

DIVISION 05

METALS

SECTION 05100 STRUCTURAL STEEL FRAMING

1.00 GENERAL

1.01 SCOPE

- A. Furnish all materials, labor, equipment, plant, tools, required to complete fabrication and erection of all structural steel and miscellaneous steel items complete, as shown and/or as specified including:
 - Furnishing of anchor bolts for structural steel columns and responsibility for their correct locations; provide templates;
 - Brackets and miscellaneous iron connections, shop-connected to structural members;
 - Beam Penetrations as indicated in the drawings;
 - Installing and removing temporary guys, shores, scaffolding and bracing required for steel erection.
- B. Where so indicated on the plans, structural members shall be joined by welding. The welds shall be of size and type indicated and shall be made by competent operators.

1.02 RESPONSIBILITY

- A. Contractor shall be responsible for the accurate location of all steel work including all items used to attach materials to other parts of the work.
- B. Contractor shall see to it that any and all items of work which are to be built into the works of other trades are installed at the proper time.
- C. Contractor shall notify the Architect / Engineer if the steel work shall be fabricated in a shop other than the site, so that arrangements can be made together with the Project Representative in the inspection of the delivered materials and in the fabrication of the steel work.
- D. Where specified steel sizes and thicknesses are found unavailable in market, all affected items shall be upgraded to next higher level of size and thickness.

1.03 REFERENCES, CODES AND STANDARDS

- A. Specifications for the Design, Fabrication and Erection of Structural Steel for Buildings of the American Institute of Steel Construction (AISC), latest edition.
- B. Code of Standard Practice for Steel Buildings and Bridges, of AISC, latest edition.
- C. Code for Welding in Building Construction, D1.1 of the American Welding Society (AWS).
- D. Specifications for Structural Joints using ASTM A 325 or A490 Bolts by the Research Council of Riveted and Bolted Structural Joints.

1.04 QUALIFICATIONS

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- A. Welding procedures, welders, welding operations and tackers shall be qualified in accord with the AWS Code.

1.05 SUBMITTALS

- A. Shop Drawings
 - 1. In accordance with the requirements of the General Conditions, furnish complete detailed fabrication and erection shop drawings including details of all connections for review and approval of the Engineer.
 - 2. The Engineer will review and approve all shop drawings. Re-submit if any corrections are required.
- B. Proof of Compliance: Submit the following in three (3) copies for review by Testing Laboratory and Architect.
 - 1. Certified reports of tensile properties and bend tests for steel shapes, bar, and plates.
 - 2. Certificates of conformance for structural steel tubing.
 - 3. Affidavit (in duplicate) that structural steel having a yield strength greater than 36 ksi conforms to requirements of Drawings and Specifications.

1.06 DELIVERY, STORAGE AND HANDLING

- A. Shipping statements shall be delivered in the jobsite. The Project Representative and the Engineer shall inspect the materials per delivery and may request additional tests on the materials delivered, if in their opinion, there is reasonable doubt as to the materials specification. The fabrication and delivery of the fabricated structural steel should conform with the approved schedule of erection and items such as anchor bolts, anchorage and others that have to be placed in concrete which shall be in jobsite before such concrete structural member will be poured. Erection marks shall be painted on structural steel members and fabricated sections. Small structural members such as rivets, bolts, nuts, washers, etc, should be shipped and kept in properly marked suitable container.
- B. Structural steel members which are stored at the site or a staging area shall be above ground on platforms, skids, or other supports. Store fasteners and welding electrodes in a weathertight and dry place until ready for use. Store packaged materials in their original containers.

2.00 PRODUCTS

- A. MATERIALS: Refer to Section 01020 Summary and Finishes.
- B. FABRICATION:
 - 1. Fabricate structural steel within tolerances specified under Codes and Standards referenced in paragraph 1.03.
 - 2. Fabricate and assemble structural steel in the shop to the greatest extent possible. Do shearing carefully and accurately using machine equipment where possible.
 - 3. Connections shall be welded or bolted as indicated. Shop connections not otherwise shown shall be welded. Eccentric connections are not permitted unless shown in detail on shop drawings.
 - 4. Surfaces required to be milled or planned are indicated on the drawings.

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5. Provide bearing plates for members bearing on footings, piers and walls.
6. Drift pins may be used for assembling parts provided metal is not distorted or holes enlarged. Holes requiring enlargement to admit bolts shall be reamed. Misaligned holes will subject members to rejection.
7. Shop Cleaning:
 - a) Cleaning: Thoroughly clean loose mill scale, rust, dirt, grease and other foreign matter from structural steel shapes.
8. Shop Painting: Shop paint structural steel work which will be exposed in the finish work and other fabrications exposed to weather. Coordinate the use of primer paint on the steel with architectural drawings and fire ratings.
 - a) Surface Preparation: After inspection and before shipping, clean steel work to be painted. Remove loose rust, loose mill scale, and spatter slag or flux deposits. Clean steel in accordance with Steel Structures Painting Council (SSPC) SP-2, SP-3, or SP-7. Remove oil and grease deposits by solvent.
 - b) Painting: Immediately after surface preparation, apply structural steel primer paint in accordance with manufacturer's instructions and at a rate to provide uniform dry film thickness on 1.5 mils. Use painting methods which will result in full coverage of joints, corners, edges, and exposed surfaces.

3.00 EXECUTION

3.01 CONDITION OF SURFACES

- A. Before starting work, verify locations and elevations of bearings and anchor bolts. Immediately report inaccuracies. Work under this Section shall include responsibility for accurate bearing of steel and correct location of anchorage.

3.02 ERECTION

- A. General - The Contractor shall use special care in unloading, handling and erecting the steel to avoid bending, twisting or otherwise distorting the steel members. The erector shall handle the materials in such a way as to minimize the damage to the shop coat of paint. The Contractor shall plan and execute the erection in such a way so that the close fit and neat appearance of the joints and the structure, as a whole will not be impaired. If temporary braces or erection slips are employed, care shall be taken to avoid any unsightliness upon removal. Tack welds shall be ground smooth and holes shall be filled with weld metal or body solder and smoothed by grinding or filing. The Contractor shall submit to the Architect or Engineer the sequence of erection for approval.
- B. Erect items of structural steel in accord with applicable provisions of Reference Standard 1.03.
- C. Erection Tolerances:
 1. Structural Steel work erection tolerances shall be in accord with "AISC Specification for the Design, Fabrication and Erection of Structural Steel for Buildings" and "AISC Code of Standard Practice for Steel Buildings and Bridges".

2. Let all structural members of single rolled shape and built-up members fabricated by riveting or welding, unless otherwise specified, be straight within the tolerances allowed by ASTM Specification.
3. Never let compression members deviate from straightness by more than 1/100 of the axial length between points which are to be laterally supported.
4. Let completed members be free from twists, bends and open joints. Sharp kinks or bends shall be the cause of rejection of materials.
- D. Field connections shall be welded or bolted as indicated.
- E. Temporary Bracing: Introduce wherever necessary to provide for loads to which structure is subjected including erection equipment and its operation. Leave in place until no longer required for safety. Make proper provisions for construction loads, piles of materials, equipment, etc., carried by structural frame during erection.
- F. Alignment: No riveting, permanent bolting or permanent welding shall be done until the structure has stiffened with the resulting stresses and properly aligned.

3.03 WELDING TECHNIQUE

- A. Perform welding in accord with appropriate Section of Reference Standards.
- B. Conform the technique of welding employed, the appearance and quality of welds made, the methods used in correcting defective work to the requirements of the Standard Code for Welding in Building Construction of the American Welding Society.
- C. Make surfaces to be welded free from loose scale, slag, rust grease, paint and any other foregoing material except that mill scale which withstands vigorous wire brushing remain. Any shop paint on surface adjacent to joints to be field welded shall be wire brushed, to reduce the paint film to a minimum.
- D. Prepare edges by gas-cutting, whenever practicable, cut by a mechanically guided torch.
- E. Let gas cut edges which will be subjected to substantial stress or which are to have weld metal deposited on them be free from gouges. Remove by grinding any gouges that remain from cutting.
- F. Shape all re-entrant corners notch free to a radius of at least 12 mm (1/2").
- G. Bring the fit of joints at contact surfaces which are not completely sealed by welds, close enough to exclude water after painting.
- H. Align all abutting parts to be welded carefully. Correct misalignments greater than 3 mm (1/8") and in making the correction, never draw parts into a slope sharper than two (2) degrees (7/16 inch in 12 inches).
- I. Position the work for flat welding whenever practicable.
- J. In assembling and joining parts of structure or of built-up members, avoid needless distortion and minimize shrinkage stresses. Where it is impossible to avoid high residual stresses in the closing welds of a rigid assembly, make closing welds in compression elements.
- K. In the fabrication of cover plated beams and built-up members, make all shop splices in each component part before such component part is welded to other parts of the member.
- L. Backing strips may be removed by gouging or gas cutting after welding is completed, provided no injury is done to the base metal and weld metal. Weld metal surface is left flush or slightly convex with full throat thickness.
- M. Terminate butt welds at the ends of a joint in a manner that will ensure soundness. Where possible, do by the use of extension bars or run-off plates. Remove extension bars or

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run-off plates upon completion of the weld. Make the ends of the weld smooth and flushed with abutting parts.

N. Undercut and overcut should be avoided.

3.04 BOLTING

- A. As erection progresses, bolt up work to take care of dead loads, construction live loads, lateral forces and erection stresses. Tighten all bolts to a bolt tension not less than the proof load given in the applicable ASTM Specification for the type of the bolt used.
- B. Unless other wise noted, erection bolts used in welded construction may be either tightened securely and left in place or removed and the holes filled with plug welds.
- C. Make high strength bolted connections in accord with Reference Standard for "high-type" connections with threads excluded from shear plane for bearing-type connections.
- D. Contact surface with "slip critical (friction) type" connections shall be free of oil, paint, lacquer, or other coatings.
- E. Tighten nuts using Direct Tension Indicators. Minimum bolt tension as per Reference Standard for each bolt type and size used. Use beveled washers to compensate for parallelism when outer face of bolted parts has a slope greater than 1:20 with respect to a plane normal to the bolt axis.
- F. Let completed member be free from twist, bends and open joints. Sharp or bends shall be the cause of rejection of materials.
- G. When bolts have been completely tightened, mark with identifying symbol.

3.05 FIELD PAINTING

- A. For convenience, all steel works shall receive final painting on the ground before erection on a higher level. Connections made on the field by bolting or welding shall receive another coat of enamel paint.
- B. All steel work connections shall be free from loose mill scale, rust, weld slag and other foreign matter.
- C. After erection, all unpainted areas including any marred or damaged surfaces shall receive one coat of same rust inhibitive paint as used in the shop painting.

