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USACE / NAVFAC / AFCEA / NASA                      UFGS-07 40 00.00 40 (April 2006)  
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Preparing Activity:    NASA                      Superseding  
   NASA-07400S (December 2005)

## UNIFIED FACILITIES GUIDE SPECIFICATIONS

References are NOT in agreement with UMRL dated 01 April 2006

Revised throughout - changes not indicated by CHG tags

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### SECTION TABLE OF CONTENTS

#### DIVISION 07 - THERMAL AND MOISTURE PROTECTION

##### SECTION 07 40 00.00 40

##### ROOFING AND SIDING PANELS

04/06

#### PART 1    GENERAL

- 1.1    REFERENCES
- 1.2    PERFORMANCE REQUIREMENTS
  - 1.2.1    Properties of Sections
  - 1.2.2    Allowable Design Stress, Deflection, and Loads
- 1.3    SUBMITTALS
- 1.4    QUALIFICATIONS FOR WELDING WORK
- 1.5    DELIVERY, HANDLING, AND STORAGE
- 1.6    FIELD MEASUREMENTS
- 1.7    GENERAL INFORMATION

#### PART 2    PRODUCTS

- 2.1    ALUMINUM MATERIALS
  - 2.1.1    Aluminum Roofing and Siding
  - 2.1.2    Exterior Sheets
  - 2.1.3    Interior Sheets
  - 2.1.4    Insulated Panel Construction
  - 2.1.5    Flashing and Accessories
- 2.2    STEEL SHEET MATERIALS
  - 2.2.1    Steel Roofing, Siding Sheets and Panels
  - 2.2.2    Profile of Sheet
  - 2.2.3    Side Laps
  - 2.2.4    Insulated Panel Construction
  - 2.2.5    Zinc-Coated Steel
  - 2.2.6    Aluminum-Coated Steel
  - 2.2.7    Baked-Enamel-Coated Steel
  - 2.2.8    Porcelain-Enamel-Coated Steel
  - 2.2.9    Protected Metal
- 2.3    SUBGIRTS AND FORMED SHAPES
  - 2.3.1    Galvanized Steel Angles
  - 2.3.2    Electrodes for Manual, Shielded Metal Arc Welding
- 2.4    FASTENERS

- 2.5 CLOSURE MATERIALS
  - 2.5.1 Mastic Closure Strips
  - 2.5.2 Adhesives for Closure Strips
  - 2.5.3 Metal Closure Strips
  - 2.5.4 Joint Sealants
    - 2.5.4.1 Sealants
    - 2.5.4.2 Shop Applied
    - 2.5.4.3 Field Applied
- 2.6 INSULATION
- 2.7 METAL WAINSCOT
- 2.8 FIRE-RATED WALLS
  - 2.8.1 Materials
  - 2.8.2 Fire-Rating
- 2.9 FABRICATION OF METAL PANELS
- 2.10 REPAIR OF FINISH-PROTECTED MATERIALS
  - 2.10.1 Galvanizing Repair Paint
  - 2.10.2 Enamel Repair Paint
  - 2.10.3 Aluminized Steel Repair Paint
- 2.11 LEAD FLASHING FOR MECHANICAL SERVICES

### PART 3 EXECUTION

- 3.1 INSTALLATION
- 3.2 ALIGNMENT OF STRUCTURAL FRAME
- 3.3 WELDING
- 3.4 FASTENING SYSTEM
  - 3.4.1 Single Sheet, Uninsulated Metal Roofing and Siding
  - 3.4.2 Sandwich Wall Construction
  - 3.4.3 Metal and Insulation-Faced Construction
- 3.5 DISSIMILAR METALS
- 3.6 JOINT SEALANTS
- 3.7 FLASHING AND CLOSURE INSTALLATION
  - 3.7.1 Metal Flashing
  - 3.7.2 Closures
- 3.8 METAL WAINSCOT
- 3.9 ACCEPTANCE PROVISIONS
  - 3.9.1 Erection Tolerances
  - 3.9.2 Leakage Tests
  - 3.9.3 Repairs to Finish
  - 3.9.4 Paint-Finish Metal Roofing and Siding

-- End of Section Table of Contents --

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### SECTION 07 40 00.00 40

#### ROOFING AND SIDING PANELS 04/06

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NOTE: Delete, revise, or add to the text in this section to cover project requirements. Notes are for designer information and will not appear in the final project specification.

This section covers aluminum and steel roofing and siding, single-sheet uninsulated and insulated metal panels, and fire-rated metal walls.

This section does not include structural steel girts, metal deck in combination with built up roofing, flashing, fascias, and copings not directly connected with metal roofing and siding work.

Drawings must indicate location and extent of work, design load assumptions, location and span of structural framing, construction details, material thicknesses, and special conditions.

Drawings must also indicate panel dimensions sheet profile, thickness, span between structural supports, wall and roof openings and special framing, color, and required fire-rating.

Drawings must indicate locations and type of closure strip required, flashing installation and wainscot height.

Comments and suggestions on this guide specification are welcome and should be directed to the technical proponent of the specification. A listing of [technical proponents](#), including their organization designation and telephone number, is on the Internet.

Recommended changes to a UFGS should be submitted as a [Criteria Change Request \(CCR\)](#).

Use of electronic communication is encouraged.

Brackets are used in the text to indicate designer choices or locations where text must be supplied by the designer.

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## PART 1 GENERAL

### 1.1 REFERENCES

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NOTE: This paragraph is used to list the publications cited in the text of the guide specification. The publications are referred to in the text by basic designation only and listed in this paragraph by organization, designation, date, and title.

