# SECTION 05120
# STRUCTURAL STEEL

## PART 1 - GENERAL

### 1.01 DESCRIPTION

A. The term "Structural Steel" is used as defined in accordance with the AISC Code of Standard Practice.

B. Provide structural steel as indicated and specified.

C. Detailing, fabrication and erection of structural steel shall comply with all applicable OSHA regulations.

### 1.02 REFERENCES

A. American Institute of Steel Construction AISC:

1. Specification for Structural Steel Buildings
2. AISC Manual of Steel Construction, Allowable Stress Design
3. AISC Code of Standard Practice for Steel Buildings and Bridges
4. AISC Specification for Structural Joints using ASTM A 325 or A 490 Bolts
5. AISC Structural Steel Detailing Manual

B. American Welding Society AWS:

1. AWS D1.1: Structural Welding Code – Steel

C. American Society for Testing and Materials (ASTM) Publications:

1. A 6/A 6M: Specification for General Requirements for Rolled Structural Steel Bars, Plates, Shapes, and Sheet Piling
2. A 36/A 36M: Specification for Carbon Structural Steel
3. A 153/A 153M: Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
4. A 194/A 194M: Specification for Carbon and Alloy-Steel Nuts for Bolts for High-Pressure and High-Temperature Service
5. A 307: Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength
6. A 325: Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength
7. A 385: Practice for Providing High Quality Zinc Coatings (Hot-Dip)
8. A 449: Specification for Quenched and Tempered Steel Bolts and Studs
9. A 563: Specification for Carbon and Alloy Steel Nuts
10. A 572: Specification for High-Strength Low-Alloy Columbium-Vanadium Structural Steel
11. A 992: Standard Specification for Steel for Structural Shapes for Use in Building Framing

12. F 436: Specification for Hardened Steel Washers

13. F 1554: Standard Specification For Anchor Bolts, Steel, 36, 55, and 105 ksi Yield

D. Occupational Safety and Health Administration (OSHA): Safety and Health Standards for the Construction Industry, 29 CFR 1926 Subpart R Safety Standards for Steel Erection

## 1.03 SUBMITTALS

A. Shop Drawings: Submit the following in conformance with Section 01300:

1. Shop and erection drawings for all structural steel to be approved by Engineer prior to fabrication.

2. Complete and checked shop and erection drawings for all structural steel components. Show materials, anchor rods, member and connection details, piece marks, openings, shop and field bolting and welding in conformance with AISC Detailing Manual, AISC Manual and AWS Structural Welding Code. Indicate cleaning and shop painting requirements.

3. Submit the welding procedure for each type of weld prior to welding.

4. Qualification test reports bearing witness certification by an independent testing laboratory for each welder, welding operator and tacker to be employed in the work.

B. Mill certificates and copy of reports for all analyses and tests required by referenced ASTM Standard Specifications and AWS Structural Welding Code.

C. Certificate stating that the zinc coating conforms to the ASTM specified requirements.

## 1.04 QUALITY ASSURANCE

A. Provide in accordance with Section 01400 as specified herein.

B. Tolerances:

1. Maintain tolerances conforming to AISC Code of Standard Practice.

2. Permissible variation tolerances conforming to ASTM A 6.

C. Tension Calibrator:

1. Provide certification by an independent testing laboratory confirming the accuracy of the tension-measuring device when slip-critical connections and connections subject to direct tension are being used. Confirm accuracy not more than 30 days prior to use on Project, and at intervals not more than six months thereafter.

2. Provide tension calibrator measuring device at the job site when high-strength bolts in slip-critical connections and connections subject to direct tension are being installed and tightened.

3. Frequency and of number confirmation tests to be performed and the test procedure to be employed to conform to the AISC Specification for Structural Joints.

4. Return tension calibrator measuring device to the independent testing laboratory for certification if Engineer questions its accuracy.

5. Use the calibrated tension measuring device to tighten high-strength bolts in slip-critical connections and connections subject to direct tension in conform to Table 05120-1.

D. Welding Qualification and Certification:

1. Furnish written welding procedure for all welds in conformance with the AWS D 1.1.
2. Each welder, welding operator and tack welder shall be certified by test to perform type of work required in conformance with AWS D 1.1.
3. If a welder or welding operator has not been engaged in a specific welding process for a period of six months or more, that individual shall be deemed unqualified and shall not perform work on the Project until the individual has been qualified again by testing in conformance with AWS D 1.1.
4. Maintain duplicate qualification and certification records at the job site readily available for examination.

Table 05120-1
Fastener Tension Required for Slip-Critical Connections and Connections Subject to Direct Tension

| Nominal Bolt Size | | Minimum Tension * | | | |
|---|---|---|---|---|---|
| | | A 325 Bolts | | A 490 Bolts | |
| Inches | mm | kips | kN | kips | kN |
| 1/2 | 13 | 12 | 53 | 15 | 67 |
| 5/8 | 16 | 19 | 84 | 24 | 107 |
| 3/4 | 19 | 28 | 125 | 35 | 156 |
| 7/8 | 22 | 39 | 173 | 49 | 218 |
| 1 | 25 | 51 | 227 | 64 | 285 |
| 1 1/8 | 28 | 56 | 249 | 80 | 356 |
| 1 1/4 | 32 | 71 | 316 | 102 | 454 |
| 1 3/8 | 35 | 85 | 378 | 121 | 538 |
| 1 1/2 | 38 | 103 | 458 | 148 | 658 |

## 1.05 DELIVERY, STORAGE AND HANDLING

A. Provide in conformance with Section 01610 and as specified.

B. Transport, handle and store materials to protect from weather, rusting, corrosion or other damage.

C. Store structural shapes off ground on supports, with webs of flanged shapes vertical. Cover and protect steel from snow, rain and ground splatter.

D. Provide carbon steel bolts, nuts and washers for connecting carbon steel members. Ship and store together in wood or metal containers.

## PART 2 - PRODUCTS

### 2.01 STRUCTURAL STEEL

A. W shapes shall conform to ASTM A 992 unless otherwise indicated or specified.

B. C, M, S and HP shapes shall conform to ASTM A 36, Grade 50, unless otherwise indicated or specified.

C. Angles, plates and bars shall conform to ASTM A 36.

D. Round, square and rectangular structural tube members (HSS) shall conform to ASTM A 500, Grade B.

E. Steel pipe shall conform to ASTM A 53, Grade B.

### 2.02 FASTENERS

A. Carbon Steel Bolts, Nuts and Washers: ASTM A 307, Grade A.

B. High-Strength Carbon Steel Bolts, Nuts and Washers: ASTM A 325, Type 1.

C. Carbon Steel Anchor Rods: ASTM F 1554.

### 2.03 CRANE RAILS

A. Provide in conformance with crane manufacturer's requirements and as indicated or specified. Provide all materials needed for fabrication and construction of crane rails, including:

1. Joint bar bolts: ASTM A 449 or ASTM A 325.
2. Joint bar nuts: ASTM A 563, Grade B or ASTM A 325.

### 2.04 WELDING

A. Class E70XX electrodes.

B. Provide equipment for welding, electrodes, welding wire and fluxes capable of producing indicated welds when used by certified welders under AWS welding procedures. Provide welding materials that comply with requirements of AWS Structural Welding Code.

### 2.05 FABRICATION

A. Fabricate each element and connection as indicated on the fabrication shop drawings approved by the Engineer. Fabricate and shop assemble work to the greatest extent practical in conformance with following publications:

1. AISC Manual
2. AISC Specification for Structural Joints
3. AISC Detailing Manual
4. AWS Structural Welding Code

B. Perform shearing, manual flame cutting with mechanically guided torch and chipping such that it will not induce residual stress in metal being cut. Radii of re-entrant corners shall be as large as practicable but not less than 3/4 inch [19 mm]. Perform flame cutting so that metal being cut is not carrying stress. Finish exposed edges.

C. Provide full cross section bearing on milled ends of columns, crane rails, monorails and bearing stiffeners.

D. Connect all members with ASTM A 325 high strength bolts unless otherwise indicated or specified. Provide clean-cut holes without torn or ragged edges and remove all outside burrs.

E. Welded Connections:

1. Connections indicated or specified shall be welded.
2. Provide complete weather seal weldments made with 1/16-in. [1.6 mm] minimum continuous fillets to all members having Type S and E Service.

F. Weld or bolt shop connections in conformance with specified AWS Structural Welding Code and AISC publications.

G. Make connections with ASTM A 307 carbon steel bolts when indicated or specified.

H. Provide ASTM F 1554 anchor rods with washer and heavy hex nuts. Provide hot-dip galvanized anchor rods, washers and heavy hex nuts with galvanized steel.

I. Provide and fasten bumpers on each end of bridge crane runway beams in conformance with the requirements of the bridge crane manufacturer.

J. Field connections shall be bolted unless welding is indicated.

K. Provide ¾" diameter ASTM A325X high strength bolts for bolted connections. Provide 13/16" diameter holes unless otherwise indicated. Provide one hardened washer under the element turned in tightening. Provide plate washers in both outer plies when oversize or slotted holes are used.

L. Provide F1554 anchor rods for anchorage to concrete and masonry as indicated. Furnish and install one washer and one heavy hex nut with ASTM F 1554 anchor rods unless otherwise indicated.