3.06 QUALITY CONTROL, TESTS AND INSPECTIONS

- A. Testing Laboratory: A qualified testing laboratory, meeting requirements of ASTM E 329 shall be approved by the Design Structural Engineer. Testing and Inspection shall be as required by Drawings as well as these Specifications. Inspection of welding shall be in accordance with the provisions of Section 6 of the Standard Code for Welding in Building Construction of the American Welding Society. All tests are charged to the contractor.
- B. Tests for structural steel shall be made and reports furnished by Testing Laboratory in accord with the following requirements:
 - 1. Mill Tests and Inspection of Structural Steel:
 - a) Test of Mill Order A36: Where steel, ordered from mill, cut to lengths, is identified by heat or melt numbers and is accompanied by mill analysis test reports, material shall be used without further local tests, provided an affidavit is given that materials

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- conform with requirements. In case of controversy, tension and bend tests of materials, either locally or at the mill, as required for local stock is mandatory.
- b) Test of Unidentified Steel: In the event that structural steel cannot be identified by heat or melt numbers and is accompanied by mill analysis and test reports, such stock may be used, provided one (1) tension and one (1) bend test is made for each 50 tons or fractional part, of stock as may be used in the work. Complete four-sided surface inspection may be required for materials. Each piece of high-strength local stock steel shall be tested and stamped.
 - c) Test Specimens shall be taken under direction of Testing Laboratory and shall be machined by the Contractor, at his expense, to dimensions as required by related applicable Standard ASTM Specification.
- C. Tests of Welding and Bolting: Testing Laboratory shall inspect shop and field welding and inspect high tensile bolting. Testing Laboratory shall certify in writing, upon completion of work, that welding and high tensile bolting has been performed in accord with Drawings and Specifications and applicable Reference standards in 1.03.
- D. Inspection of High Tensile Bolts: Testing Laboratory shall check bolt tightness on 100% of bolts.
- E. Continuous Inspection of Welds: Testing Laboratory shall inspect welded connections of column to column, column to girder, or girder to girder by ultrasonic or other approved non-destructive tests.
- a) Ultrasonic testing shall be performed by a specially trained, qualified technician, who shall operate equipment, examine welds and maintain a record of welds examined, defects found and disposition of each defect. Defective welds shall be repaired and costs of retesting defective welds shall be borne by the Contractor.
 - b) Welds requiring ultrasonic testing shall be tested at the rate of 100%.
 - c) When ultrasonic indication arising from the weld root can be interpreted as either a weld defect or backing strip, backing strip shall be removed at expense of Contractor, and if no root defect is visible, weld shall be retested. If no defect is indicated on this retest and no significant amount of base and weld metal have been removed, joint needs no further repair or welding. If a defect is indicated, it shall be repaired at no expense to Owner.
 - d) Questionable root indications that prove not to be defective shall not count against welder to increase test rates.
 - e) Ultrasonic instrumentation shall be calibrated by a qualified technician to evaluate quality of welds in accord with AWS D1.1, Appendix C.
 - f) Other methods of inspection, for example, x-ray, gamma ray, magnetic particle, or dye penetrant, may be used on welds if deemed necessary by Testing Laboratory with cooperation of Contractor.
- F. Ultrasonic Material Inspection:
- a) All column materials within 1 foot (6 inches either side) of a direct butt weld for girder flange connections is to be ultrasonically tested for laminations in accord with ASTM designation A578-Level II.
 - b) Material in designated location shall be tested for laminations by ultrasonic means prior to fabrication, with written reports submitted to Architect.
 - c) Detection of Laminations: Rejectable defect discovered by ultrasonic means are defined as follows: Using suitable calibrated ultrasonic equipment, any recordable discontinuity causing complete loss of back-reflection and which cannot be

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encompassed within a 3-inch diameter circle is unacceptable (Level II Standard of Acceptance). Should such flaws be detected, they may be repaired by welding, subject to Engineer's review.

- d) All full penetration groove welds, all partial penetration groove welds and all electroslag welds shall be subjected to ultrasonic testing.

3.07 IDENTIFICATION

- A. Mark to identify the ASTM Specifications of steel for main components.
- B. Identify such steel in completed members or assemblies by painting the designation of the piece over any shop coat of paint, prior to shipment from fabricators plant.

END OF SECTION 05100

SECTION 05200 MISCELLANEOUS METALS

1.00 GENERAL

1.01 SCOPE

- A. Furnish all materials, labor, equipment, plant, tools, required to complete all stainless steel works for roof flashing, window grilles, stone anchors, stair and ramp railing and others, as required.

10.2 MEASUREMENTS AND COORDINATION

Obtain measurements for all work required to be accurately fitted at the job and not from the drawings. The Contractor will be responsible for the accuracy of all such measurements and the precise fitting and assembly of the finish products. Coordinate the work with that of all other trades to prevent interference. Verify conditions at the job before fabrication.

2.00 PRODUCTS

Refer to Section 01020 Summary of Materials and Finishes.

3.00 EXECUTION

3.01 WORKMANSHIP

- A. Make all works well formed to shape and size shown and assemble as detailed. .Methods of fabrication and assembly however, unless otherwise specifically stated, shall be of first quality craftsmanship and at the discretion of the Contractors whose responsibility shall be to guarantee satisfactory performance as herein specified.
- B. Cut, shear and punch to produce clean, true lines and surfaces with burrs removed.
- C. Weld or bolt connections as indicated. Use countersunk screws recessed work where possible. Make all details of assembly strong with sufficient stiffness. Form joint exposed to weather in a manner to exclude water.
- D. Provide all work with proper clearances. Fabricate and install in a manner to provide for expansion and contraction but will insure rigidity and provide close fitting of sections.
- E. Fabricate and install as directed by the Manufacturer.
- F. Provide a protective clear coating which is resistant to alkaline, mortar and plaster to be applied to aluminum sections after fabrication.

3.02 PROTECTION

Protect all finished work until turnover to the Owner.

END OF SECTION 5200

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SECTION 05310 STEEL DECKING

1.00 GENERAL

1.01 SECTION INCLUDES

- A. Steel roof and floor deck, including accessories.

1.02 DESIGN AND PERFORMANCE CRITERIA

- A. Do not use floor or roof decks with integral hanger tabs. Do not provide clips or other devices for hanging directly from metal decks.
- B. Structural steel for floor framing has been designed assuming composite action with concrete floor. Number of shear studs indicated is based on an AISC stud coefficient equal to 1.0 AISC LRFD equations I3-1 and I3-2. If deck profile yields a coefficient of less than 1.0, provide additional shear studs to attain an equal shear capacity.

1.03 SUBMITTALS: Follow Section 01330.

- A. Shop Drawings: Show decking plan, deck profile dimensions, supports, projections, openings, reinforcement, finishes, pertinent details, and accessories.
- B. Product Data: For each type of deck, accessory, and product indicated.
- C. Informational Submittals: Statement of welder qualifications

1.04 QUALITY ASSURANCE: Comply with:

- A. AISI: Specification for Design of Cold-Formed Steel Structural Members.
- B. AWS: D1.3 Specification for "Structural Welding Code - Sheet Steel..
- C. SDI: Design Manual for Composite Decks, Form Decks, Roof Decks.
- D. AISC: Comply with calculated structural characteristics of steel deck according to AISI's "North American Specification for the Design of Cold-Formed Steel Structural Members.
- E. FMG Listing: Provide steel roof deck evaluated by FMG and listed in its "Approval Guide, Building Materials" for Class 1 fire rating and Class 1-90 windstorm ratings
- F. In case of conflict between Quality Assurance standards and this Specification, the more stringent requirement shall govern.

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1.05 QUALIFICATIONS

- A. Welders: AWS certified. Certify that each welder has satisfactorily passed AWS qualification tests for welding processes involved and, if pertinent, has undergone recertification.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Protect steel deck from corrosion, deformation, and other damage during delivery, storage, and handling.
- B. Stack steel deck on platforms or pallets and slope to provide drainage. Protect with a waterproof covering and ventilate to avoid condensation.

1.07 REGULATORY REQUIREMENTS

- A. Detail, fabricate, and erect steel deck in accordance with OSHA Standard, 29 CFR Part 1926, Subpart R, "Steel Erection", Sections 1926.750-761, and Appendices A through H.

2.00 PRODUCTS

2.01 DESIGN STANDARDS

- A. Structural properties specified are the design standards for the Project. Slight variation will be considered, provided that engineering data, illustrating that deck is capable of supporting both gravity and lateral loads specified, is submitted for review and approval.

2.02 ROOF DECK: 1-1/2 INCH DEEP, WIDE RIB (38 MM)

- A. Cold rolled, 20 gauge, ASTM A653/653M SS Grade 33 (minimum) steel sheet. Galvanize to Class G60.
- B. Minimum Moment of Inertia: 0.21 inches⁴ per foot.
- C. Minimum Section Modulus: 0.23 inches³ per foot.
- D. Interlocking sides.

2.03 FLOOR DECK: 3 INCH DEEP COMPOSITE DESIGN (76 MM)

- A. Cold rolled, 20 gauge, ASTM A653/653M SS Grade 33 steel sheet. Galvanize to Class G90.
- B. Minimum Moment of Inertia: 0.96 inches⁴ per foot.
- C. Minimum Section Modulus: 0.57 inches³ per foot positive and 0.60 inches³ per foot negative.

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2.04 ACCESSORIES

- A. Welding Materials: AWS D1.3.
- B. Cell Closures: Flexible rubber 1 inch thick, profiled to decking.
- C. Metal Closure Strips, Cover Plates and Related Accessories: Of required profiles and size.
- D. Concrete Pour Stops: 16 gauge minimum, size as required.
- E. Expansion Bolts: Hilti Inc.; Kwik Bolt II, or substitution subject to Section 01 63 00. For exterior locations, use galvanized bolts.
- F. Powder Actuated Fasteners: Hilti Inc.; Hilti DX System.
- G. Galvanizing Repair: SSPC Paint 20, with dry film containing at least 94 percent zinc dust by weight.

3.00 EXECUTION

3.01 INSTALLATION

- A. On steel support members provide 2 inch minimum bearing.
- B. Concrete Filled Deck: Install deck over at least three spans and weld with 5/8 inch diameter weldments at 12 inches OC. Screw side laps with No. self drilling screws 36 inches OC maximum.
- C. Bare Deck: Install deck over at least three spans and weld with 5/8 inch diameter weldments at 6 inches in corner and perimeter of plan layout with two welds in each rib in the corner area, 12 inches OC in field of plan layout. Screw side laps with No. 10 self drilling screws 36 inches OC maximum.
- D. At masonry support, provide [4] [6] inch minimum level bearing.
- E. Make field cuts with carborundum blade.
- F. Unless otherwise shown, install concrete pour stops at framed openings.
- G. Install sheet steel closures and angle flashings to close openings between deck and walls or columns.
- H. Install cell closures in locations above walls and partitions.

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3.02 REPAIRS

- A. Galvanizing Repair: Prepare and repair damaged galvanizing with repair paint following ASTM A780 and manufacturer's written instructions.

END OF SECTION 05310

Read and accepted as part of the Contract:

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SECTION 05400 COLD-FORMED METAL FRAMING

1.00 GENERAL

1.01 SECTION INCLUDES

- A. Exterior wall steel stud framing for Composite wall panels.

1.02 DESIGN AND PERFORMANCE CRITERIA

- A. Wind Load Design Criteria: Follow the current version of the National Building Codes of the Philippines (Architectural and Structural).
- B. Maximum Allowable Deflection: L/180.
- C. Design framing system to provide for movement of components without failure of joint seals, undue stress on fasteners, or other detrimental effects when subject to thermal expansion and contraction.
- D. Design system to accommodate construction tolerances, deflection of building structural members and clearances of intended openings.