Use the Reference Wizard's Check Reference feature when you add a RID outside of the Section's Reference Article to automatically place the reference in the Reference Article. Also use the Reference Wizard's Check Reference feature to update the issue dates.

References not used in the text will automatically be deleted from this section of the project specification when you choose to reconcile references in the publish print process.

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The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

#### ALUMINUM ASSOCIATION (AA)

AA ASD-1 (2003) Aluminum Standards and Data

#### AMERICAN INSTITUTE OF STEEL CONSTRUCTION (AISC)

AISC 341 (2005) Seismic Provisions for Structural Steel Buildings

#### AMERICAN IRON AND STEEL INSTITUTE (AISI)

AISI/COS/NASPEC (2001, R 2002) North American Specification for the Design of Cold-Formed Steel Structural Members

#### AMERICAN WELDING SOCIETY (AWS)

AWS A5.1/A5.1M (2004) Carbon Steel Electrodes for Shielded Metal Arc Welding

AWS D1.1/D1.1M (2004) Structural Welding Code-Steel

#### ASTM INTERNATIONAL (ASTM)

ASTM A 1008/A 1008M (2005a) Standard Specification for Steel,

	Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardened
ASTM A 123/A 123M	(2002) Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
ASTM A 36/A 36M	(2005) Standard Specification for Carbon Structural Steel
ASTM A 424	(2000) Standard Specification for Steel Sheet for Porcelain Enameling
ASTM A 463/A 463M	(2005) Standard Specification for Steel Sheet, Aluminum-Coated
ASTM A 606	(2004) Standard Specification for Steel Sheet and Strip, High-Strength, Low-Alloy, Hot-Rolled and Cold-Rolled, with Improved Atmospheric Corrosion Resistance
ASTM A 653/A 653M	(2004a) Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
ASTM A 780	(2001) Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings
ASTM A 924/A 924M	(2004) Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process
ASTM B 209	(2004) Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate
ASTM B 209M	(2004) Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate (Metric)
ASTM B 749	(2003) Standard Specification for Lead and Lead Alloy Strip, Sheet and Plate Products
ASTM C 286	(1999; 2004) Standard Terminology Relating to Porcelain Enamel and Ceramic-Metal Systems
ASTM C 553	(2002) Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications
ASTM C 920	(2005) Standard Specification for Elastomeric Joint Sealants
ASTM D 1056	(2000) Standard Specification for Flexible Cellular Materials - Sponge or Expanded Rubber

ASTM E 648 (2004) Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source

PORCELAIN ENAMEL INSTITUTE (PEI)

PEI 1001 (1996) Specification for Architectural Porcelain Enamel (ALS-100)

THE SOCIETY FOR PROTECTIVE COATINGS (SSPC)

SSPC Paint 12 (1982) Paint Specification No. 12 Cold-Applied Asphalt Mastic (Extra Thick Film)

U.S. DEPARTMENT OF DEFENSE (DOD)

MS MIL-P-28578 (1998b) Paint, Water-Borne, Acrylic or Modified Acrylic, Semi-Gloss, for Metal Surfaces

U.S. GENERAL SERVICES ADMINISTRATION (GSA)

FS SS-L-30 (Rev D; Int Am 3) Lath and Board Products, Gypsum

UNDERWRITERS LABORATORIES (UL)

UL Bld Mat Dir (2005) Building Materials Directory

## 1.2 PERFORMANCE REQUIREMENTS

### 1.2.1 Properties of Sections

Properties of steel roofing and siding sections shall be in accordance with ASTM E 648 and AISI/COS/NASPEC.

Section properties, including yield point, section modulus, and moment of inertia per millimeter foot of width, shall equal or exceed the required values of section properties.

### 1.2.2 Allowable Design Stress, Deflection, and Loads

Allowable design stress, deflection, and loads for the metal roofing and siding shall be as follows:

Deflection of metal roofing and siding shall not exceed 1/180 under the indicated total dead and live load.

Resistance to gross uplift shall be [ ] pascal [ ] pounds per square foot (psf) for eave overhang, and [ ] pascal [ ] psf for other roof areas.

Resistance to wind pressure loading shall be not less than [ ] [ ] pascal [ ] psf for exterior metal siding.

### 1.3 SUBMITTALS

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NOTE: Review Submittal Description (SD) definitions in Section 01 33 00 SUBMITTAL PROCEDURES and edit the following list to reflect only the submittals required for the project. Submittals should be kept to the minimum required for adequate quality control.

A "G" following a submittal item indicates that the submittal requires Government approval. Some submittals are already marked with a "G". Only delete an existing "G" if the submittal item is not complex and can be reviewed through the Contractor's Quality Control system. Only add a "G" if the submittal is sufficiently important or complex in context of the project.

For submittals requiring Government approval on Army projects, a code of up to three characters within the submittal tags may be used following the "G" designation to indicate the approving authority. Codes for Army projects using the Resident Management System (RMS) are: "AE" for Architect-Engineer; "DO" for District Office (Engineering Division or other organization in the District Office); "AO" for Area Office; "RO" for Resident Office; and "PO" for Project Office. Codes following the "G" typically are not used for Navy, Air Force, and NASA projects.

Choose the first bracketed item for Navy, Air Force and NASA projects, or choose the second bracketed item for Army projects.