## PART 3 - EXECUTION

### 3.01 ERECTION

A. Structural steel erection shall comply with 29 CFR 1926 Subpart R

B. Align column bases and bearing plates for beams and similar structural members with steel wedges or shims. Tighten anchor rods after alignment and positioning members and fill entire area under bearing plates with non-shrink, non-metallic grout specified in Section 03300. Remove steel wedges or shims and grout voids solid.

C. Provide anchor rods and anchors with templates for correct placement into concrete, masonry or other supporting materials.

D. Hold steelwork securely in place with temporary bracing and stays to resist all vertical and lateral loads, until members are permanently fastened and floors and roofs completed.

E. Use only calibrated wrenches for tensioning high-strength bolts for slip-critical joints and connections subjected to direct tension.

F. The Owner's testing agency shall inspect and torque test field-assembled bolted construction in conformance with AISC Specification for Structural Joints.

G. Tighten all high-strength bolts to the snug-tight condition in conformance with AISC Specification for Structural Joints, ASTM A325 or A 490 bolts, except when slip-critical joints and connections subjected to direct tension are indicated or specified.

H. High-strength tension control bolting may be substituted for calibrated wrench bolting of slip-critical joints and connections subject to direct tension.

I. Align and adjust members forming parts of a complete assembly before permanent fastening.

J. Fasten splices of compression members and members having milled ends after the abutting surfaces have been brought completely into contact.

K. Report errors in shop fabrication or deformation resulting from handling or transportation immediately to Engineer. Replace and remove from job site incorrect fabricated or deformed material at no additional cost to the Owner.

L. Perform temporary bracing and bolting of work to support construction live load and combined dead, wind, earthquake and erection loads as erection progresses.

M. Do not enlarge holes or damage metal in the vicinity of holes with drift pins during assembly.

N. Enlarge holes to admit bolts for connections only if approved in writing by Engineer. Make enlargements only by drilling. Refinish enlarged holes with paint to match the shop coat.

O. Flame cut bolt holes are not permitted.

P. Where erection bolts are abandoned in place, remove bolts, completely plug weld holes, grind flush with adjacent surfaces and paint to match shop coat.

Q. Align bridge crane runway beams in parallel and level from end to end.

R. Locate monorail beams as indicated and level from end to end.

S. Detail bracing members to avoid eccentric connections.

T. Provide temporary bracing and stays during steel erection to resist vertical and lateral loads until members are permanently fastened and construction is complete.

U. Provide 3/16" x 1" long fillet welds for electrical continuity between members at connections.

V. Provide 1" leveling plates the same size as the base plates for structural steel columns.

## 3.02 CRANE RAILS

A. Installation: Provide in conformance with crane manufacturer's printed instructions and as indicated or specified.

B. Fasten crane rails to runway beam with rail clamps, in pairs, one each side of rail, spaced not more than 30 inch centers. Bolt each clamp to runway beam top flange with two bolts and self-locking nuts. Allow one/thirty-second inch clearance between clamp plate and top of rail flange and one quarter inch clearance between clamp plate and edge of rail flange to provide a "floating rail" in conformance with AISC Manual. Do not use hook bolts. Center crane rail on the runway beam. In no case shall the crane rail eccentricity be greater than three-fourths of the runway beam web thickness. The entire assembly will be rejected if the crane rail eccentricity exceeds the three-fourths limitation. Replace and remove entire rejected assembly from job site at no additional cost to the Owner.

C. Install crane rails with milled ends and tight joints at splices. Use bolted splice bars to maintain joint alignment in conformance with AISC Manual. Do not use welded butt joints.

D. Retighten splice bolts within 30 days and every three months thereafter in conformance with AISC Manual.

## 3.03 HIGH-STRENGTH BOLTING

A. Provide workmanship and techniques for bolted construction in conformance with requirements of AISC Specification for Structural Joints and as indicated or specified.

B. Install ASTM A 325 bolts with hardened washer under element being turned in tightening. Install plate washers in both outer plies when using oversize and slotted holes

C. Do not reuse galvanized high-strength bolts, nuts and washers.

## 3.04 WELDING

A. Workmanship and techniques for welded construction to conform to requirements of AWS Structural Welding Code and as indicated or specified.

B. No field welding permitted unless indicated on Engineer approved fabrication shop drawings.

END OF SECTION 05120

# SECTION 05210
# STEEL JOISTS

## PART 1 - GENERAL

### 1.01 DESCRIPTION

A. Provide open web steel joists, long span steel joists and steel joist girders as indicated and specified.

B. Provide bridging in accordance with the Steel Joist Institute, OSHA requirements and as indicated and specified.

C. Provide accessories in accordance with Steel Joist Institute requirements.

### 1.02 REFERENCES

A. Steel Joist Institute (SJI)

1. Standard Specifications for Open Web Steel Joists, K-Series
2. Recommended Code of Standard Practice for Steel Joists and Joist Girders
3. Technical Digest #9 – Handling and Erection of Steel Joists and Joist Girders

B. American Institute of Steel Construction AISC:

1. AISC Manual of Steel Construction, Allowable Stress Design
2. AISC Code of Standard Practice for Steel Buildings and Bridges
3. AISC Specification for Structural Joints using ASTM A 325 or A 490 Bolts
4. AISC Structural Steel Detailing Manual

C. American Society for Testing and Materials (ASTM) Publications:

1. A 307: Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength
2. A 325: Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength
3. A 384: Practice for Safeguarding Against Warpage and Distortion During Hot-Dip Galvanizing of Steel Assemblies
4. A 385: Practice for Providing High Quality Zinc Coatings (Hot-Dip)
5. A 449: Specification for Quenched and Tempered Steel Bolts and Studs

D. Steel Structures Painting Council (SSPC): Specification 15 Commercial Grade Power Tool Cleaning

E. Occupational Safety and Health Administration (OSHA): Steel Erection Standard 29 CFR 1926.757

## 1.03 SUBMITTALS

A. Shop Drawings: Submit the following in conformance with the requirements of the General Conditions:

1. Complete and checked shop and erection drawings for all steel joists, joist girders and components.
   a. Indicate standard designations, sizes, spacing and locations of joists, joists, bridging, connections, attachments and top and bottom chord extensions.
   b. Shop and erection drawings for all steel joists shall be approved by Engineer prior to fabrication.

B. Certification, signed and sealed by a Professional Structural Engineer employed by the joist manufacturer and holding current registration in the state in which the joists are to be installed indicating the codes and specifications to which the joist design conforms and stating that all members, elements and connections are designed to withstand the specified loads.

C. Qualification test reports bearing witness certification by an independent testing laboratory for each welder, welding operator and tacker to be employed in the work.

D. Certificate stating that the surface preparation and painting conforms to SSPC-15.

1. Provide shop coatings proposed by type, brand and manufacturer.
2. Provide product data for determining compatibility of shop coatings with field coats.

## 1.04 QUALITY ASSURANCE

A. Provide in accordance with Section 01400 and as specified.

B. Design joists, girders and connections for the loads, moments and chord forces indicated on the drawings.

C. Design joists, girders and connections for a net uplift of 20 psf [1.0 kPa] unless otherwise indicated on the drawings.

D. Steel joist and joist girder design, manufacture, handling and installation shall conform to the Steel Joist Institute Standard Specifications and load and weight tables.

E. Bridging size and installation shall be as prescribed by the Steel Joist Institute.

F. Steel joists and joist girders shall be fabricated by manufacturer who is a member of Steel Joist Institute.

G. Steel joists and joist girders shall be Steel Joist Institute approved.

H. Welding Qualification and Certification: Each welder, welding operator and tack welder shall be certified by test to perform type of work required in conformance with the Steel Joist Institute.

## 1.05 DELIVERY, STORAGE AND HANDLING

A. Provide in conformance with Section 01610 and as specified.

B. Storage and handling shall conform to the Steel Joist Institute Technical Digest #9.

C. Transport, handle and store materials to protect from weather, rusting, corrosion or other damage.

D. Store joists on substantial timbers and blocking with webs of joists vertical. Cover and protect from snow, rain and ground splatter

E. Deliver, store and handle in a manner that prevents overstressing, deformation or damage.

F. Prevent damage to shop coat.

## PART 2 - PRODUCTS

### 2.01 STEEL JOISTS

A. Fabricate steel joists and joist girders in accordance with the approved shop drawings and the standard specifications of the Steel Joist Institute.

B. Provide top and bottom chord extensions as indicated or required. Top chord extensions shall be Type R.

C. Provide sloped bearing ends where joist or girder slope exceeds ¼" per foot.

D. Provide bearing lengths in accordance with the Steel Joist Institute unless greater bearing lengths are indicated on the drawings.

E. Joist Seats

1. Seats for K-Series joists shall be 2½ inches in depth and shall extend a minimum of 2 ½ inches over steel supports.
2. Fabricate with special seats as indicated or required.

F. Provide additional web members at points of application of concentrated loads to transfer loads to panel points.

### 2.02 JOIST BRIDGING

A. Provide bridging and bridging anchorage in accordance with the Steel Joist Institute and 29 CFR 1926.757 requirements.

B. Provide cross bridging between the last two joists at the end of a bridging line such as at end walls or expansion joints.