1.03 SUBMITTALS: Follow Section 01330.

- A. Shop Drawings: Show stud spacing, framed openings, bearing, anchorage, loading, welds, type and location of fasteners, and accessories or items required of other construction. Describe method for securing studs to tracks and for bolted or welded framing connections.
- B. Product Data: Describe framing materials, finish, product criteria and limitations. Describe touch-up paint.
- C. Informational Submittals:
 - 1. Calculations: Signed and sealed by the designing Professional Engineer registered in the Republic of the Philippines.
 - a. Structural calculations.
 - b. Seismic control calculations.
 - 2. Mill Certification: Signed by sheet steel producer indicating material complies with specified requirements.

1.04 QUALITY ASSURANCE: Comply with:

- A. AISI "Specification for the Design of Cold-Formed Steel Structural Members", including provisions for screw connections.

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1.05 REGULATORY REQUIREMENTS

- A. Design framing under direct supervision of an experienced Professional Engineer registered in the Republic of the Philippines.
- B. Follow Division 1 Section for seismic control requirements.

2.00 PRODUCTS

2.01 FRAMING MATERIALS

- A. Studs: Sheet steel, ASTM A1003/A1003M Structural Grade 50, Type H (ST50H) formed to channel shape with pre-punched slotted holes. Minimum thickness 16 gauge.
- B. Coating: ASTM A653/A653M, Grade 50, galvanized to G90.
- C. Track: Sheet steel formed to channel shape, same gauge and width as studs, tight fit, same steel grade and finish as studs. Top track shall have 2-1/2 inch extended legs to allow for deflection of overhead construction. Pre-punched slots in deflection head tracks.

2.02 ACCESSORIES

- A. Bracing, Furring, Bridging and Other Components: Formed sheet steel, thickness as required for conditions encountered, manufacturer's standard shapes, same finish as framing members.
- B. Galvanizing Repair Paint: Paint containing zinc dust in concentrations of not less than 92%, conforming to ASTM A780.

2.03 FASTENERS

- A. Screws: Self-drilling, Self-tapping; corrosion resistant coating zinc/chromate/organic, equal to Hilti "Kwikote".
- B. Bolts, Nuts and Washers: ASTM A90, hot-dip galvanized.
- C. Anchorage Devices: Power-driven or powder-actuated.
- D. Welding: Follow AWS D1.1.

2.04 FABRICATION

- A. Fabricate assembly of sections with framing members fitted, reinforced and braced to suit design requirements.
- B. Assemble in largest practical sections for delivery to site.

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3.00 EXECUTION

3.01 ERECTION

- A. Cut framing components squarely or on angle as required to fit against abutting members.
- B. Align floor and ceiling tracks; secure in place with fasteners or welding at maximum 610 mm (24 inch) OC.
- C. Place studs plumb at spacing shown, or if not shown, as required by design, but not more than 50 mm (2 inches) from abutting walls and at each side of openings. Securely fasten studs to tracks.
- D. Construct corners using minimum 3 studs. Provide double studs at wall openings, door and window jambs.
- E. Coordinate placement of insulation in stud spaces made inaccessible after erection.
- F. Install intermediate studs above and below openings to match wall stud spacing.
- G. Provide deflection allowance in stud track, directly below horizontal building framing for non-load bearing framing.
- H. Install framing between studs for attachment of mechanical and electrical items, and to prevent stud rotation.
- I. Touch up field welds and damaged galvanized surface with galvanizing repair paint.

END OF SECTION 05400

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SECTION 05500 METAL FABRICATIONS

1.00 GENERAL

1.01 SECTION INCLUDES

- A. Metal fabrications required but not specified elsewhere. Included are fabrications for mechanical and electrical work.
- B. Refer to Schedule at end of this Section, listing principal items only. Drawings may show work not scheduled.

1.02 RELATED SECTIONS

- A. Section 05100- Structural Steel, for structural column anchor bolts.
- B. Section 05511- Pre-Engineered Metal Stairs and Railings.
- C. Section 07720- Roof Specialties and Accessories, for roof mounted tieback anchors for exterior maintenance equipment.
- D. Section 08311- Access Doors.
- E. Section 08711 - Door Hardware, for lock cylinder for grating access doors.
- F. Section 10265 - Wall and Corner Guards, for aluminum guard rails.
- G. Section 11160 - Loading Dock Equipment, for steel angle pit frames for loading dock equipment.

1.03 SUBMITTALS: Follow Section 01330.

- A. Shop Drawings: For custom fabricated work only. Indicate profiles, sizes, connection attachments, reinforcing, anchorage, size and type of fasteners and accessories. Include erection drawings, elevations and details where applicable. Indicate welded connections using standard AWS A 2.0 welding symbols. Indicate net weld lengths.
- B. Product Data: For non-custom fabricated work.
- C. Samples: Only where specified or subsequently requested.
- D. Informational Submittals: Calculations: Signed and sealed by Professional Engineer registered in the Republic of the Philippines.

Read and accepted as part of the Contract:

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1. Structural calculations.
 2. Seismic control calculations.
- E. Handrail Assembly and Wall Rails: Concentrated load of 200 pounds applied in any direction at any point on rail; or uniform load of 50 pounds per linear foot applied in any direction at top of rail. Concentrated and uniform loads are not required to be applied simultaneously.
- F. Guardrail assembly:
1. Concentrated Load: 200 pounds applied in any direction at any point along top of rail, and have attachment devices and supporting structure to transfer this loading to appropriate structural elements of the building.
 2. Uniform Load: 50 pounds per linear foot applied in any direction at the top rail and be transferred through the supports to the structure..
 3. Concentrated and uniform loads are not required to be applied concurrently.
- G. Intermediate Rails, Balusters and Panel Fillers: Fabricate infill areas capable of resisting a horizontal concentrated load of 200 pounds applied on a square foot area at any point in the system This load is not required to be applied simultaneously with concentrated or uniform loads on top of rail.
- H. Conform to applicable barrier free design requirements of the Republic of the Philippines and ANSI 117.1.
- I. Follow Division 1 Section for seismic control requirements.

2.00 PRODUCTS

2.01 MANUFACTURERS

- A. Products listed are approved. Substitutions are permitted subject to Section 01 63 00.

2.02 METAL SURFACE QUALITY

- A. For metal fabrications exposed to view in the finished work, provide materials selected for their surface flatness, smoothness and freedom from surface blemishes. Do not use materials with exposed pitting, seam marks, roller marks, rolled trade names, or roughness.

2.03 FERROUS METAL

- A. Steel Plates, Shapes, and Bars: ASTM A36.
- B. Steel Tubing: ASTM A500 Grade B, seamless.

Read and accepted as part of the Contract:

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- C. Steel Pipe: ASTM A53, Schedule 40 unless otherwise specified.
 - D. Steel Sheet:
 - 1. Cold rolled, commercial quality, ASTM A1008.
 - 2. Hot rolled sheet and strip, structural and commercial quality, ASTM A1011.
 - 3. Zinc coated sheet, structural quality, ASTM A653/A653M and commercial quality, ASTM A653/A653M.
 - E. Cast Iron: ASTM A48 in Class (tensile strength) recommended by manufacturer for proposed use.
 - F. Stainless Steel: Type 302 or 304, ASTM A276, A240, A269 or A480 as applicable to purpose required. Finish: Electro-polish free of grinding marks, pits or other minor surface imperfections.

2.04 ALUMINUM

- A. Sheet and Plate: ASTM B209.
- B. Tubular Shapes: ASTM B210, B221, B483 as best suited for proposed use.
- C. Bars, Rods, Wire, Profiles and Tubes: ASTM B211 or B221 as best suited for proposed use.
- D. Structural Shapes: ASTM B308 and B429 respectively, as applicable.

2.05 FASTENERS

- A. Steel-to-Steel Connections: Follow AISC Specifications.
- B. Stainless Steel and Aluminum: Stainless steel.
- C. Include bolts, nuts, washers, shims, and special type fastening devices.

2.06 ACCESSORIES

- A. Grout: Master Builders; Embeco Masterflow 713 Non-Ferrous Non-Shrink Grout.
- B. Welding Materials: AWS D1.1; type required for materials being welded.
- C. Ungalvanized Steel Primer For Items Receiving Standard Alkyd or Latex Topcoats:
 - 1. Benjamin Moore; Rust Inhibitive Primer 168.
 - 2. Sherwin-Williams; Kem Kromik Universal Metal Primer (B50 series) or Steel Spec Universal Primer.
 - 3. Duron; Alkyd Metal Primer 33-010.
 - 4. Substitutes are acceptable with Owner's approval

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- D. Ungalvanized Steel Primer For Items Receiving Epoxy or Urethane Topcoats:
1. Sherwin-Williams; Epolon II Rust Inhibitor Primer.
 2. Southern Coatings; Enviro-Guard Universal Primer 1-6227.
 3. Duron; Universal Acrylic Metal Primer 33-105.
 4. Substitutes are acceptable with Owner's approval
- E. Galvanized Steel Primer:
1. Benjamin Moore ;Iron Clad Galvanized Metal Latex Primer 155.
 2. Sherwin-Williams; Bond Plex 46 Barrier Green.
 3. Duron; Acrylic Galvanized Metal Primer 33-100.
 4. Substitutes are acceptable with Owner's approval
- F. Aluminum Primer for items receiving Alkyd finish:
1. Sherwin-Williams; Galvite HS, B50WZ30.
 2. Pittsburgh Paints; Pitt-Tech Int/Ext Industrial DTM Primer/Finish Enamel 90-712 Series.
 3. Substitutes are acceptable with Owner's approval
- G. Alkyd Enamel Undercoater and Primer Sealers: Equal to or better than Benjamin Moore & Co.: Moorcraft Super Spec Alkyd Enamel Undercoater & Primer Sealer C245. Field Repair of Unprimed Galvanized Steel: Sherwin-Williams; Zincplate 49 Organic Primer or ZincClad IV Organic Zinc Rich Primer.
- H. Epoxy Adhesive System for Edge Angles at Slab Openings: 2 component, 100 percent solids, 100 percent reactive compound suitable for use on dry or damp surfaces; moisture insensitive.
1. Euclid Chemical Company; Euco #620.
 2. Pecora Corporation; Dyna-Poxy EP-1200.
 3. Substitutes are acceptable with Owner's approval.

2.07 FABRICATION

- A. Verify dimensions on site prior to shop fabrication.
- B. Make exposed joints flush and hairline tight.
- C. Grind exposed welds flush and smooth with adjacent finished surface. Ease exposed edges to small uniform radius.
- D. For exposed fastenings, use flush countersunk screws or bolts; unobtrusively located; consistent with design of structure, except where specifically noted otherwise.
- E. Supply components required for anchorage of metal fabrications. Fabricate anchorage and related components of same material and finish as metal fabrication, except where specifically noted otherwise.

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- F. Shop assemble in largest practical sections.

2.08 SHOP PAINTING

- A. Surface Preparation: SSPC-SP1 Solvent Cleaning and SSPC-SP3 Power Tool Cleaning. Use SSPC-SP6 Commercial Blast when required for special primers. Remove loose mill scale, rust, oil, grease, weld slag, and other foreign matter.
- B. Do not paint ferrous metal in contact with concrete or where field welding is required.
- C. Paint ferrous metal, except stainless steel, on all surfaces. Shop paint galvanized items unless shown otherwise.
- D. Paint aluminum surfaces in contact with dissimilar metals.
- E. Paint aluminum surfaces in contact with concrete or masonry, whether or not primed, with heavy-bodied bituminous paint.
- F. Do not paint aluminum surfaces in contact with joint sealants.

