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Oakhurst Dairy – New Milk Cooler**SECTION 05120 - STRUCTURAL STEEL****PART 1 - GENERAL****1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

**1.2 SUMMARY**

- A. This Section includes structural steel and grout.
- B. Related Sections include the following:
  - 1. Division 1 Section "Quality Requirements" for independent testing agency procedures and administrative requirements.
  - 2. Division 5 Section "Metal Fabrications" for steel lintels, shelf angles, or loose steel bearing plates not attached to structural-steel frame and other metal items not defined as structural steel.

**1.3 PERFORMANCE REQUIREMENTS**

- A. Connections: Provide details of simple shear connections required by the Contract Documents to be selected or completed by structural-steel fabricator to withstand ASD-service loads indicated and comply with other information and restrictions indicated.
  - 1. Select and complete connections using schematic details indicated and AISC's "Manual of Steel Construction, Allowable Stress Design," Part 4.
  - 2. Where beam reactions are not specified in the Contract Documents, the beam-to-beam and beam-to-column connection shall develop the end reaction of the connected beam. The end reaction of the connected beam shall be assumed equal to one-half the uniform load-carrying capacity of the beam for the span shown assuming full lateral support, as given in Part 2 (Beams and Girders) of the AISC Manual, Ninth Edition. Use a minimum shear capacity of 12 Kips for beams 8 inches deep or less.
- B. Construction: Type 2, simple framing.

**1.4 SUBMITTALS**

- A. General: Submit each item in the Article according to the Conditions of the Contract and Division 1 Specification Sections.
- B. Product Data: For each type of product indicated.
- C. Shop Drawings: Show fabrication of structural-steel components.
  - 1. Include details of cuts, connections, splices, camber, holes, and other pertinent data.
  - 2. Indicate welds by standard AWS symbols, distinguishing between shop and field welds, and show size, length, and type of each weld.

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3. Indicate type, size, and length of bolts, distinguishing between shop and field bolts. Identify high-strength bolted slip-critical, direct-tension, or tensioned shear/bearing connections.
- D. Qualification Data for firms and persons specified in the "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of engineers and owners, and other information specified.
- E. Mill Test Reports: Signed by manufacturers certifying that their products, including the following, comply with requirements:
  1. Structural steel including chemical and physical properties.
  2. Bolts, nuts, and washers including mechanical properties and chemical analysis.
  3. Direct-tension indicators.
  4. Shop primers.
  5. Non-shrink grout.

**1.5 QUALITY ASSURANCE**

- A. Installer Qualifications: Engage a qualified installer who meets one of the following requirements:
  1. A qualified installer who participates in the AISC Quality Certification Program and is designated an AISC-Certified Erector, Category CSE.
  2. An installer who has completed at least three similar facilities. Structural steel work from previous jobs shall be similar in material, design, and extent to that indicated for this Project. Installer shall demonstrate a record of successful in-service performance by providing and submitting a list of references with contact names, addresses, and phone numbers for previous similar projects.
- B. Fabricator Qualifications: Engage a qualified fabricator who meets one of the following requirements:
  1. A qualified fabricator who participates in the AISC Quality Certification Program and is designated an AISC-Certified Plant for Category I, Conventional Steel Structures.
  2. A fabricator who has completed at least three similar facilities. Structural steel work from previous jobs shall be similar in material, design, and extent to that indicated for this Project. Fabricator shall have a record of successful in-service performance, as well as sufficient production capacity to fabricate structural steel without delaying the Work. Fabricator to submit a list of references with contact names, addresses, and phone numbers to demonstrate past performance.
- C. Welding: Qualify procedures and personnel according to AWS D1.1, "Structural Welding Code--Steel."
- D. Comply with applicable provisions of the following specifications and documents:
  1. AISC's "Code of Standard Practice for Steel Buildings and Bridges."
  2. AISC's "Specification for Structural Steel Buildings--Allowable Stress Design and Plastic Design."

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3. AISC's "Specification for the Design of Steel Hollow Structural Sections."
4. AISC's "Specification for Allowable Stress Design of Single-Angle Members."
5. AISC's "Seismic Provisions for Structural Steel Buildings" and "Supplement No. 2."
6. RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."

**1.6 DELIVERY, STORAGE, AND HANDLING**

- A. Deliver structural steel to Project site in such quantities and at such times to ensure continuity of installation.
- B. Store materials to permit easy access for inspection and identification. Keep steel members off ground and spaced by using pallets, platforms, or other supports and spacers. Protect steel members and packaged materials from erosion and deterioration.
  1. Store fasteners in a protected place. Clean and relubricate bolts and nuts that become dry or rusty before use.
  2. Do not store materials on structure in a manner that might cause distortion, damage, or overload to members or supporting structures. Repair or replace damaged materials or structures as directed.

**1.7 COORDINATION**

- A. Furnish anchorage items to be embedded in or attached to other construction without delaying the Work. Provide setting diagrams, templates, instructions, and directions, as required, for installation.

