

**PART 1 - GENERAL:**

1-1 SUMMARY

- A. Requirements for miscellaneous metalwork.
- B. Includes fabricating and installing metal ladders, metal stairs, metal platforms, handrails, gratings, metal structural support members, and other miscellaneous metal items.

1-2 RELATED SECTIONS

- A. Section 01330: Submittals.
- B. Section 03300: Cast-In-Place Concrete.
- C. Section 05505: Anchor Bolts; Expansion Anchors, and Concrete Inserts.
- D. Section 09900: Painting.

1-3 REFERENCES

- A. ASTM A386 Zinc-Coating (Hot-Dip) on Assembled Steel Products.
- B. American Welding Society (AWS) "Structural Welding Code – Steel," D1.1.
- C. American Institute of Steel Construction (AISC), Code of Standard Practice for Steel Buildings and Bridges.
- D. American National Standards Institute (ANSI) - Z49.1, Safety in Welding and Cutting.
- E. American Welding Society (AWS).
  - 1. B2.1, Welding Procedure and Performance Qualification.
  - 2. D1.1, Structural Welding Code.
- F. Occupational Safety and Health Administration (OSHA) - Construction Safety Orders.
- G. National Association of Architectural Metal Manufacturers (NAAMM) - Pipe Railing Manual.
- H. National Fire Protection Association (NFPA) - 101, Life Safety code.

1-4 SUBMITTALS

- A. Submit in accordance with Section 01330: Submittals.
- B. Submit layouts for all stairs, landings, railings, gratings, openings in gratings, structural support systems, and other miscellaneous metal items in the water treatment facility. The layout shall be based on approved equipment for the effluent treatment system, including distribution piping, valves, pumps, etc. Grating supports shall be designed to not transmit loads to equipment.
- C. Submit designs and calculations performed by a registered professional structural engineer licensed in the State of Montana, for the approved layouts of the stairs, landings, railings, gratings, and structural support systems in the water treatment facility. The designs shall verify the ability of all members, assemblies, and connections to support the loads specified and required by applicable regulations, including IBC 06. The design criteria shall be in accordance with the following, or as specified on the drawing:

1. Stairs, landings, gratings, and platforms:
    - a. Uniform load – 100 lbs/ft<sup>2</sup>
    - b. Concentrated load – 300 lbs at mid span
    - c. Deflection – less than 3/16 inches
  2. Structural support systems shall be designed to support equipment and based on the equipment operating loads shown on the drawings or provided by the manufacturer, which ever is more stringent, and will be adjusted to accommodate for any vibration forces required.
  3. Exterior metal grating for platforms shall be serrated to provide a non-slip surface.
  4. Exterior metal grating for platforms shall be capable of supporting the selected equipment loads, within the specified deflections above as required.
  5. Handrails
    - a. Horizontal load of 50 lbs/lf applied continuously along the top rail.
    - b. Concentrated load of 200 lbs applied at any point vertically downward or horizontally.
- D. Shop Drawings and product data for all fabricated items.
1. Indicate materials, profiles, sizes, connection attachments, reinforcing, anchorage, hardware, size and type of fasteners and accessories. Provide templates for anchor and bolt installation by others.
  2. Include assembly drawings, sections, elevations and details where applicable.
  3. Indicate welded connections using standard AWS welding symbols; indicate net weld lengths and proposed field welds.
  4. Submit proposed location of all field welds. Approval required from the COR for all field welds.
- E. Submit welder certifications of qualification showing date of qualification; qualification grade and rating; and notarized signature of inspector.
- F. Before delivery of materials, provide certified laboratory test reports of materials.

#### 1-5 INSPECTION AND TESTS

- A. The right is reserved to reject any material at any time before final acceptance, if the COR finds material and/or workmanship that do not conform to specification requirements. Acceptance of any material or fabricated item shall not prevent its rejection later if defects are discovered. The Contractor shall remove and replace any installed materials or fabricated items which are rejected by the COR at no additional cost to the Government, and to the satisfaction of the COR.

### **PART 2 - PRODUCTS:**

#### 2-1 GENERAL

- A. Verify critical dimensions at the jobsite before product fabrication begins.