2.09 GALVANIZING

- A. Galvanize the following items, including anchorages, fasteners and accessories:
1. Shelf angles and lintels located in exterior walls.
 2. Other ferrous metal exposed to exterior atmosphere.
 3. Ferrous metal at building interior only where shown or specified.
- B. Products made from Rolled, Pressed and Forged Shapes, Castings, Plates, Bars, and Strips: Grade 65, ASTM A123/A123M.
- C. Fasteners: ASTM A153/A153M, Class A.
- D. Steel Sheet: G90 zinc coating, ASTM A653/A653M [A924/A924M].

3.00 EXECUTION

3.01 INSTALLATION

- A. Install work plumb, level and true and accurately fitted.

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- B. Allow for erection loads, and temporary bracing to maintain true alignment until completion of erection and installation of permanent attachments.
- C. Field weld following AWS D1.1.
- D. After installation, touch-up field welds, scratched or damaged surfaces using same primer as shop coat.
- E. Obtain approval prior to site cutting or making adjustments not scheduled.

3.02 SCHEDULE

- A. Loose Steel Lintels: Provide lintels, as required, except where pre-cast concrete or field made CMU lintels are shown. Bearing: 8 inch minimum at each end. Sizes: unless shown otherwise:
 - 1. 4, 8 and 12 Inch Nominal Masonry Walls:
 - a. Spans Less Than 5 feet: One 3 1/2 x 3 1/2 x 5/16 inch angle for each 4 inches of masonry thickness.
 - b. Spans 5 feet to 8 feet: One 6 x 3 1/2 x 5/16 inch angle for each 4 inches of masonry thickness.
 - c. Spans Over 8 feet: See Drawings.
 - 2. 6 Inch (Nominal) Masonry Walls:
 - a. Spans Less Than 5 feet: WT 4 x 9 tee.
 - b. Spans 5 feet to 8 feet: WT 7 x 11 tee.
 - c. Spans Over 8 feet: See Drawings.
- B. Shelf Angles: Steel, with slotted holes to suit supports.
- C. Ladder Rungs: 1 inch diameter galvanized steel bar, embedded 6 inches into concrete, uniformly spaced at maximum 12 inch OC. Projection: 7 inches from wall 6 to 10 inch from roof.
- D. Ladders:
 - 1. 3 x 3/8 inch flat steel bar stringers spaced 24 inches apart; 3/4 inch round steel bar rungs uniformly spaced at maximum 12 inches OC, set and welded into drilled holes in stringers.
 - 2. Set ladders 7 inches clear from center line of rungs to wall. Flat bar brackets at top and bottom, and maximum 10 feet OC. for intermediate brackets. Weld brackets to stringers. Keep ladders 2 inches clear of floor.
- E. Pipe Railings:
 - 1. 1 1/4" NPS Designation, 1.66 inch OD, schedule 80 for posts and schedule 40 for horizontal members, steel pipe with flush welded joints. Provide standards spaced as shown, or at maximum 4 feet OC if not shown.
 - 2. Make wall railings similar to pipe railings and mount on brackets. Provide radius returns to wall at ends.
 - 3. Where embedded in concrete, include pipe sleeves and grouting.

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4. Where mounted on steel, weld railings continuously to steel.
- F. Overhead Supports: Structural steel of shapes best suited for items to be supported. Include anchorage and bracing to building structure, and slotted holes spaced to receive anchoring devices. Provide overhead supports for:
1. Ceiling-hung coiling doors.
 2. Ceiling-hung pilasters of toilet compartments.
 3. Ceiling-hung pilasters of shower compartments.
 4. Folding partitions.
 5. Exhaust hoods.
 6. Ceiling hung audio-visual equipment.
- G. Channel Door Frames: Structural steel channels, with bar or channel stops where shown. Space anchors to suit masonry coursing. Prepare frames to receive finish hardware using hardware templates. All welded assembly.
- H. Dock Edge Angles: 3 x 3 x 1/4 inch steel angles with anchors welded at maximum 18 inches OC. Welded corners.
- I. Edge Angles at Slab Openings: 3 x 2 x 1/4 inch galvanized steel angles; mitered, continuous welded corners.
1. Set in continuous bed of epoxy sealant. Shimmy angles into position, fully embed in epoxy sealant.
 2. [Mechanically fasten as indicated on Drawings.]
- J. Steel Corner Guards: Steel angles, channels, or other shapes as shown, with welded anchors spaced to suit supporting construction. Unless shown otherwise, minimum thickness 1/4 inch.
- K. Wheel Guards: Cast iron, stock type, ASTM A48, Class 35, heavy duty. Include anchors suitable for supporting construction.
- L. Bench Supports: Angle type, either galvanized or factory applied baked enamel finish. Drill and countersink to receive wood screws from underside.
- M. Gratings, Pedestrian: Galvanized steelgratings meeting NAAMM "Metal Bar Grating Manual". Type: welded (steel only). Final design to be decided prior to construction. Bearing Bar Spacing: [] inches. Bearing Bar Size: [] x [] inches.
- N. Gratings, Vehicular: Galvanized steel gratings meeting NAAMM "Heavy Duty Metal Bar Grating Manual". Type: welded. Final design to be decided prior to construction. Bearing Bar Spacing: [] inches. Bearing Bar Size: [] x [] inches. Include matching opening frames, clips, bolts, sub-support members, toe plates, banding.

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- O. Window Stools: 16 gauge cold rolled sheet steel. Brake form to design shown. Include internal supporting clips for installation without use of exposed fasteners. Submit one window stool for approval before fabrication.
 - P. Bollards: 6 inch diameter steel pipe and cap, 0.375 inch wall thickness unless shown otherwise. Install bollards in concrete footing 24 inches square and 36 inches deep. Exposed bollard height: 48 inches. Fill pipe with concrete and weld cap continuously to pipe.
 - Q. Removable Pipe Standards and Chain Guards: 2 inch O.D. steel pipe with galvanized eye bolts to receive chain. Steel chain; galvanized, BBB Quality, size 3/8 inch , 11 links per foot.
 - R. Miscellaneous Framing at Roof Openings: Where required but not shown, 6 x 4 x 5/16 LLV steel angle.
 - S. Metal Protection of Concrete Curbing: Provide with welded anchorage.
 - T. Metal Capping of Masonry in Stairwells: Brake formed 18 gauge cold rolled sheet steel. Form in channel section with double metal thickness along edges turned inward against masonry. [Weld anchors on interior of channel section for embedment into masonry.]
 - U. Window Mullion Closures: Brake formed 18 gauge cold rolled sheet steel. Include internal supporting clips for installation without use of exposed fasteners.
 - V. Restraints for Gas Cylinders (for cylinders 4 to 12 inches in diameter): Manufacturer: First Safety Corporation. Cylinder Wall Brackets: All steel construction, 11 gauge hot rolled steel, epoxy coated, edges protected by reinforced vinyl guards. 1-1/2 inch wide by 54 inches long polypropylene cinch straps with steel cinch buckle.
 - 1. Model G-100 Single cylinder wall bracket.
 - 2. Model G-200 Double cylinder wall bracket.
 - 3. Model G-300 Triple cylinder wall bracket.
 - 4. Model G-401 Four cylinder wall bracket.
 - 5. Chain set: G-105. Secondary support optional.
 - W. Slotted Channel Framing for Laboratory and Utility Shelving:
 - 1. Manufacturers: Subject to compliance with requirements, the following manufacturers and products named are acceptable; substitutions are permitted subject to Section 01 63 00.
 - a. Unistrut, 35660 Clinton Street, Wayne, MI 48184 Tel: 800 521-7730.
 - b. Power Engineering Co. (Powerstrut), 420 Boston Turnpike, Shrewsbury, MA Tel: 800 274-1303.
 - c. Kumar Industries, 4881 Chino Ave., Chino, CA 91710 Tel: (909) 591-0722.
 - d. Cooper B-Line Inc. (B-Line), 509 West Monroe St., Highland, IL 62249 Tel: (618) 654-2184.

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2. Materials: Channel and framing members shall be fabricated from steel conforming to the following requirements:
- a. Framing Members:
 - 1) Concealed Framing Members and Fittings: ASTM A570 GR 33.
 - 2) Exposed Framing Members and Fittings: ASTM A653 GR A with zinc coating conforming to ASTM A653.
 - 3) Stainless Steel Framing Members and Fittings: ASTM A240 (Type 304), where indicated.
 - b. Fittings:
 - 1) Concealed Fittings: Fabricate from steel satisfying the requirements of ASTM A570 GR 33, and conform to the following ASTM specifications: A575, A576, A36, or A635. Nuts shall conform to ASTM A576 GR 1015 and screws shall conform to SAE J429 GR 2 and ASTM A307.
 - 2) Exposed Fittings: Fabricate from steel satisfying the requirements of ASTM A570 GR 33, and conform to the following ASTM specifications: A575, A576, A36, or A635. Nuts shall conform to ASTM A576 GR 1015 and screws shall conform to SAE J429 GR 2 and ASTM A307. Exposed fittings shall receive zinc coating conforming to ASTM A653.
 - 3) Stainless Steel Fittings and Hardware: Sintered Nuts shall be of ASTM B783 (Type 316N2-33) stainless steel and fittings shall be of ASTM A240 (Type 304) stainless steel. Stainless steel fittings and hardware shall be used with stainless steel framing members, or where indicated.

END OF SECTION 05500

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SECTION 05511 METAL STAIRS AND RAILINGS

1.00 GENERAL

1.01 SECTION INCLUDES

- A. Pre-engineered Steel stairs with closed riser and pans for concrete fill. and landing pans for cast-in-place concrete fill.
- B. Integral steel handrail/guardrail assemblies and matching wall mounted handrail assemblies.
- C. Hanger rods, clip angles, and other devices for attachment to structure.

1.02 DESIGN AND PERFORMANCE CRITERIA

- A. Unless otherwise specified. Limit live load deflection to $L/360$ of span.
- B. Design components to allow for expansion and contraction without buckling, excessive opening of joints, or overstressing of welds and fasteners.
- C. Handrails and Guards are to be manufactured per IBC 1607.1 and per requirements of the authorities having jurisdiction.

1.03 SUBMITTALS: Follow Section 01330.

- A. Shop Drawings:
 - 1. Show plans, elevations, details, profiles, sizes, connections, reinforcing, anchorage, openings, size and type of fasteners and accessories.
 - 2. Submit with shop drawings all calculations in reference to structural properties of all members, assemblies and connections prior to fabrication of any parts of the work and provide all additional structural members or increase gauge and weight of finished metals required for the proper erection and structural stability of the work.
 - 3. Indicate welded connections using standard AWA welding symbols.
- B. Informational Submittals:
 - 1. Calculations: For installed products indicated to comply with design loads, include structural analysis data signed and sealed by a Professional Engineer maintaining current registration in the Republic of the Philippines and who is responsible for their preparation.

Include:
 - a. Structural calculations.

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- b. Seismic control calculations.
- 2. Statement of welder qualifications.