**PART 2 - PRODUCTS****2.1 STRUCTURAL-STEEL MATERIALS**

- A. W-Shapes: ASTM A 992.
- B. Other Steel Shapes, Channels, Angles, Plates, and Bars: ASTM A 36.
- C. Cold-Formed Hollow Structural Sections (Steel Tubing): ASTM A 500, Grade B.
- D. Steel Pipe: ASTM A 53, Type E or S, Grade B.
  1. Weight Class: Standard.
  2. Finish: Black, except where indicated to be galvanized.
- E. Welding Electrodes: Comply with AWS requirements.

**2.2 BOLTS, CONNECTORS, AND ANCHORS**

- A. High-Strength Bolts, Nuts, and Washers: ASTM A 325, Type 1, heavy hex steel structural bolts, heavy hex carbon-steel nuts, and hardened carbon-steel washers.
  1. Finish: Plain, uncoated.
- B. Unheaded Anchor Rods and Threaded Rods: ASTM A 36.
  1. Nuts: ASTM A 563 heavy hex carbon steel.

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2. Plate Washers: ASTM A 36 carbon steel.
  3. Washers: ASTM F 436 hardened carbon steel.
  4. Finish: Plain, uncoated.
- C. Clevises and Turnbuckles: ASTM A 108, Grade 1035, cold-finished carbon steel.
- D. Sleeve Nuts: ASTM A 108, Grade 1018, cold-finished carbon steel.

**2.3 PRIMER**

- A. Primer: Fabricator's standard lead- and chromate-free, VOC-compliant, nonasphaltic, rust-inhibiting primer. **Verify compatibility of primer with finish coat, where finish coat is specified.**
- B. Galvanizing Repair Paint: ASTM A 780.

**2.4 GROUT**

- A. Nonmetallic, Shrinkage-Resistant Grout: ASTM C 1107, factory-packaged, nonmetallic aggregate grout, noncorrosive, nonstaining, mixed with water to consistency suitable for application and a 30-minute working time.

**2.5 FABRICATION**

- A. Structural Steel: Fabricate and assemble in shop to greatest extent possible. Fabricate according to AISC's "Code of Standard Practice for Steel Buildings and Bridges" and AISC's "Specification for Structural Steel Buildings--Allowable Stress Design and Plastic Design."
1. Camber structural-steel members where indicated.
  2. Mark and match-mark materials for field assembly.
  3. Fabricate for delivery a sequence that will expedite erection and minimize field handling of structural steel.
  4. Complete structural-steel assemblies, including welding of units, before starting shop-priming operations.
- B. Thermal Cutting: Perform thermal cutting by machine to greatest extent possible.
1. Plane thermally cut edges to be welded to comply with requirements in AWS D1.1.
- C. Bolt Holes: Cut, drill, or punch standard bolt holes perpendicular to metal surfaces.
- D. Finishing: Accurately finish ends of columns and other members transmitting bearing loads.
- E. Holes: Provide holes required for securing other work to structural steel and for passage of other work through steel framing members.
1. Cut, drill, or punch holes perpendicular to steel surfaces. Do not thermally cut bolt holes or enlarge holes by burning.
  2. Base-Plate Holes: Cut, drill, or punch holes perpendicular to steel surfaces.
  3. Weld threaded nuts to framing and other specialty items indicated to receive other work.

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Oakhurst Dairy – New Milk Cooler**2.6 SHOP CONNECTIONS**

- A. High-Strength Bolts: Shop install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for type of bolt and type of joint specified.
  - 1. Joint Type: Snug tightened, unless otherwise indicated.
- B. Weld Connections: Comply with AWS D1.1 for welding procedure specifications, tolerances, appearance, and quality of welds and for methods used in correcting welding work.
  - 1. Remove backing bars or runoff tabs, back gouge, and grind steel smooth.

**2.7 SHOP PRIMING**

- A. Shop prime steel surfaces except the following:
  - 1. Surfaces embedded in concrete or mortar. Extend priming of partially embedded members to a depth of 2 inches.
  - 2. Surfaces to be field welded.
  - 3. Galvanized surfaces.
- B. Surface Preparation: Clean surfaces to be painted. Remove loose rust and mill scale and spatter, slag, or flux deposits. Prepare surfaces according to the following specifications and standards:
  - 1. SSPC-SP 3, "Power Tool Cleaning."
- C. Priming: Immediately after surface preparation, apply primer according to manufacturer's written instructions and at rate recommended by SSPC to provide a dry film thickness of not less than 2.0 mils. Use priming methods that result in full coverage of joints, corners, edges, and exposed surfaces.
  - 1. Stripe paint corners, crevices, bolts, welds, and sharp edges.
  - 2. Apply two coats of shop paint to inaccessible surfaces after assembly or erection. Change color of second coat to distinguish it from first.

**2.8 SOURCE QUALITY CONTROL**

- A. Owner will engage an independent testing and inspecting agency to perform shop tests and inspections and prepare test reports.
  - 1. Provide testing agency with access to places where structural-steel work is being fabricated or produced to perform tests and inspections.
  - 2. Testing agency will conduct and interpret tests and provide written documentation whether test specimens comply with or deviate from requirements.
- B. Correct deficiencies in Work that test reports and inspections indicate does not comply with the Contract Documents.
- C. Additional testing, at Contractor's expense, will be performed to determine compliance of corrected Work with specified requirements.
- D. Bolted Connections: Shop-bolted connections will be tested and inspected according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."