2-2 FABRICATION

- A. Fabricate items with joints tightly fitted and secured.
- B. Fit and shop assemble in largest practical sections for delivery to site.
- C. Remove burrs from all exposed cut edges, remove spatter and grind exposed welds to match adjacent surface.
- D. Supply all components required for anchoring metal fabrications. Fabricate anchorage and related components of same material and finish as metal fabrication, except where specifically noted otherwise.

2-3 MATERIALS

- A. Steel Pipe or Pipe Sleeves: ASTM A53, Schedule 40, black or galvanized.
- B. Steel Plates, Shapes and Bars: Carbon steel, ASTM A36.
- C. Steel Tubing: ASTM A500, Grade B; ASTM A501, Grade B.
- D. Bolts: ASTM A307, Grade A, galvanized.
- E. Nuts: ASTM A563, galvanized.
- F. Washers: ASTM F436, galvanized.
- G. Bird screen and insect screen: ASTM A740, hot-dip galvanized after weaving; 1/16 inch openings.
- H. Adhesive anchors: SST Threaded stud assemblies complete with studs, nuts and washers, ASTM A307. Hilti, Type HVA, Hilti HIT C-150, EPCON A7 Adhesive System, or approved equal.
- I. Fasteners:
  - 1. Anchor bolts: Threaded fasteners cast into concrete, ASTM A307, Grade A, galvanized.
  - 2. Expansion bolts: SST, Reverse cone, self-wedging, expansion type; tightening of nut or increased tension on bolt shank acts to force wedge outward and create increased resistance to withdrawal. Hilti Kwik-Bolt, or equal.
  - 3. Welding stud anchors: AWS D1.1, Section 4, Part F. Size and type as shown on the Drawings.
- J. Welding Materials: Conform to AWS D.I.1; type required for materials being welded.
- K. Stainless Steel
  - 1. Type: AISI Type 302/304, unless otherwise indicated.
  - 2. Bar Stock: For railings use ASTM A314, Type 302/304, No. 4 finish. For all other use ASTM A276.
  - 3. Plate: ASTM A167
  - 4. Sheet: ASTM A167
  - 5. Castings: ASTM A296, iron-chromium-nickel alloy
  - 6. Pipe: ASTM A312
  - 7. Chain, Snaps, and Eye Bolts: Provide oblong 0.250-inch welded link, Type 316 stainless steel chain weighing 57 pounds per cubic foot, each link 1-1/8-inch by 7/16-inch. Provide

stainless steel eyebolts, 1/4-inch stainless steel threaded quick links and heavy duty swivel snaps with spring loaded latch.

L. Aluminum

1. Extruded Shapes and Tubes: ASTM B221 or B308, 6061-T6, 6105-T5
2. Extruded Pipe: ASTM B429, 6063-T6, 6105-T5
3. Plate and Sheet: ASTM B209, alloy 3003-H16; Use alloy 5005 H16 where anodic coatings will be applied.
4. Bars, Rods and Wire: ASTM B211
5. Castings: ASTM B26 or B108; alloy 214 for natural anodized finish, and alloy 43 for color anodized or baked enamel finish; except as otherwise recommended by aluminum producer or finisher
6. Forgings: ASTM B247, alloy 6061-T6
7. Aluminum Diamond Floor Plate (check on plate): Alloy 6061-T6

2-4 HANDRAILS AND LADDERS

A. General requirements.

1. Form changes in direction of railing members by insertion of prefabricated elbow fittings.
2. Form simple and compound curves by bending members in jigs to produce uniform curvature for each repetitive configuration required; maintain profile of member throughout entire bend without buckling, twisting or otherwise deforming exposed surfaces of handrail and railing components.
3. Toe Boards: Provide toe boards at railing systems around openings and at edge of open-sided floors and platforms. Fabricate to dimensions and details indicated, or, if not indicated, use Manufacturer's standard section, if available, to provide toe boards 4" high. Use extruded or structural shapes to resist deflection.
4. Provide wall brackets, end closures, flanges, miscellaneous fittings and anchors for interconnections of handrail and railing members to other Work. Furnish inserts and other anchorage devices for connecting handrails and railing systems to concrete, metal, or wood framed wall systems.
5. Provide wall returns at ends of wall-mounted handrails, except where otherwise indicated.

