

SECTION 04811 - CLAY UNIT MASONRY ASSEMBLIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Special Conditions and Division-1 Specification Section, apply to work of this section.

1.2 SUMMARY

- A. Clay Masonry scheduled on Drawings and specified herein. Include related reinforcements, attachments, and accessories.
- B. Section Includes:
 - 1. Structural Clay Masonry Units.
 - 2. Mortar and Grout.
 - 3. Steel Reinforcing Bars.
 - 4. Masonry Joint Reinforcement.
 - 5. Ties and Anchors
 - 6. Embedded Flashing.
 - 7. Miscellaneous Masonry Accessories
 - 8. Masonry Cell Insulation
- C. Related Sections:
 - 1. Division 1 Section "Construction Waste Management".
 - 2. Division 1 Section "LEED Requirements".
 - 3. Division 3 Section "Cast-in-Place Concrete".
 - 4. Division 4 Section "Unit Masonry Assemblies".
 - 5. Division 5 Section "Structural Steel Framing".
 - 6. Division 7 Section "Water Repellants".
 - 7. Division 7 Section "Building Insulation"
 - 8. Division 7 Section "Sheet Metal Flashing and Trim".

1.3 QUALITY ASSURANCE

- A. Codes and Standards - Comply with provisions of following codes, specifications, and standards, except where more stringent requirements are shown or specified:
 - 1. ASTM A82 - Cold-Drawn Steel Wire for Concrete Reinforcement.
 - 2. ASTM C5 - Quicklime for Structural Purposes.
 - 3. ASTM C91 - Masonry Cement.

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4. ASTM C94 - Ready-Mixed Concrete.
5. ASTM C144 - Aggregate for Masonry Mortar.
6. ASTM C150 - Portland Cement.
7. ASTM C207 - Hydrated Lime for Masonry Purposes.
8. ASTM C270 - Mortar for Unit Masonry.
9. ASTM C387 - Packaged, Dry, Combined Materials, for Mortar and Concrete.
10. ASTM C404 - Aggregates for Masonry Grout.
11. ASTM C476 - Grout for Masonry.
12. ASTM C595 - Blended Hydraulic Cement.
13. ASTM C780 - Pre-Construction and Construction Evaluation of Mortars for Plain and Reinforced Unit Masonry.
14. ASTM C1019 - Method of Sampling and Testing Grout.
15. ASTM C652 - Hollow Brick (Hollow Masonry Units Made From Clay or Shale).
16. ASTM A123 - Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
17. ASTM A615 - Deformed and Plain Billet Steel Bars for Concrete Reinforcement.
18. ASTM C90 - Hollow and Solid Load Bearing Concrete Masonry Units.
19. IMIAC - International Masonry Industry All-Weather Council: Recommended Practices and Guide Specification for Hot and Cold Weather Masonry Construction.
20. UL - Underwriters' Laboratories.
21. ASTM C979 - Standard Specification for Pigments for Integrally Colored Concrete
22. ASTM C1142 - Standard Specification for Extended Life Mortar for Unit Masonry
23. ASTM C216 - Standard Specification for Facing Brick (Solid Masonry Units Made from Clay or Shale)
24. ASTM D226 Standard Specification for Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing

- D. Coordination: Review installation procedures and coordinate with other Work that will be integrated with masonry. Coordinate brick flashing with flashing Work specified elsewhere to insure a complete, watertight flashing system designed to shed water to building exterior. Coordinate conduit in walls with vertical reinforcement locations to avoid conflicts.
- E. Manufacturer: Company specializing in manufacturing Work of this Section with minimum 5 years documented experience.
- F. Installer: Company specializing in performing Work of this Section with minimum 5 years documented experience.
- G. Fire Performance Characteristics: Where indicated, provide materials and construction that are identical to those of assemblies whose fire endurance has been determined by testing in compliance with ASTM E119 by a recognized testing and inspecting organization or by another means, as acceptable to authority having jurisdiction.
- H. Single Source Responsibility for Clay Units: Obtain exposed clay units of uniform texture and color, or a uniform blend within ranges accepted for these characteristics, from 1 manufacturer for each different product required for each continuous surface or visually related surfaces.
- I. Testing Brick Masonry Mortar:
 - 1. Mortar mixes shall be tested by an independent testing agency per ASTM C476, for each type of mortar specified.
 - 2. Test mix designs prior to beginning construction of clay masonry walls.
 - 3. 7 day compressive strength test of laboratory mix design shall meet or exceed specified 28 day design compressive strength.
 - 4. Prepare mortar test cubes per ASTM C270-92 for laboratory tests.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Accept delivery of materials only in unopened and undamaged containers.
- B. Accept clay units on site. Inspect for damage.
- C. Store admixtures to prevent contamination or damage from excessive temperature changes.
- D. Stockpile aggregates to prevent contamination from foreign materials.
- E. Immediately remove damaged or otherwise unsuitable materials, when so determined, from Project site.
- F. Store clay units on pallets and keep covered to protect from moisture damage.
- G. Maintain packaged materials clean, dry, and protected against moisture, freezing, and foreign matter.

1.5 PROJECT CONDITIONS

- A. Environmental Conditions:
Maintain materials and surrounding air temperature to minimum 50 degrees F prior to, during, and 48 hours after completion of masonry Work.
Cold Weather Protection: When temperature of outside air is below 40 degrees F, pre-condition materials and erect Work per ACI- 530.1, Section 1.8. 3.
Hot Weather Protection: Protect masonry construction from direct exposure to wind and sun per the requirements set forth in ACI- 530.1, Section 1.8.

PART 2 – PRODUCTS

2.1 CLAY MASONRY UNITS

APPROVED MANUFACTURERS: Interstate Brick or approved equal

- A. General: Provide shapes indicated and as follows:
1. Provide special shapes for lintels, corners, jambs, sash, control joints, headers, bonding, and other special conditions.
 2. Provide individual units vertically scored on both exterior and interior exposed faces to simulate Flemish Bond arrangement (a 12 inch wide face adjacent to a 4 inch wide face) when laid end to end in each course.
- B. Hollow Clay Brick:
1. Manufactured by Interstate Brick, 9780 S. 5200 W., West Jordan, Utah 84088-5689, or H.C. Muddox, 4875 Bradshaw Road, Sacramento, CA 95827-9793, supplied by Coloroc, contact Beth Branch (813) 956-9976.
 2. Color: Basis of Design, "Mountain Red" or, alternate color selected by the Architect from the manufacturer's available colors. Provide second color, as selected by Architect, from the manufacturer's available colors, for bricks located in lower courses comprising base of walls.
 3. Texture: Matte.
 4. ASTM C-652 latest edition, Grade SW, Type HBS or better.
 5. Dimensions: Match Architect's sample.
 6. Minimum compressive strength: 9,000 psi.
 7. Minimum Saturation Coefficient: 0.78.
 8. Minimum IRA: 6 g/30 sq. in.
 9. Maximum IRA 30 g/30 sq. in. Where IRA exceeds 30 g/30 sq. in., pre-wetting brick is recommended.
 10. Shapes: Where special shapes are shown on architectural drawings, manufacturer shall provide shop drawings for architect's approval prior to manufacturing shapes.

2.2 REINFORCING STEEL

- A. Uncoated Steel Reinforcing Bars: ASTM A 615/A 615M; ASTM A 616/A 616M, including Supplement 1; or ASTM A 617/A 617M, Grade 60 (Grade 400).

2.3 MASONRY JOINT REINFORCEMENT

- B. General: ASTM A 951 and as follows:
 - 1. Mill galvanized, carbon- steel wire for interior walls and hot-dip galvanized, carbon-steel wire for exterior walls.
 - 2. Wire Size for Side Rods: W2.8 or 0.188-inch diameter.
 - 3. Wire Size for Cross Rods: W1.7 or 0.148-inch diameter.
 - 4. Provide in lengths of not less than 10 feet, with prefabricated corner and tee units where indicated.
- C. For single-wythe masonry, provide truss or ladder type with single pair of side rods and cross rods spaced not more than 16 inches o.c.

2.4 TIES AND ANCHORS, GENERAL

- A. General: Provide ties and anchors, specified in subsequent articles, made from materials that comply with this Article, unless otherwise indicated.
- B. Hot-Dip Galvanized Carbon-Steel Wire: ASTM A 82; with ASTM A 153, Class B-2 coating.
- C. Steel Sheet, Galvanized after Fabrication: ASTM A 366/A 366M cold-rolled, carbon-steel sheet hot-dip galvanized after fabrication to comply with ASTM A 153.
- D. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.

2.5 MISCELLANEOUS MASONRY ACCESSORIES

- A. Compressible Filler: Premolded filler strips complying with ASTM D 1056, Grade 2A1; compressible up to 35 percent; of width and thickness indicated; formulated from PVC.
- B. Prefomed Control-Joint Gaskets: Designed to fit standard sash block and to maintain lateral stability in masonry wall; size and configuration as indicated.
- C. Bond-Breaker Strips: Asphalt-saturated, organic roofing felt complying with ASTM D 226, Type I (No. 15 asphalt felt).
- D. Reinforcing Bar Positioners: Wire units designed to fit into mortar bed joints spanning masonry unit cells with loops for holding reinforcing bars in center of cells. Units are formed from 0.142-inch steel wire, hot-dip galvanized after fabrication.

