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Oakhurst Dairy – New Milk Cooler**SECTION 05511 – METAL STAIRS****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 the following:
1. Preassembled steel stairs with concrete-filled treads.
  2. Industrial stairs with steel grating treads.
  3. Handrails and railings attached to metal stairs.
  4. Handrails attached to walls adjacent to metal stairs.
  5. Railing gates at the level of exit discharge.
- B. Related Sections include the following:
1. Division 3 Section "Cast-in-Place Concrete" for concrete fill for stair treads and platforms.
  2. Division 5 Section "Pipe Railings" for pipe and tube handrails and railings.
  3. Division 5 Section "Pipe Railings" for pipe and tube handrails and railings not attached to metal stairs or to walls adjacent to metal stairs.

**1.3 PERFORMANCE REQUIREMENTS**

- A. Structural Performance: Provide metal stairs capable of withstanding the following structural loads without exceeding the allowable design working stress of the materials involved, including anchors and connections. Apply each load to produce the maximum stress in each component of metal stairs.
1. Treads and Platforms of Metal Stairs: Capable of withstanding a uniform load of 100 lbf/sq. ft. or a concentrated load of 300 lbf on an area of 4 sq. in., whichever produces the greater stress.
  2. Stair Framing: Capable of withstanding stresses resulting from loads specified above in addition to stresses resulting from railing system loads.
  3. Limit deflection of treads, platforms, and framing members to  $L/360$  or 1/4 inch, whichever is less.
- B. Structural Performance of Handrails and Railings: Provide handrails and railings complying with requirements in ASTM E 985 for structural performance, based on testing performed according to ASTM E 894 and ASTM E 935.
- C. Structural Performance of Handrails and Railings: Provide handrails and railings capable of withstanding structural loads required by ASCE 7 without exceeding the allowable design working stress of materials for handrails, railings, anchors, and connections.

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- D. Structural Performance of Handrails and Railings: Provide handrails and railings capable of withstanding the following structural loads without exceeding the allowable design working stress of materials for handrails, railings, anchors, and connections:
1. Top Rail of Guards: Capable of withstanding the following loads applied as indicated:
    - a) Concentrated load of 200 lbf applied at any point and in any direction.
    - b) Uniform load of 50 lbf/ft. applied horizontally and concurrently with uniform load of 100 lbf/ft. applied vertically downward.
    - c) Concentrated and uniform loads above need not be assumed to act concurrently.
  2. Handrails Not Serving as Top Rails: Capable of withstanding the following loads applied as indicated:
    - a) Concentrated load of 200 lbf applied at any point and in any direction.
    - b) Uniform load of 50 lbf/ft. applied in any direction.
    - c) Concentrated and uniform loads above need not be assumed to act concurrently.
  3. Infill Area of Guards: Capable of withstanding a horizontal concentrated load of 200 lbf applied to 1 sq. ft. at any point in system, including panels, intermediate rails, balusters, or other elements composing infill area.
    - a) Load above need not be assumed to act concurrently with loads on top rails in determining stress on guards.

**1.4 SUBMITTALS**

- A. Product Data: For metal stairs and the following:
1. Prefilled metal-pan stair treads.
  2. Cast nosings.
  3. Paint products.
  4. Grout.
- B. Shop Drawings: Show fabrication and installation details for metal stairs. Include plans, elevations, sections, and details of metal stairs and their connections. Show anchorage and accessory items. Provide templates for anchors and bolts specified for installation under other Sections.
1. For installed products indicated to comply with design loads, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
- C. Welding Certificates: Copies of certificates for welding procedures and personnel.
- D. Qualification Data: For firms and persons specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.

**1.5 QUALITY ASSURANCE**

- A. Installer Qualifications: Arrange for metal stairs specified in this Section to be fabricated and installed by the same firm.

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- B. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of metal stairs (including handrails and railing systems) that are similar to those indicated for this Project in material, design, and extent.
- C. Fabricator Qualifications: A firm experienced in producing metal stairs similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.
- D. Welding: Qualify procedures and personnel according to AWS D1.1, "Structural Welding Code--Steel," and AWS D1.3, "Structural Welding Code--Sheet Steel."

**1.6 COORDINATION**

- A. Coordinate installation of anchorages for metal stairs. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

**PART 2 - PRODUCTS****2.1 MANUFACTURERS**

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Preassembled Stairs:
    - a) American Metal Works, Inc.
    - b) American Stair Corp., Inc.
    - c) National Stair & Rail, Inc.
    - d) Sharon Companies, Ltd. (The).
  - 2. Extruded Abrasive Nosings:
    - a) American Safety Tread Co., Inc.
    - b) Safe-T-Metal Co.
    - c) Wooster Products Inc.

