

**SECTION 05 50 00**  
**METAL FABRICATIONS**

**PART 1 - GENERAL**

**1.1 SUMMARY**

- A. Furnish and install:
  - 1. Soffit support framing.
  - 2. Universal grid system.
  - 3. Steel mesh infill.
- B. Perform all drilling and cutting in miscellaneous metal items required for the attachment of other items.
- C. Perform all shop painting for all surfaces of exposed to view galvanized and non-galvanized metals, and post-erection touch-up of shop prime coat, using the same material as shop- prime coating.
- D. Perform application of liquid zinc touch-up to all welds of galvanized steel items furnished hereunder.

**1.2 RELATED REQUIREMENTS**

- A. Section 06 10 00 - ROUGH CARPENTRY: Wood blocking.
- B. Section 09 22 16 - NON-STRUCTURAL METAL FRAMING: Non-loadbearing metal framing systems for interior partitions and ceilings.
- C. Section 09 91 00 - PAINTING: Applied finish coatings other than those specified herein.

**1.3 REFERENCES**

- A. Referenced Standards: Comply with applicable requirements of the following standards and those others referenced in this Section, under the provisions of Section 01 42 00 - REFERENCES. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern.
  - 1. ASTM A 36 - Structural Steel.
  - 2. ASTM A 53 – Pipe, Steel, Black and Hot-Dipped, Zinc-coated, Welded and Seamless Steel Pipe.
  - 3. ASTM A 108 - Standard Specification for Steel Bar, Carbon and Alloy, Cold Finished.
  - 4. ASTM A 123 - Zinc Coatings on Products Fabricated From Rolled, Pressed and Forged Steel Shapes, Plates, Bars, and Strip.
  - 5. ASTM A 153 - Zinc-Coating on Iron and Steel Hardware.
  - 6. ASTM A 283 - Carbon Steel Plates, Shapes, and Bars.
  - 7. ASTM A 307 - Carbon Steel Externally Threaded Standard Fasteners.
  - 8. ASTM A 325 - Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength
  - 9. ASTM A 361 - Zinc Coated (Galvanized) Iron or Steel Roofing sheets.

10. ASTM A 385 – Providing High Quality Zinc Coatings.
11. ASTM A 386 - Zinc Coating on Assembled Steel Products.
12. ASTM A 446 - Zinc Coated (Galvanized) Steel Sheets of Structural Quality, Coils and Cut Lengths.
13. ASTM A 501 - Hot-Formed Welded and Seamless Carbon Steel Structural Tubing.
14. ASTM A 525 - Specification for Sheet Steel, Zinc Coated (Galvanized).
15. ASTM A 780 – Repair of Hot-Dip Galvanizing.
16. ASTM A1011/A1011M - Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High- Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra- High Strength.
17. ASTM B117 Standard Practice for Operating Salt Spray (Fog) Apparatus.
18. ASTM B 209 - Specification for Aluminum Alloy, Sheet and Plate.
19. ASTM B 221 - Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes, and Tubes.
20. ASTM A 575 Standard Specification for Steel Bars, Carbon, Merchant Quality, M- Grades.
21. ASTM A576 Standard Specification for Steel Bars, Carbon, Hot-Wrought, Special Quality.
22. ASTM A 653 Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
23. AGAI - Inspection Manual for Hot-Dipped Galvanized Products.
24. AISC - Code of Standard Practice for Steel Buildings and Bridges.
25. AISC - Specifications for the Design, Fabrication and Erection of Structural Steel for Buildings.
26. AISI referenced standards.
27. AWS - Standard Code for Arc and Gas Welding in Building Construction.
28. FS QQ-A-250d - Aluminum and Aluminum Alloy, Plate and Sheet.
29. MIL-P-21035B - Paint High Zinc Dust Content, Galvanizing Repair (Metric) (superseding DOD-P-21035A)
30. NAAMM, applicable publications.
31. SSPC referenced standards.

#### **1.4 ADMINISTRATIVE REQUIREMENTS**

- A. Coordination:
  1. Be responsible for establishing locations and levels for all work of this Section, except such parts as may be delivered to others and set by them. In such cases assist them in properly locating said parts.
- B. Pre-Installation Meetings: At least two weeks prior to commencing fabrication work of this Section, conduct a pre-installation conference at the Project site. Comply with requirements of Section 01 31 00 - PROJECT MANAGEMENT AND COORDINATION. Coordinate time of meeting to occur prior to installation of work under the related sections named below.
  1. Required attendees: Architect, Contractor, Installer's Project Superintendent, and representatives of other related trades as directed by the Architect or

Contractor.

2. Agenda:

- a. Scheduling of metal fabrications operations.
- b. Finish and installation requirements for AESS fabricated components.
- c. Review of staging and material storage locations.
- d. Coordination of work by other trades.
- e. Installation procedures for ancillary equipment.
- f. Protection of completed Work.

C. Sequencing:

1. Field Measurements:

- a. Take field measurements before preparation of shop drawings and fabrication, where possible, to ensure proper fitting of Work.
- b. Allow for adjustments within specified tolerances wherever taking of field measurements before fabrication might delay Work.

