

ITEM 656.1
ITEM 656.2

LOW METAL FENCE – SURFACE MOUNT
LOW METAL FENCE – DIRECT BURY

FOOT
FOOT

Work under these items shall consist of furnishing and installing low metal fence at locations shown on the Plans.

All railing and component pieces shall be hot dip galvanized and factory finished in the galvanizing plant, after fabrication.

All posts shall be plumb in each direction with rail sections parallel to grade.

Submittals

Shop drawings showing layout, dimensions, spacing of components, anchorage, and installation details.

Sample: 42” minimum length sample of railing and picket panel with posts illustrating design, fabrication workmanship, and selected color.

Delivered fence shall closely match the approved sample.

Quality Standards

Metal Materials and Construction Methods

1. Workmanship and finish shall be equal to the best practice of modern shops for each item of work. Exposed surfaces shall have smooth finish and sharp, well-defined lines and arises. Sections shall be well formed to shape and size with sharp lines and angles; curved work shall be sprung evenly to curves. Castings shall have sharp corners and edges, and shall be clean, smooth, and true to pattern. Welding shall be in accordance with the Welding Code of the American Welding Society. All welding, except as otherwise indicated, shall extend the entire length of joints. All welded face joints shall be ground flush and smooth. All welds shall be watertight. Ornamental metalwork shall be cut, drilled, countersunk, and tapped as required for the attachment of other work where shown on the Plans or when instructions for such work are given on the approved shop drawings. Ornamental metalwork to be built in with concrete or masonry shall be of the form required for anchorage or shall be provided with suitable anchors or expansion shields.
2. Steel fabrication shall be accomplished using the highest standards of workmanship. Individual steel pieces shall be saw cut and carefully fit together. All connections shall be full welded and ground flush and smooth. All fabricated steel items shall be fine sanded throughout to produce a high standard of surface smoothness. All surfaces and connections shall be without visible grinding marks, surface differentiation, or variation.
3. All material that is specified to be galvanized shall be hot-dipped galvanized after fabrication, in accordance with ASTM Standard A123, A153, or A386, as applicable. The galvanizer shall provide a notarized statement indicating

compliance with the ASTM Standard.

4. Galvanized surfaces damaged by welding or other causes shall be wire brushed to remove all loose or cracked zinc coating and re-galvanized with a 95 percent zinc cold galvanizing coating prior to finishing.

Qualification of Manufacturer

Contractor shall submit verification to Engineer, which states that all proposed manufacturers of site furnishings have produced products of a similar nature and quality to that which is specified, for a minimum of 5 years and that each manufacturer is capable of producing the quantity of site improvements required by this contract within the time allocated in the project schedule.

MATERIALS

All metal used in the fabrication and installation of the site improvements of this Section shall conform to the following Specifications:

1. Steel Tubing: steel for fabrication shall be in conformance with ASTM A500 Grade B requirements and steel sections for tubing shall have a 5mm minimum wall thickness, unless otherwise noted on Plans.
2. Steel Bar Stock: Steel flat bar stock shall be in conformance to ASTM A36.
3. Steel Hardware: All hardware shall be galvanized steel or stainless steel as indicated on the Plans and in Specifications.
 - a. Galvanized steel hardware shall conform to ASTM A307 requirements and shall be galvanized per ASTM 153.
 - b. Hardware for use in standard steel joints shall conform to ASTM A325 and shall be galvanized per ASTM 153.
 - c. Stainless steel hardware shall be AISI Type 304 conforming to the requirements of ASTM A193.
4. Cast Iron: Conform to ASTM A48 Class 35A for cast grey iron. Cast components shall have surfaces free from injurious defects and burnt-on sand, and shall be reasonably smooth, all-in conformance with industry standards for "Ornamental Castings." Runners, risers, fins, and other cast-on variations from the design shall be removed by shot-blasting or grinding, except that in no case shall striations caused by grinding be visible nor shall projection be removed closer than 1 inch above the cast surface as drawn. Repairs made by welding to restore the thickness or surface relief of the casting will not be permitted.
5. Casting shall be manufactured true to pattern. Component parts shall be fabricated for uniform fit.