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Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are [for Contractor Quality Control approval.] [for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government.] Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

#### SD-02 Shop Drawings

[Fabrication Drawings](#) for metal roofing and siding units shall be in accordance with paragraph entitled, "General Information," of this section.

Installation drawings for the following items shall indicate completely dimensioned structural frame and erection layouts, openings in roof and walls, special framing details, construction details at corners, ridges, eaves, building intersections, curbs and flashing, location and type of mastic and metal filler strips, location and erection of subgirts, sandwich walls, and fire-rated walls.

[Aluminum Roofing and Siding](#)  
[Steel Roofing, Siding Sheets and Panels](#)

## Flashing and Accessories

### SD-03 Product Data

Manufacturer's data shall be submitted indicating percentage of recycle material in roofing and siding panels to verify affirmative procurement compliance.

Total weight and volume quantities of roofing and siding panels with recycle material shall be submitted.

Manufacturer's catalog data shall be submitted for the following items:

- Aluminum Materials
- Steel Sheet Materials
- Subgirts and Formed Shapes
- Closure Materials
- Insulation
- Metal Wainscot
- Fire-Rated Walls
- Galvanizing Repair Paint
- Lead Flashing
- Enamel Repair Paint
- Aluminized Steel Repair Paint

### SD-04 Samples

Contractor shall submit three pieces each of the following samples:

- Aluminum Roofing and Siding
- Steel Roofing, Siding Sheets and Panels
- Fasteners
- Metal Closure Strips, 250 millimeter 10 inches long of each type
- Sandwich Wall, 200 by 280 millimeter 8 by 11 inches
- Insulation, approximately 200 by 280 millimeter 8 by 11 inches

Contractor shall submit three pieces each of the different color panels used in design for this contract, approximately 100 by 100 millimeter 4 by 4 inches. Color shall be selected in accordance with the various applications for steel roofing, siding, flashing, fasteners, calk and sealants, and repair paint as specified in the design.

### SD-06 Test Reports

Test reports for the following shall be submitted in accordance with the referenced articles in this section.

#### Leakage Tests

Coatings and base metals of metal roofing and siding type of test as specified in paragraphs entitled, "Aluminum Materials" and "Steel Sheet Materials," and in various referenced standards in this section.

### SD-07 Certificates

Certificates shall be submitted for the following items showing



conformance with referenced standards contained in this section.

Fasteners  
Galvanizing Repair Paint  
Enamel Repair Paint  
Aluminized Steel Repair Paint  
Fire Rated Wall Construction  
Gypsum Wallboard

#### 1.4 QUALIFICATIONS FOR WELDING WORK

Welding procedures shall be in accordance with AWS D1.1/D1.1M.

Operators shall be permitted to make only those types of weldments for which each is specifically qualified.

#### 1.5 DELIVERY, HANDLING, AND STORAGE

Metal roofing and siding shall be carefully handled at all times to prevent damage to the surfaces, edges, and ends. Contractor shall be responsible for arrangement with the manufacturer for adequate packaging and protection during shipment and offsite storage. Upon arrival at the job site, the sheets shall be checked for damage, dampness, and wet storage stain.

Moisture shall be removed from dampened or wetted sheets. Sheets not immediately used in the work shall be stored and protected in a covered, dry location that provides good air circulation free from effects of moisture and other corrosive environments. Sheets found with damage or stain shall not be used in the work.

#### 1.6 FIELD MEASUREMENTS

Field measurements shall be taken prior to preparation of drawings and fabrication.

#### 1.7 GENERAL INFORMATION

Fabrication Drawings for metal roofing and siding units shall indicate material, thickness, width and length, and any special miter or bevel cuts.

### PART 2 PRODUCTS

#### 2.1 ALUMINUM MATERIALS

##### 2.1.1 Aluminum Roofing and Siding

Aluminum roofing and siding shall be continuous, roll-formed sheets, Alclad 3004-H36 alloy, with a minimum ultimate tensile strength of 235 Megapascal 34,000 pounds per square inch (psi) and a minimum yield strength of 207 Megapascal 30,000 psi, and shall conform to ASTM B 209M ASTM B 209 and AA ASD-1.

Aluminum roofing sheets shall be of sufficient length to bridge at least three spans plus the required end lap. Siding sheets shall extend full height of walls without horizontal joints.

[Finish of sheets shall be manufacturer's standard stucco embossed pattern.]

[Finish of sheets shall be low specular gloss finish.]

### 2.1.2 Exterior Sheets

[Sheets shall be corrugated aluminum, 68 millimeter pitch by 22 millimeter depth, 0.81 millimeter 2.67 inch pitch by 7/8 inch depth, 0.032 inch thick.]

[Sheets shall be ribbed aluminum, 100 millimeter pitch by 25 millimeter depth, 1.0 millimeter 4 inch pitch by 1 inch depth, 0.040 inch thick.]

[Sheets shall be ribbed aluminum, 200 millimeter pitch by 25 millimeter depth, 1.0 millimeter 8 inch pitch by 1 inch depth, 0.040 inch thick.]

[Sheets shall be V-beam aluminum, 124 millimeter pitch by 45 millimeter depth, 1.0 millimeter 4-7/8 inch pitch by 1-3/4 inch depth, 0.040 inch thick.]

[Sheets shall be vertical, ribbed or fluted architectural pattern.]

### 2.1.3 Interior Sheets

\*\*\*\*\*  
NOTE: Select one of the following two paragraphs,  
when insulated construction with inner sheets is  
required.  
\*\*\*\*\*

[Interior sheets shall be corrugated aluminum sheets, 68 millimeter pitch by 22 millimeter depth, 0.61 millimeter 2.67 inch pitch by 7/8 inch depth, 0.024 inch thick.]

