles designation, sizes, connection attachments, reinforcing, anchorage, size and type of fasteners, and accessories. Include erection drawings, elevations, and details where applicable. Indicate welded connections using standard AWS A2.4 welding symbols. Indicate net weld lengths.

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- D. All welds and associated Welding Procedure Specification (WPS) and procedure qualification record, in accordance with AWS D1.1 and B2.1 or ASME Section IX if applicable.
- E. Welders Certificates: Certify welders employed on the Work, verifying AWS qualification within previous 12 months.
- F. Delegated Design Submittals: Submit signed and sealed Shop Drawings with design calculations and assumptions.
- G. The steel fabricator and/or installation contractor shall have a quality control system. This system must include a written description and checklist explaining in detail the quality-controlled manufacturing process. The written description (quality control manual) must explain the company's organized and systematic way of specifying traceable procedures involving each level of design, material, fabrication, testing, and inspection.

1.5 QUALITY

- A. Provide workmanship, fabrication, assembly, erection, inspection, quality control, and testing in accordance with AISC 303.
- B. Structural weld seams shall conform to AISC 360.
- C. All shop and field welding to be carried out by AWS or ASME qualified welders, as appropriate for the work. The welder shall be employed by the steel fabricator, erection firm and/or installation contractor certified as specified above.
- D. Steel Fabricator's Quality Control: Arrange for the inspection and testing of welds by a qualified welding engineer, welding inspector or testing agency approved by the Engineer. The weld test records shall be kept in an orderly and traceable manner.
- E. Shop and field testing: The following testing schedule will apply for general structural steel fabrication and erection:
 - 1. All welds performed in both shop and field are to be 100% visually inspected.
- F. Water conveyance fabrication and erection:
 - 1. Manufacture steel pipe to meet the requirements of the applicable pipe specification or standard. Weld seams not specified by the pipe fabrication standard including field weld seams shall comply with the requirement of AWS or ASME.

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2. Design weld seams for 100% complete penetration except where noted otherwise.
 3. 100% of fillet welds for bell and spigot joints shall be examined by a non-destructive testing method (ultrasonic or magnetic flux).
 4. 50 % of all fillet welds located in areas other than bell and spigot joints shall be examined by a Non-destructive testing method (magnetic flux or dye penetration). If defects are found, 100% of that joint and the repairs to it shall be retested.
 5. 100% of full penetration welds shall be ultrasonically or radiographically tested.
- G. Defective work will be rejected and repaired or replaced at the direction of the Engineer. All defective work and repairs shall be documented in an orderly and traceable manner with explanations as to the cause of the defect and the methods used for repair.
- H. The Engineer may to carry out random tests and inspections of the work independently and in addition to the steel fabricator's quality control procedures and may designate an independent testing authority.

1.6 SHOP INSPECTION

- A. Shop inspection may be conducted to review fabrication work for general conformance with contract documents, workmanship and to establish the standard of quality for the fabrication of the steel work. Such review will not relieve the steel fabricator of his responsibility for general and detail dimensions, correct fit, good workmanship, integrity of welds and any errors or omissions.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Product Requirements: Requirements for transporting, handling, storing, and protecting products.
- B. Inspection: Accept metal fabrications on-site in labeled shipments. Inspect for damage.
- C. Protect metal fabrications from damage by exposure to weather or by ground contact.

PART 2 - PRODUCTS

2.1 STRUCTURAL STEEL

- A. Structural steel shapes: ASTM A992.

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- B. Other carbon structural steel: to ASTM A36, minimum yield strength is 36 ksi, unless indicated otherwise.
- C. Hollow structural section (HSS): ASTM A500 Grade B.
- D. Steel pipe: ASTM A53 Grade B or ASTM A139 Grade B.

2.2 BOLTS, NUTS AND WASHERS

- A. Bolts: to ASTM F3125, Grade A325 plain / hot-dip galvanized as noted on drawings.
- B. Nuts: to ASTM A563 Class 8S / 10S (carbon steel), plain / hot-dip galvanized as noted on drawings.
- C. Washers: to ASTM F436 Type 1 (carbon steel), plain / hot-dip galvanized as noted on drawings.
- D. Anchor Bolts/Anchor Rods: to ASTM A307 Grade C (A36) or hot rolled threadbar to ASTM A615 as shown on the drawings.

2.3 WELDING MATERIALS

- A. Welding materials: AWS D1.1. Minimum weld size: 3/16 inches unless noted otherwise.