Non-shrink Epoxy Grout

Non-shrink epoxy grout for anchor bolts shall be Five Star Epoxy Grout as manufactured

by Five Star Products, Fairfield, CT; Sika Corp. Lyndhurst, NJ, Fosroc- Preco Industries Ltd, Plainview, NJ, or equal.

Galvanizing

Items designated for galvanizing in the finish schedule shall be galvanized as follows:

1. Following fabrication, steel shall be thoroughly cleaned of all dirt, oil, residue or foreign substance and then hot dip galvanized in compliance with ASTM A123, A143, A153, and/or A384, A385, A386 and A780 as applicable. The zinc bath shall contain not less than .5% nickel by weight. Final film thickness of zinc shall be a minimum of 3.4 mils.
2. Following galvanizing, steel shall receive surface grinding to remove lumps, sags or spikes resultant from the galvanizing process. The finished surface following grinding shall be hand smooth and without irregularities. Take care not to damage the galvanized surface coating.

Surface Preparation Prior to Painting

1. All hot dip galvanized material shall be cleaned in accordance with Steel Structure Painting Council Specification SSPC-SP-1.
2. Following cleaning and prior to the application of the finish coat, materials shall be visually inspected to confirm complete absence of contaminants.

Coatings – General

1. All coatings shall be manufactured by the same coating manufacturer.
2. Two-part coating materials shall be packaged in two (2) preportioned separate containers such that mixing the entire contents of both containers will yield the correct mixing ratio.
3. All coating containers shall bear labels on which shall be clearly shown the name of the coating manufacturer, the name of the product, the lot and batch number, the date of manufacture and the end of shelf-life date. The label shall also include complete specific instructions for the opening, mixing, thinning and application of the contained coating material.
4. Thinning of primer or topcoat coatings shall only be done with materials manufactured by the coating manufacturer for that purpose and shall be used in quantities which maintain the volatile organic compound level of the thinned coating below the 3.5 lb/gal. maximum allowed.

Priming

Items designated for epoxy primer and color finish in the finish schedule shall be painted as follows:

1. Following galvanizing and prior to coating the hot dip galvanized steel shall be prime coated by the galvanizer.

2. Primer Material:

a. The primer material shall be a high-build, two component, polyamide epoxy primer which is compatible with recognized quality topcoats. Custom color shall contrast with selected topcoat color.

b. The primer coat shall display compatibility with and adhesion to cast iron and hot-dip galvanized surfaces which have been solvent cleaned.

c. Primer coat shall conform to the following requirements:

Temperature Continuous 93°C

Resistance Intermittent 121°C
Dry Film

Curing Time To Touch - 4 hours min.
@ 24°C To Handle - 16 hours
min. or recoat

Shelf Life 12 month minimum

Preportioned One Part A to One Part B
Mixing Ratio

Generic Type Part A - Polyamide Resin
Vehicle Part B - Epoxy Resin based on Bisphenol - A
and Epichlorohydrin

Total Solids 58%
by Volume

Weight per Gallon 12.7 lbs.

Pot Life @ 25°C 16 hrs min./20 hrs max.

V.O.C. 3.5 lb/gallon max.
(Volatile Organic Compounds)

3. Performance Criteria: Test panels of hot-dip galvanized steel meeting the requirements of this section and having dimensions of 75mm x 150mm shall be cleaned in accordance with Steel Structure Painting Council Surface Preparation No. 1 (SSPC-SP-1) and then prime painted as specified to meet the following test requirements:

Abrasion

Method: Fed. Test Method Std. No. 141 Method 6192, CS-17 Wheel, 1,000-gram load.

System: One coat, high-build polyamide epoxy

Requirements: No more than .0046 oz loss after 1,000 cycles

Adhesion

Method: Elcometer Adhesion Tester (0-1,000 PSI)

System: One coat high-build polyamide epoxy over hot-dip galvanizing

Requirements: Not less than 800 PSI pull, average of three pulls

4. Primer Application: Primer shall be applied by airless spray in shop, 1 coat, with a minimum dry film thickness (DFT) of 4.0 mils. If this cannot be achieved with a single coat, then a second coat will be required. Primer shall be applied over clean, dry, hot dipped galvanized steel by the galvanizer at his own facility within 12 hours of galvanizing.