B. Rails and Posts shall conform to ASTM A 53-90a, Schedule 40 and shall be standard weight and galvanized.

C. Welded fittings for steel pipe shall be standard weight fittings, conforming to ASTM A234-90a.

D. Mountings for handrails and ladders shall be galvanized or stainless steel as shown on the Drawings and material designations as specified herein.

E. The handrail shall be a three rail system and the aluminum pipe for handrails shall be 1½-inch nominal diameter

F. Handrailing height shall be 3 feet, 6 inches.

G. Splice Connectors: Steel.

- H. Handrails shall be installed with chain link fence fabric where shown on the Drawings. Fence fabric: galvanized, 6 gauge, chain link, woven in a two-inch diamond mesh with bottom and top salvage knuckles. The fence fabric shall be attached with 9 gauge aluminum wires at intervals sufficient to keep fabric taut and secure on handrail.
- I. Ladders shall be a product as shown on the Drawings or approved equal.

#### 2-5 PAINT AND PROTECTIVE FINISHES

- A. Handrails, ladders, stairs, gratings, planks, and grating supports to be galvanized.
- B. Clean surfaces of rust, scale, grease, and foreign matter before finishing.
- D. Galvanizing: 1.25 ounces per square foot zinc coating in accordance with ASTM A386.

#### 2-6 FABRICATION

- A. Use materials of size and thickness indicated, or if not indicated, as required size and thickness to produce strength and durability in finished product for use intended. Weld corners and seams continuously to produce a neat, even finished appearance, complying with AWS recommendations. Form exposed connections with hairline joints, flush and smooth; using concealed fasteners wherever possible. Provide for anchorage of type indicated, coordinated with supporting structure. Cut, reinforce, drill and tap to receive finish hardware and similar items. Field welding of aluminum shall not be permitted.

### **PART 3 - EXECUTION:**

#### 3-1 PREPARATION

- A. Examine surfaces for defects that would impair installation.
- B. Obtain the COR's approval before site cutting, field welding, or making nonscheduled adjustments.
- C. Clean steel items to bare metal where site welding is scheduled.
- D. Provide for erection loads with temporary bracing. Keep Work in alignment.
- E. Supply setting templates for items required to be cast into concrete.

#### 3-2 INSTALLATION

- A. Provide anchor bolts and manufacturer's templates as required. Install in accordance with manufacturer's published instructions, shop drawings, and as shown on the Drawings.
- B. Install items plumb and level, accurately fitted, and free from distortion or defects.
- C. Fence fabric shall be installed so there is free access to the top handrail for slip and fall protection.
- E. Except as otherwise specified, the fabrication and erection of structural steel and miscellaneous metalwork shall conform to the requirements of the AISC "Manual of Steel Construction".
- F. Fabricate structural steel and miscellaneous metal items to straight lines and true curves. Drilling and punching shall not leave burns or deformations. Continuously weld permanent connections along the entire area of contract. Exposed work shall have a smooth finish with welds ground smooth. Joints shall have a close fit with corner joints coped or mitered and shall be in true alignment. Unless