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- E. Provide units with either two loops or four loops as needed for number of bars indicated.

2.6 MORTAR AND GROUT MATERIAL

- A. Mortar shall be Type S consisting by proportion:
 - 1 part Portland cement (ASTM C-150 Type I or II, Low Alkali), less than 6 months old,
 - 1/2 part hydrated lime (ASTM C-207),
 - 4-1/2 parts sand (ASTM C-144).Color proportion as determined by manufacturer.
- B. Grout shall be by proportion:
 - 1 part Portland cement (ASTM C-150 Type I or II, Low Alkali), less than 6 months old,
 - 3 parts sand (ASTM C-144),
 - 2 parts pea gravel (ASTM C-404). Pea gravel may be omitted for fine grout mix.
- C. Provide custom color mortar. Basis of design: Mortamix, Holcim Brick Red

2.7 MORTAR MIXES

- A. Refer to Mortar Schedule for mixes required.

2.8 GROUT MIXING

- A. Thoroughly mix mortar ingredients in quantities needed for immediate use per ASTM C476 Course grout.
- B. Add admixtures per manufacturer's instructions. Provide uniformity of mix.
- C. Do not use anti-freeze compounds to lower freezing point of grout.

2.9 MORTAR MIXING

- A. Thoroughly mix mortar ingredients in quantities needed for immediate use per ASTM C270.
- B. Add admixtures per manufacturer's instructions. Provide uniformity of mix.
- C. Do not use anti-freeze compounds to lower freezing point of mortar.
- D. If water is lost by evaporation, retemper only within 2 hours of mixing.

- E. Use mortar within 2 hours after mixing at temperatures of 80 degrees F, or 2-1/2 hours at temperatures under 50 degrees F.
- F. Mix colored mortar per manufacturer's instructions.

2.10 MASONRY-CELL INSULATION

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Forced Foam insulation in Masonry:
 - a. Core-Fill 500 by Tailored Chemical Products, Inc.
 - b. Thermco Foam Insulation by Thermco Corporation of America.
 - c. cfiFOAM, Inc. by Southern Foam Insulation, Inc.

2.11 ACCESSORIES

- A. Cleaning Solutions: General purpose cleaning agent, not harmful to masonry Work or adjacent materials.
- B. Compressible Joint Material: Urethane open-cell foam, 1/2 inch thick by width of masonry unit, adhesive on 1 side only.
- C. Bond Breaker Strips: Asphalt saturated organic felt complying with ASTM D226, Type 1, 15 pound asphalt felt.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and conditions under which Work of this Section will be performed.
- B. Correct conditions detrimental to timely and proper completion of Work.
- C. Do not proceed until unsatisfactory conditions are corrected.
- D. Verify items provided by other Sections of Work are properly sized and located.
- E. Verify that built-in items are in proper location, and ready for roughing into masonry Work.
- F. Beginning of installation means installer accepts existing conditions.

3.2 PREPARATION

- A. Direct and coordinate placement of metal anchors supplied to other Sections.

3.3 MORTAR AND GROUT INSTALLATION

- A. Work grout into masonry cavities to eliminate voids where detailed or indicated.
- B. Remove grout spaces of excess mortar.
- C. Tool exterior mortar joints as noted.

3.4 INSTALLATION

- A. Install masonry construction aligned, plumb, and true in required layout, making straight, level courses, unless otherwise indicated.
- B. Construct masonry to full thickness as shown with masonry units of sizes noted and specified, using whole units wherever possible.
- C. When required, cut brick neatly by wet-saw to obtain sharp edges without damage to unit, as approved for providing required bond pattern and proper fit at adjoining items.
- D. Build-in items furnished by other trades, and leave accurate openings necessary for subsequent installation of other Work in a manner to maintain required strength and appearance of masonry construction.
- E. Fill solidly with mortar around conduit and sleeves passing through masonry Work.
- F. Build-in loose angle steel lintels, providing bearing specified and bed lintels in mortar.
- G. Provide threaded steel anchors where indicated on Drawings to be built into masonry construction for attachment of Work by other trades.
- H. Conform to requirements of ASTM A307.
- I. Include nuts with hardened washers where required.
- J. Provide minimum 1/2 inch shank diameter by 10 inch length with pigtail end, where size and type are not indicated on Drawings.
- K. Hot-dip galvanize anchors where used in exterior exposed construction.
- L. Prevent grout, mortar, and soil from staining face of brick to be left exposed. Remove grout and mortar from these surfaces immediately.

- M. Protect base of brick walls from rain splashed mud and mortar splatters by means of coverings spread on ground or over wall surfaces.

3.5 COURSING

- A. Establish lines, levels, and coursing indicated on Drawings. Protect from displacement.
- B. Maintain brick courses to uniform dimension. Form vertical and horizontal joints of uniform thickness.
- C. Lay scored brick units end to end (running bond) to simulate Flemish Bond arrangement (a 12" wide face adjacent to a 4" wide face in each course, with each course staggered so that the 4" wide face is centered on the 12" wide face above and below, with the faces of the same width aligned vertically every other course) on both exterior and interior exposed faces. Form concave mortar joints.

3.6 PLACING AND BONDING

- A. Lay brick units, in full bed of mortar, with full head joints uniformly jointed with other Work.
- B. Back-bevel bed joints to remove excess mortar droppings in cavity as Work progresses.
- C. Buttering corners of joints or excessive furrowing of mortar joints are not permitted.
- D. Remove excess mortar as Work progresses.
- E. Interlock intersections and external corners.
- F. Do not shift or tap brick units after mortar has achieved initial set. Where adjustment needs to be made, remove mortar and replace.
- G. Perform job-site cutting of brick units with waterbath diamond blade saws to provide straight, clean, unchipped edges. Prevent broken brick unit corners or edges.

3.7 COMPRESSIBLE JOINT MATERIAL

- A. Install compressible joint material horizontally on top of brick unit below steel shelf angles to provide an expansion joint to allow deflection of angle. Fill joint with backer rod and sealant on weather side.

3.8 WEEPS AND VENTILATORS

- A. Install weep holes in brick veneer masonry at maximum 16 inches on center horizontally above through-wall flashing, above shelf angles, lintels, bottom of walls, and elsewhere as indicated on Drawings.
- B. Install cavity ventilators in masonry at maximum 48 inches on center horizontally, at 2 courses above through-wall base flashing, and 3 courses below top of wall.

3.9 MASONRY-CELL INSULATION INSTALLATION

- A. Foam wall insulation is to be pumped into open brick cavities indicated to receive insulation, taking care to fill voids completely. Maintain inspection ports to show presence of insulation at extremities of each pour area. Close ports after confirming complete coverage. Follow manufacturer's recommendations for product liquid ratios at mixing gun.
- B. Foam wall insulation shall be installed from interior face of brick units. Plug injection holes and inspection ports with brick materials matching adjacent brick materials in type, finish and color

3.10 GROUTED COMPONENTS

- A. Reinforce bond beam with 2 No. 5 bars, placed top and bottom, unless noted otherwise.
- B. Lap splices minimum 24 bar diameters.
- C. Support and secure reinforcing bars from displacement. Maintain position within 1/2 inch of dimensioned position.
- D. Place and consolidate grout fill without displacing reinforcing.

3.11 CONTROL AND EXPANSION JOINTS

- A. Do not continue horizontal joint reinforcement through control and expansion joints.
- B. Install preformed control joint device in continuous lengths. Seal butt and corner joints per manufacturer's instructions.
- C. Size control joint in compliance with Section 07 90 00 for sealant performance.
- D. Provide fire-stopping sealant at construction joints in fire-rated walls and partitions. Provide and install per 07 84 00.

- E. Install control joints at jambs of masonry openings, and at locations indicated on Drawings, and at maximum 30 feet on center if not indicated otherwise.
- F. Form expansion joint as indicated on Drawings.

3.12 BUILT-IN WORK

- A. As Work progresses, build in metal door and glazed frames, fabricated metal frames, window frames, wood nailing strips, anchor bolts, plates, and other items specified in other Sections.
- B. Build in items plumb and level.
- C. Bed anchors of metal door and glazed frames in adjacent mortar joints. Fill frame voids solid with grout. Fill adjacent masonry cores with grout minimum 8 inches from framed openings.
- D. Do not build in organic materials subject to deterioration.