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- E. Welded Connections: In addition to visual inspection, shop-welded connections will be tested and inspected according to AWS D1.1 and the following inspection procedures, at testing agency's option:
  - 1. Liquid Penetrant Inspection: ASTM E 165.
  - 2. Magnetic Particle Inspection: ASTM E 709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration will not be accepted.
  - 3. Ultrasonic Inspection: ASTM E 164.
  - 4. Radiographic Inspection: ASTM E 94 and ASTM E 142; minimum quality level "2-2T."

**PART 3 - EXECUTION****3.1 EXAMINATION**

- A. Verify elevations of concrete- and masonry-bearing surfaces and locations of anchor rods, bearing plates, and other embedments, with steel erector present, for compliance with requirements.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

**3.2 PREPARATION**

- A. Provide temporary shores, guys, braces, and other supports during erection to keep structural steel secure, plumb, and in alignment against temporary construction loads and loads equal in intensity to design loads. Remove temporary supports when permanent structural steel, connections, and bracing are in place, unless otherwise indicated.

**3.3 ERECTION**

- A. Set structural steel accurately in locations and to elevations indicated and according to AISC's "Code of Standard Practice for Steel Buildings and Bridges" and "Specification for Structural Steel Buildings--Allowable Stress Design and Plastic Design."
- B. Base, Bearing, and Leveling Plates: Clean concrete- and masonry-bearing surfaces of bond-reducing materials, and roughen surfaces prior to setting base, bearing, or leveling plates. Clean bottom surface of base and bearing plates.
  - 1. Set base, bearing, or leveling plates for structural members on wedges, shims, or setting nuts as required.
  - 2. Snug-tighten anchor rods after supported members have been positioned and plumbed. Do not remove wedges or shims but, if protruding, cut off flush with edge of base or bearing plate before packing with grout.
  - 3. Promptly pack grout solidly between bearing surfaces and plates so no voids remain. Neatly finish exposed surfaces; protect grout and allow to cure. Comply with manufacturer's written installation instructions for shrinkage-resistant grouts.
- C. Maintain erection tolerances of structural steel within AISC's "Code of Standard Practice for Steel Buildings and Bridges."

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- D. Align and adjust various members forming part of complete frame or structure before permanently fastening. Before assembly, clean bearing surfaces and other surfaces that will be in permanent contact with members. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.
  - 1. Level and plumb individual members of structure.
  - 2. Establish required leveling and plumbing measurements on mean operating temperature of structure. Make allowances for difference between temperature at time of erection and mean temperature when structure is completed and in service.
- E. Splice members only where indicated.
- F. Do not use thermal cutting during erection.
- G. Do not enlarge unfair holes in members by burning or using drift pins. Ream holes that must be enlarged to admit bolts.

**3.4 FIELD CONNECTIONS**

- A. High-Strength Bolts: Shop install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for type of bolt and type of joint specified.
  - 1. Joint Type: Snug tightened, unless otherwise indicated.
- B. Weld Connections: Comply with AWS D1.1 for welding procedure specifications, tolerances, appearance, and quality of welds and for methods used in correcting welding work.
  - 1. Comply with AISC's "Code of Standard Practice for Steel Buildings and Bridges" and "Specification for Structural Steel Buildings--Allowable Stress Design and Plastic Design" for bearing, adequacy of temporary connections, alignment, and removal of paint on surfaces adjacent to field welds.

**3.5 FIELD QUALITY CONTROL**

- A. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to inspect field welds and high-strength bolted connections.
  - 1. Testing agency will conduct and interpret tests and provide written documentation whether the tested Work complies with or deviates from the requirements.
- B. Bolted Connections: Field-bolted connections will be tested and inspected according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."
- C. Welded Connections: Field welds will be visually inspected according to AWS D1.1.
  - 1. In addition to visual inspection, field welds will be tested according to AWS D1.1 and the following inspection procedures, at testing agency's option:
    - a) Liquid Penetrant Inspection: ASTM E 165.
    - b) Magnetic Particle Inspection: ASTM E 709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration will not be accepted.
    - c) Ultrasonic Inspection: ASTM E 164.

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- d) Radiographic Inspection: ASTM E 94 and ASTM E 142; minimum quality level "2-2T."
- D. Correct deficiencies in Work that test reports and inspections indicate does not comply with the Contract Documents.
- E. Additional testing, at Contractor's expense, will be performed to determine compliance of corrected Work with specified requirements.

**3.6 REPAIRS AND PROTECTION**

- A. Touchup Painting: After installation, promptly clean, prepare, and prime or reprime field connections, rust spots, and abraded surfaces of prime-painted joists and accessories, bearing plates, and abutting structural steel.
  - 1. Clean and prepare surfaces by SSPC-SP 2 hand-tool cleaning or SSPC-SP 3 power-tool cleaning.
  - 2. Apply a compatible primer of same type as shop primer used on adjacent surfaces.

END OF SECTION 05120