D. Scheduling:

1. Coordinate the work of this Section with the respective trades responsible for installing inserts and anchorages furnished by this Section; make arrangements for delivery, receipt and installation of inserts and anchorages to prevent delay of the Work.

## **1.5 SUBMITTALS**

A. Information and Review Submittals: Submit the following under provisions of Section 01 33 00 - SUBMITTAL PROCEDURES:

1. Product Data: Manufacturer's complete product data and specifications for all prefabricated items, shop primer paints, liquid zinc coating, and hydraulic cements, to be furnished hereunder.
  - a. For epoxy anchoring systems: Furnish ICC-ES Code approvals and performance data that includes recommended loading for each application.
1. Shop Drawings, bearing registration stamp of a Professional Structural Engineer registered in Commonwealth of Virginia:
  - a. Include large scale details of items of all metal fabrications to be furnished hereunder, showing proposed methods of anchorage to surrounding structure and conditions.
  - b. Include large scale details of railings.
  - c. Include large scale details of metal fabrications supporting work of other trades.
  - d. Indicate on the shop drawings all erection marks for various places of miscellaneous metals, and ensure that the actual field pieces bear corresponding marks.
2. Selection Samples:
  - a. Sample card indicating Manufacturer's full range of colors of shop applied finishes available for selection by Architect.
3. Verification Samples:
  - a. Factory/shop finishes: 3 inch by 6 inch samples of factory-applied coatings and colors proposed for use for approval prior to coating application.

- b. Provide minimum 24 by 24 inch (or equivalent for shapes) of fabricated and finished ornamental metal components, demonstrating the quality of fabrication work, and finish.
  - 4. Certificates:
    - a. Certificate of Compliance from Galvanizer: Submit notarized Certificate of Compliance with application for payment for galvanizing, signed by galvanizer, indicating compliance with requirements of specifications. Include scope of services provided, and quantity and itemized description of items processed.
    - b. Welders certificates as specified under Article entitled “QUALITY ASSURANCE”.
  - 5. Delegated Design Submittals:
    - a. Provide calculations for loading and stresses for metal railings bearing the Professional Structural Engineer’s seal. Show how design load requirements and other performance requirements as required by the Virginia State Building Code have been satisfied.
- B. Closeout Submittals: Submit the following under provisions of Section 01 78 00 - CLOSEOUT SUBMITTALS.
- 1. Special Inspections: Submit prior to request for Certificate of Occupancy, to both Architect and local Building Official having jurisdiction, the following:
    - a. All certifications, reports and programs required by the Virginia State Building code for work engineered by Contractor’s Professional Engineer under the requirements of this Section.

## **1.6 QUALITY ASSURANCE**

- A. General: Notify the Architect where conflicts apply between referenced standards and existing materials, and existing methods of construction.
  - 1. Galvanizer’s tagging: The galvanizer shall mark all lots of material with a clearly visible stamp or tag indicating the name of the galvanizer, the weight of the zinc coating, and the applicable ASTM Specification Numbers.
- B. Qualifications:
  - 1. Fabricator/Installer: Minimum of 5 years documented experience demonstrating previously successful work of the type specified herein, and approved by product manufacturer.
  - 2. Welders: Utilize only qualified welders employed on the Work. Submit verification that Welder’s are AWS D1.1 and D1.4 qualified within the previous 12 months.
  - 3. Licensed Professionals: Provide the services of a Professional Structural Engineer, registered in the Commonwealth of Virginia to design and certify that the work of this section meets or exceeds the performance requirements specified in this section and as required by the Virginia State Building Code.
    - a. Prepare Shop Drawings for railings under direct supervision of a same Engineer experienced in design of this work.

## **1.7 DELIVERY, STORAGE AND HANDLING**

- A. Delivery and Acceptance Requirements:
  - 1. Do not order or deliver any materials until all submittals, required in the listed

Specification Sections included as part of this Subcontract, have been received and approved by the Architect.

- B. Storage and Handling Requirements:
1. Handle and store materials under cover in a manner to prevent defacement, deformation, or other damage to the materials and to shop finishes, and to prevent the accumulation of foreign matter on the metal work. All such work shall be repaired and cleaned prior to erection.