3.13 TOLERANCES

- A. Maximum Variation From Unit to Adjacent Unit: 1/32 inch.
- B. Maximum Variation From Plane of Wall: 1/4 inch in 10 feet and 1/2 inch in 20 feet or more.
- C. Maximum Variation From Plumb: 1/4 inch per story non-cumulative.
- D. Maximum Variation From Level Coursing: 1/8 inch in 3 feet; 1/4 inch in 20 feet.
- E. Maximum Variation of Joint Thickness: 1/16 inch in 3 feet.
- F. Maximum Variation From Cross Sectional Thickness of Walls: 1/4 inch.

3.14 CLEANING AND SEALING

- A. Remove brick units which are loose, chipped, broken, stained, or otherwise damaged, and replace with new units, or if units do not match adjoining units as intended. Provide new units to match adjoining units and install in fresh mortar or grout, pointed to eliminate evidence of replacement.
- B. Pointing: During tooling of joints, enlarge voids or holes, except weep holes, and completely fill with mortar. Point-up joints including corners, openings, and adjacent Work to provide a neat, uniform appearance, prepared for application of sealant.

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- C. Final Cleaning: After mortar is thoroughly set and cured, clean brick as per methods recommended by SCPI and NCMA and as follows:
- D. Remove large mortar particles by hand with wooden paddles and non-metallic scrape hoes or chisels
- E. Test cleaning methods on sample wall panel; leave 1/2 panel uncleaned for comparison. Obtain Architect's approval of sample cleaning before proceeding with cleaning of masonry.

3.15 PROTECTION

- A. Without damaging completed Work, provide protective boards at exposed external corners that may be damaged by construction activities.
- B. Provide weather-tight protective cover over masonry walls exposed to elements during construction to keep moisture out of cores and cavities.
- C. Provide final protection and maintain conditions in a manner acceptable to installer, which ensures brick masonry Work being without damage and deterioration at time of Substantial Completion.

END OF SECTION 04811

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SECTION 05120 - STRUCTURAL STEEL

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Special Conditions and Division 1 Specification Sections apply to work on this Section.

1.02 SUMMARY

- A. Section Includes:

- 1. Structural steel.

- B. Related Sections:

- 1. Division 1 Section "LEED Requirements".
- 2. Division 1 Section "Quality Requirements".
- 3. Division 1 Section "Construction Waste Management".
- 4. Division 5 Section "Steel Deck".
- 5. Division 9 Sections "Exterior and Interior Painting".

1.03 DESCRIPTION OF WORK

- A. Provide structural steel work as shown on drawings and specified herein. Hoisting of the metal deck shall be the responsibility of Contractor. Structural steel is that work defined in AISC "Code of Standard Practice" and as otherwise shown on drawings.

1.04 QUALITY ASSURANCE

- A. Codes and Standards

- 1. Comply with provisions of following, except where more stringent requirements are shown or specified
- 2. AISC "Code of Standard Practice for Steel Buildings and Bridges."
- 3. AISC "Specifications for the Design, Fabrication, and Erection of Structural Steel for Buildings," including the "Commentary" and Supplements thereto as issued.

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4. AISC "Specifications for Structural Joints using ASTM A 325 or A 490 Bolts" approved by the Research Council on Riveted and Bolted Structural Joints of the Engineering Foundation.
 5. AWS D1.1 "Structural Welding Code," latest editions.
 6. ASTM A 6 "General Requirements for Delivery of Rolled Steel Plates, Shapes, Sheet Piling and Bars for Structural Use.
- B. Qualifications for Welding Work
1. Qualify welding processes and welding operators in accordance with the WS "Standard Qualification Procedure."
 2. Provide certification that welders to be employed in the work have satisfactorily passed AWS qualification tests within the previous 12 months.
 3. If recertification of welders is required, retesting will be the Contractor's responsibility and at his expense.

1.05 COORDINATION

- A. Contractor shall fully coordinate the structural steel work. Coordinate with Metal Deck Installer for hoisting of the metal deck.
- B. Contractor shall fully verify all dimensions and details. Any discrepancies shall be immediately reported to the Architect.
- C. Contractor shall locate dimensionally on setting plans all anchor bolts, inserts, base plates, etc. and shall prepare and deliver all required templates and fully dimensioned setting plans, all in time for the proper execution of the work.
- D. Contractor shall set the anchor bolts and inserts. Contractor shall field survey all such settings for correctness after they have been cast in place, and before proceeding with steel erection. Checking shall be performed within ten days of notification by concrete installer that his work is complete.
- E. Contractor shall within 10 days report to the Architect and certify that he has complied with the above checking requirements and shall indicate any inaccuracies found and corrections which must be made. Any inaccuracies not included in this report and found during or after steel erection shall be the responsibility of the Contractor, and the cost of corrective measures shall be borne by him.

- F. Use base lines, bench marks, or other standards for survey work. If permanent building bench marks have been established, they will be used for the aforementioned field checking.
- G. Contractor shall coordinate erection areas and sequence and temporary bracing locations.

1.06 SUBMITTALS

A. Product Data

- 1. Submit 4 copies of producer's or manufacturer's specifications and installation instructions for following products. Include laboratory test reports and other data to show compliance with specifications (including specified standards).
 - a. Structural Steel (each type), including certified copies of mill reports covering the chemical and physical properties.
 - b. High strength bolts.
 - c. Structural steel primer paint.

B. LEED Submittal:

- 1. Product Data for Credit MR 4 and Credit MR 4.2: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content. Include statement indicating costs for each product having recycled content.

C. Shop Drawings

- 1. Structural steel shop drawings shall be signed, sealed and dated by the professional engineer registered in the state of Florida. Shop drawings shall give all necessary information for the fabrication and erection of the structure and shall be based on AISC Specifications. Minimum connections used shall be as indicated on the drawings and shall support the total uniform load capacity of members. Provisions for the connection of other work required shall be indicated and provided by Steel Installer. Index sheets shall be furnished with all beam and column details at the same time the details are submitted for the review of the Architect. Standard connection details conforming to those shown on the drawings shall be submitted with first erection plan. All details shown are typical; similar details apply to similar conditions, unless otherwise indicated.
- 2. The review of shop drawings shall be for size and arrangement of principal members and strength of connections only.

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3. Provide anchor bolt and setting drawings, templates, and directions for installation of anchor bolts and other anchorages to be installed by others.
4. Promptly notify the Architect whenever design of members and connections for any portion of the structure are not clearly indicated.
5. Shop drawings shall bear the initials of the detailer's checker prior to submission.
6. Shop drawings shall indicate the sequence and extent of areas to be erected by using division or derrick numbers.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials to site at such intervals to insure uninterrupted progress of work.
- B. Deliver anchor bolts and anchorage devices, which are to be embedded in cast-in-place concrete or masonry, in ample time so as not to delay that work.
- C. Store materials to permit easy access for inspection and identification. Keep steel members off the ground, using pallets, platforms, or other supports. Protect steel members and packaged materials from corrosion and deterioration. The Contractor shall be responsible for any demurrage charges due to failure to unload or store materials properly. Structural steel shall be kept properly drained. Do not store materials on the structure in a manner that might cause distortion or damage to the members of the supporting structures.
- D. Protection - Use all means necessary to protect the materials of this Section before, during, and after installation, and to protect the installed work and materials of all other trades.
- E. Replacement - In the event of damage, immediately make all repairs and replacements necessary to the approval of the Architect and at no additional cost to the Owner.
- F. Shop Fabrication and Assembly
 1. Fabricate and assemble structural assemblies in shop to greatest extent possible. Fabricate items of structural steel in accordance with AISC Specifications and as indicated on approved shop drawings. Provide camber in structural members where indicated.
 2. Properly mark and match-mark materials for field assembly. Fabricate for delivery sequence which will expedite erection and minimize field handling of materials.

G. Connections

1. Shop connections shall be welded or high strength bolted. Field Connections shall be bolted with high strength bolts in friction-type connections conforming to ASTM Designation A325, except where welded connections or other connections are indicated.
2. Combinations of bolts and welds in the same connections are not permitted, unless otherwise shown on the drawings.
3. Where structural joints are made using high strength bolts, hardened washers and nuts tightened to a high tension; the materials, methods of installation and tension control, type of wrenches to be used, and inspection methods shall conform to ASTM Designation A325 as approved by the Research Council on Riveted and Bolted Structural Joints of the Engineering Foundation. Each bolt shall have a hardened washer under the nut.
4. The high strength bolts used shall have a suitable identifying mark placed on top of the head before leaving the factory.
5. Tightening of nuts shall be done with properly calibrated pneumatic wrenches. The minimum bolt tension for the size of the bolt used shall be in accordance with tables listed in the above referenced Standards. Each wrench shall be checked for accuracy at least once daily for actual conditions of application.
6. Bolts that have been completely tightened shall be marked with identifying symbols.
7. The Contractor shall have a properly calibrated torque gauge on hand, and when requested by the Architect, shall provide a check on any bolt at any time until final acceptance of the work by the Owner.