1.04 REGULATORY REQUIREMENTS

- A. Live load per national structural code of the Philippines and ICC.
- B. Stair Assembly: Fabricate stairs, landings and connections to support live loads of minimum 100 pounds per square foot and a concentrated load of 300 pounds on 4 square inches of tread, and placed in a position which would cause the maximum stress..
- C. Handrail Assembly and Wall Rails: Fabricate rails, components and connections capable of resisting a concentrated load of at least 200 pounds applied at any point and in any direction. Handrails shall also be designed and constructed for a uniform load of 50 pounds per foot applied in any direction. The concentrated and uniform loading conditions shall not be applied simultaneously.
- D. Guardrail assembly:
 - 1. Concentrated Load: 200 pounds applied in any direction at any point along top of rail, and have attachment devices and supporting structure to transfer this loading to appropriate structural elements of the building.
 - 2. Uniform Load: 50 pounds per linear foot applied in any direction at the top rail and be transferred through the supports to the structure..
 - 3. Concentrated and uniform loads are not required to be applied concurrently.
- E. Intermediate Rails, Balusters and Panel Fillers: Fabricate infill areas capable of resisting a horizontal concentrated load of 200 pounds applied on a square foot area at any point in the system This load is not required to be applied simultaneously with concentrated or uniform loads on top of rail.
- F. Conform to applicable barrier free design requirements of the State of Virginia, Americans with Disabilities Act (ADA), and ANSI 117.1.
- G. Follow Division 1 Section for seismic control requirements.

2.00 PRODUCTS

2.01 BASIS OF DESIGN

- A. American Stair Corporation, Inc., manufactured steel stair and railing system with steel sub-treads and landings for field poured-in-place concrete fills.
- B. At Contractor's option, steel stair and railing system(s) may be other company's equivalent stair and railing systems or shop fabricated steel stair and railings.

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2.02 MATERIALS

- A. Steel Sections: ASTM A36.
- B. Sheet Steel: 12 gauge minimum, hot rolled, ASTM A569.
- C. Steel Tubing: Cold Formed, ASTM A500B and A513.
- D. Steel Pipe: ASTM A53, type and grade selected by manufacturer as required for design loading.
- E. Wall Mounted Handrail Assemblies: Match stair mounted assemblies.
- F. Threaded End Hanger Rods: 16 mm (5/8 inch) diameter minimum, ASTM A36.
- G. Pipe Columns (If Required): 50 mm (2 inch) nominal minimum.
- H. Plates, Angles, and Other Accessories: ASTM A36.
- I. Reinforcing for Concrete Fill: No. 5 bars, grade 40, 356 mm (14 inches) OC maximum.
- J. Welding Material: AWS D1.1; type required for materials being welded.
- K. Bolts, Nuts, Washers, and Other Fasteners: ASTM A307.
- L. Paint Primer for Steel: Manufacturer's standard.
- M. Stair Nosing: 76 mm wide x minimum 6 mm thick x 3 mm less than tread width (3 inches wide x minimum 1/4 inch thick x 1/8 inch less than tread width). Provide with abrasive finish, American Stair: Style 331-3". Acceptable substitutions include:
 - 1. American Safety Tread Co. Inc.: Type 8511.
 - 2. Balco Inc.: R-305LP
 - 3. Wooster: Type 231BF.
 - 4. Other pre-engineered steel stair company with manufacturing operations in the Philippines.

2.03 FABRICATION

- A. General: Fabricate stairs to conform to sizes and arrangements indicated. Join stairs and components together by welding unless otherwise indicated .

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- B. Stairs are to be complete assemblies including metal framing, hangers, railings, struts, clips, brackets, bearing plates and other components necessary for support of stairs, platforms required to anchor and contain stairs on the supporting structure members.
- C. Fabricate components required for anchorage to each other and to building structure. Form Sections to required shapes and sizes, with true angles. Provide necessary rebates and brackets for assembly.
- D. Reinforce undersides to meet design load criteria.
- E. Where ends of railings are exposed, close ends with welded on caps. Provide close radius 90 degree bend. Terminate railings 50 mm (1/2 inch) from wall.
- F. Field Poured Concrete Stair Treads: Fourteen (12) gauge or greater (depending on span) steel formed into sub-treads for 50 mm (2 inch) field poured-in-place concrete treads.
- G. Risers: Manufactured from 12 gauge or greater (depending on span) hot rolled mild steel.
- H. Concrete Platforms and Landings: Formed of manufacturer's standard fourteen (12) gauge or greater (depending on span) steel sub-deck reinforced with No. 5 rebars at 14 inch centers and field poured-in place with concrete.
- I. Fabricate stair guards and handrails of 38 mm (1½ inch) eleven (11) gauge square tubing or 41 mm (1 5/8 inch) fourteen (14) gauge round structural steel tubing with 19 mm (¾ inch) square steel vertical pickets at 100 mm (4 inches) on center. Weld connections and grid joints smooth. Close posts and rail ends (as applicable), weld and grind smooth.
- J. Handrails are to be mounted to walls and/or guardrails with brackets spaced no more than 1220 mm (4 feet) OC. Form railings with end extensions as indicated with closed ends.
- K. Supply all components for proper anchorage of handrails
- L. Joints and Welds:
 - 1. Grind contact surfaces of connected members true. Assemble parts for flush and hairline tight joints.
 - 2. Exposed mechanical fasteners, if required, shall be flush countersunk type, unobtrusively located.
 - 3. Except as otherwise shown or specified, welds exposed to view shall be continuous for full length of connection.
 - 4. Use welding method which develops strength required to comply with structural performance criteria.
 - 5. Grind exposed welds flush and smooth with adjacent finished surface. Ease exposed edges to small uniform radius.

2.04 FINISH

- A. Clean surfaces of rust, scale, grease and foreign matter prior to priming.
- B. Shop prime paint; one coat.
- C. Do not prime surfaces in direct contact bond with concrete or where field welding is required.

3.00 EXECUTION

3.01 EXAMINATION

- A. Verify that field measurements are acceptable to suit stair assembly tolerances.
- B. Verify that supports and anchors are correctly positioned.
- C. Beginning of installation means acceptance of existing conditions.

3.02 ERECTION

- A. Erect stairs, railings, handrails and components square, level, plumb and free from distortion or defects detrimental to appearance and performance.
- B. Ensure alignment with adjacent construction. Coordinate with related work to ensure no interruption in installation.
- C. Perform necessary cutting and altering for installation of work of other Sections. Do not perform other additional cutting without the review of the Architect.
- 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 surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.
- E. 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.

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- F. Adjust railing systems before anchoring to ensure matching alignment at abutting joints. Space posts at spacing indicated or, if not indicated, as required by design loads. Plumb posts in each direction. Secure posts and rail ends to building construction.

3.03 TOUCH-UP AND REPAIR

- A. Following erection, clean all steel work of mud and dirt accumulated during erection. Thoroughly clean mud from areas that will be exposed in the finished work, touch-up prime coat and leave ready for finish painting.
- B. Verify that installation is neat and flush in appearance, and that there are no burrs, projections, or defects that might snag fingers or clothing. Correct deficiencies.

3.04 PROTECTION

- A. Provide adequate fire protection during welding operations.

3.05 WASTE REMOVAL

- A. Remove from site and legally dispose of waste materials resulting from or caused by work of this section.

END OF SECTION 05511

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SECTION 05513

FACTORY-APPLIED METAL COATINGS

1.00 GENERAL

1.01 SCOPE

- A. High performance fluoropolymer color coating finishes applied to steel or aluminum surfaces specified in other Specification Sections.

1.02 INFORMATIONAL SUBMITTALS: Follow Section 01330.

- A. Special Warranty: Warrant that fluoropolymer coatings will meet specified requirements for color retention, gloss retention, and film adhesion for the stated periods from date of Substantial Completion.
 - 1. Extrusions: 5 years, except, 10 years using standard 3 coat system.
 - 2. Coil Stock: 20 years.
- B. LEED Submittals: Follow Section 01813.
 - 1. Credit EQ 4.2: Product Data for paints and coatings used on the interior of the building indicating chemical composition and VOC content of each product used. List each product including the manufacturer's name, product name, specific VOC data and the corresponding allowable VOC from the list in part 2 of Section 01813. Indicate VOC content in g/L calculated according to 40 CFR 59, Subpart D (EPA method 24).

1.03 PERFORMANCE CRITERIA

- A. Color Retention: Maximum of 5 delta E units (Hunter) of color change as calculated in accordance with ASTM D2244.
- B. Specular Gloss: Gloss values shall be within plus or minus 5 units of manufacturer's specification, when measured in accordance with ASTM D523 using a 60 degree gloss meter.
- C. Film Adhesion: No removal of film under tape within or outside test specimen, when tested in accordance with AAMA 2605.

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2.02 PRODUCTS

2.01 DESIGN STANDARD MANUFACTURER:

PPG INDUSTRIES, INC. Substitutions subject to Section 01 63 00 are:

- A. Akzo.
- B. BASF.
- C. Valspar.
- D. Other substitutions are permitted subject to the Owner's approval.

2.02 DESCRIPTION

- A. High performance fluoropolymer color coating, containing at least 70 percent polyvinylidene fluoride (PVDF) resin by weight. AUTOFINA Chemicals Inc. Kynar 500 or Ausimont Hylar 5000.
- B. Coating shall be factory applied and oven baked on pre-treated and primed substrates.
- C. Color and Gloss: As selected from manufacturer's standard range.
- D. Field Applied Touch-up Material: 100 percent fluorocarbon Duranar ADS Series air-dry system (ADS) of same color.

2.03 STANDARD 2 COAT SYSTEM

- A. Corrosion inhibitive primer and color coat. PPG; Duranar.
 - 1. Aluminum Extrusion: 0.2 to 0.3 mil primer, 1.0 mil minimum color coat.
 - 2. Aluminum or Steel; Coil: 0.2 mil primer, 0.8 mil color coat.

2.04 STANDARD 3 COAT SYSTEM

- A. Corrosion inhibitive primer, color coat and clear topcoat. PPG; Duranar XL.
 - 1. Aluminum Extrusion: 0.2 to 0.3 mil primer, 1.0 mil minimum color coat, 0.4 to 0.8 mil clear.
 - 2. Aluminum or Steel; Coil: 0.2 mil primer, 0.75 mil color coat, 0.50 mil clear.

2.05 HEAVY 2 COAT SYSTEM

- A. Corrosion inhibitive primer and color coat. Aluminum or Steel; Coil: 0.80 mil primer, 0.80 mil color coat. PPG; Duranar Plus.

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2.06 HEAVY 3 COAT SYSTEM

- A. Corrosion inhibitive primer, color coat and clear topcoat. Aluminum or Steel; Coil: 0.80 mil primer, 0.80 mil color coat, 0.80 mil clear. PPG; Duranar XL Plus.

2.07 4 COAT SYSTEM

- A. Corrosion inhibitive primer, barrier coat, color coat and clear topcoat.
1. Aluminum Extrusion: 0.2 to 0.3 mil primer, 1.0 to 1.2 mil barrier, 1.0 mil color, 0.4 to 0.8 mil clear. PPG; Duranar XL/BC.
 2. Aluminum or Steel; Coil: 0.20 mil primer, 0.80 mil barrier, 0.75 mil color, 0.50 mil clear. PPG; Duranar XLE.

2.08 APPLICATION

- A. Clean, pre-treat and otherwise prepare surfaces to receive coating.
- B. Apply coating in accordance with manufacturer's recommendations.

3.00 EXECUTION

Not Used.