## **PART 2 - PRODUCTS**

### **2.1 MATERIALS**

- A. General: All materials shall be new stock, free from defects impairing strength, durability, or appearance, and of best commercial quality for each intended purpose. Unless specifically called for otherwise, work shall be fabricated from the following:
1. Aluminum: Provide alloy and temper recommended by aluminum producer or finisher for the type of use and finish indicated
    - a. Extruded bar and shapes: ASTM B 221, alloy 6063--T6 or alloy 6463--T52.
    - b. Extruded pipe and tube: ASTM B 429, alloy 6063-T6.
    - c. Drawn Seamless tube: ASTM B 483, alloy 6063-T832.
    - d. Plate and sheet: ASTM B209, alloy 6063--T6 or Alloy 3003-H14
  2. Steel shapes, plates and bars: ASTM Designation A 36.
  3. Steel pipe: ASTM A53, grade A, seamless pipe, black finish unless otherwise noted.
  4. Structural steel tubing, square and rectangular shapes: ASTM A500, Grade B.
  5. Steel tubular shapes: ASTM A 501.
  6. Steel plates to be bent or cold-formed: ASTM A283, grade C.
  7. Steel bars and bar-size shapes: ASTM A36.
  8. Cold-finished steel bars: ASTM A108.
  9. Galvanized carbon steel sheets: ASTM A526, with G90 zinc coating in accordance with ASTM A525.
- B. Steel materials: to be hot dip-galvanized: Provide steel chemically suitable for metal coatings complying with the following requirements: Carbon below 0.25 percent, silicon below 0.24 percent, phosphorous below 0.05 percent, and manganese below 1.35 percent. Notify galvanizer if steel does not comply with these requirements to determine suitability for processing.
- C. Metal surfaces, general: For metal fabrications exposed to view upon completion of the Work, provide materials selected for their surface flatness, smoothness and freedom from surface blemishes. Do not use materials whose exposed surfaces exhibit pitting, seam marks, roller marks, rolled trade names, roughness, and, for steel sheet, variations in flatness exceeding those permitted by reference standards for stretcher-leveled sheet.
- D. Welding rods: AWS E70XX grade, or select in accordance with AWS specifications for the metal alloy to be welded and in accordance with the recommendation of the welding rod manufacturer.
1. Where stainless steel is welded to mild steel, select rods to minimize dilution effects on the stainless steel component.

## 2.2 UNIVERSAL GRID SYSTEM

- A. Specified Manufacturer: To establish a standard of quality, design and function desired, Drawings and specifications have been based on Unistrut Corporation, Itasca IL.
  - 1. Acceptable Manufacturers and products: Subject to compliance with the requirements specified herein, manufacturers offering products which may be incorporated in the work include the following.
    - a. Unistrut Corporation, Itasca IL., product “Unistrut”
    - b. Thomas & Betts Corporation, Memphis TN, product “Kindorf Superstrut”.
  - 2. There are no other manufacturers of this product type available in the United States, fabricators may choose to fabricate grid system components using structural steel shapes, with submittal and approval of complete engineering Drawings and calculations as a substitution.
  - 3. Finish:
    - a. Rust inhibiting acrylic enamel paint applied by electro-deposition after cleaning and phosphating, and thoroughly baked shall be used at exposed to view grid components. Color is per Federal Standard 595a color number 14109 (dark limit V-). Finish to withstand minimum 400 hours salt spray when tested in accordance with ASTM B 117.
    - b. Zinc coated after all manufacturing operations are complete. Coating shall conform ASTM A 123 or A 153.
- B. All channel members shall be fabricated from structural grade steel confirming to the following ASTM specifications:
  - 1. ASTM A 653 Grade A
- C. All fittings shall be fabricated from steel conforming to one of the following ASTM specifications:
  - 1. ASTM A 36, A 575, or A 576.
- D. All materials shall be stamped and identifiable by manufacturer and part number (where appropriate). Materials that appear damaged, distressed, unidentifiable or rusted shall not be used and will not be accepted.

## 2.3 STEEL MESH INFILL

- A. Specified Manufacturer: To establish a standard of quality, design and function desired, Drawings and specifications have been based on McNichols Company, model 3621200048, consisting of the following characteristics:
  - 1. Product type: Plain steel, cold-rolled rectangular mesh.
  - 2. Weight: 0.7 #/SF.
  - 3. Construction type: Welded trimmed.
  - 4. Mesh size 1: 2 inches.
  - 5. Mesh size 2: 1 inch.
  - 6. Opening size 1: 1.8800.
  - 7. Opening size 2: 0.8800.
  - 8. Wire diameter parallel width: 0.1200.

9. LWO parallel to: Width.
10. Percent of open area: 84.
11. Width: 48 inches.
12. Length, (span for grating): 96 inches.
13. SKU type: Sheet.
14. Wire diameter parallel length: 0.1200.
15. Acceptable Manufacturers and products: Subject to compliance with the requirements specified herein, manufacturers offering products which may be incorporated in the work include the following.
  - a. McNichols Company, North Billerica, MA.
  - b. WireCrafters LLC, Louisville, KY.