C. Provide a line of bridging near each of the first bottom chord panel points for joists subjected to uplift.

D. Provide bridging to brace the top chord of joists supporting standing seam roofing under gravity loads.

E. Additional bridging shall be provided as required and where indicated on the drawings

F. Manufacturer of joists shall furnish bridging and bridging anchorage.

## 2.03 CONNECTIONS

A. Provide bolted connections using ASTM A325 bolts.

B. Provide welded connections in conformance with the Steel Joist Institute.

## 2.04 SHOP PAINTING

A. Provide manufacturer's standard SSPC-15 (gray) shop coat primer.

# PART 3 - EXECUTION

## 3.01 PREPARATION

A. Coordinate placement of anchorages in concrete and masonry construction for securing bearing plates, angles and bridging anchors.

B. Verify that completed construction is ready for and will support steel joist and joist girder placement.

C. Notify the Engineer if discrepancies are found. Do not proceed or install joists and joist girders in areas of discrepancy until those discrepancies have been fully resolved to the satisfaction of the Engineer.

## 3.02 JOISTS

A. Steel joist erection shall comply with 29 CFR 1926.757.

B. Install in accordance with the Steel Joist Institute specifications, manufacturers printed instruction and as indicated and specified.

C. Install in straight parallel lines at spacing indicated within a tolerance of 1/4-in. plus or minus.

D. Secure by welding to steel support beams or steel plates.

E. Do not apply loads to joists until secured in place and bridging is installed and anchored at its ends.

F. Do not use damaged joists. Replacement joists shall be furnished at Contractors expense.

## 3.03 BRIDGING

A. Bridging and bridging anchorage shall be provided in accordance with the Steel Joist Institute recommendations and 29 CFR 1926.757 requirements.

## 3.04 FIELD BOLTED CONNECTIONS

A. Provide bolted connections between joist and columns which are not braced in at least two directions by structural steel members.

## 3.05 FIELD WELDING

A. Field welding shall be performed in accordance with the American Welding Society, the Steel Joist Institute and the approved shop drawings.

B. Workmanship and techniques for welded construction shall conform to the requirements of the Steel Joist Institute and as indicated or specified.

C. No field welding will be permitted unless indicated on Engineer approved shop drawings.

## 3.06 SHOP PAINTING

A. Remove looses scale, rust or other foreign materials from fabricated joists, joist girders and accessories.

B. Apply one coat of the manufacturer's standard shop coat.

## 3.07 FIELD PAINTING

A. Provide field painting in accordance with Section 09900.

END OF SECTION 05210

# SECTION 05300
# STEEL DECK

## PART 1 - GENERAL

### 1.01 DESCRIPTION

A. Provide steel deck and accessories as indicated and specified.

### 1.02 REFERENCES

A. American Iron and Steel Institute AISI: AISI, Specifications for the Design of Cold-Formed Steel Structural Members

B. Steel Deck Institute:

1. Publication No. 23: Design Manual for Floor Decks and Roof Decks
2. Publication No. 29: Design Manual for Composite Decks, Form Decks, Roof Decks and Cellular Deck Floor Systems with Electrical Distribution

C. American Society for Testing and Materials (ASTM) Publications:

1. ASTM A 611: Standard Specification for Steel, Sheet, Carbon, Cold-Rolled Structural Quality.
2. ASTM A 653/A 653M: Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
3. ASTM A 780: Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings

D. American Welding Society AWS: AWS D1.3: Structural Welding Code - Sheet Steel

E. Factory Mutual Engineering Corporation: FM 1-28: Loss Prevention Data

F. American Concrete Institute: ACI 318: Building Code Requirements for Structural Concrete

### 1.03 DESIGN REQUIREMENTS

A. Design Criteria:

1. Section properties of steel deck shall be calculated in conformance with AISI Specification for the Design of Cold-Formed Steel Structural Members
2. Material and steel deck profiles shall conform to the applicable requirements of the Steel Deck Institute specifications.
3. Steel roof deck shall be capable of supporting all superimposed dead load and the live load indicated on the Drawings with a maximum fiber stress in the deck of 20,000 psi. Superimposed dead loads and all loads to be suspended from the decking shall be accounted for in the design of the deck units.

4. Steel deck shall be anchored to the supporting members to resist an uplift of 45 psf for eave overhangs and 30 psf for all other roof areas.

5. Maximum allowable deflection of roof deck under live load shall not exceed L/240 of the span.

6. Steel deck shall be capable of supporting a construction load of 200 pounds distributed over a one foot width at midspans and at the ends of cantilevers with a maximum fiber stress of 26,000 psi and a maximum deflection of L/240.

7. Steel floor deck shall be capable of supporting the dead load and live load indicated compositely with concrete with a maximum fiber stress in the deck of 20,000 psi. Superimposed dead loads and all loads to be suspended from the decking shall be accounted for in the design of the deck units.

8. Steel floor deck shall be capable of supporting the weight of wet concrete without the need for temporary shoring during concrete placement.

9. Maximum allowable deflection of composite floor deck under live load shall not exceed L/360 of the span.

10. The deck shall be designed to account for construction loads as determined by the Steel Deck Institute construction loading criteria. As a minimum, the steel floor deck shall be capable of supporting the combined weight of the deck, the wet concrete and a 20 psf uniform load or 150 pound concentrated load over a one foot width at midspans and at the ends of cantilevers with a maximum fiber stress of 21,600 psi and a maximum deflection of L/180 or 3/4" relative to the supporting members.

## 1.04 SUBMITTALS

A. Submit the following in conformance with the requirements of the General Conditions:

1. Shop and erection drawings for all steel deck and accessories shall be approved by the Engineer prior to fabrication. Show support framing, openings, length, type, gage, zinc coating, markings of deck units and accessories, weld size, type, location and sequence.

2. Qualification test reports bearing witness certification by an independent testing laboratory for each welder and welding operator to be employed in the work.

3. Manufacturer's literature indicating steel deck load capacity for various deck styles, gages, spans and depth indicated or specified.

4. Product data for mechanical fasteners to be used.

## 1.05 QUALITY ASSURANCE

A. Provide in accordance with Section 01400 and as specified.

B. Welding Qualification and Certification:

1. Furnish written welding procedure for all welds in conformance with AWS D 1.3.

2. Each welder, welding operator and tack welder shall be certified by test to perform type of work required in conformance with AWS D 1.3.

3. Maintain duplicate qualification and certification records at the job site readily available for examination.

C. Steel deck shall comply with the specifications and tolerances of the Steel Deck Institute.

D. Roof deck shall comply with tests and approvals as a component for Class 1 roofs in accordance with Factory Mutual FM 1-28.

E. Replace or repair damaged galvanized material as directed by the Engineer at no additional cost to the Owner.

## 1.06 DELIVERY, STORAGE AND HANDLING

A. Provide in conformance with Section 01610 and as specified.

B. Protect steel deck panels from damage at all times.

C. Use care during loading, transportation and unloading to prevent damage and injury to ends, sides and faces of panels.

D. Use nylon slings or padded cables for handling steel deck. Do not drop or drag materials.

E. Store steel deck and accessories off ground on platform or skid supports and protect from snow, rain and ground spatter.

## 1.07 USE OF DECK DURING ERECTION

A. Do not use steel deck for storage or working platforms until permanently secured in position.

B. Do not allow construction loads to exceed carrying capacity of deck.

# PART 2 - PRODUCTS

## 2.01 MATERIALS

A. Provide steel deck, ridge plates, valley plates, closures, flashing and sump pans manufactured from galvanized steel sheet conforming to the requirements of ASTM A 653, structural quality, with a minimum yield stress of 33,000 psi.

B. Provide galvanized coating conforming to ASTM A 653 G60.

C. Decking thickness shall be as indicated, but not less than 20 gage 0.034 inches [.86 mm].

D. Ridge plates, valley plates, flat plates at changes in deck direction, closures, accessories and flashings: 18 gage.

E. Sump Pans: Flat, recessed, 14 gage.

F. Welding Washers: 16 gage.

G. Flexible Cell Closures: Rubber, manufacturer's standard.

H. Concrete: 3,000 psi at 28 days conforming to Section 03300, Cast-In-Place Concrete.

## 2.02 STEEL ROOF DECK

A. Wide Rib (WR) style deck shall conform to the following dimensional requirements:

1. Rib depth shall be a minimum of 1 1/2 inches and spaced at 6 inches on center.
2. Rib width shall be a minimum of 1 3/4 inches at the bottom and a maximum of 2 1/2 inches at the top.

## 2.03 FABRICATION

A. Fabricate steel deck units in three span lengths or longer, except where one or two span lengths are necessitated due to interruptions at roof or floor openings. Lap ends of units a minimum of 2 inches. Laps shall be made over supports.

B. Bearing flanges of sump pans to overlap steel decking by a minimum of 3 inches. Shape, dimension and reinforce opening in bottom of sump pans to receive roof drains.

# PART 3 - EXECUTION

## 3.01 PREPARATION

A. Check all supporting elements for correct layout and alignment. Correct any deficiencies as required before securing deck units.

B. Remove debris from all surfaces to support steel deck.

## 3.02 INSTALLATION

A. Install decking and accessories on structural supports in conformance with Steel Deck Institute specifications, the Steel Deck Institute Manual of Construction with Steel Deck, in accordance with placement plans, and as indicated and specified.