[Interior sheets shall be vertical, ribbed or fluted architectural pattern aluminum sheets.]

### 2.1.4 Insulated Panel Construction

Insulated panel construction shall be composed of the specified exterior and interior aluminum sheet erected in accordance with manufacturer's printed instructions. Insulation shall be of thickness and density required.

### 2.1.5 Flashing and Accessories

Field-formed flashing, corners, closers, fillers, and aluminum expansion joints shall be flat aluminum sheet, 1.0 millimeter 0.040 inch thick, same finish and alloy as specified for roofing and siding, except that temper may be Alclad 3004-0 annealed temper.

Preformed aluminum sheet flashing for corrugated sheet and plain-ridge rolls shall be 0.81 millimeter 0.032 inch thick Alclad 3004-0, same finish as the specified roofing and siding.

## 2.2 STEEL SHEET MATERIALS

### 2.2.1 Steel Roofing, Siding Sheets and Panels

Roofing and siding sheets and panels shall be roll formed to the specified profile, thickness and depth as indicated. Material shall be plumb and true, and within the tolerances listed in ASTM A 653/A 653M and ASTM A 924/A 924M.

Flashings, dormers, closers, fillers, metal expansion joints, ridge rolls, and other sheet metal accessories shall be factory-formed material of the same type and quality finish as specified for roofing and siding sheets, and shall be not less than 0.61 millimeter 0.0239 inch thick.

Roofing sheets shall be of sufficient length to bridge at least three spans plus the required end lap. Siding sheets shall extend full height of walls, without horizontal joints.

Roofing material, before coating, shall be not less than 0.76 millimeter 0.0299 inch thick. Siding material, before coating, shall be not less than 0.61 millimeter 0.0239 inch thick.

#### 2.2.2 Profile of Sheet

[Profile shall be corrugated pattern, 68 millimeter 2.67 inch pitch by [14] [22] millimeter [9/16] [7/8] inch depth, thickness.]

[Profile shall be ribbed corrugated pattern, 100 millimeter pitch by 25 millimeter depth, 41 millimeter top flat and 35 millimeter 4 inch pitch by 1 inch depth, 1-5/8 inch top flat and 1-3/8 inch bottom flat.]

[Sheet profile shall be ribbed corrugated pattern, 200 millimeter pitch by 25 millimeter depth, 143 millimeter top flat and 35 millimeter 8 inch pitch by 1 inch depth, with 5-5/8 inch top flat and 1-3/8 inch bottom flat.]

[Profile shall be V-beam corrugated pattern, 124 millimeter pitch by 45 millimeter depth, with 19 millimeter 4-7/8 inch pitch by 1-3/4 inch depth with 3/4 inch top and bottom flat.]

[Profile shall be fluted architectural pattern, 300 millimeter wide by 38 millimeter 12 inches wide by 1-1/2 inches deep, profile and thickness as indicated, and with continuous interlocking ribs at the side joints.]

[Profile shall be vertical, ribbed or fluted architectural pattern.]

#### 2.2.3 Side Laps

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NOTE: Delete paragraph heading and following two paragraphs if architectural pattern fluted sheets are selected.

When corrugated pattern sheets are required, select the type of side lap application.

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[Side joint laps shall be manufacturer's standard lapped joint for the specified corrugation profile, sealed, and then fastened with sheet metal screws.]

[Side joint lap shall be a factory-formed, interlocking side joint, formed with a standing seam side lap, approximately 38 millimeter 1-1/2 inches high, and with a factory-applied joint seal.]

#### 2.2.4 Insulated Panel Construction

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**NOTE: Delete paragraph heading and following paragraphs if sandwich or insulated metal wall construction is not required.**

**When insulated sandwich wall construction with an interior steel sheet is required, select first paragraph.**

\*\*\*\*\*

[Panel shall consist of an exterior and interior steel sheet of profile and coating specified with insulation of thickness indicated. Panels shall be secured in accordance with manufacturer's instructions.]

[Panel shall consist of an exterior steel sheet of profile and coating specified with insulation of thickness indicated. Panels shall be secured in accordance with manufacturer's instructions.]

Glass-Fiber and Mineral Wool/Fiber are materials listed in the EPA's Comprehensive Procurement Guidelines (CPG) (<http://www.epa.gov/cpg/>)

EPA's recommended Recovered Materials Content Levels for building insulation.

Product	Material	Percent Of Post Consumer Materials	Percent Of Total Consumer Materials
Rock Wool	Slag		75
Fiberglass	Glass Cullet		20 - 25
Cellulose Loose Fill & Spray-on	Post Consumer Paper	75	75
Perlite Composite Board	Post Consumer Paper	23	23
Plastic Rigid Foam, Polyisocyanurate/ Polyurethane			
Rigid Foam			9
Foam-in-Place			5
Glass Fiber Reinforced			6
Phenolic Rigid Foam			5
Plastic, Non- Woven Batt	Recovered and /or Post Consumer Plastics		100

The recommended recovered materials content levels are based on the weight (not volume) of materials in the insulating core only.