PART 2 – PRODUCTS

2.01 MATERIALS

- A. Metal Surfaces, General - For fabrication of work which will be exposed to view, use only materials which are smooth and free of surface blemishes, including pitting, seam markers, roller marks, rolled trade names, and roughness. Remove such blemishes by grinding or by welding and grinding prior to cleaning, treating, and application of surface finishes.
- B. Structural Steel Shapes, Plates, and Bars - ASTM A36
- C. Steel Pipe - ASTM A53, Types E or S, Grade B.

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- D. Anchor bolts shall conform to ASTM A307 with size and shape as indicated on the drawings.
- E. Column Base Plates - ASTM A36
- F. Arc Welding Electrodes shall conform to the AWS Code as Revised. All electric current require shall be furnished by Contractor.
- G. Paint for Shop Painting Structural Steel and Field Touch-up shall be manufacturer's standard primer.
- H. All items exposed to weather, such as beams, shelf angles and items as noted on the drawings, shall be zinc coated in accordance with the provisions of ASTM Designation A123 as revised to date.

2.02 FABRICATION

- A. General - Fabricate items of structural steel in accordance with AISC Specifications and as indicated on the approved shop drawings.
- B. Bearing surfaces shall be planed to true beds, and abutting surfaces shall be closely fitted. All columns and bearing stiffeners shall be milled to give full bearings.
- C. Bolt holes shall be drilled or punched in accordance with AISC Specifications, subject to the provisions specified herein. Holes shall be accurately centered and shall register true upon erection. Poor matching of holes shall be cause for a rejection. Small errors may be repaired by drilling or reaming.
- D. Contact surfaces shall be thoroughly cleaned before assembly. Assembled parts shall be brought into close contact. Drift pins shall be used only for aligning members and shall not be used in a manner which will damage metal or enlarge or distort holes. Members requiring accurate alignment shall be provided with slotted holes and/or washers for truing up the steel as required. All finished members shall be true to line and free from twists, bends, and open joints.
- E. Welding shall be performed by operators qualified in accordance with the American Welding Society "Standard Qualification Procedure" to perform the type of work required. Such qualification test shall have been passed within the preceding 12-month period. Shop drawings shall indicate the size, length, spacing, and type of all welds. Comply with AWS Code for procedures, appearance and quality of welds, and for methods used in correcting welding work.
- F. Holes for Other Work - Provide holes required for securing other work to structural steel framing, and for passage of other work through steel framing members, as shown on approved shop drawings.

- G. Provide threaded nuts welded to framing and other specialty items as indicated to receive other work.
- H. Cut, drill, or punch holes perpendicular to metal surfaces. Do not flame cut holes or enlarge holes by burning. Drill holes in bearing plates.

2.03 SHOP PAINTING

- A. Provide one shop coat of paint as specified under Article "Materials" to all steel except for members receiving galvanizing or as specified hereafter.
- B. Paint shall be delivered to the shop in original sealed containers which shall be clearly marked with the manufacturer's name and the identifying brand number or name. The paint shall be used as prepared by the manufacturer without thinning or other admixtures.
- C. Surface Preparation - After inspection and before shipping, clean steelwork to be painted complying with Steel Structures Painting Council (SSPC) SP-2 "Hand Tool Cleaning," or SSPC SP-3 "Power Tool Cleaning."
- D. Do not paint contact surfaces which are to be welded or high-strength bolted. No paint shall be applied within 3" of any high strength bolt holes.
- E. Do not paint any zinc-coated items.
- F. Paint shall be applied under dry and dust-free conditions and unless otherwise allowed by the Architect, shall not be applied when the temperature is below 45 deg. F. Painting shall be done in workmanlike manner so as to produce an even dry film of uniform thickness of 2 mil. Edges, corners, crevices, and joints shall receive special attention so that they are thoroughly cleaned and they receive an adequate thickness of paint.

PART 3 – EXECUTION

3.01 ERECTION

- A. General - Installer must examine the areas and conditions under which structural steel work is to be installed, and notify the Contractor in writing of conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions have been corrected in a manner acceptable to the installer.

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- B. Codes - Comply with the AISC Specifications and Code of Standard Practice, and as herein specified. Maintain work in a safe and stable condition during erection.
- C. Anchor Bolts - Steel installer shall furnish anchor bolts and other connectors required for securing structural steel to foundations and other in-place work. Steel installer shall furnish templates and other devices as necessary for presetting bolts and other anchors to accurate locations. Contractor shall set anchor bolts and other insert anchors required.
- D. Field Assembly - Set structural members to the lines and elevations indicated. Align and adjust the various members forming a part of a complete frame or structure before permanently fastening. Clean bearing surfaces and other surfaces which will be in permanent contact before assembly. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.
- E. Temporary Shoring and Bracing - Provide as required, with connections of sufficient strength to bear imposed loads. Remove temporary members and connections when permanent members are in place and final connections are made. Provide temporary guy line to achieve proper alignment of the structures as erection proceeds. Coordinate locations of temporary bracing with the Contractor.
- F. Splice members only where indicated.
- G. Do not enlarge unfair holes in members by burning or by the use of drift pins. Ream or drill holes that must be enlarged to admit bolts.
- H. Do not use gas cutting torches in the field for correcting fabrication errors in the structural framing.
- I. Touch-up Painting - Immediately after erection, clean field welds, bolted connections, and abraided areas of the shop paint, and paint all exposed areas with the same materials as used for shop painting. Apply by brush or spray to provide a minimum dry film thickness of 2.0 mils.

3.02 QUALITY CONTROL

- A. The Contractor shall notify the Architect in writing five days in advance of the starting of fabrication and of erection of the structural steel.
- B. The Owner and his agents shall have free access and the Contractor shall provide same, to all points where materials for this project are being fabricated and/or erected, and all materials, equipment and workmanship shall be subject to inspection, tests and approval by the Owner's agents or laboratories. They shall have full authority to reject all material and work that fails to conform in every respect to these specifications.

- C. Owner will engage in independent testing and inspection agency to inspect high-strength bolted connections and welded connections and to perform tests and prepare test reports.
- D. Testing agency shall conduct and interpret tests and state in each report whether test specimens comply with requirements and specifically state any deviations therefrom.
- E. Testing agency may inspect structural steel at plant before shipment; however, Architect reserves right, at any time before final acceptance, to reject material not complying with specific requirement.
- F. Shop inspection will include periodic inspection at the place of fabrication and identification of tested material, checking of fabrication for compliance with approved shop drawing and these Specifications, and inspection of shop painting, as well as the following:
 - 1. Examination of all steel for straightness and alignment.
 - 2. Examination of all fabricated pieces and checking of same with erection plans and detail drawings.
 - 3. Shop-Bolted Connections - Inspect in accordance with AISC Specifications. See paragraph entitled "High Strength Bolt Inspection" below.
 - 4. Shop Welding - Inspect and test during fabrication of structural steel assemblies as follows:
 - a. Check that welders are certified. Record type and locations of defects found in work. Record work required and performed to correct deficiencies or defects found.
 - b. Perform periodic visual inspections of random welds.
 - c. Perform the following:
 - 1. Ultrasonic Inspections - ASTM E164. 100% of first 400 butt welds or more until rejection rate is less than 5% and then 25% as long as rejection rate remains below 5%.
 - 2. Magnetic Particle Testing - ASTM E109. 25% of fillet welds with size larger than 3/8".
 - 5. Examination of surface preparation, painting/priming and galvanizing.

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- G. Field inspection will include periodic inspection after delivery at site of material, fabrication, and shop painting, and work connected with erection and field painting of steel structure, as well as the following:
1. Proper erection of all pieces.
 2. Proper installation of bolts.
 3. Plumbness of structure.
 4. Condition of shop painting after erection and field touch-up painting.
 5. Field-Bolted Connections: Inspect in accordance with AISC specifications. See paragraph below titled "High-Strength Bolt Inspection."
 6. Field Welding - Inspect and test during erection of structural steel as follows:
 - a. Check that welders are certified. Record types and locations of defects found in work. Record work required and performed to correct deficiencies or defects found.
 - b. Perform periodic visual inspections of random welds.
 - c. Perform the following:
 1. Ultrasonic Inspection - All penetrating welds performed in the field shall be tested by ultrasonic testing.
 2. Magnetic Particle Testing - Perform as described above.
 3. High Strength Bolt Inspection - Perform inspection of installation of high-strength bolts to determine that selected installation procedures as prescribed in the Specification for structural joints using ASTM A325 or A490 bolts are properly used and that bolts are properly tightened and as follows:
 - a. All bolted connections shall be visually inspected.
 - b. At least two bolts of every connection between girders and columns and trusses and columns shall be checked.
 - c. All bolted connections that fail shall be corrected and all bolts in that connection shall be retested.

- H. Contractor shall correct deficiencies in structural steel work, which inspections and laboratory test reports have indicated to be not in compliance with requirements, perform additional tests, at Contractor's expense, as may be necessary to re-confirm any non-compliance of the original work, and as may be necessary to show compliance of corrected work.