B. Place deck panels on steel supports and adjust to final position with ends lapped over structural supports with a minimum end bearing of 1 1/2 inches. Place deck panel from low end upward for decking with a slope greater than 1/4 inch per foot.

C. Permanently fasten deck panels to the structural supports immediately after placement.

D. Cut and fit decking and accessories around openings and other penetrations.

## 3.03 ATTACHMENT

A. Anchor decking to supporting members with puddle welds or approved mechanical fasteners in accordance with the attachment pattern shown on the placement drawings.

B. Powder actuated or pneumatically driven mechanical fasteners or self drilling screws may be used in lieu of welding only if product data is submitted and approved by the Engineer.

C. Attachment to supports shall conform to the following minimum requirements:

1. Ends and intermediate supports: 3/4 inch diameter puddle welds (or #12 TEK screws as an alternate) at each rib. Penetrate all layers of deck material with weld material at end laps.
2. Weld side laps of adjacent units between supports at intervals not exceeding 12 inches [300 mm] apart with each weld not less than 1 inch long, or as an alternate use #10 TEK screws.

D. Cutting and Fitting:

1. Steel deck erector shall perform all cutting and fitting of units as may be required.
2. Do not make holes that are not indicated on manufacturer's erection shop drawings without prior written approval of Engineer.

E. Accessories:

1. Provide flashing, ridge and valley plates; sump pans and other accessories necessary for a complete and finished installation. Install sump pan at each roof drain.
2. Close open ends of all cell runs with cell closures at columns, openings, walls etc. and ends where cells change direction.
3. Provide and weld flashings into position to close openings between steel deck units and columns, beams and girders.
4. Provide all other closures and flashings required for a complete installation and as recommended by deck manufacturer.
5. Fasten all closures, flashings and sump pans by tack welding at a maximum spacing of 24-in. on center, but not less than one weldment on each corner.
6. Provide special end and side closures at spandrels and openings to act as edging.
7. Provide flexible closures to seal flutes of acoustical deck where it passes over partitions extending to undersides of steel deck.

F. Repair of Zinc Coatings:

1. Clean all weldments by chipping or wire brushing to remove all slag immediately prior to applying galvanize touch-up.
2. Clean with wire brush and prime coat all cut edges with galvanize touch-up as specified herein.
3. Apply galvanize touch-up immediately upon completion of cleaning weldments, abraded and damaged areas. Conform to the following requirements:
4. Galvanize Touch-Up: Where galvanizing is damaged, touch-up abraded areas, using brushed-on method, with zinc-rich coating. Touch-up repair with zinc-rich coating of not less than 3 mil and not more than 6 mil dry film thickness.
5. Repair galvanize using paints containing zinc dust in conformance with ASTM A 780.

6. Materials:
   a. Endupor, zinc-rich coating by Dampney Manufacturing Co., Everett, MA
   b. ZiRP, zinc-rich coating by Duncan Galvanizing Corp., Everett, MA
   c. ZRC Cold Galvanizing Compound or ZRC Galvilite by ZRC Worldwide, Division of Norfolk Corp., Marshfield, MA; or equal.

## 3.04 CLEANING

A. Remove oil, grease, dirt and debris from deck and leave ready for work of next trade.

END OF SECTION 05300

# SECTION 05400
# COLD-FORMED METAL FRAMING

## PART 1 - GENERAL

### 1.01 SCOPE

A. This Section includes the following:

1. Interior ceiling joist framing.
2. Furring channels

### 1.02 PERFORMANCE REQUIREMENTS

A. Structural Performance: Provide cold-formed metal framing capable of withstanding design loads within limits and under conditions indicated.

1. Design Loads: As follows:
   a. Dead Loads: Weights of materials and construction.
   b. Live Loads: 30 psf
2. Deflection Limits: Design framing systems to withstand design loads without deflections greater than the following:
   a. Interior ceiling joist framing: Vertical deflection of 1/240 of the span.
3. Design framing systems to provide for movement of framing members without damage or overstressing, sheathing failure, connection failure, undue strain on fasteners and anchors, or other detrimental effects when subject to a maximum ambient temperature change of 120 deg F (67 deg C).

B. Cold-Formed Steel Framing, General: Design according to AISI's "Standard for Cold-Formed Steel Framing - General Provisions."

### 1.03 SUBMITTALS

A. Submittals shall be made in accordance with the requirements of the General Conditions. In addition, the following specific information shall be provided:

1. Product Data: For type of cold-formed metal framing product and accessory indicated.
2. Shop Drawings: Show layout, spacings, sizes, thicknesses, and types of cold-formed metal framing; fabrication; and fastening and anchorage details, including mechanical fasteners. Show reinforcing channels, supplemental framing, bracing, splices, accessories, connection details, and attachment to adjoining work.
   a. For cold-formed metal framing indicated to comply with design loads, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

B. Qualification Data: From professional engineer.

C. Product Test Reports: From a qualified testing agency, unless otherwise stated, indicating that each of the following complies with requirements, based on evaluation of comprehensive tests for current products:

1. Steel sheet.
2. Expansion anchors.
3. Mechanical fasteners.

## 1.04 QUALITY ASSURANCE

A. Engineering Responsibility: Preparation of Shop Drawings, design calculations, and other structural data by a qualified professional engineer.

B. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in the State of Georgia and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of cold-formed metal framing that are similar to those indicated for this Project in material, design, and extent.

C. Product Tests: Mill certificates or data from a qualified independent testing agency indicating steel sheet complies with requirements, including base-metal thickness, yield strength, tensile strength, total elongation, chemical requirements, ductility, and metallic-coating thickness.

D. AISI Specifications and Standards: Comply with AISI's "North American Specification for the Design of Cold-Formed Steel Structural Members" and its "Standard for Cold-Formed Steel Framing - General Provisions."

## 1.05 DELIVERY, STORAGE, AND HANDLING

A. Protect cold-formed metal framing from corrosion, deformation, and other damage during delivery, storage, and handling.

B. Store cold-formed metal framing, protect with a waterproof covering, and ventilate to avoid condensation.

# PART 2 - PRODUCTS

## 2.01 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide cold-formed metal framing by one of the following:

1. Dale/Incor.
2. Dietrich Metal Framing; a Worthington Industries Company.
3. MarinoWare; a division of Ware Industries.
4. Or equal.

## 2.02 MATERIALS

A. Steel Sheet: ASTM A 1003/A 1003M, Structural Grade, Type H, metallic coated, of grade and coating weight as follows:

1. Grade: As required by structural performance.
2. Coating: G90 (Z275) or equivalent.

## 2.03 CEILING JOIST FRAMING AND FURRING CHANNELS

A. Steel Ceiling Joists: Manufacturer's standard C-shaped steel sections, of web depths indicated, punched with enlarged service holes, with stiffened flanges, and as follows:

1. Minimum Base-Metal Thickness: 0.0677 inch .
2. Flange Width: 8-in. minimum.

B. Furring Channel: Provide 20 gage galvanized – channel, 7/8-in.

## 2.04 FRAMING ACCESSORIES

A. Fabricate steel-framing accessories from steel sheet, ASTM A 1003/A 1003M, Structural Grade, Type H, metallic coated, of same grade and coating weight used for framing members.

B. Provide accessories of manufacturer's standard thickness and configuration, unless otherwise indicated, as follows:

1. Supplementary framing.
2. Bracing
3. Anchor clips.
4. End clips.

## 2.05 ANCHORS, CLIPS, AND FASTENERS

A. Steel Shapes and Clips: ASTM A 36/A 36M, zinc coated by hot-dip process according to ASTM A 123/A 123M.

B. Expansion Anchors: Fabricated from corrosion-resistant materials, with capability to sustain, without failure, a load equal to 5 times design load, as determined by testing per ASTM E 488 conducted by a qualified independent testing agency.

C. Mechanical Fasteners: ASTM C 1513, corrosion-resistant-coated, self-drilling, self-tapping steel drill screws.

1. Head Type: Low-profile head beneath sheathing, manufacturer's standard elsewhere.

## 2.06 MISCELLANEOUS MATERIALS

A. Galvanizing Repair Paint:

B. Shims: Load bearing, high-density multimonomer plastic, nonleaching.

C. Sealer Gaskets: Closed-cell neoprene foam, 1/4 inch (6.4 mm) thick, selected from manufacturer's standard widths to match width of bottom track or rim track members.

## 2.07 FABRICATION

A. Fabricate cold-formed metal framing and accessories plumb, square, and true to line, and with connections securely fastened, according to referenced AISI specifications and standards, manufacturer's written instructions, and requirements in this Section.

1. Fabricate framing assemblies using jigs or templates.
2. Cut framing members by sawing or shearing; do not torch cut.
3. Fasten cold-formed metal framing members by screw fastening, clinch fastening, as standard with fabricator. Wire tying of framing members is not permitted.
   a. Locate mechanical fasteners and install according to Shop Drawings, with screw penetrating joined members by not less than three exposed screw threads.
4. Fasten other materials to cold-formed metal framing by screw fastening, according to Shop Drawings.

B. Reinforce, stiffen, and brace framing assemblies to withstand handling, delivery, and erection stresses. Lift fabricated assemblies to prevent damage or permanent distortion.