## **2.4 FASTENERS**

- A. General: Provide all fasteners and attachments as required for work specified herein and as indicated on the Drawings.
  1. In general,
    - a. Provide all fasteners and attachments of the same material and finish as the metal to which it is applied unless otherwise noted.
      - 1) Provide Type 304 stainless-steel fasteners for exterior use.
      - 2) Provide Type 304 stainless-steel fasteners for fastening aluminum.
- B. Steel Bolts, Nuts and Washers: ASTM A307, galvanized to ASTM A153 for galvanized components.
- C. Fasteners at blind structural tubes or other blind conditions: Lindaptor North America, Ann Arbor MI, product: "Type HB Hollo-Bolt", or approved equal.
  1. Acceptable Manufacturers, or approved equal.
    - a. Lindaptor North America, Ann Arbor MI.
    - b. Simplified Building Components, Rochester NY.
    - c. Avdel USA LLC, Stanfield NC.
  2. Head type: Button head.
  3. Material: Stainless steel.
- D. Stainless-Steel Bolts and Nuts: Regular hexagon-head annealed stainless-steel type 304 bolts, nuts and, where indicated, flat washers; ASTM F 593 for bolts and ASTM F 594 for nuts, Alloy Group 1.
- E. Anchor Bolts: ASTM F 1554, Grade 36.
  1. Provide hot-dip or mechanically deposited, zinc-coated anchor bolts where item being fastened is indicated to be galvanized.
- F. Eyebolts: ASTM A 489.
- G. Machine Screws: ASME B18.6.3.
- H. Lag Bolts: ASME B18.2.1.
- I. Wood Screws: Flat head, ASME B18.6.1.

- J. Plain Washers: Round, ASME B18.22.1.
- K. Lock Washers: Helical, spring type, ASME B18.21.1

## **2.5 ACCESSORIES**

- A. Adhesive for attaching anchors and for direct pinning: high-modulus, high strength, moisture tolerant, epoxy adhesive. Two-component 100 percent solids, epoxy resin complying with ASTM C 881.
  - 1. Minimum performance properties (as cured at 70 degrees F. and 50 percent relative humidity):
    - a. Minimum Compressive Strength, tested per ASTM D-695: 1) at 3 days: 11300 psi (31.0 MPa).  
2) at 7 days: 11800 psi (44.8 MPa).  
3) at 28 days: 12200 psi (58.6 MPa).
    - b. Shear Strength, tested per ASTM D-732 at 14 days: 6200 psi (43 MPa)
    - c. Minimum Flexural Strength tested per ASTM D-790 at 14 days: 10700 psi (74 MPa).
    - d. Minimum Bond Strength tested per ASTM C-882 at 14 days:
      - 1) Plastic Concrete to Hardened Concrete 2200 psi (13.8 Mpa).
      - 2) Plastic Concrete to Steel 2000 psi (13.8Mpa).
    - e. Maximum Water Absorption, tested per ASTM D-570: 24 hour 0.27%
    - f. Minimum Tensile properties tested per ASTM D-638: Tensile Strength 6900 psi (48 Mpa).
  - 2. Products which may be considered as equal include the following:
    - a. Sika Corporation, Lyndhurst NJ., product: "Sikadur 32 Hi-Mod Gel.
    - b. Simpson Strong Tie, Pleasanton, CA, product "SET High Strength Epoxy".
    - c. Symons Corporation, Des Plaines, IL, product "Rescon Gel anchor 304".
- B. Grout: Ready mixed, non-metallic high-strength controlled expansion grout of flowable consistency, conforming to ASTM C 1107 with minimum compressive strength of 8,000 pounds per square inch (55.2 MPa) at 28 days.
  - 1. Products which may be considered as equal include the following:
    - a. Five Star Products, Inc., Fairfield CT, product "Five Star Grout."
    - b. L&M Construction Chemicals, Omaha NE, Product: "Crystex."
    - c. BASF Construction Chemicals, Cleveland, OH, product "Masterflow 713".
    - d. Sika Corporation, Lyndhurst, NJ, product "SikaGrout 212".
    - e. ChemMasters, Madison, OH, product "Conset".
- C. Metal paste filler: 2 component epoxy, high strength, structural adhesive putty:
  - 1. Products which may be considered as equal include the following:
    - a. Abatron, Inc. Gilberts IL, product: "Ferrobond-P".
    - b. Dynatron/Bondo Corp., Atlanta, GA, product: "Bondo Plastic Filler".
    - c. U.S. Chemical & Plastics Company., Massillon OH, product "Metal filled epoxy".
- D. Liquid zinc coating, for touch-up of welds, scratches, and abrasions in galvanized steel: Low VOC organic zinc-rich coating containing 92% metallic zinc, by weight in the dried



film (ASTM D520, Type III) and conforming to SSPC Paint 20, Type II, Level 1. Liquid zinc coating shall be recognized under the Component Program of Underwriter's Laboratories, Inc. as an equivalent to hot-dip galvanizing; conforming to MIL-P-21035B and SSPC Paint 29, Type II, Level I, for repair of hot-dip galvanizing and meeting the requirements for Zinc- Rich Paints.

1. VOC limit: not more than 250 g/L.
  2. Specified manufacturer and product: ZRC Worldwide, Marshfield MA, product "ZRC- 221".
- E. Primer for non-galvanized steel surfaces, modified alkyd rust-inhibitive, high solids primer:
1. Products which may be considered as equal include the following:
    - a. International (Courtaulds Coatings): Interlac 260HS.
    - b. Rust-Oleum: 1069 Heavy Duty Rust Inhibitive Red Primer.
    - c. Sherwin Williams: Kem Flash Primer HS, Red Oxide E61R702.
    - d. Tnemec: 10-99 Red Primer.
    - e. Wibur & Williams (California Products Corporation): 1703 Universal Metal Primer.