- I. When required by Architect or Contractor's engaged Inspection Organization, Contractor shall make available to Inspector a calibrated torque wrench and calibrating device, as well as the manpower required to operate same, for the purpose of checking high-strength bolts. Adequate platforms and scaffolding shall be provided to ensure safe performance of this operation.

- J. Report Copies and timing - Immediately after tests or inspection have been made, and in no case later than seven (7) days after tests of inspection have been made, the laboratory shall furnish copies of all test and inspection reports as follows:
 - 1. One (1) copy to the Architect.
 - 2. One (1) copy to Contractor.
 - 3. One (1) copy to Master Consulting Engineers, Inc.
 - 4. One (1) copy to Owner.

END OF SECTION 05120

SECTION 05210 – STEEL JOISTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Special Conditions and Division - 1 Specification Section, apply to work of this section.

1.2 DESCRIPTION OF WORK

- A. Provide steel joists work as shown on the drawings and specified herein.
 - 1. Related Work Specified Elsewhere
 - a. Structural Steel - Section 05120.
 - b. Steel Deck - Section 05310.
- B. References: (All latest editions)
 - 1. ASTM A 307 - Carbon Steel Threaded Standard Fasteners.
 - 2. ASTM A 325 - High Strength Bolts for Structural Steel Joints.
 - 3. AWD D1.1 - Structural Welding Code.
 - 4. SSPC - Steel Structures Painting Council.
 - 5. Steel Joist Institute (SJI) - Standard Specification for Open Web Steel Joists, K-Series, Standard Specifications for Long Span Steel Joists, LH Series and Deep Long Span Steel Joists, DLH Series, and Standard Specification for Joist Girders.

1.3 QUALITY ASSURANCE

- A. Inform to SJI Standard Specifications, Load Tables, and Weight Tables.

1.4 SUBMITTALS

- A. Product Data: For each type of joist, accessory, and product indicated.
- B. LEED Submittal:
 - 1. Product Data for Credit MR 4 and Credit MR 4.2: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content. Include statement indicating costs for each product having recycled content.

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1.5 SHOP DRAWINGS

- A. Indicate profiles, sizes, spacing, and locations of structural members, connections, attachments, fasteners, cambers, and loads.
- B. Indicate specified procedures concerning erection and fastening of steel joists.
- C. Provide welding certificates for welders used to fabricate joists.
- D. The specialty engineer for the steel joist supplier certify (signed and sealed) that the steel joist bottom chords will safely resist the wind uplift, considering the spacing of bridging.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Open Web Steel Joist Members - SJI Type K Open Web and Type LH longspan.
- B. Primer - Manufacturer's standard primer.

2.2 FABRICATION

- A. Fabricate steel joists in accordance with SJI Standard Specifications, including headers, supplementary framing, and cambers.
- B. Provide bottom and top joist chord extensions when indicated.
- C. Clean steel work to be painted complying with Steel Structures Painting Council, SSPC SP-3, "Power Tool Cleaning".
- D. Shop prime structural steel members. Do not prime surfaces to be field welded or high strength bolted. Apply one coat of primer paint to steel joists and accessories, by spray, dipping, or other method to provide a continuous dry paint film thickness of not less than 1.00 mil. Bituminous type primers will not be allowed

PART 3 - EXECUTION

3.1 ERECTION

- A. Erect steel joists in accordance with SJI Standard Specifications.
- B. Bear joists on supports in accordance with SJI Standard Specifications and the drawings.

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- C. During erection, provide temporary bracing for induced loads and stresses.
- D. Field weld joist seat to bearing surface after aligning and positioning joists and after installation of bridging. Deep longspan joists and joist girders shall be high strength bolted.
- E. Do not field cut or alter joists without approval of the Architect.
- F. After erection, prime welds, abrasions, and surfaces not primed. Use the same primer as the specified shop coat.

END OF SECTION 05210

SECTION 05310 – STEEL DECK

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Special Conditions and Division-1 Specification Section, apply to work of this section.

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Acoustical cellular roof deck.
- B. Related Sections:
 - 1. Division 1 Section "LEED Requirements".
 - 2. Division 5 Section "Structural Steel" for shop- and field-welded shear connectors.
 - 3. Division 9 Section "Interior Painting" for repair painting of primed deck.
 - 4. Division 16 Section "Underfloor Raceways" for preset inserts, activation kits, afterset inserts, service fittings, header ducts, and trench header ducts used with cellular floor-deck systems.

1.3 DESCRIPTION OF WORK

- A. Provide metal decking as shown on the drawings, including basic layout and type of deck units required, and specified herein.

1.3 QUALITY ASSURANCE

- A. Codes and Standards: Comply with provisions of the following codes and standards, except as otherwise shown or specified;
 - 1. AISI "Specifications for the Design of Cold-Formed Steel Structural Members."
 - 2. AWS "Structural Welding Code."
 - 3. SDI "Design Manual for Floor Decks and Roof Decks."
 - 4. MRDTI "Specifications for Steel Roof Deck Construction" as adopted by the Metal Roof Deck Technical Institute.
- B. Qualifications of Field Welding
 - 1. Qualify welding processes and welding operators in accordance with AWS "Standard Qualification Procedure." Welding decking in place is subject to inspection and testing by a Testing Laboratory engaged by the Owner.

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Remove and replace work found to be defective and not complying with requirements.

1.4 PERFORMANCE REQUIREMENTS

- A. Uplift Loading
 - 1. Install and anchor roof deck units to resist the net uplift loading indicated in the plans.

- B. Underwriter's Label
 - 1. Provide metal deck units manufactured by a firm listed in the Underwriter's laboratories "Fire Resistance Director - Index of Manufacturers." Each required type deck unit shall bear the UL label and marking.

1.5 SUBMITTALS

- A. Product Data
 - 1. Submit four copies of manufacturer's specifications and installation instructions for each type of decking and accessories. Include manufacturer's certification as may be required to show compliance with these specifications.

- B. LEED Submittal:
 - 1. Product Data for Credit MR 4.1 and Credit MR 4.2: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content.
 - a. Include statement indicating costs for each product having recycled content.

- C. Shop Drawings
 - 1. Submit detailed drawings showing size and location of floor and roof framing supports, layout and types of deck panels, deck finish and method, lengths and piece marks of deck units, fastening and anchorage details, and any openings to be cut in field. Deck units shall be marked to show sequence or erection. Detailed drawings shall also indicate closure pieces, fittings, sump pans, any special jointing, and other accessories necessary to provide a complete decking installation. Indicate welds by standard welding symbols adopted by The American Welding Society. Weld washers shall be used for all roof deck.

1.6 COORDINATION

- A. Contractor shall coordinate loading of deck units on the steel frame and erection

sequence with Structural Steel Installer. Contractor shall coordinate the actual size and depth of sump pans.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Roof Deck Units: Roof deck shall be wide rib, galvanized metal deck size and gage as indicated in the plans.
 - 1. Basis of Design: Subject to compliance with requirements, provide EPICORE ER3.5A ACOUSTICAL METAL ROOF DECK or approved equal.
 - a) Approved equal: VERSA-DEK 3.5LS with acoustical features (manufactured by Metal Dek Group).
 - 2. Provide factory applied baked enamel finish on exposed surfaces.
 - a) Color: Match Architect's color sample
- B. Metal Cover Plates: Fabricate metal cover plates for end-abutting deck units of not less than 18 gage sheet steel. Form to match contour of deck units and approximately 6 inches wide.
- C. Metal Closure Strips: Fabricate metal closure strips, for openings between decking and other construction, of not less than 18-gage sheet steel. Form to provide tight-fitting closure at open ends of cells or flutes and sides of decking.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Installer must examine areas and conditions under which metal decking is to be installed and notify Contractor in writing of conditions detrimental to proper and timely completion of work. Do not proceed with work until satisfactory conditions have been corrected in a manner acceptable to installer.

3.2 INSTALLATION

- A. General
 - 1. Install deck units and accessories in accordance with manufacturer's recommendations and approved shop drawings, and as specified herein.
 - 2. Place deck units on supporting steel framework and adjust to final position with ends accurately aligned and bearing on supporting members before being permanently fastened. Do not stretch or contract side lap interlocks.
 - 3. Place deck units in straight alignment for entire length of run.
 - 4. Place deck units flat and square, secured to adjacent framing without warp or excessive deflection.
 - 5. Coordinate and cooperate with structural steel installer in loading decking bundles to prevent overloading of structural members.

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6. Do not use floor deck units for storage or working platforms until permanently secured.
- B. End Closures: Tack weld or use machine screws at 3'-0" o.c. for fastening end closures.
 1. Comply with AWS requirements and procedures for manual shielded metal arc welding, the appearance and quality of welds, and the methods used in correcting welding work.
 - C. Side Laps: Steel roof deck and floor deck shall have nesting side laps of adjacent units attached by 3/4-inch diameter #12 screws or button punching at the center of each span or 20 inches o.c., whichever is a least dimension, unless noted otherwise on plans.
 - D. Cutting and Fitting: Saw cut and neatly fit deck units and accessories around other work projecting through or adjacent to the decking as shown on the drawings.
 - E. Joint Covers: Provide metal joint covers at abutting ends and changes in direction of floor deck units.
 - F. Closure Strips: Provide metal closure strips at all open perimeter ends, interior openings, uncovered ends and edges of roof and floor decking, and in the voids between decking and other construction. Weld into position to provide a complete decking installation.
 - G. Touch-Up Painting: After decking installation, wire brush, clean and paint scarred areas, welds and rust spots on the top surface of roof deck units.
 - H. Touch-up painted surfaces with the above specified paint applied in accordance with the manufacturer's instructions.