C. Fabrication Tolerances: Fabricate assemblies level, plumb, and true to line to a maximum allowable tolerance variation of 1/8 inch in 10 feet (1:960) and as follows:

1. Spacing: Space individual framing members no more than plus or minus 1/8 inch (3 mm) from plan location. Cumulative error shall not exceed minimum fastening requirements of finishing materials.
2. Squareness: Fabricate each cold-formed metal framing assembly to a maximum out-of-square tolerance of 1/8 inch (3 mm).

# PART 3 - EXECUTION

## 3.01 EXAMINATION

A. Examine supporting substrates and abutting CMV walls for compliance with requirements for installation tolerances and other conditions affecting performance.

1. Proceed with installation only after unsatisfactory conditions have been corrected.

## 3.02 PREPARATION

A. Install load bearing shims or grout between the underside of wall bottom track or rim track and at joist locations to ensure a uniform bearing surface on supporting masonry construction.

B. Install sealer gaskets to isolate the underside of wall bottom track or rim track and the top of wall at stud or joist locations.

## 3.03 INSTALLATION, GENERAL

A. Cold-formed metal framing shall be shop fabricated for installation.

B. Install cold-formed metal framing according to AISI's "Standard for Cold-Formed Steel Framing - General Provisions" and to manufacturer's written instructions unless more stringent requirements are indicated.

C. Install cold-formed metal framing and accessories plumb, square, and true to line, and with connections securely fastened.

1. Cut framing members by sawing or shearing; do not torch cut.
2. Fasten cold-formed metal framing members by screw fastening, or clinch fastening. Wire tying of framing members is not permitted.
   a. Locate mechanical fasteners and install according to Shop Drawings, and complying with requirements for spacing, edge distances, and screw penetration.

D. Install framing members in one-piece lengths unless splice connections are indicated for track or tension members.

E. Install temporary bracing and supports to secure framing and support loads comparable in intensity to those for which structure was designed. Maintain braces and supports in place, undisturbed, until entire integrated supporting structure has been completed and permanent connections to framing are secured.

F. Erection Tolerances: Install cold-formed metal framing level, plumb, and true to line to a maximum allowable tolerance variation of 1/8 inch in 10 feet (1:960) and as follows:

1. Space individual framing members no more than plus or minus 1/8 inch from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.

## 3.04 JOIST INSTALLATION

A. Install perimeter joist track sized to match joists. Align and securely anchor or fasten track to supporting structure at corners, ends, and spacings indicated on Shop Drawings.

B. Install joists bearing on supporting frame, level, straight, and plumb; adjust to final position, brace, and reinforce. Fasten joists to both flanges of joist track.

1. Install joists over supporting frame with a minimum end bearing of 1-1/2 inches .
2. Reinforce ends and bearing points of joists with web stiffeners, end clips, joist hangers, steel clip angles, or steel-stud sections as indicated on Shop Drawings.

C. Space joists not more than 2 inches from abutting walls, and as follows: Joist Spacing: 12 inches.

D. Install joist reinforcement at interior supports with single, short length of joist section located directly over interior support, with lapped joists of equal length to joist reinforcement, or as indicated on Shop Drawings.

1. Install web stiffeners to transfer axial loads of walls above.

E. Install bridging at intervals indicated on Shop Drawings. Fasten bridging at each joist intersection as follows:

1. Bridging: Combination of flat, taut, steel sheet straps of width and thickness indicated and joist-track solid blocking of width and thickness indicated. Fasten flat straps to bottom flange of joists and secure solid blocking to joist webs.

F. Secure joists to load-bearing interior walls to prevent lateral movement of bottom flange.

G. Install miscellaneous joist framing and connections, including web stiffeners, closure pieces, clip angles, continuous angles, hold-down angles, anchors, and fasteners, to provide a complete and stable joist-framing assembly.

## 3.05 REPAIRS AND PROTECTION

A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on fabricated and installed cold-formed metal framing with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.

B. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure that cold-formed metal framing is without damage or deterioration at time of Substantial Completion.

END OF SECTION 05400

# SECTION 05500
# MISCELLANEOUS METAL

## PART 1 - GENERAL

### 1.01 SCOPE

A. The Contractor shall furnish all labor, materials, equipment and incidentals required and install all miscellaneous metals as shown on the Drawings and specified herein. The miscellaneous metal items include but are not limited to the following:

1. Anchors or anchor bolts except those specified to be furnished with all equipment.
2. Bars, rods and channels for grates.
3. Galvanized steel lintels.
4. Embedded angles with welded studs.
5. Miscellaneous steel trim, including the following: Edgings
6. Pipe and tube railings
7. Miscellaneous metal fabrications
8. Shop Coatings
9. Pipe bollards
10. Access Hatches

B. Related Work Specified Elsewhere

1. Section 05120: Structural Steel.
2. Section 05515: Steel Ladders and Platforms
3. Anchor bolts for equipment are included in the respective Sections of Divisions 11, 13, 14 and 15.
4. Pipe hangers, supports and concrete inserts are included under Division 15.
5. Cast iron manholes and fences are included under Division 2.

### 1.02 SUBMITTALS

A. Manufacturer's data on all materials listed in Part 2 of this Section.

B. Detail drawings, as provided for in the General Conditions, showing sizes of members, method of assembly, anchorage, and connection to other members shall be submitted to the Engineer for review before fabrication.

C. Shop Drawings: For each fabricated item, show the following:

1. Shop drawings detailing fabrication and erection of each metal fabrication indicated. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items. Provide templates for anchors and bolts specified for installation under other Sections.

2. Plans and elevations.
3. Jointing and connections.
4. Indicate welded connections using standard AWS symbols; indicate net weld length.
5. Profiles of sections and reinforcing.
6. Fasteners and anchors.
7. Accessories.
8. Location of each finish.
9. Provide manufacturer's product data for all access hatches. Shop drawings shall show profiles, accessories, location, and dimensions.
10. Vault access door manufacturer shall provide the manufacturer's Warranty prior to contract close-out.

## 1.03 QUALITY ASSURANCE

A. Reference Standards: Unless otherwise specified, materials shall conform to the following:

1. Life Safety Code - NFPA 1010.
2. Structural Steel - ASTM A36.
3. Gray Iron Castings - ASTM A48, Class 30.
4. Galvanizing, general - ASTM A123.
5. Galvanizing, hardware - ASTM A153.
6. Galvanizing, assemblies - ASTM A386.
7. Bolts and Nuts - ASTM A307.
8. Stainless Steel Bolts, Bars & Shapes - ASTM A276.
9. Welding Rods for Steel - AWS Spec. for Arc Welding.

## 1.04 QUALITY CONTROL

A. Contractor shall establish and maintain records sufficient to furnish evidence of quality of materials, equipment and workmanship.

B. Where fabrications are specified to comply with structural performance requirements, provide design certified by a registered professional engineer.

## 1.05 COORDINATION

A. The work of this Section shall be completely coordinated with the work of other Sections. Verify at the site both the dimensions and work of other trades adjoining items of work in this Section before fabrication and installation of items herein specified.

B. Furnish to the pertinent trades all items included under this Section that are to be built into the work of other Sections.

C. Coordination with Masonry and Concrete Work: Where fabricated items or their anchors are to be embedded into concrete and masonry work, deliver such items to those performing the installation, together with coordination drawings and installation instructions.

## 1.06 FIELD MEASUREMENTS

A. Field measurements shall be taken at the site to verify or supplement indicated dimensions and to ensure proper fitting of all items.

B. Check actual locations of walls and other construction to which metal fabrications must fit by accurate field measurements before fabrication. Show recorded measurements on final shop drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

C. Where field measurements cannot be made without delaying the Work, guarantee dimensions and proceed with fabricating products without field measurements. Coordinate construction to ensure that actual dimensions correspond to guaranteed dimensions.

D. Fit fabrications accurately to actual construction. Record field measurements on shop drawings.

## 1.07 PERFORMANCE REQUIREMENTS

A. Structural Performance Requirements: Where complete sizes or dimensions of structural members, connections, or fasteners of any item are not indicated, design the item to produce strength appropriate to the use intended.

B. Handrails: Design to resist the loads specified by applicable building code(s).

C. Guardrails: Design to resist loads specified by applicable building code(s).

## 1.08 WARRANTY

A. Provide a warranty against defective equipment and workmanship in accordance with the requirements of the General Conditions of the Contract Documents.

# PART 2 - PRODUCTS

## 2.01 ANCHORS, BOLTS, AND FASTENING DEVICES

A. Anchors, bolts, etc., shall be furnished as necessary for installation of the work of this Section.

B. The bolts used to attach the various members to the anchors shall be the sizes shown or required. Aluminum and stainless steel shall be attached to concrete by means of stainless steel machine bolts and iron or steel shall be attached with steel machine bolts unless otherwise specifically noted.

C. structural purposes, unless otherwise noted, expansion bolts shall be Wej-it "Ankr-Tite", Phillips Drill Co. "Wedge Anchors", or HILTI-HIT(C-100). When length of bolt is not called for on the Drawings, the length of bolt provided shall be sufficient to place the wedge portion of the bolt a minimum of 1-inch behind the reinforcing steel within the concrete.

D. Material shall be as noted on the Drawings. If not listed, 316 stainless steel.

## 2.02 STEEL ITEMS

A. All miscellaneous lintels and closures not shown on the Drawings shall be galvanized steel and shall be provided as a part of this Section.