## **2.6 FABRICATION - GENERAL**

- A. Metal surfaces shall be clean and free from mill scale, flake, rust and rust pitting; well-formed and finished to shape and size, true to details with straight, sharp lines, and angles and smooth surfaces. Curved work shall be to true radii. Exposed sheared edges shall be eased.
- B. Shop fabricate items wherever practicable, accurately fitting all parts and making all joints tight. Do not fabricate materials until all specified submittals have been submitted to, and approved by, the Architect.
- C. Do all cutting, punching, drilling, and tapping required for attachment of anchor bolts and other hardware and for attachment of work by other trades. All such work shall be done prior to hot-dip galvanizing of the various components.
- D. Grind all edges of bars and plates completely free from nicks and machine marks, prior to galvanizing and/or shop priming.
- E. Grind all exposed-to-view welds completely smooth and flush to the surface plane of the base metals. Perform welding work prior to galvanizing in all cases, except where field welding is necessary, in which case, completely coat all such welds with two coats of specified liquid zinc coating, after performing grinding operations.
- F. Use screws and bolts only where welding cannot be performed, of sufficient size to ensure against loosening from normal usage of miscellaneous metal items furnished hereunder.
  1. Countersink all screw heads and bolt heads as far as practicable. Use not less than two screw, bolts, or other anchorage items, at each connection point.
  2. Draw up all threaded connections tightly, after buttering same with pipe joint compound, to exclude water.
- G. Carefully coordinate the installation of metal fabrications with the work of trades responsible for the installation of interfacing work, and for the installation of work into the various assemblies furnished hereunder, and permit the installation of the related

materials to be made at the appropriate times.

- H. Fit and assemble metal fabrications in largest practical sections for delivery to site, ready for installation.
  - 1. Galvanized assemblies: Where size of assembly is too large for galvanizing kettle, galvanize components prior to fabrication and assemble after galvanizing.

## **2.7 FABRICATION - RAILINGS**

- A. Refer to the Drawings for location and details of steel railings to be furnished and installed hereunder.
  - 1. Verify heights shown in Drawings comply with referenced codes and regulations.
- B. Railing performance requirements; conform to all requirements of those codes and regulations referenced under Section 01 41 00 - REGULATORY REQUIREMENTS.
  - 1. Design, fabricate and install all railings in a manner which will ensure the railings will be capable of withstanding loads as follows, required by the International Building Code, Section 1607.
    - a. Resist a load of 50 pounds per linear foot (0.73 kN/m) applied in any direction at the top and to transfer load through railing supports to structure.
    - b. Resist a single concentrated load of 200 pounds (0.89kN) applied in any direction at any point along the top, and to transfer load through railing supports to structure.
    - c. Intermediate rails, balusters and panel fillers shall resist a horizontally applied load of 200 pounds (0.89kN) on an area equal to 1 square foot (.093m<sup>2</sup>), including openings and space between rails.
- C. Fabrication, Railings: Fabricate to comply with requirements indicated for design, dimensions, details, finish, and member sizes, including wall thickness of tube, post spacings, and anchorage, but not less than that needed to withstand indicated loads and deflection criteria. Indicate on shop drawings sizes of all members, gages and configurations of handrails, and guardrails.
  - 1. Fabricate railings with welded connections. Cope components at connections to provide close fit, or use fittings designed for this purpose. Weld all around at connections, including at fittings.
    - a. Finish welds to comply with NOMMA's "Voluntary Joint Finish Standards" for Type 1 welds: no evidence of a welded joint.
  - 2. Form changes in direction of railings as indicated on drawings, with radius bends of radius indicated. Form simple and compound curves by bending members in jigs to produce uniform curvature for each repetitive configuration required; maintain cross section of member throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of components.
  - 3. Close exposed ends of railing members with prefabricated end fittings.
  - 4. Provide wall returns at ends of wall-mounted handrails unless otherwise indicated. Close ends of returns unless clearance between end of rail and wall is 1/4 inch (6 mm) or less.
  - 5. Brackets, Flanges, Fittings, and Anchors: Provide wall brackets, end closures, flanges, miscellaneous fittings, and anchors for interconnecting components and

for attaching to other work. Furnish inserts and other anchorage devices for connecting to concrete or masonry work.

- a. Connect posts to stair framing by direct welding unless otherwise indicated.