END OF SECTION 05513

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SECTION 05521 ALUMINUM TUBE RAILINGS

1.00 GENERAL

1.01 SCOPE

Furnish all materials, labor, equipment, plant, tools, required to complete all aluminum pipe and tube for exterior installations and interior utility trays, laboratory overhead service frames and others, as required.

1.02 MEASUREMENTS AND COORDINATION

Obtain measurements for all work required to be accurately fitted at the job and not from the drawings. The Contractor will be responsible for the accuracy of all such measurements and the precise fitting and assembly of the finish products. Coordinate the work with that of all other trades to prevent interference. Verify conditions at the job before fabrication.

1.03 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Design railings, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
- B. General: In engineering railings to withstand structural loads indicated, determine allowable design working stresses of railing materials based on the following:
 - 1. Aluminum: The lesser of minimum yield strength divided by 1.65 or minimum ultimate tensile strength divided by 1.95.
- C. Structural Performance: Railings shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:
 - 1. Handrails and Top Rails of Guards:
 - a. Uniform load of 50 lbf/ ft. applied in any direction.
 - b. Concentrated load of 200 lbf applied in any direction.
 - c. Uniform and concentrated loads need not be assumed to act concurrently.
 - 2. Infill of Guards:
 - a. Concentrated load of 50 lbf applied horizontally on an area of 1 sq. ft.
 - b. Infill load and other loads need not be assumed to act concurrently.
- D. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes acting on exterior metal fabrications by preventing buckling,

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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.

E. Control of Corrosion: Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.

1.04 SUBMITTALS

A. Product Data: For the following:

1. Manufacturer's product lines of mechanically connected railings.
2. Railing brackets.
3. Grout, anchoring cement, and paint products.

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

C. Samples for Initial Selection: For products involving selection of color, texture, or design.

D. Samples for Verification: For each type of exposed finish required.

1. Sections of each distinctly different linear railing member, including handrails, top rails, posts, and balusters.
2. Fittings and brackets.
3. Assembled Sample of railing system, made from full-size components, including top rail, post, handrail, and infill. Sample need not be full height.
 - a. Show method of finishing members at intersections.

E. 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.

F. Qualification Data: For qualified professional engineer.

G. Welding certificates.

H. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, according to ASTM E 894 and ASTM E 935.

1.05 QUALITY ASSURANCE

A. Source Limitations: Obtain each type of railing from single source from single manufacturer.

B. Welding Qualifications: Qualify procedures and personnel according to the following:

1. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum."

1.06 PROJECT CONDITIONS

Read and accepted as part of the Contract:

Bidder / Contractor

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

1.07 COORDINATION AND SCHEDULING

- A. Coordinate installation of anchorages for railings. 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.
- B. Schedule installation so wall attachments are made only to completed walls. Do not support railings temporarily by any means that do not satisfy structural performance requirements.

2.00 PRODUCTS

2.01 METALS, GENERAL

- A. Metal Surfaces, General: Provide materials with smooth surfaces, without seam marks, roller marks, rolled trade names, stains, discolorations, or blemishes.
- B. Brackets, Flanges, and Anchors: Cast or formed metal of same type of material and finish as supported rails unless otherwise indicated.

2.02 ALUMINUM

- A. Aluminum, General: Provide alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated, and with not less than the strength and durability properties of alloy and temper designated below for each aluminum form required.
- B. Extruded Structural Round Tubing: ASTM B 429/B 429M, Alloy 6063-T6.
 - 1. Provide Standard Weight (Schedule 40) pipe, unless otherwise indicated.
- C. Drawn Seamless Tubing: ASTM B 210, Alloy 6063-T832.
- D. Plate and Sheet: ASTM B 209, Alloy 6061-T6.

2.03 FASTENERS

- A. General: Provide the following:
 - 1. Aluminum Railings: Type 304 stainless-steel fasteners.
- B. Fasteners for Anchoring Railings to Other Construction: Select fasteners of type, grade, and class required to produce connections suitable for anchoring railings to other types of construction indicated and capable of withstanding design loads.
- C. Fasteners for Interconnecting Railing Components:
 - 1. Provide concealed fasteners for interconnecting railing components and for attaching them to other work, unless otherwise indicated.

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2. Provide concealed fasteners for interconnecting railing components and for attaching them to other work, unless exposed fasteners are unavoidable or are the standard fastening method for railings indicated.
 3. Provide tamper-resistant flat-head machine screws for exposed fasteners unless otherwise indicated.
- D. Post-Installed Anchors: Torque-controlled expansion anchors capable of sustaining, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing according to ASTM E 488, conducted by a qualified independent testing agency.

2.04 MISCELLANEOUS MATERIALS

- A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.
1. or aluminum railings, provide type and alloy as recommended by producer of metal to be welded and as required for color match, strength, and compatibility in fabricated items.
- B. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.
- C. 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.
- D. Anchoring Cement: Factory-packaged, nonshrink, nonstaining, hydraulic-controlled expansion cement formulation for mixing with water at Project site to create pourable anchoring, patching, and grouting compound.
1. Water-Resistant Product: At exterior locations provide formulation that is resistant to erosion from water exposure without needing protection by a sealer or waterproof coating and that is recommended by manufacturer for exterior use.

2.05 FABRICATION

- A. General: Fabricate railings to comply with requirements indicated for design, dimensions, member sizes and spacing, details, finish, and anchorage.
- B. Assemble railings in the shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation. Use connections that maintain structural value of joined pieces.
- C. 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.
- D. Form work true to line and level with accurate angles and surfaces.

Read and accepted as part of the Contract:

Bidder / Contractor

- E. Fabricate connections that will be exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.
- F. Cut, reinforce, drill, and tap as indicated to receive finish hardware, screws, and similar items.
- G. Connections: Fabricate railings with welded connections unless otherwise indicated.
- H. Welded Connections for Aluminum Pipe: Fabricate railings to interconnect members with concealed internal welds that eliminate surface grinding, using manufacturer's standard system of sleeve and socket fittings.
- I. Nonwelded Connections: Connect members with concealed mechanical fasteners and fittings. Fabricate members and fittings to produce flush, smooth, rigid, hairline joints.
 - 1. Fabricate splice joints for field connection using an epoxy structural adhesive if this is manufacturer's standard splicing method.
- J. Form changes in direction as follows:
 - 1. By bending or by inserting prefabricated elbow fittings.

2.06 ALUMINUM FINISHES

- A. Clear Anodic Finish: AAMA 611, [AA-M12C22A41, Class I, 0.018 mm] [AA-M12C22A31, Class II, 0.010 mm] or thicker.

3.00 EXECUTION

3.01 EXAMINATION

- A. Examine locations receive anchors, to verify that locations have been clearly marked for Installer. Locate reinforcements and mark locations if not already done.

3.02 INSTALLATION, GENERAL

- A. Fit exposed connections together to form tight, hairline joints.
- B. Perform cutting, drilling, and fitting required for installing railings. Set railings accurately in location, alignment, and elevation; measured from established lines and levels and free of rack.
 - 1. Do not weld, cut, or abrade surfaces of railing components that have been coated or finished after fabrication and that are intended for field connection by mechanical or other means without further cutting or fitting.
 - 2. Set posts plumb within a tolerance of 1.6 mm in 910 mm (1/16 inch in 3 feet).
 - 3. Align rails so variations from level for horizontal members and variations from parallel with rake of steps and ramps for sloping members do not exceed 6.35 mm in 3660 mm (1/4 inch in 12 feet).
- C. Corrosion Protection: Coat concealed surfaces of aluminum that will be in contact with grout, concrete, masonry, wood, or dissimilar metals, with a heavy coat of bituminous paint.

Read and accepted as part of the Contract:

Bidder / Contractor

- D. Adjust railings before anchoring to ensure matching alignment at abutting joints.
- E. Fastening to In-Place Construction: Use anchorage devices and fasteners where necessary for securing railings and for properly transferring loads to in-place construction.

3.03 RAILING CONNECTIONS

- A. Non-welded Connections: Use mechanical or adhesive joints for permanently connecting railing components. Seal recessed holes of exposed locking screws using plastic cement filler colored to match finish of railings.
- B. Welded Connections: Use fully welded joints for permanently connecting railing components. Comply with requirements for welded connections in "Fabrication" Article whether welding is performed in the shop or in the field.
- C. Expansion Joints: Install expansion joints at locations indicated but not farther apart than required to accommodate thermal movement. Provide slip-joint internal sleeve extending 50 mm (2 inches) beyond joint on either side, fasten internal sleeve securely to one side, and locate joint within 150 mm (6 inches) of post.

3.04 ANCHORING POSTS

- A. Use metal sleeves preset and anchored into concrete for installing posts. After posts have been inserted into sleeves, fill annular space between post and sleeve with nonshrink, nonmetallic grout or anchoring cement, mixed and placed to comply with anchoring material manufacturer's written instructions.
- B. Cover anchorage joint with flange of same metal as post, attached to post with set screws.
- C. Leave anchorage joint exposed, wipe off surplus anchoring material, and leave 1/8-inch buildup, sloped away from post.
- D. Anchor posts to metal surfaces with oval flanges, angle type, or floor type as required by conditions, connected to posts and to metal supporting members as follows:
 - 1. For aluminum pipe railings, attach posts using fittings designed and engineered for this purpose.
- E. Install removable railing sections, where indicated, in slip-fit metal sockets cast in concrete.

3.05 ATTACHING HANDRAILS TO WALLS

- A. Attach railings to wall with wall brackets. Provide brackets with 1-1/2-inch clearance from inside face of handrail and finished wall surface. Locate brackets as indicated or, if not indicated, at spacing required to support structural loads.
 - 1. Use type of bracket with flange tapped for concealed anchorage to threaded hanger bolt.
 - 2. Locate brackets as indicated or, if not indicated, at spacing required to support structural loads.

Read and accepted as part of the Contract:

Bidder / Contractor

- B. Secure wall brackets and railing end flanges to building construction as follows:
 - 1. For concrete and solid masonry anchorage, use drilled-in expansion shields and hanger or lag bolts.
 - 2. For steel-framed partitions, use self-tapping screws fastened to steel framing or to concealed steel reinforcements.

3.6 ADJUSTING AND CLEANING

- A. Clean aluminum by washing thoroughly with clean water and soap and rinsing with clean water.
- B. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed 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.

3.02 PROTECTION

Protect all finished work until turnover to the Owner.

END OF SECTION 5521

Read and accepted as part of the Contract:

Bidder / Contractor

SECTION 05531 ALUMINUM EQUIPMENT SCREEN

1.00 GENERAL

1.01 SCOPE

- A. Extruded-aluminum louver gratings used as equipment screens on roof.
- B. Related Sections:
 - 1. Division 5 Section "Structural Steel" for structural-steel framing system components.
 - 2. Division 5 Section "Metal Fabrications" for miscellaneous steel used for connections to structural supports.

1.02 MEASUREMENTS AND COORDINATION

Obtain measurements for all work required to be accurately fitted at the job and not from the drawings. The Contractor will be responsible for the accuracy of all such measurements and the precise fitting and assembly of the finish products. Coordinate the work with that of all other trades to prevent interference. Verify conditions at the job before fabrication.

1.03 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Design gratings, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
- B. Structural Performance: Gratings shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated.
 - 1. Roof Screen: Meet design wind loads per structural design criteria for Manila.
 - 2. Limit deflection to L/240 or 1/4 inch, whichever is less.
- C. Seismic Performance: Provide gratings capable of withstanding the effects of earthquake motions determined according to the seismic zone in which the project is located.