END OF SECTION 05310

SECTION 05400 – COLD-FORMED METAL FRAMING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. The Bidding Requirements, Contractual Conditions, and General Requirements of Division 1 shall apply to all work hereunder.

1.2 WORK INCLUDED

- A. The intent of this Section provides for the furnishing and installation of structural steel studs as shown on Drawings and specified herein, including all materials, labor, equipment, accessories and incidental items necessary to complete the work.
- B. Work under this Section shall be coordinated with other trades to insure proper spacing and location of studs for application of other materials, windows, equipment, etc.

1.3 SUMMARY

- A. This Section includes the following:
 - 1. Exterior load-bearing wall framing.
 - 2. Interior load-bearing wall framing.
 - 3. Exterior non-load-bearing wall framing.
 - 4. Ceiling joist framing.
- B. Related Sections include the following:
 - 1. Division 1 Section "LEED Requirements".
 - 2. Division 9 Section "Gypsum Board Assemblies".
 - 3. Division 9 Section "Portland Cement Plaster".

1.4 QUALITY ASSURANCE

- A. All structural properties and allowable weld loads shall conform with the AISI and AISC Specifications for the Design Light-Gauge of Cold-Formed Steel Structural Members, latest edition, as well as Standard Engineering Design Practices.
- B. Welding - In accordance with the Standard Code of Arc and Gas Welding in Building Construction and conform to American Welding Society (AWS) D.13, latest edition of Structural Welding Code - Sheet Steel.
- C. Materials shall be obtained in as much as possible from a single manufacturer.

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1.5 REFERENCES

- A. American Iron and Steel Institute (AISI) - Design of Cold Formed Steel Structural Members, latest edition.
- B. American Welding Society, (AWS) D.1.3, latest edition, Structural Welding Code - Sheet Steel.
- C. American Society for Testing and Materials (ASTM)
 - 1. ASTM A446.
 - 2. ASTM A525.
 - 3. ASTM A568.
 - 4. ASTM A645.
- D. American Institute of Steel Construction (AISC) - Manual of Steel Construction, latest edition.
- E. All Federal, State and Local Codes. Should conflict occur, the most stringent requirements shall prevail.

1.6 SUBMITTALS

- A. Shop Drawings - In accordance with Section 01340; furnish complete calculations, properties, loading, fabrication and erection drawings for approval prior to commencement of fabrication. Include descriptive literature containing product installation specifications and details, as well as current and valid welder's certificates. Indicate that calculations for wind loading are based on ASCE 7-02 Code, and shall be designed for the wind speed shown in the structural plan documents. The deflection shall be limited to L/600 for those areas with brick cladding, and L/360 for other finishes. Submit drawings and calculations for all framing required to support all surfaces and finishes indicated on the drawings.
- B. LEED Submittal:
 - 1. Product Data for Credit MR 4.1 and Credit MR 4.2: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content.
 - a. Include statement indicating costs for each product having recycled content.
- C. Certification - Submit written certification from manufacturer that studs, components and accessories are compatible and suitable for intended application.

1.7 DELIVERY, STORAGE AND HANDLING

- A. Upon delivery, all materials shall be protected from inclement weather. Store material off ground, covered where required to protect material from the elements,

ventilated to prevent condensation and sloped to permit drainage.

- B. Handle materials to prevent damage. Any material damaged, rusted, bent, etc. shall be removed from the job site immediately.

PART 2 - PRODUCTS

2.1 MANUFACTURER'S

- A. Subject to compliance with requirements, the following manufacturer's offer products that may be incorporated into the work:
 - 1. Unimast.
 - 2. Dale/Incor Industries.
 - 3. Dietrich Industries, Inc.
 - 4. Gold Bond Building Products.
- B. Other manufacturers offering similar products may be considered subject to complete data submittal and Architect approval prior to bidding in accordance with Division 1.

2.2 MATERIALS

- A. All framing members shall be formed from hot-dipped galvanized steel meeting the requirements of ASTM A653, with a minimum yield strength of 50 ksi for studs, and ASTM A653, with a minimum yield strength of 33 ksi for runner tracks. Materials shall comply with AISC "Specifications for the Design, Fabrication and Erection of Structural Steel for Buildings", Eight Edition.
- B. Studs shall be "C" shaped of minimum 18 gauge galvanized, punched members. Channel shaped runner tracks shall be minimum 16 gauge galvanized, unpunched members, and as shown on the Drawings.
- C. Galvanizing shall conform to ASTM A525, G-60. All framing components shall be galvanized. Other components or accessories shall be galvanized or given a coat of rust-resistant paint, lead free.
- D. Bridging channels shall be 1-1/2" cold-rolled 16 gauge galvanized steel with a minimum yield point of 33,000 psi. Bridging channels shall be spaced vertically 4'-0" o.c. maximum.
- E. Miscellaneous clips, angles, splice plates, etc. shall be of minimum 16 gauge galvanized steel, located as shown or where required to complete the stud assembly.
- F. Welding is the preferred method of attachment, however, if screws are used, Type S-12, head type as required, shall be utilized. Follow manufacturer's recommendations for screw attachment, quantity, torque, etc.

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2.3 FABRICATION

- A. Structural metal stud framing components may be prefabricated into panels prior to erection. Prefabricated panels must fit precisely into wall system. No splicing will be allowed at any time.
- B. All framing components shall be cut squarely, or on an angle, as required to fit squarely and accurately against abutting members. Members shall be held firmly in position until properly fastened.
- C. Attachments of similar components shall be done by welding. Dissimilar stud components shall be attached by welding, screw attaching, or bolting. Wire tying of framing components in structural applications shall not be permitted.
- D. Prefabricated panels shall be square and braced against racking. Lifting of prefabricated panels shall be done in a manner so as not to cause local distortion in any member.
- E. Tracks shall be continuous and welded to all vertical studs.
- F. Abrasions and welds shall be touched-up with approved galvanizing paint.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Inspection - Prior to installation, inspect work of all other trades. Verify that all such work is complete and accurate to the point where this installation may properly commence in strict accordance with framing Shop Drawings.
- B. Discrepancies
 - 1. Immediately notify Architect of all discrepancies.
 - 2. Do not proceed with installation in areas of discrepancies until such discrepancy has been fully resolved. Beginning installation indicates acceptance of conditions and responsibility for performance of complete specified system.

3.02 ERECTION

- A. All studs and runner tracks shall be welded to horizontal steel angles, welded to steel structure or anchored to concrete slab as shown on Drawings. Provide diagonal stud braces as shown or otherwise required to resist lateral loads.
- B. Studs shall be seated squarely in the track with the stud web and flanges abutting the track web, plumbed or aligned and securely attached to the flanges or web of both the upper and lower tracks. Studs shall be plumb, aligned, and vertical to maximum 1/8" in 10'-0" any direction. Maximum deviation in any one (1) run shall be 3/8" total variation.

- C. Butt welds or splices shall be used at all butt joints in the track.
- D. Splices in axial loaded studs shall not be permitted.
- E. All welds shall be fully developed fillet plug, butt or seam type.
- F. Where studs abut back to back, they shall be secured together by bolting or welding at the point of attachment to horizontal steel angles.
- G. All connections shall be carefully examined. Defective, faulty or suspect conditions shall be corrected immediately.
- H. Temporary bracing, where required, shall be provided until erection is completed.
- I. Provide insulation equal to that specified elsewhere in all double jamb studs, double header members, or other areas which may be inaccessible to the insulation installer at time of installation.
- J. Isolate all studs and metal components from dissimilar materials that may cause adverse reactions.
- K. At door and window openings, unless otherwise specified, provide double studs at each side of opening and headers of 16 gauge runner track. At window sill, provide 16 gauge runner track.
- L. At all building expansion joints, discontinue runner track top and bottom and place stud each side of joint. At other material control joints, provide stud each side of joint as required.

3.3 WELDING RECOMMENDATIONS

- A. Arc welding is the most common method for joining framing components.
 - 1. Shielded metal arc welding (SMAW) is typically used for 18 gauge and heavier steel members. Good welds may be obtained with 3/32" or 1/8" diameter AWS Type E-6012, E-6013 or E-7014 rods. Equipment heat settings vary depending on material thickness. A 200 ampere "hot box" electric welder or gasoline generator welder is suitable.
 - 2. Gas metal arc welding (GMAW) is preferred for lighter 20 gauge members. Good welds may be obtained with AWS E-705-3, -5 or -6 wire electrode in .030" to .035" diameter using CO₂, Argon-oxygen, or Argon CO₂ gas shielding. A wire-feed welder with a capacity of 60-11- amperes at approximately 23 volts requiring 220-volt, 3 phase electric service is suggested for fast, uniform welding.
- B. Welding may be employed in the field, or in the shop when prefabricated panels are utilized.