## **2.8 FABRICATION - SUPPORTS**

- A. Design, engineer and fabricate structural overhead support for equipment, furnishings, and products furnished under Sections, which includes, but is not limited to:
  1. Equipment furnished under individual specification sections.
  2. Owner's furnished equipment.
- B. Fabricate support system to carry the entire load of supported products to building structure above without transferring any horizontal or vertical load to ceiling system(s). Provide frequently spaced holes for multiple adjustments. Provide diagonal bracing. Use of a "Universal Grid" system members is acceptable.
- C. Fabricate supports for medical equipment and surgical lights utilizing a "Universal Grid" system with rails extending wall-to-wall, perpendicular to the path of travel of the equipment.
  1. Design, engineer and fabricate supporting framework to support a concentrated load at any single point along the exposed rails, as exerted by the equipment to be purchased by the Owner.
    - a. Installed framework shall have a minimum loading safety factor of 2.5, based upon ultimate strength under static loading conditions.
    - b. The concentrated load shall be the maximum that will be encountered by positioning the equipment at the extremities of its travel (maximal load configurations).
    - c. Base loads on the most severe conditions as may be encountered by any of the manufacturers producing equipment for the type of services of the rooms indicated.
  2. Rail shall be on centers as required by equipment manufacturer and allow continuous attachment along any point on the rail.
  3. System shall be true, plumb and level to the tolerances indicated, with no more than 1/720th of the span maximum deflection in either plane, when maximum loading  
Conditions are applied due to equipment operations.

## **2.9 FINISHES - HOT-DIP GALVANIZING**

- A. Surface preparation prior to galvanizing: Pickle steel prior to galvanizing in conformance with SSPC-SP8. Remove all rust, dirt, weld flux, weld spatter, and other foreign matter.
- B. Hot-Dip Galvanizing: For steel exposed to the elements, weather or corrosive environments and other steel indicated to be galvanized, provide coating for iron and steel fabrications applied by the hot-dip process.
  1. Basis-of-Design: "Duncan Galvanizing, Everett, MA, product "Duragalv."
  2. Comply with ASTM A 123 for fabricated products and ASTM A 153 for bolts, nuts, washers, and other rough hardware. Provide thickness of galvanizing specified in referenced standards.
  3. Wherever possible, perform galvanizing after assembly of items.

4. Galvanized items shall be straightened to remove all warpage and distortion caused by the galvanization process.
5. Fill vent holes after galvanizing (if applicable), and grind smooth.
6. Touch-up all breaks on hot-dip surfaces caused by cutting, welding, drilling or undue abrasion with liquid zinc coating as specified herein above. Apply liquid zinc by brush or spray on all damaged areas in two coats to a total dry film thickness of not less than 3 mils. Apply first coat within two hours after damage to hot-dip film to prevent undue oxidation of exposed surface. On all welds remove weld spatter by power wire brushing or equivalent before applying liquid zinc coating. Repair material should extend at least 3 inches beyond all edges of the damaged galvanized area as possible to assure continuity of galvanic protection.
7. Touch-up of galvanized surfaces with aerosol spray, silver paint, bright paint, brite paint, or aluminum paints is not acceptable.

## **2.10 FINISHES - SHOP APPLIED COATINGS**

- A. Schedule: Shop applied coatings as scheduled at end of Section and as indicated on Drawings.
- B. For non-galvanized steel surfaces:
  1. Surface preparation prior to priming: Thoroughly clean all steel of all loose mill scale by power wire brushing or sandblasting. Remove all rust, dirt, weld flux, weld spatter, and other foreign matter by wire-brushing or scraping (power wire-brushing, if necessary). Grind smooth any sharp projections.
  2. Shop apply specified primers thoroughly and evenly on the surfaces and worked into the joints and other open areas on the surfaces. Surfaces inaccessible after assembly shall be given two coats. Dry film thickness of primer shall be not less than 2.4 mils per coat.
- C. For hot-dipped galvanized steel items scheduled for field applied painted finish:
  1. Touch-up all breaks on hot-dip surfaces caused by cutting, welding, drilling or undue abrasion with liquid zinc coating as specified above under the Article entitle "Hot Dip Galvanizing".
  2. Factory-Applied Primer over Galvanized Steel: Provide factory-applied prime coat, certified OTC/VOC compliant less than 2.8 lbs/gal. and conforming to EPA and local requirements. Apply primer within 12 hours after galvanizing at the same galvanizer's plant in a controlled environment meeting applicable environmental regulations and as recommended by the primer coating manufacturer. Primer coat shall exhibit a rugosity (smoothness) not greater than 4 rug (16-20 microns of variation) when measured by a profilometer over a 1 inch straight line on the surface of architectural and structural elements that are less than 24 pounds per running foot. Profilometer shall be capable of operating in 1 micron increments. Blast cleaning of the surface is unacceptable for surface preparation. Primer shall have a minimum two year re-coat window for application of finish coat. Coatings must meet or exceed the following performance criteria as stipulated by the coatings manufacturer:
    - a. Basis-of-Design: Primergalv by Duncan Galvanizing, Everett, MA.
    - b. Abrasion Resistance: ASTM D 4060 (CS17 Wheel, 1,000 grams load).1kg load, 200 mg loss.
    - c. Adhesion: ASTM D4541, 1050 psi.
    - d. Corrosion Weathering: ASTM D5894, 13 cycles, 4,368 hours; rating 10