1.04 SUBMITTALS

- A. Product Data: For the following:
 - 1. Extruded-aluminum louver gratings.
 - 2. Clips and anchorage devices for gratings.
- B. Shop Drawings: Include plans, sections, details, and attachments to other work.
- C. 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.

Read and accepted as part of the Contract:

Bidder / Contractor

- D. Qualification Data: For qualified professional engineer.
- E. Welding certificates.
- F. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers certifying that shop primers are compatible with topcoats.

1.05 QUALITY ASSURANCE

- A. Metal Bar Grating Standards: Comply with NAAMM MBG 531, "Metal Bar Grating Manual " and NAAMM MBG 532, "Heavy-Duty Metal Bar Grating Manual."
- B. Welding Qualifications: Qualify procedures and personnel according to the following:
 - 1. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum."

1.06 PROJECT CONDITIONS

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

1.07 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 for gratings, grating frames, and supports. 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.

2.00 PRODUCTS

2.01 ALUMINUM

- A. Aluminum, General: Provide alloy and temper recommended by aluminum producer for type of use indicated, and with not less than the strength and durability properties of alloy and temper designated below for each aluminum form required.
- B. Extruded Bars and Shapes: ASTM B 221, alloys as follows:
 - 1. 6061-T6 or 6063-T6, for bearing bars of gratings and shapes.
 - 2. 6061-T1, for grating crossbars.
- C. Aluminum Sheet: ASTM B 209, Alloy 5052-H32.

2.02 FASTENERS

- A. General: Provide Type 304 stainless-steel fasteners. Select fasteners for type, grade, and class required.

Read and accepted as part of the Contract:

Bidder / Contractor

- B. Steel Bolts and Nuts: Regular hexagon-head bolts, ASTM A 307, Grade A; with hex nuts, ASTM A 563; and, where indicated, flat washers.
- C. Stainless-Steel Bolts and Nuts: Regular hexagon-head annealed stainless-steel bolts, nuts, and, where indicated, flat washers; ASTM F 593 for bolts and ASTM F 594 for nuts, Alloy Group 1.
- D. Anchor Bolts: ASTM F 1554, Grade 36, of dimensions indicated; with nuts, ASTM A 563; and, where indicated, flat washers.
 - 1. Hot-dip galvanize or provide mechanically deposited, zinc coating where item being fastened is indicated to be galvanized.
- E. Plain Washers: Round, ASME B18.22.1.
- F. Lock Washers: Helical, spring type, ASME B18.21.1.
- G. Post-Installed Anchors: Torque-controlled expansion anchors capable of sustaining, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing according to ASTM E 488, conducted by a qualified independent testing agency.
 - 1. Material for Exterior Locations and Where Stainless Steel is Indicated: Alloy Group 1 stainless-steel bolts, ASTM F 593, and nuts, ASTM F 594.

2.03 MISCELLANEOUS MATERIALS

- A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy that is welded.

2.04 FABRICATION

- A. Shop Assembly: Fabricate grating sections 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.
- B. Cut, drill, and punch material 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 from materials of size, thickness, and shapes indicated, but not less than that needed to support indicated loads.
- D. Fit exposed connections accurately together to form hairline joints.
- E. Welding: Comply with AWS recommendations and 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.

Read and accepted as part of the Contract:

Bidder / Contractor

- F. Provide for anchorage of type indicated; coordinate with supporting structure. Fabricate and space the anchoring devices to secure gratings, frames, and supports rigidly in place and to support indicated loads.

2.05 EXTRUDED-ALUMINUM LOUVER GRATINGS

- A. Basis of Design Manufacturer: Ohio Gratings, Inc. LG-75. Subject to compliance with requirements, provide the named product or a comparable product by one of the following:
 - 1. Alabama Metal Industries Corporation; a Gibraltar Industries company.
 - 2. IKG Industries; a division of Harsco Corporation.
 - 3. Seidelhuber Metal Products; Division of Brodhead Steel Products.
- B. Grating: Swaged Pressure-Locked Aluminum Louver Bar Grating: Fabricated by assembled square crossbars through diamond shaped hole in louver extruded bearing bars are permanently locked in place by swaging by manufacturer.
- C. Bearing Bars: Type 6105-T5 aluminum louver bars 2-1/2" overall depth with tapered flange on a maximum of 48/16" centers.
- D. Cross Bars: Type 6105-T5 aluminum 5/16" diamond bar mechanically locked at right angles to bearing bars at a maximum of 8" on center.
- E. Surface: Plain.
- F. Percent Open: 64% Open Area.

2.06 GRATING FRAMES AND SUPPORTS

- A. Provide galvanized steel frames and supports as detailed:
 - 1. All exterior steel supports for aluminum louver grating to be galvanized per ASTM A 123/A 123M.

2.07 ALUMINUM FINISHES

- A. Mill Finish.

3.00 EXECUTION

3.01 INSTALLATION, GENERAL

- A. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing gratings to in-place construction. Include threaded fasteners for concrete and masonry inserts, through-bolts, lag bolts, and other connectors.
- B. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing gratings. Set units accurately in location, alignment, and elevation; measured from established lines and levels and free of rack.
- C. Provide temporary bracing or anchors in formwork for items that are to be built into concrete or masonry.
- D. Fit exposed connections accurately together to form hairline joints.

Read and accepted as part of the Contract:

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- E. Prior to grating installation, contractor shall inspect supports for correct size, layout and alignment. Any inconsistencies between contract drawings and supporting structure deemed detrimental to grating placement shall be reported in writing to the architect or owner's agent prior to placement.
- F. Install grating in accordance with shop drawings and standard installation clearances as recommended by ANSI / NAAMM Metal Bar Grating Manual
- G. Cutting, Fitting and Placement.
 - 1. Perform all cutting and fitting required for installation. Grating shall be placed such that cross bars align.
 - 2. Wherever grating is pierced by pipes, ducts and structural members, cut openings neatly and accurately to size and weld a rectangular band bar of the same height and material as the bearing bars.
 - 3. Cutouts for circular obstructions are to be at least 50 mm (2 inches) larger in diameter than the obstruction.
 - 4. Utilize standard panel widths wherever possible.
- H. 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. 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 for bolted or screwed field connections.
 - 3. Obtain fusion without undercut or overlap.
 - 4. Remove welding flux immediately.
- I. 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.

3.02 ADJUSTING AND CLEANING

- A. Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with same material as used for shop painting to comply with SSPC-PA 1 requirements for touching up shop-painted surfaces.

END OF SECTION 05531

SECTION 05532 FIBERGLASS GRATINGS

1.00 GENERAL

1.01 SCOPE

This section provides for gratings at depressed slab locations and openings in concrete for equipment and piping penetrations, and for floor trench coverings where corrosive cleaners shall be used.

1.02 SUMMARY

- A. Section Includes:
 - 1. Glass-fiber-reinforced plastic gratings.
- B. Related Sections:
 - 1. Division 3 Section "Cast-in-Place Concrete" for recessed concrete floor slabs.

1.03 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Design gratings, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
- B. Structural Performance: Gratings shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated.
 - 1. Floors: Uniform load of 125 lbf/sq. ft. or concentrated load of 2000 lbf, whichever produces the greater stress.
 - 2. Limit deflection to L/240 or 355 mm (1/4 inch), whichever is less.
- C. Seismic Performance: Provide gratings capable of withstanding the effects of earthquake motions determined according to structural seismic criteria for the seismic zone and equipment requirements.

1.04 SUBMITTALS

- A. Product Data: For the following:
 - 1. Glass-fiber-reinforced plastic gratings.
 - 2. Clips and anchorage devices for gratings.
- B. Shop Drawings: Include plans, sections, details, and attachments to other work.
- C. 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.
- D. Qualification Data: For qualified professional engineer.

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- E. Mill Certificates: Signed by manufacturers of stainless-steel sheet certifying that products furnished comply with requirements.

1.05 QUALITY ASSURANCE

- A. Installer Qualifications: Capable of assuming engineering responsibility and performing Work of this Section and who is acceptable to manufacturer.

1.06 PROJECT CONDITIONS

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

1.07 COORDINATION

- A. Coordinate installation of anchorages for gratings, grating frames, and supports. 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.

2.00 PRODUCTS

2.01 FASTENERS

- A. General: Use fasteners approved by manufacturer. Select fasteners for type, grade, and class required.
- B. Stainless-Steel Bolts and Nuts: Regular hexagon-head annealed stainless-steel bolts, nuts, and, where indicated, flat washers; ASTM F 593 for bolts and ASTM F 594 for nuts, Alloy Group 1.
- C. Anchor Bolts: ASTM F 1554, Grade 36, of dimensions indicated; with nuts, ASTM A 563; and, where indicated, flat washers.
- D. Plain Washers: Round, ASME B18.22.1.
- E. Lock Washers: Helical, spring type, ASME B18.21.1.
- F. Post-Installed Anchors: Torque-controlled expansion anchors capable of sustaining, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing according to ASTM E 488, conducted by a qualified independent testing agency.
 - 1. Material for Exterior Locations and Where Stainless Steel is Indicated: Alloy Group 1 stainless-steel bolts, ASTM F 593, and nuts, ASTM F 594.

2.02 FABRICATION

- A. Shop Assembly: Fabricate grating sections in shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping

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Bidder / Contractor

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 material 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 from materials of size, thickness, and shapes indicated, but not less than that needed to support indicated loads.
- D. Fit exposed connections accurately together to form hairline joints.
 - 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.
- E. Provide for anchorage of type indicated; coordinate with supporting structure. Fabricate and space the anchoring devices to secure gratings, frames, and supports rigidly in place and to support indicated loads.

2.03 GLASS-FIBER-REINFORCED PLASTIC GRATINGS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. American Grating, LLC.
 - 2. Creative Pultrusions, Inc.
 - 3. Enduro Systems Inc.; Composite Products Division.
 - 4. Fibergrate Composite Structures Inc.
 - 5. Strongwell Corporation.
 - 6. McNichols.
- B. Pultruded Glass-Fiber-Reinforced Gratings: Bar gratings assembled from components made by simultaneously pulling glass fibers and extruding thermosetting plastic resin through a heated die under pressure to produce a product without voids and with a high glass-fiber content.
 - 1. Configuration: I4010; 1-inch I-bars spaced 1 inch o.c. (40 percent open) .
 - 2. Weight: 4.10 lb/sq. ft. .
 - 3. Resin Type: Vinyl Ester.
 - a. Flame-Spread Index: 25 or less when tested according to ASTM E 84.
 - 4. Color: Yellow.
 - 5. Traffic Surface: Applied abrasive finish.
- C. Fabricate cutouts in grating sections for penetrations indicated. Arrange cutouts to permit grating removal without disturbing items penetrating gratings.

Read and accepted as part of the Contract:

Bidder / Contractor

2.04 GRATING FRAMES AND SUPPORTS

- A. Frames and Supports for Glass-Fiber-Reinforced Plastic Gratings: Fabricate from glass-fiber-reinforced plastic shapes of sizes, shapes, and profiles indicated and as necessary to receive gratings. Miter connections for perimeter angle frames. Cut, drill, and tap units to receive hardware and similar items.
 - 1. Unless otherwise indicated, use shapes made from same resin as gratings.