1. Provide galvanized loose steel lintels for openings and recesses in masonry walls as shown. Weld adjoining members together to form a single unit. Provide not less than 8-inch bearing at each side of openings unless otherwise indicated.

2. Provide CMU partition support angles as indicated on Drawings. Fabricate from structural steel shapes. Hot-dip galvanize after fabrication.

B. Miscellaneous steel shall be fabricated and installed in accordance with the Drawings and shall include: beams, angles, support brackets, splice plates, anchor bolts (except for equipment furnished in Divisions 11, 13, 14 and 15); lintels and any other miscellaneous steel called for on the Drawings and not otherwise specified.

C. Trench grate shall be as dimensioned on the Drawings.

## 2.03 ALUMINUM ITEMS

A. Access Doors

1. Access doors shall be provided for vaults as shown on the Drawings. Doors shall be single or double leaf as shown on the Drawings and shall be watertight.

2. Door leaf(s) shall be aluminum diamond pattern plate reinforced to support a minimum live load of 300 psf with a maximum deflection of $1/150^{th}$ of the span. The frame shall be ¼-inch extruded aluminum with an anchor flange around the perimeter.

3. Door leaf(s) shall be equipped with heavy duty hinges, pins, compression spring operators for easy operation and an automatic hold-open arm with release handle. The door leaf(s) shall open to 90 degrees and lock automatically in that position. A snap lock with removable handle shall be provided. All hardware shall be stainless steel. Aluminum finish shall be mill-finish with bituminous coating applied to the exterior of the frame.

4. Provide a 1-1/2 inch drain coupling located in the corner of the channel frame.

5. Fall Protection Grating: Furnish and install on vault access doors, where indicated on plans, fall protection grating system. Panels shall be fiberglass, molded in one piece, with load bearing bars in both directions to allow for use without continuous side support. Grating shall be designed to support a 300 PSF live load. Grating shall be provided with lift assistance for ease of operation.

6. Ladder Extension Post: Furnish and install where indicated on plans ladder safety post. Tubular post shall lock automatically when fully extended. Safety post shall have controlled upward and downward movement. Release lever shall disengage the post to allow it to be returned to its lowered position. Post shall have adjustable mounting brackets to fit ladder rung spacing up to 14" on center and clamp brackets to accommodate ladder rungs up to 1-3/4" in diameter. The post shall be manufactured of high strength square tubing. A pull up loop shall be provided at the upper end of the post to facilitate raising the post.

7. Manufacturer shall be The Bilco Company or Equal.

## 2.04 PAINT

A. Shop Primer for Ferrous Metal: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with performance requirements of FS TT-P-664, selected for good resistance to normal and corrosive atmospheric corrosion, compatibility with finish paint systems indicated, and capability to provide a sound foundation for field-applied topcoats despite prolonged exposure.

B. Galvanizing Repair Paint: High-zinc-dust-content paint for regalvanizing welds in galvanized steel, with dry film containing not less than 94 percent zinc dust by weight, and complying with DOD-P-21035 or SSPC-Paint20.

C. Bituminous Paint: Cold-applied asphalt mastic complying with SSPC-Paint12, except containing no asbestos fibers.

# PART 3 - EXECUTION

## 3.01 FABRICATION - GENERAL

A. All miscellaneous metal work shall be formed true to detail, with clean, straight, sharply defined profiles and smooth surfaces of uniform color and texture and free from defects impairing strength or durability.

B. Connections and accessories shall be of sufficient strength to safely withstand stresses and strains to which they will be subjected. Steel accessories and connections to steel or cast iron shall be steel, unless otherwise specified. Threaded connections shall be made so that the threads are concealed by fitting.

C. Welded joints shall be rigid and continuously welded or spot welded as specified or shown. The face of welds shall be dressed flush and smooth. Exposed joints shall be close fitting and jointed where least conspicuous.

D. Welding of parts shall be in accordance with the Standard Code for Arc and Gas Welding in Building Construction of the AWS and shall only be done where shown, specified, or permitted by the Engineer. All welding shall be done only by welders certified as to their ability to perform welding in accordance with the requirements of the AWS Code. Component parts of built-up members to be welded shall be adequately supported and clamped or held by other adequate means to hold the parts in proper relation for welding.

E. All steel finish work shall be thoroughly cleaned, by effective means, of all loose mill scale, rust, and foreign matter. Abrasions in the field shall be touched up with zinc rich paint immediately after erection.

F. Galvanizing, where required, shall be the hot-dip zinc process after fabrication. Following all manufacturing operations, all items to be galvanized shall be thoroughly cleaned, pickled, fluxed, and completely immersed in a bath of molten zinc. The resulting coating shall be adherent and shall be the normal coating to be obtained by immersing the items in a bath of molten zinc and

allowing them to remain in the batch until their temperature becomes the same as the bath. Coating shall be not less than 2 oz. per sq. ft. of surface. The galvanized coating shall be chromate treated.

G. Form metal fabrications from materials of size, thickness, and shapes indicated but not less than that needed to comply with performance requirements indicated. Work to dimensions indicated or accepted on shop drawings, using proven details of fabrication and support. Use type of materials indicated or specified for various components of each metal fabrication.

H. Allow for thermal movement resulting from the following maximum change (range) in ambient temperature in the design, fabrication, and installation of installed metal assemblies to prevent buckling, opening up of joints, and overstressing of welds and fasteners. Base design calculations on actual surface temperatures of metals due to both solar heat gain and nighttime sky heat loss.

I. Fabricate joints that will be exposed to weather in a manner to exclude water, or provide weep holes where water may accumulate.

J. Shop Assembly: Preassemble items in shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.

## 3.02 ROUGH HARDWARE

A. Furnish bent, or otherwise custom-fabricated, bolts, plates, anchors, hangers, dowels, and other miscellaneous steel and iron shapes as required for framing and supporting woodwork, and for anchoring or securing woodwork to concrete or other structures. Straight bolts and other stock rough hardware items are specified in Division 6 Sections.

B. Fabricate items to sizes, shapes, and dimensions required. Furnish malleable-iron washers for heads and nuts that bear on wood structural connections, and furnish steel washers elsewhere.

C. Fabricate and shop-assemble in largest practical sections for delivery to site.

1. Prepare and reinforce fabrications as required to receive applied items.
2. Fabricate items with joints tightly fitted and secured.
3. Make exposed joints tight, flush, and hairline.

D. Fasteners: Use concealed fasteners if possible.

1. Exposed Fasteners: Flathead, countersunk type unless otherwise indicated.

E. Anchors: Fabricate to suit conditions indicated; use anchors of same material and finish as item except where specifically indicated otherwise.

F. Welding

1. Welding of steel: Comply with AWS D1.1 recommendations.
2. Provide continuous welds at welded corners and seams.
3. Exposed welds: Grind flush and smooth.

G. Joints Exposed to Weather: Fabricate to keep water out, or provide adequate drainage of water that penetrates.

## 3.03 FABRICATION - SHEET METAL

A. Comply with general fabrication requirements.

B. Bend sheet metal corners to smallest possible radius.

C. Welding Steel Sheet: Comply with AWS D1.3 recommendations.

## 3.04 FABRICATION – RAILING

A. Railings - General: Construct as indicated.

1. Preassemble in shop to maximum extent practicable.
2. Bending of members: Use jigs to make each similar configuration the same; make neat bends without other deformation.
3. Close exposed open ends of members using same material as used in member.
4. Expansion joints: Slip joints located not more than 6 inches from posts and at not more than 40 feet on center; provide an internal sleeve at least 4 inches longer than width of joint, fastened to one side of joint.
5. Toeboards: 4 inch by 1/8 inch thick plate; provide for railings around floor openings and at open-sided floors.
6. Provide all components necessary for assembly of railings and for attachment to other work.
   a. For attachment to concrete or masonry: Provide inserts for installation into concrete or masonry, or provide other type of anchorage.
      i) Provide matching metal flange, welded to post, to cover grouted joint.
   b. For anchoring to solid masonry: Use fittings fastened to masonry with bolts and expansion shields unless otherwise indicated.
   c. For anchoring to hollow masonry: Use fittings fastened to masonry with toggle bolts unless otherwise indicated.
   d. Fasten fittings to railings in same manner as railing connections.
7. Exterior railings: Provide weep holes or other means for evacuation of water trapped in hollow members.
8. Wall mounted handrails: Return railing to wall at ends except where otherwise indicated.

B. Steel Pipe/Tube Railings

1. Black steel pipe, Schedule 40, standard weight.
2. Hot-dip galvanize all exterior steel pipe/tube railings; shop prime remainder.
3. Connections: Welded and ground.
4. Welding: Fill joints completely and grind off flush.
5. Elbows: Bends, only.
6. Tee and cross intersections: Coped and welded.

7. Exposed ends: Close with prefabricated fittings or with 3/16-inch-thick steel plate fully welded.

C. Removable Railing Sections: Provide sockets to receive posts; provide removable tamperproof socket covers.

## 3.05 FABRICATION - GRATINGS

A. Gratings - General: Provide toeboards at open sides of elevated gratings when curb is not otherwise indicated.

## 3.06 MISCELLANEOUS STEEL TRIM

A. Unless otherwise indicated, fabricate units from structural steel shapes, plates, and bars of profiles shown with continuously welded joints, and smooth exposed edges. Miter corners and use concealed field splices wherever possible.