Topcoat Finish

1. Items designated for a urethane topcoat shall be painted in compliance with the following requirements:
 - a. The topcoat material shall be a specifically formulated, high-build, two component, high gloss catalyzed aliphatic urethane. Custom color shall be approved by Engineer.
 - b. The topcoat material shall display compatibility with and adhesion to the approved polyamide epoxy primer.
 - c. Topcoat shall conform to the following requirements:

Temperature	Continuous	77°C
Resistance, Dry Film	Intermittent	93°C

Curing Time	To Touch	2.5 hr min.
@ 23°C	To Handle or recoat	24 hr min.

Preportioned Mixing Ratio	4:1 by Volume
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Generic Type Total Solids	Aliphatic Urethane Resin Vehicle 73%
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by Volume

Weight per Gallon 11.5 lbs.

Pot Life @ 25°C 2.5 hrs

V.O.C. 3.5 lb/gallon max.
(Volatile Organic Compounds)

2. Performance Criteria: Test panels of hot-dip galvanized steel meeting the requirements of this section with polyamide epoxy primer and having dimensions of 3-inch x 6-inch shall be cleaned and then painted with topcoat material as specified, to meet the following testing requirements:

Abrasion

Method: Fed. Test Method Std. No. 141, Method 6192, CS-17 Wheel, 2.20-pound load.

System: One coat, high-build aliphatic urethane over one coat of high-build polyamide epoxy

Requirements: No more than .0034 oz. loss after 1,000 cycles

Adhesion

Method: Elcometer Adhesion Tester (0-1,000 PSI) ASTM D 4541

System: One coat high-build aliphatic urethane over one coat of high-build polyamide epoxy over hot-dip galvanizing

Requirements: No less than 800 PSI pull, average of three pulls

3. Topcoat application: Topcoats shall be factory applied by airless spray in a two-coat application to provide a total topcoat thickness of 5.0 mils (DFT) minimum. This shall be applied over clean dry epoxy prime-coated, galvanized steel or cast iron.
4. Topcoat color and gloss level: Finish color of all components shall be black.

General Finishing Requirements

1. Primer and topcoats shall be applied under the following atmospheric conditions, within the following tolerances:

Air Temp	50° F min., 89.6° F
max. Steel	50° F min., 100° F max.
Topcoat	69.8° F
Humidity	65% maximum

Dew Point not within 5° of air temperature

2. To facilitate curing the top coated material shall be dried in a force drying facility capable of reaching a temperature of 150.8° F (with a sustained capability of 100° F).
3. Surface must be dry and free from dust, dirt, oil, grease or other contaminants.
4. Keep environment free of airborne dust and dirt until coating is dry.
5. To ensure compliance with this Specification all temperature and humidity levels will be continuously monitored with a recording hydrothermograph.
6. Both the spray and cure facility shall be in full compliance with all applicable Federal, State, Local, OSHA, EPA and fire regulations.

Inspection, testing and certification: The final coating shall be tested for proper wet film thickness during application by using an approved wet film thickness gauge. Upon curing of topcoats, the final mil thickness shall be determined on random areas utilizing a "Tooke" gauge. Tested area shall be touch-up painted with specified coatings. Magnetic "pull-off" types of gauges will not be permitted. Adhesion shall be tested on random samples in conformance with Federal Specification TT-C-490B Paragraph 4.2.8. Contractor shall supply to the Engineer a notarized certificate of compliance with these Specifications.

Supply Engineer with full particulars and schedule for all paint finishing materials utilized.

Warranty: The galvanizer shall furnish a warranty stating that the galvanizing top coated in accordance with the Specification shall remain free from more than 5% rust for a period of ten years.