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NOTE: If the Architect/Engineer determines that use of certain materials meeting the CPG content standards and guidelines would result in inadequate competition, do not meet quality/performance specifications, are available at an unreasonable price or are not available within a reasonable time frame, the Architect/Engineer may submit to Contracting Officer a written justification and supporting documentation for not procuring designated items containing recovered material using the Recovered Materials Determination Form.  
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For informational purposes, a list of known sources for roofing and siding panels using recycled material is provided in the EPA/CPG Supplier database at [http://www.ergweb2.com/cpg4review/user/cpg\\_search.cfm](http://www.ergweb2.com/cpg4review/user/cpg_search.cfm).

Note that the Contractor is not limited to these sources. A product meeting CPG recycle requirements from other sources may be submitted for the Government's approval.

Contractor shall submit recycled material content data for roofing and siding panels indicating compliance with affirmative procurement.

Contractor shall submit total weight and volume quantities of roofing and siding panels with recycle material.

\*\*\*\*\*  
NOTE: Select one of the following five categories of coated steel for steel roofing and siding of the required quality and durability.  
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#### 2.2.5 Zinc-Coated Steel

Roofing and siding sheets shall be fabricated from hot-dip-galvanized steel conforming to ASTM A 653/A 653M, Grade A, and corrugation dimensions and profile as specified. Sheets shall be coated in accordance with ASTM A 653/A 653M and ASTM A 924/A 924M.

#### 2.2.6 Aluminum-Coated Steel

Roofing and siding sheets shall be fabricated from aluminum-coated steel sheets conforming to ASTM A 463/A 463M, Type II, and furnished in the profile specified. Steel shall be cold-rolled, low-carbon steel conforming to ASTM A 606, ASTM E 648 and AISI/COS/NASPEC. Coating shall be 99 percent commercially pure aluminum with a maximum of 1 percent silicon plus iron. Coating shall be hot-dip applied to both sides of the steel sheet to a total of at least 300 gram 1 ounce of aluminum per square meter foot of surface, both sides, and a total thickness of at least 0.051 millimeter. 2 mils.

#### 2.2.7 Baked-Enamel-Coated Steel

Roofing and siding sheets shall be enamel-coated, hot-dip galvanized steel conforming to ASTM A 653/A 653M, Grade A. Corrugation dimensions and profile shall be as specified. Sheets shall have a coating in accordance

with ASTM A 653/A 653M and ASTM A 924/A 924M.

Pretreated steel shall be given a two-coat, baked-on, thermo-setting acrylic enamel, alkyd melamine, or vinyl-solution finish with a minimum dry-film thickness of 0.025 millimeter. 1 mil.

Roofing sheets and siding sheets exposed on one side only, shall have finish coat one side and standard wash coat on the reverse side. Siding sheets exposed on two sides shall be finish coated on both sides. Color of sheets shall be as selected from manufacturer's standard colors.

#### 2.2.8 Porcelain-Enamel-Coated Steel

Roofing and siding sheets shall be porcelain-enamel-coated steel sheets conforming to ASTM C 286, with panel tolerances not to exceed 5 millimeter convex and 3 millimeter concave on 0.75 square metal panels. PEI 1001. Sheets shall be "enameling iron or steel" of low metalloid and copper content, conforming to ASTM A 424, or commercial quality, cold-rolled sheets conforming to ASTM A 1008/A 1008M; with the added requirement that steel sheet shall have a medium skin pass and can be satisfactorily porcelain enameled.

Porcelain-enamel coating shall consist of not less than two coats fused to both sides and edges of each sheet at not less than 788 egrees C. 1,450 degrees F. Finish coat shall be 0.25 millimeter 0.010 inch thick, minimum. Unexposed surface of the sheet shall be coated to the same thickness as the exposed surface with either the finish coating or a slurry coating.

Finish Color of porcelain-enamel coating shall be as follows:

[Selected from manufacturer's standard colors, and shall match the indicated PEI color number and the approved sample.]

[Selected from manufacturer's custom matte decorator colors, and shall match the approved sample.]

#### 2.2.9 Protected Metal

At the option of the Contractor, and in lieu of the zinc-coated non-asbestos felt protection specified, metal sheets shall be commercial-quality galvanized steel sheets conforming to ASTM A 653/A 653M, Grade A, coating designation ASTM A 653/A 653M and ASTM A 924/A 924M. After zinc coating, the sheets shall be heated and coated with adhesive. After the coated sheet has been cured, two separate coats of a weather-resistant and chemical- and fume-resistant protective bituminous compound shall be applied. Immediately after the second protective bituminous compound coat has been applied, a layer of mica shall be applied to both sides of the sheet under heat and pressure. Total dry-film thickness of bituminous compound and mica shall be not less than 0.635 millimeter 25 mils and shall average 0.762 millimeter. 30 mils. Mica-coated sheets shall be uniform in appearance; nonuniform appearing sheets will be rejected. Dry-film thickness of color coating shall be not less than 0.152 millimeter 0.006 inch and shall provide complete hiding to the extent that the application of additional paint will not cause a change in color.

#### 2.3 SUBGIRTS AND FORMED SHAPES

Panel subgirts, T-bars, Z-bars, and angle closers shall be die-formed

shapes fabricated from steel conforming to ASTM A 36/A 36M, hot-dip galvanized in accordance with ASTM A 653/A 653M and ASTM A 924/A 924M.

Die-formed subgirts shall have a minimum uncoated thickness of 1.2 millimeter 0.0478 inch (No. 18 U.S. standard gage) and bar shapes shall be at least 6.4 by 25 millimeter. 1/4 by 1 inch. T-bars shall have a minimum uncoated thickness of 0.76 millimeter 0.0299 inch (No. 22 U.S. standard gage) and Z-bars shall have a minimum uncoated thickness of 1.9 millimeter. 0.0747 inch (No. 14 U.S. standard gage).

