

**CONCRETE STEPS, HANDRAILS, AND SAFETY RAIL****PART 1 - GENERAL****1.01 SECTION INCLUDES**

- A. Concrete Steps
- B. Handrails
- C. Safety Rail

**1.02 DESCRIPTION OF WORK**

- A. Construction of concrete steps.
- B. Furnishing and installation of handrails.
- C. Furnishing and installation of safety rail.

**1.03 SUBMITTALS**

Comply with Division 1 - General Provisions and Covenants, as well as the following:

- A. Submit color samples and product literature for primer, paint, and powder coating to be used on handrails and safety rail.
- B. Submit shop drawings for handrails and safety rail.

**1.04 SUBSTITUTIONS**

Comply with Division 1 - General Provisions and Covenants.

**1.05 DELIVERY, STORAGE, AND HANDLING**

Comply with Division 1 - General Provisions and Covenants.

**1.06 SCHEDULING AND CONFLICTS**

Comply with Division 1 - General Provisions and Covenants.

**1.07 SPECIAL REQUIREMENTS**

- A. Provide 1 gallon of color matched exterior grade polyurethane paint for each color specified, for the Contracting Authority's maintenance use.
- B. Label each container with the manufacturer's name, product number, and color number.

**1.08 MEASUREMENT AND PAYMENT****A. Concrete Steps:**

1. **Measurement:** Measurement will be the area of concrete steps in square feet for each type of concrete step. The length will be the horizontal length between expansion joints, and the width will include curbs.
2. **Payment:** Payment will be at the unit price per square foot of concrete steps.
3. **Includes:** Unit price includes, but is not limited to, reinforcement, expansion joint material, and preparation of subgrade.

**B. Handrail:**

1. **Measurement:** Measurement will be in linear feet for each type of handrail, measured along the top of the handrail from end of rail to end of rail.
2. **Payment:** Payment will be at the unit price per linear foot for each type of handrail.
3. **Includes:** Unit price includes, but is not limited to, posts, mounting hardware or concrete grout, and finishing (painted, galvanized, or powder coated).

**C. Safety Rail:**

1. **Measurement:** Measurement will be in linear feet for safety rail, measured along the top of the safety rail from end post to end post.
2. **Payment:** Payment will be at the unit price per linear foot of safety rail.
3. **Includes:** Unit price includes, but is not limited to, posts, concrete for ground mounting, pickets, mounting hardware, epoxy grout, and finishing (painted, galvanized, or powder coated).

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**PART 2 - PRODUCTS****2.01 STEPS**

- A. Concrete:** Class C concrete complying with [Section 6010, 2.03](#).
- B. Reinforcing Steel:** Comply with [Iowa DOT Section 4151](#) for epoxy coated reinforcement. Comply with ACI-318 for dowel bar substitutes.
- C. Expansion Joint:** Comply with [Iowa DOT Section 4136.03, A](#).
- D. Forms:** Comply with [Iowa DOT Section 2403](#).

**2.02 HANDRAIL**

1 1/4 to 2 inches in diameter; ensure post diameter matches handrail diameter.

- A. Steel:** Welded or seamless black steel pipe and posts complying with ASTM A 53, Grade A or B.
- B. Aluminum:** Aluminum-alloy extruded structural pipe complying with ASTM B 429, alloy 6061-T6 or 6063-T6, schedule 40 (if specified; for use with grouted connection only).
- C. Bends:** Provide manufactured pipe bends and connections for handrail. Do not field bend pipe.

**2.03 SAFETY RAIL**

- A. Rails and Posts:** Provide 2 1/2 inch by 2 1/2 inch tubular high strength steel with 1/4 inch minimum wall thickness. Comply with ASTM A 500, Grade B.
- B. Pickets:** Provide 1 inch by 1 inch tubular high strength steel with 1/8 inch minimum wall thickness. Comply with ASTM A 500, Grade B.