- per ASTM D714 for blistering and rating 7 per ASTM D610 for rusting.
- e. Direct Impact Resistance: ASTM D2794, 160 in. lbs.
- f. Flexibility: Method: ASTM D522, 180 degree bend, 1 inch mandrel, passes.
- g. Pencil Hardness: ASTM D3363, 3B.
- h. Moisture Condensation Resistance: ASTM D4585, 100 degrees F, 2000 hours; passes, no cracking or delamination.
- i. Dry Heat Resistance: Method: ASTM D2485, 250 degrees F.
- 3. Touch-up finish in conformance with manufacturer's recommendations. Provide touch-up such that repair is not visible from a distance of 6 feet.
- D. For hot-dipped galvanized steel items scheduled for shop applied coating:
  - 1. Touch-up all breaks on hot-dip surfaces caused by cutting, welding, drilling or undue abrasion with liquid zinc coating as specified above under the Article entitled "Hot Dip Galvanizing", herein above.
  - 2. Finish: Provide factory-applied architectural coating over hot-dip galvanized steel matching approved samples.
    - a. Basis-of-Design: Duncan Galvanizing, Everett, MA, product "Colorgalv 10".
    - b. Primer coat shall be factory-applied. Apply primer within 12 hours after galvanizing and within 3 hours of surface preparation at the same facility where the galvanizing is done in a controlled environment meeting applicable environmental regulations and as recommended by the primer coating manufacturer. Primer must meet or exceed the criteria for the following categories as stipulated by the coatings manufacturer:
      - 1) Abrasion Resistance: ASTM D4060 (CS17 Wheel, 1,000 grams load) 1kg load, 200 mg loss.
      - 2) Adhesion: ASTM D4541, 1050 psi.
      - 3) Corrosion Weathering: ASTM D5894, 13 cycles, 4,368 hours; rating 10 per ASTM D714 for blistering and rating 7 per ASTM D610 for rusting.
      - 4) Direct Impact Resistance: ASTM D2794, 160 in. lbs.
      - 5) Flexibility: Method: ASTM D522, 180 degree bend, 1 inch mandrel, passes.
      - 6) Pencil Hardness: ASTM D3363, 3B.
      - 7) Moisture Condensation Resistance: ASTM D4585, 100 degrees F, 2000 hours; passes, no cracking or delamination.
      - 8) Dry Heat Resistance: Method: ASTM D2485, 250 degrees F.
    - c. Finish coat shall be factory-applied high performance architectural finish. Apply finish coating at the galvanizer's plant, in a controlled environment meeting applicable environmental regulations and as recommended by the finish coating manufacturer. Finish must meet or exceed the criteria for the following categories as stipulated by the coatings manufacturer:
      - 1) Abrasion Resistance: ASTM D 4060, CS17 Wheel, 1,000 cycles 1kg load, 87.1 mg loss.
      - 2) Adhesion: ASTM D4541, 1050 psi.
      - 3) Direct Impact Resistance: ASTM D2794, greater than 28 in. pounds.
      - 4) Indirect Impact Resistance: ASTM D2794, 12-14 in. pounds.
      - 5) Dry Heat Resistance: ASTM D2485, 200 degrees F.
      - 6) Salt Fog Resistance: ASTM B117 9,000 hours, rating 10 per ASTM D714 for blistering.

- 7) Flexibility: ASTM D522, 180 degree bend, 1/8 inch mandrel, passes.
- 8) Pencil Hardness: ASTM D3363, 2H.
- 9) Moisture Condensation Resistance: ASTM D4585, 100 degrees F, 1000 hours, no blistering or delamination.
- 10) Xenon Arc Test: ASTM D 4798, pass 300 hours.
- d. Coatings shall be certified VOC compliant and conform to applicable regulations and EPA standards. Apply the galvanizing, primer and coating within the same facility and provide single-source responsibility for galvanizing, priming and finish coating. Blast cleaning of the galvanized surface is not acceptable.
- 3. Engage the services of a galvanizing facility which will assume single-source responsibility for galvanizing and finish coating.
  - a. Touch-up finish in conformance with manufacturer's recommendations. Provide touch-up such that repair is not visible from a distance of 6 feet.
- 4. Alternate finish: An acceptable alternate to specified "Colorgalv 10" finish; aliphatic acrylic polyurethane enamel shop applied coating system, within 12 hours of galvanizing as follows:
  - a. Preparation: Mechanically abrade all surfaces.
  - b. Acid etch coat, if recommended by paint manufacturer:
    - 1) Courtaulds/International Polyvinyl Butyral Primer "Interprime Etch Primer" at 0.4 to 0.5 mils DFT.
  - c. First Coat: (epoxy intermediate)
    - 1) Courtaulds/International "Intergard 475" at 4.0 to 6.0 mils DFT.
    - 2) Tnemec Series 27 "F.C. Typoxy" at 4.0 to 6.0 mils DFT.
  - d. Second Coat: Aliphatic Acrylic Polyurethane, Gloss Finish
    - 1) Courtaulds/International "Interthane 870" at 4.0 to 5.0 mils DFT.
    - 2) Tnemec Series 74 "Endura Shield" at 4.0 to 5.0 mils DFT.
- E. For aluminum fabrications: Shop-applied standard electrostatically applied baked enamel coating complying with AAMA 603. Coating shall be applied to 1.5 to 2 mils dry film thickness in color selected from manufacturer's fully available range.
- F. Field touch-up: Shall be the responsibility of the installing contractor and shall include the filling, and touch-up of exposed job made bolt or screw holes, refinishing of raw surfaces resulting from job fitting, repair of job inflicted scratches and marks, and final cleaning up of the finished surfaces.
  - 1. Touch-up finishes shall be fully compatible with, and exactly match shop applied finish, color, texture and sheen.