Concealed clips shall be fabricated from hot-dip-galvanized steel conforming to ASTM A 1008/A 1008M, coating designation ASTM A 653/A 653M and ASTM A 924/A 924M.

#### 2.3.1 Galvanized Steel Angles

Galvanized steel angles shall be hot-rolled carbon steel conforming to ASTM A 36/A 36M, and hot-dip galvanized in accordance with ASTM A 123/A 123M.

#### 2.3.2 Electrodes for Manual, Shielded Metal Arc Welding

Electrodes for manual, shielded metal arc welding shall meet the requirements of AWS D1.1/D1.1M, and shall be covered, mild-steel electrodes conforming to AWS A5.1/A5.1M.

### 2.4 FASTENERS

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**NOTE: Fasteners can be correlated English to Metric using ISO 261, ISO 262, Metric Screw Threads Plan and Sizes, and ISO 263, Inch Screw Threads Plan and Selection.**  
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Exposed fasteners for securing sheets to structural steel framing or to subgirts shall be M6 by 0.75 No. 14 self-tapping, Type B, recessed hexagon-head, Type 305 corrosion-resistant steel screws with cadmium-plate finish; length as required for the application. Fastener assembly shall include a corrosion-resistant steel washer and a neoprene washer, or an integral corrosion-resistant steel and neoprene washer. Exposed head of fastener shall match Color of roofing and siding sheets by means of plastic caps or factory-coated heads.

Exposed fasteners for securing overlap-type side laps of corrugated profile steel materials, and for securing accessory steel flashing, shall be M6 by 0.75 by 20 millimeter No. 14 by 3/4 inch long Type B recessed hexagon-head, Type 305 corrosion-resistant, chromium-nickel-steel screws with corrosion-resistant steel and neoprene washers. Screw head caps shall match color of sheets.

Exposed fasteners for securing sidelaps of aluminum sheets and for securing aluminum flashing to roofing and siding sheets, shall be M5 by 0.5 by 20 millimeter No. 12 by 3/4 inch long, slotted pan-head Type A aluminum, sheet metal screws with aluminum and neoprene washers.

## 2.5 CLOSURE MATERIALS

### 2.5.1 Mastic Closure Strips

Mastic closure strips shall be closed-cell, expanded cellular rubber conforming to [ASTM D 1056](#), Type S, Class SCE-41 CMP. Closure strips shall be cut or premolded to the exact configuration of the specified roofing and siding material.

Closure strips shall be uniform in appearance, free of weak sections, bubbles, cracks, and defects.

### 2.5.2 Adhesives for Closure Strips

Adhesive for use with closure strips shall be the type recommended and furnished by the closure strip manufacturer.

### 2.5.3 Metal Closure Strips

Metal closure strips shall be factory fabricated accessories matching the type, thickness, and corrugation profile of the specified roofing and siding. Aluminum closure strips shall be mill-finish aluminum, Alclad 3004-H36, not less than [0.813 millimeter](#) [0.032 inch](#) thick. Steel closure strips shall be the same thickness and finish as the exterior roofing and siding panels.

### 2.5.4 Joint Sealants

#### 2.5.4.1 Sealants

Sealants shall be an approved gunnable type for use in hand- or air-pressure calking guns at temperatures above [4 degrees C](#) [40 degrees F](#) (or frost-free application at temperatures above [minus 12 degrees C](#) [10 degrees F](#)). They shall be used around doors, windows, masonry, and other construction material. Solids content shall be a minimum of 85 percent of the total volume. Sealant shall dry with a tough, durable surface skin which permits it to remain soft and pliable underneath, providing a weathertight joint. No migratory staining shall be permitted on painted or unpainted metal, stone, glass, vinyl, or wood.

Joints shall be primed with a compatible one-component or two-component primer as recommended by the sealant manufacturer.

#### 2.5.4.2 Shop Applied

Sealant for shop-applied calking shall be an approved gun grade, nonsag one-component polysulfide or silicone conforming to [ASTM C 920](#), Type II, and with a curing time to ensure the sealant's plasticity at the time of field erection.

#### 2.5.4.3 Field Applied

Sealant for field-applied calking shall be an approved gun grade, nonsag one-component polysulfide or two-component polyurethane with an initial maximum Shore A durometer hardness of 25, and shall conform to [ASTM C 920](#), Type II. [Color](#) shall match panel colors.



## 2.6 INSULATION

Insulation shall be semirigid glass-fiber insulation board conforming to [ASTM C 553](#), Form A, Class 1, Class A fire-hazard classification with a minimum density of [24.8 kilogram per cubic meter](#), and [38 millimeter 1.55 pounds per cubic foot \(pcf\)](#), and [1-1/2 inches](#) thick. Thermal conductivity (K) shall be not more than [0.42 watt per meter per degree K. 0.24](#).

Insulation shall be rigid glass-fiber insulation conforming to [ASTM C 553](#), Form A, Class 1, Class A fire-hazard classification with a minimum density of [96 kilogram per cubic meter](#), and [25 millimeter 6 pcf](#), and [1 inch](#) thick. Thermal conductivity (K) shall be not more than [0.38 watt per meter per degree K. 0.22](#). Insulation shall have a factory-painted, glass-mat surface on the exposed side.