B. Provide cutouts, fittings, and anchorages as required to coordinate assembly and installation with other work. Provide anchors, welded to trim, for embedding in concrete or masonry construction, spaced not more than 6 inches (150 mm) from each end, 6 inches (150 mm) from corners, and 24 inches (600 mm) o.c., unless otherwise indicated.

C. Galvanize miscellaneous steel trim in the following locations:

1. Exterior locations.
2. All interior locations unless otherwise indicated.

## 3.07 CAST NOSINGS, TREADS, AND THRESHOLDS

A. Fabricate units of material, sizes, and configurations indicated. If not indicated, provide cast-iron units with an integral abrasive finish. Furnish in lengths as required to accurately fit each opening or conditions.

B. Cast units with an integral abrasive grit consisting of aluminum oxide, silicon carbide, or a combination of both.

C. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. American Safety Tread Co., Inc.
2. Amstep Products.
3. Armstrong Products, Inc.
4. Balco/Metalines, Inc.
5. Safe-T-Metal Co.
6. Wooster Products Inc.

D. Provide anchors for embedding units in concrete, either integral or applied to units, as standard with the manufacturer.

E. Drill for mechanical anchors with countersunk holes located not more than 4 inches (100 mm) from ends and not more than 12 inches (300mm) o.c., evenly spaced between ends, unless otherwise indicated. Provide closer spacing if recommended by the manufacturer.

F. Provide 2 rows of holes for units over 5 inches (125 mm) wide, with 2 holes aligned at ends and intermediate holes staggered.

G. Apply black asphaltic coating to concealed bottoms, sides, and edges of cast-iron units set into concrete.

H. Provide a plain surface texture, except where fluted or cross-hatched surfaces are indicated.

## 3.08 PIPE BOLLARDS

A. Fabricate pipe bollards from Schedule 80 steel pipe.

1. Cap bollard as detailed on Drawings.

## 3.09 FABRICATION - SHOP COATINGS

A. Hot-dip galvanize steel and iron assemblies set in concrete and masonry.

B. Shop prime all iron and steel fabrications, except:

1. Fabrications embedded in concrete or mortar.

C. Prepare surfaces to be coated as follows:

1. Solvent-clean in accordance with SSPC-SP 1.
2. Exterior fabrications: Clean in accordance with SSPC-SP 5, SSPC-SP 6, SSPC-SP 8, or SSPC-SP 10.
3. Interior fabrications: Clean in accordance with SSPC-SP 3, SSPC-SP 5, SSPC-SP 6, SSPC-SP 8, or SSPC-SP 10.

D. Shop Priming: Comply with SSPC-PA 1.

1. Apply primer immediately following surface preparation.
2. Do not prime surfaces to be welded.
3. Do not prime surfaces in direct contact bond with concrete.
4. Apply extra coat to corners, welds, edges, and fasteners.

E. Shop Painting: Comply with SSPC-PA 1.

## 3.10 INSTALLATION

A. Install all items furnished except items to be imbedded in concrete, which shall be installed under Division 3. Items to be attached to concrete or masonry after such work is completed shall be installed in accordance with the details shown and in accordance with manufacturer's instructions

and approved shop drawings. All dimensions shall be verified at the site before fabrication is started.

B. All steel surfaces to come in contact with exposed concrete or masonry shall receive a protective coating of an approved heavy bitumastic troweling mastic applied in accordance with the manufacturer's instructions prior to installation.

C. Install manufactured components in accordance with manufacturer's instructions.

## 3.11 PREPARATION

A. Coordinate and furnish anchorages, setting drawings, diagrams, templates, instructions, and directions for installing anchorages, including concrete inserts, sleeves, anchor bolts, and miscellaneous items having integral anchors that are to be embedded in concrete or masonry construction. Coordinate delivery of such items to Project site.

B. Center nosings on tread widths with noses flush with riser faces and tread surfaces.

C. Set sleeves in concrete with tops flush with finish surface elevations. Protect sleeves from water and concrete entry.

## 3.12 INSTALLATION, GENERAL

A. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing miscellaneous metal fabrications to in-place construction. Include threaded fasteners for concrete and masonry inserts, toggle bolts, through-bolts, lag bolts, wood screws, and other connectors as required.

B. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing miscellaneous metal fabrications. Set metal fabrication accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.

C. Provide temporary bracing or anchors in formwork for items that are to be built into concrete masonry or similar construction.

D. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop-welded because of shipping size limitations. Do not weld, cut, or abrade the surfaces of exterior units that have been hot-dip galvanized after fabrication and are intended for bolted or screwed field connections.

E. Corrosion Protection: Coat concealed surfaces of aluminum that will come into contact with grout, concrete, masonry, wood, or dissimilar metals with a heavy coat of bituminous paint.

## 3.13 INSTALLATION - RAILINGS

A. Cut cored holes for posts.

B. Align joints before anchoring railing.

C. Verify that posts are plumb before anchoring.

D. Set posts with grout.

## 3.14 CLEANING AND TOUCH-UP

A. Touch up damage to galvanized surfaces using galvanizing repair paint in accordance with ASTM A 780.

B. Touch up shop paint immediately after erection.

1. Clean field welds, bolted joints, and areas where primer is damaged.
2. Paint with material used for shop painting, minimum 2 mils dry film thickness.

END OF SECTION 05500

# SECTION 05515
# STEEL LADDERS AND PLATFORMS

## PART 1 - GENERAL

### 1.01 DESCRIPTION

A. Provide, erect, set and fasten steel ladders and platforms as shown on the Drawings and as specified herein.

### 1.02 REFERENCES

A. American Institute of Steel Construction (AISC): Specification for the Design, Fabrication and Erection of Structural Steel for Buildings.

B. American Welding Society (AWS): D1.1: Structural Welding Code - Steel.

C. American Society for Testing and Materials (ASTM) Publications:

1. A 6/A 6M: Specification for General Requirements for Rolled Structural Steel Bars, Plates, Shapes, and Sheet Piling
2. A 36/A 36M: Specification for Carbon Structural Steel
3. A 47: Specification for Ferritic Malleable Iron Castings.
4. A 48: Specification for Gray Iron Castings.
5. A 123: Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
6. A 143: Practice for Safeguarding Against Embrittlement of Hot-Dip Galvanized Structural Steel Products and Procedures for Detecting Embrittlement.
7. A 153/A 153M: Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
8. A 269: Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service.
9. A 276: Specification for Stainless Steel Bars and Shapes.
10. A 307: Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength
11. A 312: Specification for Seamless and Welded Austenitic Stainless Steel Pipe.
12. A 325: Specification for High Strength bolts for Structural Steel Joints.
13. A 366: Specification for Steel, Carbon, Cold-Rolled Sheet, Commercial Quality.
14. A 384: Practice for Safeguarding Against Warpage and Distortion During Hot-Dip Galvanizing of Steel Assemblies
15. A 385: Practice for Providing High Quality Zinc Coatings (Hot-Dip)
16. F 436: Specification for Hardened Steel Washers
17. A 500: Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.
18. A 501: Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing.

19. A 563: Specification for Carbon and Alloy Steel Nuts
20. A 569: Specification for Steel, Carbon (0.15 Maximum, Percent), Hot-Rolled Sheet and Strip, Commercial Quality.
21. A 780: Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings.

## 1.03 DESIGN CRITERIA

A. Ladders shall be designed to withstand a minimum uniform live load of 100 psf or a concentrated live load of 300 pounds applied on an area of 4 square inches at any point along the element.

B. Platforms shall be designed for a minimum uniform live load of 100 psf or a concentrated live load of 300 pounds applied on an area of 4 square inches at any point along the element.

C. Ladders shall be designed to withstand a minimum of two loads of 250 pounds each, concentrated between any two consecutive attachments. The number and spacing of additional loads shall be in accordance with the anticipated usage of the ladder. Individual steps or rungs shall be designed to support a load of 250 pounds applied at any point.

## 1.04 SUBMITTALS

A. Shop Drawings: Submit in accordance with the requirements of the General Conditions of the Contract Documents:

1. Manufacturer's specifications, load tables, anchor details and installation details.
2. Shop drawings showing materials, sizes, finishes, locations, attached hardware and fittings, and details for grating and frames.
3. Setting diagrams, erection plans, templates including field erection details showing cuts, copes, connections, holes, threaded fasteners and welds. Indicate welds, both shop and field, by symbols conforming to AWS standards.

B. Certificate stating that the zinc coating conforms to the ASTM specified requirements.

## 1.05 QUALITY ASSURANCE

A. Provide in accordance with Section 01400 and as specified.

B. Obtain field measurements prior to preparation of shop drawings and fabrication.

C. Welding Qualification and Certification:

1. Furnish written welding procedure for all welds in conformance with AWS Structural Welding Code.
2. Each welder, tacker and welding operator shall be certified by test within the past six months to perform type of work required in conformance with AWS Structural Welding Code. Testing shall be conducted, and witnessed by an independent testing laboratory.
3. Maintain duplicate qualification and certification records at the job site readily available for examination.