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- C. All welds and abrasions shall be touched-up with approved galvanizing paint after erection.
- D. Welds and techniques shall be verified with steel stud manufacturer prior to fabrication or erection.

3.4 CLEANING

- A. Prior to installation of any track, thoroughly clean surface to receive track.
- B. During and after installation, remove discarded, scrap and excess materials, waste products, construction debris, etc. caused by steel stud erection process. Leave site clean and ready for next trade.
- C. After installation, and just prior to enclosing the stud system with sheathing or gypsum wallboard, inspect complete assembly for proper attachment, weld integrity, rigidity, etc. Remove, replace or repair any faulty conditions immediately. Any rust shall be removed and spot painted.

END OF SECTION 05400

SECTION 05500 - METAL FABRICATIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:

1. Steel framing and supports for operable partitions.
2. Steel framing and supports for overhead doors.
3. Steel framing and supports for countertops.
4. Steel framing and supports for mechanical and electrical equipment.
5. Steel framing and supports for applications where framing and supports are not specified in other Sections.
6. Shelf angles.

7. Miscellaneous steel trim including steel angle corner guards and steel edgings.
8. Metal bollards.
9. Loose bearing and leveling plates for applications where they are not specified in other Sections.

- B. Products furnished, but not installed, under this Section:

1. Loose steel lintels.
2. Anchor bolts, steel pipe sleeves, slotted-channel inserts, and wedge-type inserts indicated to be cast into concrete or built into unit masonry.
3. Steel weld plates and angles for casting into concrete for applications where they are not specified in other Sections.

- C. Related Sections:

1. Division 2 Section "Site Furnishings" for bicycle racks.
2. Division 3 Section "Cast-in-Place Concrete" for installing anchor bolts, steel pipe sleeves, slotted-channel inserts, wedge-type inserts and other items cast into concrete.
3. Division 4 Section "Unit Masonry Assemblies" for installing loose lintels, anchor bolts, and other items built into unit masonry.
4. Division 5 Section "Structural Steel."

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5. Division 6 Sections for metal framing anchors and timber connectors.

1.3 PERFORMANCE REQUIREMENTS

- A. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes acting on exterior metal fabrications by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects.
 1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

1.4 SUBMITTALS

- A. Product Data: For the following:
 1. Nonslip aggregates and nonslip-aggregate surface finishes.
 2. Paint products.
 3. Grout.
- B. LEED Submittals:
 1. Product Data for Credit MR 4.1 and Credit MR 4.2: Indicating percentages by weight of postconsumer and preconsumer recycled content for products having recycled content. Include statement indicating costs for each product having recycled content.
- C. Shop Drawings: Show fabrication and installation details for metal fabrications.
 1. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items.
- D. Delegated-Design Submittal: For installed products indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
- E. Qualification Data: For qualified professional engineer.
- F. Mill Certificates: Signed by manufacturers of stainless-steel certifying that products furnished comply with requirements.
- G. Welding certificates.
- H. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers certifying that shop primers are compatible with topcoats.

1.5 QUALITY ASSURANCE

- A. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- B. Welding Qualifications: Qualify procedures and personnel according to the following:
 - 1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
 - 2. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum."
 - 3. AWS D1.6, "Structural Welding Code - Stainless Steel."

1.6 PROJECT CONDITIONS

- A. Field Measurements: Verify actual locations of walls and other construction contiguous with metal fabrications by field measurements before fabrication.

1.7 COORDINATION

- A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another.
- B. Coordinate installation of anchorages and steel weld plates and angles for casting into concrete. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

PART 2 - PRODUCTS

2.1 METALS, GENERAL

- A. Metal Surfaces, General: Provide materials with smooth, flat surfaces unless otherwise indicated. For metal fabrications exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.

2.2 FERROUS METALS

- A. Recycled Content of Steel Products: Provide products with average recycled content of steel products so postconsumer recycled content plus one-half of preconsumer recycled content is not less than 25 percent.
- B. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.

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- C. Stainless-Steel Sheet, Strip, and Plate: ASTM A 240/A 240M or ASTM A 666, Type 304.
- D. Stainless-Steel Bars and Shapes: ASTM A 276, Type 304.
- E. Rolled-Steel Floor Plate: ASTM A 786/A 786M, rolled from plate complying with ASTM A 36/A 36M or ASTM A 283/A 283M, Grade C or D.
- F. Rolled-Stainless-Steel Floor Plate: ASTM A 793.
- G. Abrasive-Surface Floor Plate: Steel plate with abrasive granules rolled into surface] [or] [with abrasive material metallically bonded to steel.
- H. Steel Tubing: ASTM A 500, cold-formed steel tubing.
- I. Steel Pipe: ASTM A 53/A 53M, standard weight (Schedule 40) unless otherwise indicated.
- J. Slotted Channel Framing: Cold-formed metal box channels (struts) complying with MFMA-4.
 - 1. Size of Channels: **1-5/8 by 1-5/8 inches**.
 - 2. Material: Galvanized steel, ASTM A 653/A 653M, commercial steel, Type, with **G90** coating; **0.108-inch** nominal thickness.
 - 3. Material: Cold-rolled steel, ASTM A 1008/A 1008M, commercial steel, Type B; **[0.0966-inch** minimum thickness; unfinished.
- K. Cast Iron: Either gray iron, ASTM A 48/A 48M, or malleable iron, ASTM A 47/A 47M, unless otherwise indicated.

2.3 NONFERROUS METALS

- A. Aluminum Plate and Sheet: **ASTM B 209**, Alloy 6061-T6.
- B. Aluminum Extrusions: **ASTM B 221**, Alloy 6063-T6.
- C. Aluminum-Alloy Rolled Tread Plate: ASTM B 632/B 632M, Alloy 6061-T6.
- D. Aluminum Castings: ASTM B 26/B 26M, Alloy 443.0-F.
- E. Bronze Plate, Sheet, Strip, and Bars: ASTM B 36/B 36M, Alloy UNS No. C28000 (muntz metal, 60 percent copper).
- F. Bronze Extrusions: ASTM B 455, Alloy UNS No. C38500 (extruded architectural bronze).

- G. Bronze Castings: ASTM B 584, Alloy UNS No. C83600 (leaded red brass) or No. C84400 (leaded semired brass).
- H. Nickel Silver Extrusions: ASTM B 151/B 151M, Alloy UNS No. C74500.
- I. Nickel Silver Castings: ASTM B 584, Alloy UNS No. C97600 (20 percent leaded nickel bronze).

2.4 FASTENERS

- A. General: Unless otherwise indicated, provide Type 304 stainless-steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B 633 or **ASTM F 1941**, Class Fe/Zn 5, at exterior walls. Select fasteners for type, grade, and class required.
 - 1. Provide stainless-steel fasteners for fastening aluminum.
 - 2. Provide stainless-steel fasteners for fastening stainless steel.
 - 3. Provide stainless-steel fasteners for fastening nickel silver.
 - 4. Provide bronze fasteners for fastening bronze.

2.5 MISCELLANEOUS MATERIALS

- A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.
- B. Shop Primers: Provide primers that comply with Division 9 painting Sections.
- C. Universal Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI#79 and compatible with topcoat.
 - 1. Use primer containing pigments that make it easily distinguishable from zinc-rich primer.
- D. Epoxy Zinc-Rich Primer: Complying with MPI#20 and compatible with topcoat.
- E. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 and compatible with paints specified to be used over it.
- F. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.
- G. Nonshrink, Metallic Grout: Factory-packaged, ferrous-aggregate grout complying with ASTM C 1107, specifically recommended by manufacturer for heavy-duty loading applications.
- H. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107. Provide grout specifically recommended by manufacturer for interior and exterior applications.

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- I. Concrete: Comply with requirements in Division 3 Section "Cast-in-Place Concrete" for normal-weight, air-entrained, concrete with a minimum 28-day compressive strength of **3000 psi**.

2.6 FABRICATION, GENERAL

- A. Shop Assembly: Preassemble items in the shop to greatest extent possible. 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.
- B. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately **1/32 inch** unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.
- C. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.
- D. Form exposed work with accurate angles and surfaces and straight edges.
- E. Weld corners and seams continuously to comply with the following:
 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 2. Obtain fusion without undercut or overlap.
 3. Remove welding flux immediately.
 4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.
- F. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners or welds where possible. Where exposed fasteners are required, use Phillips flat-head (countersunk) fasteners unless otherwise indicated. Locate joints where least conspicuous.
- G. Fabricate seams and other connections that will be exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.
- H. Cut, reinforce, drill, and tap metal fabrications as indicated to receive finish hardware, screws, and similar items.
- I. Provide for anchorage of type indicated; coordinate with supporting structure. Space anchoring devices to secure metal fabrications rigidly in place and to support indicated loads.
 1. Where units are indicated to be cast into concrete or built into masonry, equip with integrally welded steel strap anchors, **1/8 by 1-1/2 inches**, with a minimum **6-**

inch embedment and 2-inch hook, not less than 8 inches from ends and corners of units and 24 inches o.c., unless otherwise indicated.