Insulation shall be a mineral fiber insulation conforming to [ASTM C 553](#), Form A, Class 1, Class A fire-hazard classification, with a minimum density of [96 kilogram per cubic meter](#), and [25 millimeter 6 pcf](#), and [1 inch](#) thick. Thermal conductivity (K) shall be not more than [0.38 watt per meter per degree K. 0.22](#). Insulation shall have factory-applied, UL rated, [0.0635 millimeter 0.0025](#) aluminum-foil facing on the exposed surface.

## 2.7 METAL WAINSCOT

Sheet metal wainscot shall be aluminum alloy 3003-H154, stucco embossed E-5 pattern in accordance with [ASTM B 209M ASTM B 209](#).

Sheet metal wainscot shall be hot-dip galvanized steel conforming to [ASTM A 653/A 653M](#), Grade A. Coating shall conform to, [ASTM A 653/A 653M](#) and [ASTM A 924/A 924M](#), and shall have a two-coat baked-on, [thermosetting acrylic enamel] [alkyd melamine] [vinyl solution finish] with a minimum dry-film thickness of [0.025 millimeter. 1 mil](#).

## 2.8 FIRE-RATED WALLS

### 2.8.1 Materials

Materials for fire-rated wall construction shall be as follows:

Wallboard shall be UL labeled, and listed 40 U18.23 [UL Bld Mat Dir](#) fire-retardant [Gypsum Wallboard](#) conforming to [FS SS-L-30](#), Type III, Grade X, Class 1, Form c, Style 3, [1200 millimeter 48 inches](#) wide by [13 millimeter 1/2 inch](#) thick by maximum practical length.

Impaling clips, accessories, and fasteners shall be UL listed 40 U18.24 [UL Bld Mat Dir](#) galvanized steel sheet or impaling bolts welded to each wall unit joint and spaced not more than [1200 millimeter 48 inches](#) on center.

Bar subgirts shall be [38 by 3 millimeter 1-1/2- by 1/8 inch](#) galvanized steel with slotted holes for welding to end of impaling clip spikes.

Structural angles and flashing angles shall be galvanized steel, gage or thickness as indicated, or material as specified. Flashing angles shall be not less than [1.3 millimeter thick No. 18 U.S. standard gage](#).

[Facing panels shall be aluminum, E-5 stucco embossed finish.]

[Metal facing shall be hot-dip galvanized steel conforming to

ASTM A 653/A 653M, Grade A. Coating shall conform to, ASTM A 653/A 653M and ASTM A 924/A 924M.]

[Metal facing shall be indicated and fabricated of enamel-coated hot-dip galvanized steel conforming to ASTM A 653/A 653M, Grade A. Coating shall conform to ASTM A 653/A 653M and ASTM A 924/A 924M. Finish shall have a Class A fire hazard classification. Flame spread, fuel contributed, or smoke developed shall not exceed a value of 25.]

#### 2.8.2 Fire-Rating

\*\*\*\*\*  
NOTE: Refer to UL building material directory UL  
Bld Mat Dir 40 UL 8.24 for fire rated assemblies.  
\*\*\*\*\*

Fire Rated Wall Construction for fire-retardant partition shall be a UL design, [2] [3]-hour-rated, [aluminum] [steel]-faced partition, constructed in accordance with the indicated details and the roofing and siding manufacturer's instructions.

#### 2.9 FABRICATION OF METAL PANELS

Manufacturer's standard product fabrication and details shall be provided. Flat and curved panels shall be provided as required.

System components shall be factory fabricated ready for field installation.

#### 2.10 REPAIR OF FINISH-PROTECTED MATERIALS

##### 2.10.1 Galvanizing Repair Paint

Galvanizing repair paint shall be a high-zinc-dust content paint, compatible with the specified galvanized-finish roofing and siding material, and shall conform to ASTM A 780.

##### 2.10.2 Enamel Repair Paint

Repair paint for color finish enameled roofing and siding shall be compatible paint of the same formula and Color as the specified finish furnished by the roofing and siding manufacturer.

##### 2.10.3 Aluminized Steel Repair Paint

Repair paint for aluminized steel shall be an acrylic paint conforming to MS MIL-P-28578.

\*\*\*\*\*  
NOTE: Delete paragraph heading and following  
paragraph if lead flashing for mechanical piping and  
services is not required.  
\*\*\*\*\*

#### 2.11 LEAD FLASHING FOR MECHANICAL SERVICES

Lead flashing shall be 1.8 kilogram 4-pound lead conforming to ASTM B 749, Grade B, or 1.1 kilogram, 2-1/2-pound, 6 percent antimonial hard lead of the best commercial grade.

For ordering lead 25.4 millimeter 1 inch thick, weight is 293 kilogram per square meter. 60 pounds per square foot.

### PART 3 EXECUTION

#### 3.1 INSTALLATION

Roofing and siding shall be erected in accordance with the approved erection drawings, the printed instructions and safety precautions of the manufacturer.

Sheets shall not be subjected to overloading, abuse, or undue impact. Bent, chipped, or defective sheets shall not be applied.

Sheets shall be erected true and plumb and in exact alignment with the horizontal and vertical edges of the building, securely anchored, and with the indicated rake, eave, and curb overhang.

Work shall be installed to allow for thermal movement of the roofing and siding, movement of the building structure, and to provide permanent freedom from noise due to wind pressure.

Exterior panels of insulated walls shall be installed to provide ventilation of the space between the exterior panel and the insulation.

Weld burns and abrasions due to assembly shall be touched up with the proper finish repair material.

Uncovered edge of the top sheet at sidelaps shall turn down for roofing and turn in for siding and doors.