**2.04 FINISH**

- A. Painted:** Provide factory-mixed paint / primer.
  - 1. Primer:** Provide single component, water-based rust and corrosion resistant primer specifically designed for use on steel surfaces.
  - 2. Paint:** Provide water-based, abrasion-resistant paint specifically designed for use on steel surfaces.
- B. Galvanized:** When specified in the contract documents, galvanize handrail and safety rail.
  - 1. Provide zinc coating complying with ASTM A 123.
  - 2. Hot-dip galvanize components after fabrication.
  - 3. For hot-dip galvanized components that will be powder coated, utilize the dry-kettle (pre-fluxing) process. Air cool galvanized components. Do not quench in water or chromate.
- C. Powder Coated:** Apply powder coat to steel, galvanized steel, or aluminum handrail and safety rail when specified in the contract documents. Comply with the manufacturer's recommendations for surface preparation, application of primer, and application of the powder coating, in addition to the following minimum requirements.

**2.04 FINISH (Continued)****1. Surface Preparation:****a. Steel Substrate:**

- 1) Remove oils and surface contamination by solvent cleaning. Comply with the requirements of SSPC-SP 1. Rinse thoroughly with hot water or water pressure and dry completely.
- 2) Remove loose rust, loose mill scale, and other foreign substances by hand or power tool cleaning. Comply with SSPC-SP 2 or 3.
- 3) Remove all dirt, grease, rust scale, mill scale, paint, slag, and other foreign substances by blast cleaning. Comply with SSPC-SP 6.
- 4) Remove all blast cleaning products by means of vacuuming or compressed air.
- 5) Chemically clean surface to remove residual contamination, apply conversion coating, and apply sealing agent to prepare the surface for powder coating.
- 6) Begin powder coating as soon as possible after surface preparation to prevent the development of iron oxide on the surface of the steel.

**b. Galvanized Steel Substrate:**

- 1) Remove all tears, spikes, high spots, or other surface defects caused by the galvanizing process using hand or power tools.
- 2) Apply an alkaline solution, with a pH between 11 and 12, to remove traces of oil, grease, and dirt.
- 3) Remove residual zinc oxide by spraying surface with a mild acidic solution (pH of 3.5 to 4.5).
- 4) Apply conversion coating to the surface and apply sealing agent to prepare the surface for powder coating.

**c. Aluminum Substrate:**

- 1) Clean surface by power washing to remove contaminants.
- 2) Clean surface with an aqueous alkaline solution by immersion or scrubbing with a soft brush. Do not scrub with a steel bristle brush. Dry completely after cleaning.
- 3) Remove oils and surface contamination by solvent cleaning. Comply with the requirements of SSPC-SP 1.
- 4) Remove light deposits of aluminum reaction by-products by hand or power tool cleaning. Comply with SSPC-SP 2 or 3.
- 5) Remove aluminum oxide by sweep blasting or chemical treatment:
  - a) Sweep Blasting:
    - i) Utilize oil-free compressed air to prevent contamination of cleaned surface.
    - ii) Utilize blast media with a MOH hardness of 5 or less, or utilize organic media such as corn cobs or walnut shells. Do not roughen surface.
    - iii) Powder coat surface within 60 minutes of sweep blasting to prevent re-formation of aluminum oxide.
  - b) Chemical Treatment: Comply with ASTM D 1730 for Type B treatment.
- 6) Chemically clean surface to remove residual contamination, apply conversion coating, and apply sealing agent to prepare the surface for powder coating.

2. **Priming:** Apply as recommended by coating manufacturer for specific substrate to all surfaces, unless specifically not required by coating manufacturer.

**3. Coating:****a. General:**

- 1) Provide complete multi-coat systems formulated and recommended by the manufacturer for the application indicated.
- 2) Provide urethane, TGIC polyester, polyester wrinkle, or non-TGIC polyester based powder coatings as recommended by the powder coating manufacturer to provide long term exterior durability.