2.7 MISCELLANEOUS FRAMING AND SUPPORTS

- A. General: Provide steel framing and supports not specified in other Sections as needed to complete the Work.
- B. Fabricate units from steel shapes, plates, and bars of welded construction unless otherwise indicated. Fabricate to sizes, shapes, and profiles indicated and as necessary to receive adjacent construction.
 - 1. Fabricate units from slotted channel framing where indicated.
 - 2. Furnish inserts for units installed after concrete is placed.
 - 3. Revise first paragraph below if tubing is used. Revise default weld size requirement, or delete
- C. Galvanize miscellaneous framing and supports where indicated.
- D. Prime miscellaneous framing and supports with zinc-rich primer where indicated.

2.8 SHELF ANGLES

- A. Fabricate shelf angles from steel angles of sizes indicated and for attachment to concrete framing. Provide horizontally slotted holes to receive 3/4-inch bolts, spaced not more than 6 inches from ends and 24 inches o.c., unless otherwise indicated.
 - 1. Provide mitered and welded units at corners.
 - 2. Provide open joints in shelf angles at expansion and control joints. Make open joint approximately 2 inches larger than expansion or control joint.
- B. For cavity walls, provide vertical channel brackets to support angles from backup masonry and concrete.
- C. Galvanize shelf angles located in exterior walls.
- D. Prime shelf angles located in exterior walls with zinc-rich primer.
- E. Furnish wedge-type concrete inserts, complete with fasteners, to attach shelf angles to cast-in-place concrete.

2.9 MISCELLANEOUS STEEL TRIM

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

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- B. Provide cutouts, fittings, and anchorages as needed to coordinate assembly and installation with other work.
 - 1. Provide with integrally welded steel strap anchors for embedding in concrete or masonry construction.
- C. Galvanize miscellaneous steel trim.
- D. Prime miscellaneous steel trim with zinc-rich primer.

2.10 METAL BOLLARDS

- A. Fabricate metal bollards from Schedule 40 steel pipe.
 - 1. Cap bollards with **1/4-inch**-thick steel plate.
 - 2. Where bollards are indicated to receive controls for door operators, provide necessary cutouts for controls and holes for wire.
 - 3. Where bollards are indicated to receive light fixtures, provide necessary cutouts for fixtures and holes for wire.
- B. Fabricate bollards with **3/8-inch**-thick steel baseplates for bolting to concrete slab. Drill baseplates at all four corners for **3/4-inch** anchor bolts.
 - 1. Where bollards are to be anchored to sloping concrete slabs, angle baseplates for plumb alignment of bollards.
- C. Fabricate sleeves for bollard anchorage from steel pipe or tubing with **1/4-inch**-thick steel plate welded to bottom of sleeve. Make sleeves not less than **8 inches** deep and **3/4 inch** larger than OD of bollard.
- D. Fabricate internal sleeves for removable bollards from Schedule 40 steel pipe or **1/4-inch** wall-thickness steel tubing with an OD approximately **1/16 inch** less than ID of bollards. Match drill sleeve and bollard for **3/4 inch** steel machine bolt.
- E. Prime bollards with zinc-rich primer.

2.11 FINISHES, GENERAL

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Finish metal fabrications after assembly.
- C. Finish exposed surfaces to remove tool and die marks and stretch lines, and to blend into surrounding surface.

2.12 STEEL AND IRON FINISHES

- A. Galvanizing: Hot-dip galvanize items as indicated to comply with ASTM A 153/A 153M for steel and iron hardware and with ASTM A 123/A 123M for other steel and iron products.
 - 1. Do not quench or apply post galvanizing treatments that might interfere with paint adhesion.
- B. Shop prime iron and steel items not indicated to be galvanized unless they are to be embedded in concrete, sprayed-on fireproofing, or masonry, or unless otherwise indicated.
 - 1. Shop prime with primers specified in Division 9 painting Sections unless indicated.
- C. Preparation for Shop Priming: Prepare surfaces to comply with SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
 - 1. Exterior Items: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
 - 2. Items Indicated to Receive Zinc-Rich Primer: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
 - 3. Items Indicated to Receive Primers Specified in Division 9 Section "High-Performance Coatings": SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
 - 4. Other Items: SSPC-SP 3, "Power Tool Cleaning."
- D. Shop Priming: Apply shop primer to comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.
 - 1. Stripe paint corners, crevices, bolts, welds, and sharp edges.

2.13 ALUMINUM FINISHES

- A. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.
- B. As-Fabricated Finish: AA-M10 (Mechanical Finish: as fabricated, unspecified).
- C. Class I, Clear Anodic Finish: AA-M12C22A41 (Mechanical Finish: nonspecular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class I, clear coating 0.018 mm or thicker) complying with AAMA 611.

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PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal fabrications. Set metal fabrications accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.
- B. 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 surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.
- C. Field Welding: Comply with the following requirements:
 - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - 2. Obtain fusion without undercut or overlap.
 - 3. Remove welding flux immediately.
 - 4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.
- D. Fastening to In-Place Construction: Provide anchorage devices and fasteners where metal fabrications are required to be fastened to in-place construction. Provide threaded fasteners for use with concrete and masonry inserts, toggle bolts, through bolts, lag screws, wood screws, and other connectors.
- E. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.
- F. Corrosion Protection: Coat concealed surfaces of aluminum that will come into contact with grout, concrete, masonry, wood, or dissimilar metals with the following:
 - 1. Cast Aluminum: Heavy coat of bituminous paint.
 - 2. Extruded Aluminum: Two coats of clear lacquer.

3.2 INSTALLING MISCELLANEOUS FRAMING AND SUPPORTS

- A. General: Install framing and supports to comply with requirements of items being supported, including manufacturers' written instructions and requirements indicated on Shop Drawings.
- B. Anchor supports for operable partitions securely to and rigidly brace from building structure.

- C. Support steel girders on solid grouted masonry, concrete, or steel pipe columns. Secure girders with anchor bolts embedded in grouted masonry or concrete or with bolts through top plates of pipe columns.
 - 1. Where grout space under bearing plates is indicated for girders supported on concrete or masonry, install as specified in "Installing Bearing and Leveling Plates" Article.
- D. Install pipe columns on concrete footings with grouted baseplates. Position and grout column baseplates as specified in "Installing Bearing and Leveling Plates" Article.
 - 1. Grout baseplates of columns supporting steel girders after girders are installed and leveled.

3.3 INSTALLING METAL BOLLARDS

- A. Fill metal-capped bollards solidly with concrete and allow concrete to cure seven days before installing.
 - 1. Do not fill removable bollards with concrete.
- B. Anchor bollards to existing construction with expansion anchors. Provide four **3/4-inch** bolts at each bollard unless otherwise indicated.
 - 1. Embed anchor bolts at least **4 inches** in concrete.
- C. Anchor bollards in concrete with pipe sleeves preset and anchored into concrete. Fill annular space around bollard solidly with nonshrink, nonmetallic grout; mixed and placed to comply with grout manufacturer's written instructions. Slope grout up approximately **1/8 inch (3 mm)** toward bollard.
- D. Anchor bollards in place with concrete footings. Center and align bollards in holes **3 inches (75 mm)** above bottom of excavation. Place concrete and vibrate or tamp for consolidation. Support and brace bollards in position until concrete has cured.
- E. Anchor internal sleeves for removable bollards in concrete by inserting into pipe sleeves preset into concrete. Fill annular space around internal sleeves solidly with nonshrink, nonmetallic grout; mixed and placed to comply with grout manufacturer's written instructions. Slope grout up approximately **1/8 inch** toward internal sleeve.
- F. Anchor internal sleeves for removable bollards in place with concrete footings. Center and align sleeves in holes **3 inches** above bottom of excavation. Place concrete and vibrate or tamp for consolidation. Support and brace sleeves in position until concrete has cured.
- G. Place removable bollards over internal sleeves and secure with **3/4-inch** machine bolts and nuts. After tightening nuts, drill holes in bolts for inserting padlocks. Owner will furnish padlocks.

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- H. Fill bollards solidly with concrete, mounding top surface to shed water.
 - 1. Do not fill removable bollards with concrete.

3.4 ADJUSTING AND CLEANING

- A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas. Paint uncoated and abraded areas with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.
 - 1. Apply by brush or spray to provide a minimum **2.0-mil** dry film thickness.
- B. Touchup Painting: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint are specified in Division 9 painting Sections.
- C. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780.

END OF SECTION 05500