- specifically indicated on the Drawings, there shall be no bends, twists, or open joints in any finished member nor any projecting edges or corners at intersections.
- G. Conceal fastenings wherever possible. Built-up parts shall be free of warp. Exposed ends and edges of metal shall be slightly rounded. Bolt holes shall be 1/16 inch in diameter larger than bolt size, unless specified otherwise on the Drawings. Holes shall be cut, drilled or punched at right angles to the surface of the metal, and shall not be made or enlarged by burning.
  - H. All bolted connections shall be in conformance with applicable provisions of the AISC “Manual of Steel Construction”.
  - I. All welding shall be by the shielded metal-arc method, the submerged-arc method, or the gas-shielded arc method, as described in the AWS “Welding Handbook,” and supplemented by other pertinent standards of the AWS. Qualification of welders shall be in accordance with the AWS standards governing.
  - J. In assembly and during welding, the component parts shall be adequately clamped, supported and restrained to minimize distortion and for control of dimensions. Weld reinforcement shall be as specified by the AWS Code. Upon completion of welding, remove all weld splatter, flux, slag and burrs. Welds shall be repaired to produce a workmanlike appearance, with uniform weld contours and dimensions. All sharp corners of material to be painted or coated shall be ground to a minimum of 1/32-inch on the flat.
  - K. Do not use a gas-cutting torch in the field for correcting fabrication errors on any member in structural framing. Use a gas-cutting torch only on minor members when the members are not under stress.
  - L. Structural steel and miscellaneous metalwork fabricated from carbon steel shall be hot-dip galvanized in accordance with applicable ASTM standards referenced in Part 2, above. All steel shall be thoroughly cleaned of rust and scale before galvanizing. Unless otherwise permitted, all galvanizing shall be performed after fabrication, in the largest sections practicable. Any galvanized part that becomes warped during the galvanizing operation shall be straightened.
  - M. Structural steel or miscellaneous metalwork with damaged galvanized surfaces shall be repaired or replaced at no additional cost to the Government. Field repairs of galvanized surfaces shall be made using “Galvinox,” “Galvo-Weld,” or approved equal. Apply in accordance with the manufacturer’s instructions.
  - N. Anchor handrailings, posts, steps, and eye bolts to structure. Coordinate with concrete placement in Section 03300: Cast-in-Place Concrete.
  - O. Remove burrs from all exposed cut edges, remove spatter and grind exposed welds to match adjacent surface.
  - P. After installation, touch-up field welds and scratched or damaged galvanized surfaces in accordance with ASTM A780.
  - Q. Install wire mesh on new handrail. Attach with new galvanized metal clips, or approved equal.
- 3-3 GALVANIZED SURFACE REPAIRS
- A. All zinc-coating damaged in handling or transporting or in welding, riveting, or bolting shall be repaired by the application of galvanizing repair zinc-based solders in conformance with ASTM A780.

**PART 4 – MEASUREMENT AND PAYMENT:**

4-1 MEASUREMENT

- A. Miscellaneous metalwork shall not be measured for payment.

4-2 PAYMENT

- A. Compensation to the Contractor for all work required in this section shall be included in the prices bid in the schedule for other items of work. No separate payment to the Contractor will be made for miscellaneous metalwork.

**END OF SECTION 05500**

**PART 1 – GENERAL:**

1-1 SUMMARY

- A. Furnish all labor, materials, equipment and incidentals required to provide anchor bolts, expansion anchors, and concrete inserts as shown and specified.
- B. This Section includes all bolts, anchors, and inserts required for the Work but not specified under other Sections.
- C. The types of work using the bolts, anchors, and inserts include, but are not limited to the following:
  - 1. Rails
  - 2. Hangers and brackets
  - 3. Equipment
  - 4. Piping
  - 5. Electrical, Plumbing and HVAC Work
  - 6. Grating

1-2 RELATED SECTIONS

- A. Section 03300: Cast in Place Concrete.

1-3 SUBMITTALS

- A. Submit in accordance with Section 01330: Submittals.
- B. Samples
  - 1. Submit representative samples of bolts, anchors and inserts as may be requested by the Engineer.
  - 2. Review will be for type and finish only.
  - 3. Compliance with all other requirements is exclusive responsibility of Contractor.
- C. Shop Drawings
  - 1. Submit setting drawings and templates for location and installation of anchorage devices.
  - 2. Submit copies of manufacturer's specifications, load tables, dimension diagrams and installation instructions for the devices.
  - 3. Provide design load documentation and calculations for items sized or selected.

1-4 QUALITY ASSURANCE

- A. Reference Standards
  - 1. ASTM A 307, Carbon Steel Externally and Internally Threaded Standard Fasteners.
  - 2. ASTM A 320, Alloy-Steel Bolting Materials for Low-Temperature Service.
- B. Expansion anchors and inserts shall be Underwriters Laboratories or Factory Mutual approved.

**PART 2 – PRODUCTS:**

2-1 DESIGN CRITERIA

- A. When the size, length or load carrying capacity of an anchor bolt, expansion anchor, or concrete insert is not shown on the Drawings, provide the size, length and capacity required to carry the design load times a minimum safety factor of four.
- B. Determine design loads as follows:
  - 1. Equipment Anchors: Use the design load recommended by the manufacturer and reviewed by the Engineer.
- C. Allowances for vibration are included in the safety factor specified above.