Handling: Galvanizer shall handle, pack, and ship in such a manner as to minimize damage to the finish. Upon arrival at job site, it shall be the Contractor's responsibility to take equal precautions. Since some surface damage is inevitable, suitable touch-up material shall be readily available from the galvanizer for the Contractor's use.

Touch-up Material: Upon acceptance of construction and installation of each item, the galvanizer shall supply to the City's representative: the equivalent of one quart of touch-up material for each item installed. Touch up material shall be delivered in containers which were factory-filled and sealed.

Fabrication

In assembling and during welding of the top and bottom rails, the component parts shall be held by sufficient clamps or other means to keep the parts straight and level.

Arc welding procedures and materials used for welding shall conform to the current Specifications of the American Welding Society for the metals involved with all welds ground smooth.

After being deposited, welds shall be brushed with wire brushes, show uniform section, smoothness of weld metal, feather edges without envelopes and freedom from porosity. Visual inspection at edges and ends of fillets and butt joint welds shall indicate good fusion with and penetration into the base metals. All welds shall be watertight, and precaution shall be taken to minimize locked-up stresses and distortion due to heat.

Galvanizing

All metal items shown on the Plans shall be hot-dipped galvanized after fabrication in accordance with ASTM A 385. Zinc coating shall weight at least 1.5 oz per 10.76 square feet of metal surface. All hot-dip galvanized material shall be finished within 12 hours of galvanizing with an epoxy primer and polyurethane finish.

Paint Color

Color to be black.

CONSTRUCTION METHODS

Handling

Galvanizer shall handle, pack, and ship in such a manner as to minimize damage to the finish. Upon arrival at job site, it is the Contractor's responsibility to take equal precautions. Touch-up material shall be provided by the galvanizer for touch-up of damaged areas.

Installation

Surface Mount Fence (for Hardscape Areas)

Install fence as indicated on the Plans and approved shop drawings.

Posts and pickets must, in all cases, be truly vertical as shown on the Plans. Rails and bars must be parallel to grade. Fence panels must align to each other in a consistent grade. Dimensions of fence panels may vary as required by existing conditions.

Do not install bent, bowed, or otherwise damaged panels. Remove damaged components from site and replace.

Secure fence panels to posts with stainless-steel bolts. All visible nuts, washers, and ends of all bolts must be painted with touch-up paint.

Any field welding shall be performed by a certified welder.

Touch-up damaged finish with paint matching original coating.

Direct Bury Fence (for Planting Areas)

Install fence as indicated on the Plans and approved shop drawings.

Direct bury low metal fence must be erected in soil only. The steel spikes must be set in place and properly supported to hold them to line and grade according to the Plans.

Posts and pickets must, in all cases, be truly vertical as shown on the Plans. Rails and bars must be parallel to grade. Fence panels must align to each other in a consistent grade. Dimensions of fence panels may vary as required by existing conditions.

Do not install bent, bowed, or otherwise damaged panels. Remove damaged components from site and replace.

Secure fence panels to posts with stainless-steel bolts. All visible nuts, washers, and ends of all bolts must be painted with touch-up paint.

Any field welding shall be performed by a certified welder.

Touch-up damaged finish with paint matching original coating.

METHOD OF MEASUREMENT

Low Metal Fence – Surface Mount will be measured for payment by the foot, complete-in-place. Measurements will be taken in a horizontal plane.

Low Metal Fence – Direct Bury will be measured for payment by the foot, complete-in-place. Measurements will be taken in a horizontal plane.

BASIS OF PAYMENT

Low Metal Fence – Surface Mount will be paid for at the Contract unit price per foot, which price shall include all labor, materials, equipment, and incidental costs required to complete the work. No separate payment will be made for submittals, fabrication, installation, core drilling, anchor bolts, or grout, but all costs in connection therewith shall be included in the Contract unit price bid.

Low Metal Fence – Direct Bury will be paid for at the Contract unit price per foot, which price shall include all labor, materials, equipment, and incidental costs required to complete the work. No separate payment will be made for submittals, fabrication, installation, core drilling, anchor bolts, or grout, but all costs in connection therewith shall be included in the Contract unit price bid.