### **PART 3 - EXECUTION**

#### **3.1 ERECTION - GENERAL**

- A. General: Accurately set all work to established lines and elevations, and rigidly fasten in place with suitable attachments to the construction of the building. At the completion of the work, check all work, re-adjust as required, and leave in perfect condition. Grind all exposed to view welds smooth to the touch.
- B. Setting bearing and leveling plates:

1. Clean concrete and masonry bearing surfaces of bond-reducing materials, and roughen to improve bond to surfaces. Clean bottom surface of plates.
2. Set bearing and leveling plates on wedges, shims, or leveling nuts. After bearing members have been positioned and plumbed, tighten anchor bolts. Do not remove wedges or shims but, if protruding, cut off flush with edge of bearing plate before packing with grout.
  - a. Use nonshrink grout, either metallic or nonmetallic, in concealed locations where not exposed to moisture; use nonshrink, nonmetallic grout in exposed locations, unless otherwise indicated.
  - b. Pack grout solidly between bearing surfaces and plates to ensure that no voids remain.
- C. Miscellaneous framing and supports: Install framing and supports to comply with requirements of items being supported, including manufacturers' written instructions and additional requirements indicated on Shop Drawings.
  1. Anchor supports for operable partitions, and similar products, securely to and rigidly braced to building structure.

### **3.2 FIELD WELDING**

- A. Field weld components indicated on approved shop drawings in accordance with AWS D1.1. Weld profile, quality, and finish shall be consistent with approved samples and mock-ups.
  1. Welds ground smooth: . For groove welds, the weld shall be made flush to the surfaces of each side and be within + 1/16", -0" of plate thickness.
  2. Contouring and blending of welds: Where fillet welds are indicated to be ground contoured, or blended, oversize welds as required; grind to provide a smooth transition and to match profile on approved mock-up .
  3. Continuous Welds: Where noted on the drawings, provide continuous welds of a uniform size and profile.
  4. Minimize Weld Show Through: At locations where welding on the far side of an exposed connection occurs, grind distortion and marking of the steel to a smooth profile with adjacent material.
- B. Immediately after welding, touch-up welds, burned areas and damaged surface coatings.
  1. Thoroughly remove all spatter by power wire-brushing (or if inaccessible, wire brushing) per SSPC, surface preparation specification SP2 or SP3. Allow surface to cool to ambient temperature. Clean surface with solvent wipe to remove oils, grease and dirt in accordance with SSPC surface preparation specification SP1.
  2. Apply one coat of liquid zinc to attain a minimum of 1.5 mils dry film thickness. Coating should extend at least two inches beyond either side of weldment to ensure complete coverage of welded area.

### **3.3 FIELD BOLTING**

- A. Accurately drive all bolts into holes, protecting the bolt heads so as not to damage the thread during the driving. Ensure that bolt heads and nuts rest squarely against the metal. Where structural members have sloping flange faces, provide approved beveled washers at the bolted connections to afford square seating for bolt heads or nuts. Nick bolt threads for unfinished bolts to prevent the nuts from backing off.

1. Bolt Head Orientation: All bolt heads shall be oriented as indicated on the contract documents. Where bolt-head alignment is specified, the orientation shall be noted for each connection on the erection drawings. Where not noted, the bolt heads in a given connection shall be oriented to one side.
- B. Use an approved calibrated manual or power torque wrench to obtain the proper torque and tension as recommended by the bolt manufacturer for all ASTM A 325 bolts.

#### **3.4 INSTALLATION OF RAILINGS**

- A. Adjust railings prior to anchoring to ensure matching alignment at abutting joints. Space posts at spacing indicated, or if not indicated, as required by design loading. Plumb posts in each direction. Secure posts and railing ends to building construction as follows:
  1. Anchor posts to steel with steel flanges, angle type or floor type as required by conditions, welded to posts and bolted to steel supporting members.
  2. Anchor rail ends to steel with round flanges welded to rail ends and bolted to structural steel members, unless otherwise indicated.
  3. Install removable railing sections where indicated in slip-fit metal sockets cast into concrete. Accurately locate sockets to match post spacing.

#### **3.5 TOUCH-UP**

- A. Touch-up all welds, burned areas, scratches, abrasions, on galvanized metals, using specified liquid zinc coating.
- B. Touch-up all welds, scratches, abrasions, and other surface damaged on shop-primed or painted metals, using the same coatings as specified under shop applied finishes, herein above.

**END OF SECTION**