2-2 MATERIALS

- A. Anchor Bolts
  - 1. Exposed Locations: Provide stainless steel bolts 316L.
  - 2. Anchors shall be Stainless Steel. Stainless steel anchors shall be used in all locations subject to submergence or splash.
  - 3. As required, nuts shall be stainless steel.
- B. Expansion Anchors
  - 1. Provide stainless steel anchors 316L.
    - a. Size: As required for the concrete strength specified.
    - b. Provide stud type (male thread) or flush type (female thread), as required.
  - 2. Products/Manufacturers
    - a. Wej-it Corporation
    - b. ITT Phillips Drill Company
    - c. Kwik Bolt/Hilti
    - d. Molly
  - 3. Anchors shall be Stainless Steel. Stainless steel anchors shall be used in all locations. As required, nuts shall be stainless steel.
- C. Concrete Inserts as shown on the drawings or as follows:
  - 1. For piping, grating and floor plate, provide stainless steel inserts. Provide those recommended by the manufacturer for the required loading.
    - a. Concrete threaded inserts for piping shall be 3/4" stainless steel with a minimum working capacity of 3000 pounds.
  - 2. Finish: Stainless Steel.
  - 3. Continuous insert – Stainless Steel.

4. Concrete wedge inserts complete with askew head, bolt nut and washer for bolting shelf angles to concrete shall be a minimum of 3/4" and shall have a minimum working capacity of 4000 pounds.
- D. Adhesive Anchors
1. Adhesive Material
    - a. Adhesive material shall consist of a polyester resin and dibenzol peroxide hardening agent with a mineral filler.
    - b. Adhesive material shall be packaged in a pre-measured plastic container to insure proper mixing of components.
  2. Products/Manufacturers
    - a. Hilti, Inc.
    - b. EPCON
  3. Adhesive anchors shall not be used unless approved by the Engineer.
- E. Powder-actuated fasteners and other types of bolts and fasteners not specified herein shall not be used unless acceptable to the Engineer.

**PART 3- EXECUTION:**

3-1 INSTALLATION

- A. Do not install anchor bolts, expansion anchors or concrete inserts until the item to be anchored and the anchoring device as well as related layout drawings have been reviewed by the Engineer.
- B. Drilling equipment used and installation of expansion anchors shall be in accordance with manufacturer's instructions.
- C. Assure that embedded items are protected from damage and are not filled in with concrete.
- D. Use the type of anchoring device specified below or shown on the Drawings.
- E. Expansion anchors may be used for hanging or supporting pipe 4 inches diameter and smaller. Expansion anchors shall not be used for larger pipe.
- F. Unless otherwise shown, conform to following for expansion anchors:
  1. Minimum embedment depth in concrete: 5 diameters.
  2. Minimum anchor spacing on centers: 10 diameters.
  3. Minimum distance to edge of concrete: 5 diameters.
  4. Increase dimensions above if required to develop the required anchor load capacity.
- G. Installation of Adhesive Anchors
  1. Pre-drilled hole shall be manufacturer's recommended diameter and depth for the specific application.
  2. The hole shall be thoroughly cleaned to insure proper bonding.
  3. Adhesive material shall be mechanically injected into rear of hole. Enough material to completely fill hole with rod/rebar shall be used.

4. Insert rod/rebar by hand with slight turning motion.
5. Manufacturer's representative shall be present during initial installation to insure proper procedure is followed.

3-2 CLEANING

- A. After embedding concrete is placed, remove protection and clean bolts and inserts.

**PART 4 – MEASUREMENT AND PAYMENT:**

4-1 MEASUREMENT

- A. Bolts, anchors, and concrete inserts installed shall not be measured for payment.

4-2 PAYMENT

- A. Compensation to the Contractor for all work required in this section shall be included in the prices bid in the schedule for other items of work. No separate payment to the Contractor will be made for any work required in this section.

**END OF SECTION 05505**

**END OF DIVISION 5**