**2.2 FERROUS METALS**

- A. Metal Surfaces, General: Provide metal free from pitting, seam marks, roller marks, and other imperfections where exposed to view on finished units. Do not use steel sheet with variations in flatness exceeding those permitted by referenced standards for stretcher-leveled sheet.
- B. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
- C. Steel Tubing: Cold-formed steel tubing complying with ASTM A 500.

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- D. Steel Pipe: ASTM A 53, standard weight (Schedule 40), unless another weight is indicated or required by structural loads.
- E. Rolled-Steel Floor Plate: ASTM A 786/A 786M, rolled from plate complying with ASTM A 36/A 36M or ASTM A 283/A 283M, Grade C or D.
- F. Steel Bars for Gratings: ASTM A 36/A 36M.
- G. Wire Rod for Grating Crossbars: ASTM A 510.
- H. Uncoated, Cold-Rolled Steel Sheet: Commercial quality, complying with ASTM A 366/A 366M; or structural quality, complying with ASTM A 611, Grade A, unless another grade is required by design loads.
- I. Uncoated, Hot-Rolled Steel Sheet: Commercial quality, complying with ASTM A 569/A 569M; or structural quality, complying with ASTM A 570/A 570M, Grade 30, unless another grade is required by design loads.
- J. Galvanized Steel Sheet: ASTM A 653/A 653M, G90 coating, either commercial quality or structural quality, Grade 33, unless another grade is required for design loads.
- K. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.

**2.3 FASTENERS**

- A. General: Provide zinc-plated fasteners with coating complying with ASTM B 633, Class Fe/Zn 25 for exterior use, and Class Fe/Zn 5 where built into exterior walls. Select fasteners for type, grade, and class required.
- B. Bolts and Nuts: Regular hexagon-head bolts, ASTM A 307, Grade A; with hex nuts, ASTM A 563; and, where indicated, flat washers.
- C. Machine Screws: ASME B18.6.3.
- D. Lag Bolts: ASME B18.2.1.
- E. Plain Washers: Round, carbon steel, ASME B18.22.1.
- F. Lock Washers: Helical, spring type, carbon steel, ASME B18.21.1.
- G. Expansion Anchors: Anchor bolt and sleeve assembly of material indicated below with capability to sustain, without failure, a load equal to six times the load imposed when installed in unit masonry and equal to four times the load imposed when installed in concrete, as determined by testing per ASTM E 488, conducted by a qualified independent testing agency.
  - 1. Material: Carbon-steel components zinc-plated to comply with ASTM B 633, Class Fe/Zn 5.
  - 2. Material: Alloy Group 1 or 2 stainless-steel bolts complying with ASTM F 593 and nuts complying with ASTM F 594.

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- A. Shop Primers: Provide primers that comply with Division 9 Section "Painting."
- B. Shop Primer for Ferrous Metal: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with performance requirements in FS TT-P-664, selected for good resistance to normal atmospheric corrosion, compatibility with finish paint systems indicated, and capability to provide a sound foundation for field-applied topcoats despite prolonged exposure.
- C. Galvanizing Repair Paint: High-zinc-dust-content paint for regalvanizing welds in steel, complying with SSPC-Paint 20.

**2.5 CAST ABRASIVE NOSINGS**

- A. Fabricate units from cast iron in sizes and configurations indicated and in lengths necessary to accurately fit openings or conditions. Provide units with an integral abrasive finish consisting of aluminum oxide, silicon carbide, or a combination of both.
- B. Provide anchors for embedding units in concrete, either integral or applied to units, as standard with manufacturer.
- C. Drill for mechanical anchors and countersink. Locate not more than 4 inches from ends and not more than 12 inches o.c., evenly spaced between ends, unless otherwise indicated. Provide closer spacing if recommended by manufacturer.
- D. Apply bituminous paint to concealed bottoms, sides, and edges of units set into concrete.
- E. Provide a plain surface texture, unless fluted or cross-hatched surfaces are indicated.

**2.6 GROUT**

- A. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107. Provide grout specifically recommended by manufacturer for interior and exterior applications.

**2.7 CONCRETE FILL AND REINFORCING MATERIALS**

- A. Concrete Materials and Properties: Comply with requirements in Division 3 Section "Cast-in-Place Concrete" for normal-weight, ready-mixed concrete with a minimum 28-day compressive strength of 3000 psi, unless higher strengths are indicated.

**2.8 FABRICATION, GENERAL**

- A. Provide complete stair assemblies, including metal framing, hangers, struts, handrails, railings, clips, brackets, bearing plates, and other components necessary to support and anchor stairs and platforms on supporting structure.
- B. NAAMM Stair Standard: Comply with "Recommended Voluntary Minimum Standards for Fixed Metal Stairs" in NAAMM AMP 510, "Metal Stairs Manual," for class of stair designated, unless more stringent requirements are indicated.
  - 1. Service class, unless otherwise indicated.
  - 2. Industrial class, where indicated.