**2.04 FINISH (Continued)****b. Application:**

- 1) Apply coating to the thickness specified by the coating manufacturer. Comply with coating manufacturer's recommendations for application of powder coating.
- 2) Apply coating in uniform thickness coats without runs, drips, pinholes, brush marks, or variations in color, texture, or finish. Finish edges, crevices, corners, and other changes in dimension with full coating thickness.

4. **Curing:** Cure the powder coating at the temperature and for the time recommended by the powder coating manufacturer.

**2.05 ATTACHMENT****A. Bolted Connection:**

1. **Anchor plate:** 1/4 inch thick, 6 inch by 6 inch steel anchor plate with a 46,000 psi yield strength. Paint or galvanize anchor plate to match handrail or safety rail.
2. **Bolts:** Provide 3/8 inch galvanized anchor bolts or threaded rod with length as required to provide a 3 inch embedment. Comply with ASTM A 36.
3. **Adhesive Anchoring Material:**
  - a. Epoxy complying with ASTM C 881, Type IV. Provide appropriate epoxy class based upon concrete temperature at time of installation.
  - b. Grout on approved products list in [Iowa DOT Materials I.M. 491.11](#), Appendix C.

**B. Grouted Connection:**

1. **Polymer Grout:** Comply with [Iowa DOT Materials I.M. 491.11](#).
2. **Non-shrink Grout:** Comply with [Iowa DOT Materials I.M. 491.13](#).

**PART 3 - EXECUTION****3.01 INSTALLATION OF STEPS**

- A. Prepare Subgrade:** In fill areas, construct and compact subgrade to 95% of maximum Standard Proctor Density.
- B. Forming:** Comply with [Iowa DOT Article 2403.03, B.](#)
- C. Concrete:** Comply with [Section 6010, 3.02.](#) Deposit concrete for the full depth of the steps in one operation.
- D. Reinforcing Steel:** Comply with [Iowa DOT Section 2404.](#) Provide a minimum 2 inches of cover on all reinforcing steel.

**3.02 INSTALLATION OF RAIL****A. General:**

- 1. Install rail continuously with no gaps or breaks along the length specified in the contract documents.
- 2. Use welded connections between rail components. Grind connections to remove sharp or abrasive edges and to remove other irregularities.

- B. Handrail:** Install the top rail between 34 inches and 38 inches above the nose of the step tread. Maintain a consistent height above the step treads. Install the bottom rail midway between the nose of the step and the top rail.

**C. Safety Rail:**

- 1. **Rails:** Install the top rail a minimum of 42 inches above the finished grade. Install the bottom rail a maximum of 4 inches above finished grade.
- 2. **Pickets:** Locate pickets in the center of the top and bottom rails and space evenly between posts. Provide a maximum clear opening between pickets of 4 inches.

- D. Posts:** Install posts at a maximum spacing of 8 feet. Attach handrail posts in one of following two ways.

**1. Bolted Connection:**

- a. Weld anchor plate to the bottom of the handrail posts.
- b. Layout location and drill four 7/16 inch holes for anchor bolts at each post attachment point. Drill holes with a carbide drill bit; do not core drill anchor bolt holes.
- c. Apply adhesive anchoring material according to manufacturer's published recommendations and install threaded rod or anchor bolts.

**2. Grouted Connection:**

- a. Form a 6 inch deep hole in the concrete curb 1 inch larger than the outside diameter of the post. Alternatively, hole may be core drilled in hardened concrete.
- b. After the concrete hardens, set handrail posts into holes and temporarily secure.
- c. Fill the void between the post and holes with non-shrink or polymer grout.

**3.03 PAINTING**

Do not paint hot dipped galvanized or aluminum handrail or safety rail.

- A. Mix paint and/or primer to correct consistency in accordance with manufacturer's instructions before application. Do not reduce, thin, or dilute coatings or add materials to paint unless such procedure is specifically described in manufacturer's product instructions.
- B. Shop coat handrail, safety rail, posts, pickets, and anchor plates with primer following fabrication.
- C. Apply two field coats of paint upon completion of installation.

END OF SECTION