D. Reference Standards. Comply with all Federal and State laws or ordinances, as well as all applicable codes, standards, regulations and/or regulatory agency requirements including the partial listing below:

E. Galvanize:

1. Reject all galvanized material, including bolt assemblies, not conforming to specifications.
2. Reject all galvanized material arriving at the site damaged or damaged during construction.

## 1.06 DELIVERY, STORAGE AND HANDLING

A. Provide in accordance with Section 01610 and Section 01611 and as specified.

B. Identify and match-mark, materials, items and fabrications, for installation and field assembly.

C. Deliver items to jobsite as complete units, wherever practicable, ready for installation or erection, with anchors, hangers, fasteners and miscellaneous metal items required for installation.

D. Carefully handle and store materials, protected from weather, rusting and other damage.

E. Store off the ground on suitable supports.

# PART 2 - PRODUCTS

## 2.01 MATERIALS

A. Steel plates, shapes, pipe and castings shall conform to the following ASTM specifications:

1. Structural steel shapes, bars and plates: ASTM A 36.
2. Steel Pipe: ASTM A 53.
3. Cold-rolled or hot-rolled carbon steel sheets: ASTM A 366 or ASTM A 569.
4. Structural tubing: ASTM A 500 or ASTM A 501.
5. Castings: ASTM A 47 (Grade 32510) or ASTM A 48 (Class 30).
6. Nuts, bolts and washers: ASTM A 325.

B. Stainless Steel:

1. AISI Type 316 unless otherwise indicated or specified. AISI Type (or Grade) 316L for welding.
2. Shapes and Bars: ASTM A 276.
3. Sheet, strip, plate and flat bar: ASTM A 167.
4. Pipe: ASTM A 312.
5. Tubing: ASTM A 269.

C. Welding:

1. Provide filler materials that appropriate for the alloys and tempers in accordance with the AWS Structural Welding Code.
2. Provide Class E70XX electrodes.

## 2.02 FABRICATION

A. General:

1. Fabricate true to shape, size and tolerances as indicated and specified.
2. Straighten work bent by shearing or punching.
3. Dress exposed edges and ends of metal smooth, with no sharp edges and with corners slightly rounded.
4. Provide sufficient quantity and size of anchors for the proper fastening of the work.
5. Fabricate details and connection assemblies in accordance with drawings, with projecting corners clipped and filler pieces welded flush.
6. Provide clips, lugs, brackets, straps, plates, bolts, nuts, washers, and similar items, as required for fabrication and erection.
7. Use connections of type and design required by forces to be resisted, and to provide secure fastening.
8. Fit work together in fabrication shop and deliver complete, or in parts, ready to be set in place.

B. Welding:

1. Grind exposed edges of welds to a 1/8 inch minimum radius. Grind burrs, jagged edges and surface defects smooth.
2. Prepare welds and adjacent areas such that there is no undercutting or reverse ridges on the weld bead and no sharp peaks or ridges along the weld bead.
3. Grind embedded pieces of electrode or wire flush with adjacent surface of weld bead.

C. Bolting:

1. Provide galvanized stud bolts, nuts and washers for fastening galvanized steel material.
2. Provide holes required for the connection of adjacent or adjoining work wherever noted on drawings. Locate holes for bolting to supports to a tolerance of + 1/16 inch of exact dimensions indicated.

## 2.03 STEEL PLATFORMS

A. Provide galvanized steel platforms fabricated from structural steel shapes, grating, plates, pipes and tubes as indicated.

B. Provide galvanized steel rectangular bar grating.

C. Provide galvanized steel riveted grating.

D. Railings and Handrails: Provide galvanized steel pipe railing.

E. Provide platforms fabricated from 1/4 inch thick tread. Provide platform plate with nonskid pattern surface.

## 2.04 STEEL LADDERS

A. Provide steel ladders fabricated from 1-1/4 inch IPS, Schedule 40, galvanized steel pipe uprights and 3/4 inch solid round galvanized steel rod rungs mortised and welded to uprights.

B. Provide rungs spaced at a maximum of 12 inches apart vertically and projecting 7 inches from face of wall to centerline of rungs.

C. Provide steel grab bars built into wall above hinged floor plate covers. Grab bar construction and material to match the steel rungs.

D. Provide safety cages fabricated from galvanized steel components around ladders where the vertical distance between floors or landings is 20 feet or more.

E. Conform to OSHA Regulation 1910.27 for safety cages.

## 2.05 RAILINGS AND HANDRAILS

A. Railings and Handrails: Provide steel pipe railing and with flush welded joints ground smooth and secured to stringers as indicated.

## 2.06 FALL PREVENTION SYSTEM

A. Provide ladders with a rigid fall prevention system manufactured of Type 316 stainless steel construction.

B. System Components:

1. Rigid notched carrier rail (1 5/16 inch stainless steel tubing) with guide channel, alignment guide and connecting strap.
2. Saf-t-lok sleeve and safety locking mechanism; mounting brackets.
3. Safety belt with two side "D" rings for attaching
4. Body strap (nylon w/elk leather wrap) with buckle of stainless steel.

C. Conform to OSHA Regulation 1910.27 for fall prevention system.

## 2.07 HOT-DIP GALVANIZING

A. Provide hot-dip galvanizing in conformance with ASTM A 123, Grade 100 to all grating and frames.

B. Provide hot-dip galvanizing, in conformance with ASTM A 153, to all bolts, nuts and washers that will be used with galvanized steel.

C. Complete all fabrication and prepare surfaces of steel by removing all weld spatter, flux, residue, burrs and metal surface defects before galvanizing. Clean weldments with power wire brush prior to galvanizing.

D. Provide steel dipped into solution of zinc chloride plus ammonium chloride immediately prior to galvanizing. Do not use galvanizing process utilizing flux blanket overlaying molten zinc.

E. Chromate treat all pieces that will be in contact with or encased in concrete or masonry after galvanizing. One coat of one of the following coal tar epoxy coating systems may be substituted for the chromate treatment:

1. 46H-413 Hi-Build Tneme Tar by Tnemec Co. Inc.
2. Bitumastic 300M by Carboline Co.
3. Targuard by Sherwin Williams Co.
4. Or equal.

F. Tap bolt nuts after hot-dip galvanizing in conformance with ASTM A 563.

G. Inspect galvanized material for compliance with these specifications. Mark the material with a clearly visible stamp indicating the name of the galvanizer, the ASTM number and the weight of zinc coating in ounces per square foot.

## 2.08 GALVANIZE TOUCH-UP

A. Repair damaged galvanized coating using paints containing zinc dust in conformance with ASTM A 780.

B. Field touch-up all damaged galvanized surfaces after installation with one of the following zinc rich coatings:

1. Endupor, zinc-rich coating by Dampney Manufacturing Co. ZiRP, zinc-rich coating by Duncan Galvanizing Corp.
2. ZRC Cold Galvanizing Compound by ZRC Chemical Products Co., Division of Norfolk Corp.
3. Or equal.

## 2.09 SHOP PAINTING

A. Primer and Finish Paint: Shop apply a high solids epoxy with the following characteristics to all galvanized ferrous surfaces:

1. Solids by Volume: Minimum 69% (± 2%)
2. Type: Self Priming Polyamidoamine
3. Dry Film Thickness: 4-8 mils [.10-.20 mm] per coat
4. Number of Coats: Two
5. Volatile Organic Compound Limit: 2.79 lbs./gallon maximum
6. Color: To be selected by the Engineer

B. Topcoat: Shop apply an aliphatic acrylic polyurethane coating with the following characteristics over the finish paint coating:

1. Solids by Volume: Minimum 58% (± 2%)
2. Dry Film Thickness: 4 mils [.10 mm]
3. Number of Coats: One
4. Volatile Organic Compound Limit: 3.5 lbs./gallon maximum
5. Color: To be selected by the Engineer
6. Topcoat and finish paint shall be compatible and from the same coating manufacturer.

C. Surface preparation, mixing, application and safety requirements shall be in accordance with the paint manufacturer's printed instructions.

D. Provide additional shop paint coating and topcoat for touch-up of surfaces after installation is completed and accepted.

## PART 3 - EXECUTION

### 3.01 GENERAL

A. Set and secure in place as indicated. Where bolted connections are used, draw together and draw nuts tightly. Use bolts of lengths required so that they do not project more than 1/4-inch beyond face of nut. Do not use washers unless specified. Provide hexagonal head bolts with hexagonal nuts.

B. Locate anchors and anchor bolts and build into connecting work. Insert expansion bolts into drilled holes.

C. Install ladders in accordance with approved shop drawings.

### 3.02 LADDERS

A. Anchor uprights to wall with angles or bent plates welded to uprights and anchored to wall. Grind smooth all welds.

B. Secure interior ladders to slabs with floor flanges.

C. Provide safety cages or fall prevention system as indicated.

D. Provide galvanized structural steel angles, struts, rod hangers, closure plates, and brackets indicated.

### 3.03 FALL PREVENTION SYSTEM

A. Install in accordance with manufacturer's printed instructions.

## 3.04 GALVANIZE TOUCH-UP

A. Touch-up abraded hot-dip galvanized areas by the brush applied method with zinc-rich coatings as specified herein having dry film thickness of not less than 6 mils. Make all repairs to galvanized surfaces in conformance with ASTM A 780.

END OF SECTION 05515