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- C. Shop Assembly: Preassemble stairs in shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.
- D. Form exposed work true to line and level with accurate angles and surfaces and straight sharp edges. Shear and punch metals cleanly and accurately. Remove sharp or rough areas on exposed surfaces.
- E. Ease exposed edges to a radius of approximately 1/32 inch, unless otherwise indicated. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.
- F. Weld connections to comply with the following:
  - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
  - 2. Obtain fusion without undercut or overlap.
  - 3. Remove welding flux immediately.
  - 4. Weld exposed corners and seams continuously, unless otherwise indicated.
  - 5. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.
- G. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners where possible. Use exposed fasteners of type indicated or, if not indicated, Phillips flat-head (countersunk) screws or bolts. Locate joints where least conspicuous.
- H. Fabricate joints that will be exposed to weather in a manner to exclude water, or provide weep holes where water may accumulate.

**2.9 STEEL-FRAMED STAIRS**

- A. Stair Framing: Fabricate stringers of structural-steel channels, plates, or a combination of both, as indicated. Provide closures for exposed ends of stringers. Construct platforms of structural-steel channel headers and miscellaneous framing members as indicated. Bolt or weld headers to stringers; weld framing members to stringers and headers.
  - 1. Where masonry walls support metal stairs, provide temporary supporting struts designed for erecting steel stair components before installing masonry.
- B. Metal Risers, Subtread Pans, and Subplatforms: Form to configurations shown from steel sheet of thickness necessary to support indicated loads, but not less than 0.0677 inch.
  - 1. Steel Sheet: Uncoated hot-rolled steel sheet, unless otherwise indicated.
  - 2. Directly weld metal pans to stringers; locate welds on side of subtreads to be concealed by concrete fill. Do not weld risers to stringers.
  - 3. Attach risers and subtreads to stringers with brackets made of steel angles or bars. Weld brackets to stringers and attach metal pans to brackets by welding, riveting, or bolting.
  - 4. Shape metal pans to include nosing integral with riser.
  - 5. Attach cast abrasive nosings to risers. Make nosings full width of tread, with noses flush with riser faces and level with tread surfaces.

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6. Attach extruded abrasive nosings to risers. Make nosings full width of tread, with noses flush with riser faces and level with tread surfaces.
- C. Formed-Metal Risers, Treads, and Platforms: Form to configurations shown from steel sheet of thickness necessary to support indicated loads, but not less than 0.0966 inch.
1. Steel Sheet: Uncoated hot-rolled steel sheet, unless otherwise indicated.
  2. Directly weld risers and treads to stringers; locate welds on underside of stairs.
  3. Provide platforms of configuration indicated or, if not indicated, the same as treads. Weld platforms to platform framing.
  4. Finish tread and platform surfaces with manufacturer's standard epoxy-bonded abrasive finish. Provide material with coefficient of friction of 0.6 or higher when tested according to ASTM C 1028.
- D. Steel Floor Plate Treads, Risers, and Platforms: Form to configurations shown from raised-pattern steel floor plate of thickness necessary to support indicated loads, but not less than 1/4 inch.
- E. Floor Grating Treads and Platforms: Form to configurations shown from metal bar grating; fabricate to comply with NAAMM MBG 531, "Metal Bar Grating Manual for Steel Stainless Steel, and Aluminum Gratings and Stair Treads."
1. Fabricate treads and platforms from welded steel grating with 1-1/4-by-3/16-inch bearing bars at 15/16 inch o.c. and crossbars at 4 inches o.c., NAAMM designation: W-15-4 (1-1/4 x 3/16) STEEL.
  2. Fabricate treads and platforms from pressure-locked steel grating with 1-by-3/16-inch bearing bars at 1/16 inch o.c. and crossbars at 4 inches o.c., NAAMM designation: P-11-4 (1 x 3/16) STEEL.
  3. Surface: Plain.
  4. Surface: Serrated.
  5. Finish: Shop primed.
  6. Finish: Painted.
  7. Finish: Galvanized.
  8. Fabricate grating treads with cast abrasive nosing and with steel angle or steel plate carrier at each end for stringer connections. Secure treads to stringers with bolts.
  9. Fabricate grating platforms with nosing matching that on grating treads. Provide toeplates at open-sided edges of grating platforms. Weld grating to platform framing.

**2.10 STAIR HANDRAILS AND RAILINGS**

- A. General: Comply with applicable requirements in Division 5 Section "Pipe and Tube Railings" for handrails and railings, and as follows:
- B. General: Comply with applicable requirements in Division 5 Section "Ornamental Handrails and Railings" for handrails and railings, and as follows:
1. Fabricate newels of steel tubing and provide newel caps of gray-iron castings, as shown.