3.00 EXECUTION

3.01 INSTALLATION, GENERAL

- A. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing gratings to in-place construction. Include threaded fasteners for concrete and masonry inserts, through-bolts, lag bolts, and other connectors.
- B. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing gratings. Set units accurately in location, alignment, and elevation; measured from established lines and levels and free of rack.
- C. Provide temporary bracing or anchors in formwork for items that are to be built into concrete or masonry.
- D. Fit exposed connections accurately together to form hairline joints.

3.02 INSTALLING GLASS-FIBER-REINFORCED PLASTIC GRATINGS

- A. Comply with manufacturer's written instructions for installing gratings. Use manufacturer's standard stainless-steel anchor clips and hold-down devices for bolted connections.

3.03 ADJUSTING AND CLEANING

- A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with same material as used for shop painting to comply with SSPC-PA 1 requirements for touching up shop-painted surfaces.

END OF SECTION 05532

SECTION 05811

ARCHITECTURAL JOINT SYSTEMS

1.00 GENERAL

1.01 SCOPE

- A. This Section includes labor and materials to install architectural joint systems for building interiors and building exteriors.
- B. Related Sections:
 - 1. Division 3 Section "Cast-in-Place Concrete" for cast-in architectural-joint-system frames furnished, but not installed, in this Section.
 - 2. Division 4 Section "Unit Masonry Assemblies" for masonry wall joint systems.
 - 3. Division 7 Section "Sheet Metal Flashing and Trim" for sheet metal wall joint systems.
 - 4. Division 7 Section "Fire-Resistive Joint Systems" for fire barriers installed in joint systems.
 - 5. Division 7 Section "Joint Sealants" for liquid-applied joint sealants.

1.02 DEFINITIONS

- A. Maximum Joint Width: Widest linear gap a joint system tolerates and in which it performs its designed function without damaging its functional capabilities.
- B. Minimum Joint Width: Narrowest linear gap a joint system tolerates and in which it performs its designed function without damaging its functional capabilities.
- C. Movement Capability: Value obtained from the difference between widest and narrowest widths of a joint opening typically expressed in numerical values (mm or inches) or a percentage (plus or minus) of nominal value of joint width.
- D. Nominal Joint Width: The width of the linear opening specified in practice and in which the joint system is installed.

1.03 SUBMITTALS

- A. Samples for Initial Selection: For each type of joint system indicated.
 - 1. Include manufacturer's color charts showing the full range of colors and finishes available for each exposed metal and elastomeric seal material.
- B. Samples for Verification: For each type of architectural joint system indicated.
 - 1. Full width by 6 inches long, for each system required.

1.04 QUALITY ASSURANCE

- A. Installer Qualifications: An employer of workers trained and approved by manufacturer.

Read and accepted as part of the Contract:

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- B. Product Options: Drawings indicate size, profiles, and dimensional requirements of architectural joint systems and are based on the specific systems indicated. Refer to Division 1 Section "Product Requirements."
 - 1. Do not modify intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If modifications are proposed, submit comprehensive explanatory data to Architect for review.
- C. Accessibility Requirements: Comply with applicable provisions in the Philippine accessibility guidelines and the U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA), Accessibility Guidelines (ADAAG)".

1.05 COORDINATION

- A. Coordinate installation of exterior walljoint systems with roof expansion assemblies to ensure that wall transitions are watertight. Roof expansion assemblies are specified in Division 7.

2.00 PRODUCTS

2.01 MATERIALS

- A. Aluminum: ASTM B 221, Alloy 6063-T5 for extrusions; ASTM B 209, Alloy 6061-T6 for sheet and plate.
 - 1. Apply manufacturer's standard protective coating on aluminum surfaces to be placed in contact with cementitious materials.
- B. Elastomeric Seals: Preformed elastomeric membranes or extrusions to be installed in metal frames.
- C. Cellular Foam Seals: Extruded, compressible foam designed to function under compression.
- D. Accessories: Manufacturer's standard anchors, clips, fasteners, set screws, spacers, and other accessories compatible with material in contact, as indicated or required for complete installations.
- E. Fire Barrier: Furnished and installed in joint under Section 07842.

2.02 ARCHITECTURAL JOINT SYSTEMS, GENERAL

- A. General: Provide architectural joint systems of design, basic profile, materials, and operation indicated. Provide units with capability to accommodate variations in adjacent surfaces.
 - 1. Furnish units in longest practicable lengths to minimize field splicing. Install with hairline mitered corners where joint changes direction or abuts other materials.

2. Include factory-fabricated closure materials and transition pieces, tee-joints, corners, curbs, cross-connections, and other accessories as required to provide continuous joint systems.
- B. Design architectural joint systems for the following size and movement characteristics:
 1. Nominal Joint Width: 100 mm (4 inches).
 2. Movement Capability: Plus or minus 50 percent.

2.03 ARCHITECTURAL JOINT SYSTEMS FOR BUILDING INTERIORS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. Balco, Inc.
 2. Construction Specialties, Inc.
 3. MM Systems Corporation.
 4. Nystrom, Inc.
 5. Watson Bowman Acme Corp.
- B. Floor-to-Floor Joint Systems:
 1. Basis-of-Design Product: Construction Specialties, Inc., SJPF-400 with Fire Barrier.
 2. Type: Extruded aluminum frames in recessed slab. Spring-loaded turnbar assembly with aluminum cover plate.
 - a. Exposed Metal and Frame: Aluminum.
 - 1) Finish: Manufacturer's standard finish.
 - b. Turnbar: Stainless Steel.
 - c. Recess Depth: As required to accommodate adjacent flooring.
 3. Attachment Method: Mechanical anchors.
 4. Load Capacity: Standard duty.
- C. Wall-to-Wall Joint Systems:
 1. Basis-of-Design Product: Construction Specialties, Inc., FWFC-400M.
 2. Type: Aluminum frame with Elastomeric seal.
 - a. Exposed Metal: Aluminum.
 - 1) Finish: Manufacturer's standard finish.
 - b. Seal Material: Elastomeric.
 - 1) Color: As selected by Architect from manufacturer's full range.
- D. Floor to Wall Joint Systems:

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1. Basis-of-Design Product: Construction Specialties, Inc., SJPFW-400 with Fire Barrier.
 2. Type: Extruded Aluminum frame in recessed slab on one side.
 - a. Exposed Metal: Aluminum.
 - 1) Finish: Manufacturer's standard finish.
 - b. Seal Material: Elastomeric.
 - 1) Color: As selected by Architect from manufacturer's full range.
- E. Ceiling-to-Ceiling Joint Systems:
1. Basis-of-Design Product: Construction Specialties, Inc., FCF-400.
 2. Type: Elastomeric seal.
 - a. Exposed Metal: Aluminum.
 - 1) Finish: Manufacturer's standard finish.
 - b. Seal Material: Elastomeric.
 - 1) Color: As selected by Architect from manufacturer's full range.

2.04 ARCHITECTURAL JOINT SYSTEMS FOR BUILDING EXTERIORS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Balco, Inc.
 2. Construction Specialties, Inc.
 3. EMSEAL Joint Systems, Ltd.
 4. MM Systems Corporation.
 5. Nystrom, Inc.
 6. Tremco Sealant/Weatherproofing Division.
 7. Watson Bowman Acme Corp.
- B. Roof to Wall Exterior Joint Systems :
1. Basis-of-Design Product: Construction Specialties, Inc., BRJW-400 with Fire Barrier.
 2. Type: Aluminum frame with preformed cellular foam.
 - a. Foam Material: Manufacturer's standard.
 - 1) Color: As selected by Architect from manufacturer's full range.
Provide up to two different colors.
 - b. Exposed Metal: Aluminum.
 - c. Finish: Manufacturer's standard finish
 3. Attachment Method: Mechanically fastened.
- C. Wall to Wall Exterior Joint System
1. Basis-of-Design Product: Construction Specialties, Inc., FWF-400 with Fire Barrier.
 2. Type: Aluminum frame with elastomeric seal and secondary moisture barrier.
 - a. Outer Seal: Elastomeric.

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- 1) Color: As selected by Architect from manufacturer's full range. Provide up to two different colors.
 - b. Inner Seal: Manufacturer's standard.
 - c. Metal Frame: Aluminum.
- 1) Finish: Manufacturer's standard finish.
 - a. Exterior Cover Plate: Aluminum
 - 1) Finish: Match adjacent wall panels.
- D. Attachment Method: Mechanically fastened.

2.05 FINISHES

- A. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Noticeable variations in joint system pieces on the same elevations are not acceptable.

3.00 EXECUTION

3.01 EXAMINATION

- A. Examine surfaces and blockouts where architectural joint systems will be installed for installation tolerances and other conditions affecting performance of work.
 - 1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

- A. Prepare substrates according to architectural joint system manufacturer's written instructions.
- B. Repair concrete slabs and block-outs using manufacturer's recommended repair grout of compressive strength adequate for anticipated structural loadings.
- C. Coordinate and furnish anchorages, setting drawings, and instructions for installing joint systems. Provide fasteners of metal, type, and size to suit type of construction indicated and to provide for secure attachment of joint systems.

3.03 INSTALLATION

- A. Comply with manufacturer's written instructions for storing, handling, and installing architectural joint assemblies and materials unless more stringent requirements are indicated.
- B. Metal Frames: Perform cutting, drilling, and fitting required to install joint systems.
 - 1. Install in true alignment and proper relationship to joints and adjoining finished surfaces measured from established lines and levels.
 - 2. Adjust for differences between actual structural gap and nominal design gap due to ambient temperature at time of installation. Notify Architect where discrepancies occur that will affect proper joint installation and performance.

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3. Cut and fit ends to accommodate thermal expansion and contraction of metal without buckling of frames.
 4. Locate in continuous contact with adjacent surfaces.
 5. Standard-Duty Systems: Shim to level where required. Support underside of frames continuously to prevent vertical deflection when in service.
 6. Locate anchors at interval recommended by manufacturer, but not less than 80 mm (3 inches) from each end and not more than 610 mm (24 inches) OC.
- C. Seals in Metal Frames: Install elastomeric seals and membranes in frames to comply with manufacturer's written instructions. Install with minimum number of end joints.
1. Provide in continuous lengths for straight sections.
 2. Seal transitions according to manufacturer's written instructions. Vulcanize or heat-weld field-spliced joints as recommended by manufacturer.
 3. Installation: Mechanically lock seals into frames or adhere to frames with adhesive or pressure-sensitive tape as recommended by manufacturer.
- D. Compression Seals:
1. Apply adhesive as recommended by manufacturer before installing compression seals.
 2. Seal transitions according to manufacturer's written instructions.
 3. Install silicone sealant fillet beads at edges as recommended by manufacturer, color to be selected by Architect from manufacturer's standard colors.
- E. Water Barrier: Provide water barrier at exterior joints and where called for on Drawings.

3.04 PROTECTION

- A. Do not remove protective covering until finish work in adjacent areas is complete. When protective covering is removed, clean exposed metal surfaces to comply with manufacturer's written instructions.
- B. Protect the installation from damage by work of other Sections. Where necessary due to heavy construction traffic, remove and properly store cover plates or seals and install temporary protection over joints. Reinstall cover plates or seals prior to Final Acceptance of the Work.

END OF SECTION 05811