2.4 GALVANIZING

- A. Carbon steel items indicated on the Drawings as permanent to be hot-dipped galvanized in accordance with ASTM A123, unless noted on the Drawings.

PART 3 - EXECUTION

3.1 FABRICATION

- A. In accordance with AISC 325.
- B. Fabricate items with joints tightly fitted and secured.
- C. Continuously seal joined members by continuous welds, unless indicated otherwise.

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- D. Grind exposed joints flush and smooth with adjacent finish surface. Make exposed joints butt tight, flush, and hairline. Ease exposed edges to small, uniform radius.
- E. Water Conveyance fabrication (Pipe, Bends, Reducers):
 - 1. Manufacture to the applicable pipe specification or ASME BPVC Section VIII.
 - 2. Welding processes are restricted to shielded metal arc (SMAW), flux cored arc (FCAW), submerged arc (SAW), gas metal arc (GMAW) and gas tungsten arc (GTAW). Welding procedures must be qualified to the standards used for manufacturing, conforming to the Drawings and Specifications, and approved by the Engineer prior to fabrication.
 - 3. Prepare plate edges for welding procedure chosen. Visually examine plate edges for signs of delamination, shearing cracks and other imperfections. Remove defects prior to fabricating pipe.
 - 4. Mandatory minimum pre-heating temperature is 50 °F.
 - 5. Field end joints: bevelled ends for field butt welding or flanged where shown on the Drawings.
 - 6. Lap joints shall not be used unless shown on Drawings.
 - 7. Weld reinforcement on the surfaces of the penstock shall be ground to a smooth contour not exceeding 1/8 inch in height and shall blend smoothly into the plate surface except as shown on the Drawings.
 - 8. Welding of joints shall be balanced about the weld axis to minimize distortion. Manual circumferential welds shall be carried out in a manner that maximizes downhand welding.
- F. Galvanizing:
 - 1. All carbon steel shall be hot dipped galvanized per ASTM A123 unless noted otherwise.
 - 2. Clean structural steel in accordance with SSPC-SP-6 prior to galvanizing.
 - 3. Metallic coating designations:
 - a. Exterior steelwork left uncoated: 3.9 mils.
 - b. Other galvanized steelwork: 3.3 mils.
 - 4. Size bolt holes to accommodate galvanizing.

3.2 INSTALLATION

- A. Erection of structural steel in accordance with AISC 325.
- B. Clean and strip primed steel items to bare metal where Site welding is required.
- C. Install items plumb and level, accurately fitted, and free from distortion or defects.

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- D. Make provisions for erection stresses. Install temporary bracing to maintain alignment until permanent bracing and attachments are installed.
- E. Field-weld components indicated on Drawings.
- F. Perform field welding according to AWS D1.1.
- G. Obtain approval prior to Site cutting or making adjustments not scheduled.
- H. Where welded connections are made between galvanized elements, grind off galvanizing 2 in each side of joint prior to welding. On same day following welding touch up galvanizing with colour matching zinc-rich paint.

3.3 TOLERANCES

- A. Fabrication Tolerance:
 - 1. Squareness: 1/8-inch maximum difference in diagonal measurements.
 - 2. Maximum Offset between Faces: 1/16 inch.
 - 3. Maximum Misalignment of Adjacent Members: 1/16 inch.
 - 4. Maximum Bow: 1/8 inch in 48 inches.
 - 5. Maximum Deviation from Plane: 1/16 inch in 48 inches.
- B. Water Conveyance items (Pipe, Bends, Reducers) Fabrication Tolerances:
 - 1. Pipe manufacturing tolerances to meet the requirements of the applicable pipe specification or standard.
 - 2. Fabrication to meet the requirements of the applicable dimensional tolerances, including but not limited to AWWA C207 and C208.

3.4 SHOP AND FIELD QUALITY CONTROL

- A. Replace damaged or improperly functioning hardware.
- B. After erection, touch up welds, abrasions, and damaged finishes with prime paint or galvanizing repair paint to match shop finishes.
- C. Touch up factory-applied finishes according to manufacturer-recommended procedures.

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3.5 PROTECTION AND CLEANUP

- A. At completion and during progress of the Work maintain premises in a neat and orderly manner. Dispose of rubbish, construction debris and surplus materials at least on a weekly basis.
- B. Cover and protect the work from damage by Work of other sections or other contractors.
- C. Protect the Work of other sections from damage resulting from the work of this section.

END OF SECTION 05 12 00