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2. Fabricate newels of steel tubing and provide newel caps of pressed steel, as shown.
3. Railings may be bent at corners, rail returns, and wall returns, instead of using prefabricated fittings.
4. Connect railing posts to stair framing by direct welding, unless otherwise indicated.

**2.11 FINISHES**

- A. Comply with NAAMM'S "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Finish metal stairs after assembly.
- C. Galvanizing: Hot-dip galvanize items as indicated to comply with applicable standard listed below:
  1. ASTM A 123, for galvanizing both fabricated and unfabricated iron and steel products made of uncoated rolled, pressed, and forged shapes, plates, bars, and strips 0.0299 inch thick and heavier.
  2. ASTM A 153/A 153M, for galvanizing steel and iron hardware.
  3. Fill vent and drain holes that will be exposed in finished Work, unless indicated to remain as weep holes, by plugging with zinc solder and filing off smooth.
- D. Preparation for Shop Priming: Prepare uncoated ferrous-metal surfaces to comply with minimum requirements indicated below for SSPC surface-preparation specifications and environmental exposure conditions of installed products:
  1. Exteriors (SSPC Zone 1B): SSPC SP 6/NACE No. 3, "Commercial Blast Cleaning."
  2. Interiors (SSPC Zone 1A): SSPC SP 3, "Power Tool Cleaning."
- E. Apply shop primer to prepared surfaces of metal stair components, unless otherwise indicated. Comply with SSPC-PA 1, "Paint Application Specification No. 1," for shop painting. Primer need not be applied to surfaces to be embedded in concrete or masonry.
  1. Do not apply primer to galvanized surfaces.
  2. Stripe paint corners, crevices, bolts, welds, and sharp edges.

**PART 3 - EXECUTION****3.1 INSTALLATION, GENERAL**

- A. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing metal stairs to in-place construction. Include threaded fasteners for concrete and masonry inserts, through-bolts, lag bolts, and other connectors.
- B. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal stairs. Set units accurately in location, alignment, and elevation, measured from established lines and levels and free from rack.
- C. Install metal stairs by welding stair framing to steel structure or to weld plates cast into concrete, unless otherwise indicated.

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- D. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.
- E. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.
- F. Field Welding: Comply with the following requirements:
  - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
  - 2. Obtain fusion without undercut or overlap.
  - 3. Remove welding flux immediately.
  - 4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

**3.2 INSTALLING METAL STAIRS WITH GROUTED BASEPLATES**

- A. Clean concrete and masonry bearing surfaces of bond-reducing materials, and roughen to improve bond to surfaces. Clean bottom surface of baseplates.
- B. Set steel stair baseplates on wedges, shims, or leveling nuts. After stairs have been positioned and aligned, tighten anchor bolts. Do not remove wedges or shims but, if protruding, cut off flush with edge of bearing plate before packing with grout.
  - 1. Use nonmetallic, nonshrink grout, unless otherwise indicated.
  - 2. Pack grout solidly between bearing surfaces and plates to ensure that no voids remain.

**3.3 INSTALLING STEEL TUBE RAILINGS AND HANDRAILS**

- A. Adjust handrails and railing systems before anchoring to ensure matching alignment at abutting joints. Space posts at spacing indicated or, if not indicated, as required by design loads. Plumb posts in each direction. Secure posts and railing ends to building construction as follows:
  - 1. Anchor posts to steel by welding directly to steel supporting members.
  - 2. Anchor handrail ends to concrete and masonry with steel round flanges welded to rail ends and anchored with postinstalled anchors and bolts.
- B. Attach handrails to wall with wall brackets. Provide bracket with 1-1/2-inch clearance from inside face of handrail and finished wall surface. Locate brackets as indicated or, if not indicated, at spacing required to support structural loads. Secure wall brackets to building construction as follows:
  - 1. Use type of bracket with flange tapped for concealed anchorage to threaded hanger bolt.
  - 2. Use type of bracket with predrilled hole for exposed bolt anchorage.
  - 3. For concrete and solid masonry anchorage, use drilled-in expansion shields and hanger or lag bolts.

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4. For hollow masonry anchorage, use toggle bolts.
5. For wood stud partitions, use hanger or lag bolts set into wood backing between studs. Coordinate with carpentry work to locate backing members.
6. For steel-framed gypsum board assemblies, use hanger or lag bolts set into wood backing between studs. Coordinate with stud installation to locate backing members.
7. For steel-framed gypsum board assemblies, fasten brackets directly to steel framing or concealed reinforcements using self-tapping screws of size and type required to support structural loads.

**3.4 ADJUSTING AND CLEANING**

- A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.
  1. Apply by brush or spray to provide a minimum 2.0-mil dry film thickness.
- B. Touchup Painting: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint are specified in Division 9 Section "Painting."
- C. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780.

END OF SECTION 05511