Roofing sheets shall be laid with corrugations in the direction of the roof slope.

Siding sheets shall be installed with corrugations vertical.

Separate aluminum from contacting dissimilar metals, except zinc and cadmium coatings, with heavy-bodied bituminous coating or resilient gasket.

\*\*\*\*\*

**NOTE: Minimum slope of roofing is assumed to be 75 millimeter in 300 millimeter 3 inches in 12 inches. When a lesser slope is required, end lap must be extended.**

\*\*\*\*\*

End laps of exterior roofing sheets shall be not less than 200 millimeter; 8 inches; the side laps of standard exterior corrugated sheets shall be not less than 2-1/2 corrugations and not less than 1-1/2 corrugations for V-beam corrugated sheets.

End laps of exterior siding sheets shall be not less than 150 millimeter; 6 inches; the side laps of external siding sheets shall be not less than two full corrugations for standard corrugated sheets and not less than one and one-half corrugations for V-beam and ribbed corrugated sheets.

#### 3.2 ALIGNMENT OF STRUCTURAL FRAME

Erected structural-steel frame shall be inspected for plumb and true

surfaces. Misalignment of framing and erection not in accordance with and ASTM E 648 AISC 341 shall be corrected before commencing installation of roofing and siding.

### 3.3 WELDING

Procedures for manual, shielded metal-arc welding, the appearance and quality of welds made, and the methods used in correcting welding work shall be in accordance with AWS D1.1/D1.1M.

### 3.4 FASTENING SYSTEM

[Fastening system shall consist of exposed fasteners of materials and spacing as specified, with applied plastic head caps to match color of specified roofing and siding.]

[Fastening system shall consist of concealed clips and fasteners installed in accordance with the manufacturer's printed instructions.]

#### 3.4.1 Single Sheet, Uninsulated Metal Roofing and Siding

Roofing and siding shall be attached with fasteners of a length to penetrate the support member and extend at least 6 millimeter 1/4 inch on the inside of the member.

[Standard, corrugated, 100 and 200 millimeter 4- and 8 inch fasteners shall be spaced approximately 200 millimeter 8 inches on center at each support and 100 millimeter 4 inches on center at end lap supports. Side lap fasteners shall be spaced at not more than 300 millimeter 12 inches on center.]

[V-beam roof and side sheet fasteners shall be spaced at approximately 125 millimeter 5 inches on center at end lap supports and 250 millimeter 10 inches on center at intermediate supports. Side lap fasteners shall be spaced at not more than 300 millimeter 12 inches on center.]

[Interlocking side laps shall be fastened by die-clinching at approximately 600 millimeter 24 inches on center for walls and at approximately 300 millimeter 12 inches on center for roofs.]

#### 3.4.2 Sandwich Wall Construction

Temporary self-tapping screws for interior sandwich walls or interior roof panels shall be spaced in sufficient number to securely hold the sheet until the insulation and exterior sheets are installed.

End laps of interior roofing and siding sheets shall be not less than 100 millimeter. 4 inches. Side laps shall be in accordance with the manufacturer's written instructions for the type and profile of the specified sheet.

Interlocking side joints shall be factory calked. Overlap joints shall be sealed with a continuous bead of the specified joint sealant.

[Subgirts shall be installed at indicated spacing but not more than 1200 millimeter 48 inches on center and secured through the interior sheet into steel supports with self-tapping screw fasteners spaced at not more than 200 millimeter 8 inches on center.]

[Subgirts shall be installed at indicated spacing but not more than 1200 millimeter 48 inches on center and secured to the interlocking edge of the interior sheets with self-tapping screw fasteners, fillet welding, or clips, spaced at not more than 300 millimeter 12 inches on center.]

[Insulation shall be placed against the inner sheet and supported on subgirt, butting each insulation board tightly together.]

[Insulation shall be placed between subgirts and interior sheets in accordance with manufacturer's printed instructions, butting each board tightly together, and immobilized by impaling spikes or bolts.]

[Insulation shall be placed between flanges of T-bar and butted tightly against T-bar web to provide a snug fit.]

[Exterior sheets shall be fastened to subgirts with exposed fasteners at the specified spacing.]

[Exterior sheets shall be fastened to subgirts with concealed clips and fasteners spaced in accordance with the manufacturer's printed instructions for roofing and siding installed in a hurricane velocity wind area.]

#### 3.4.3 Metal and Insulation-Faced Construction

Metal and insulation-faced construction shall consist of the specified exterior metal roofing, siding, and rigid insulation board. Insulation shall be installed at right angles to the structural supports and screw-fastened through metal, insulation, and into the support. Fastener spacing shall be as noted.

Metal and insulation-faced construction shall consist of the specified exterior metal roofing, siding, and rigid insulation board, installed on T-bars and in accordance with the manufacturer's instructions.

#### 3.5 DISSIMILAR METALS

Dissimilar metals, except corrosion-resistant steel and zinc, shall be insulated from each other by painting, or other approved system, as recommended by the roofing and siding manufacturer.

Aluminum shall be insulated from other metals by painting the other metal with one coat of bituminous paint conforming to SSPC Paint 12 cold-applied asphalt mastic to a thickness of at least 1.6 millimeter. 1/16 inch.

Aluminum surface shall be backpainted where it is impractical to paint the other material.

Aluminum surfaces in contact with lime mortar, concrete, or other masonry materials shall be backpainted with a 1.6 millimeter 1/16 inch thick coat of No. 12 asphalt mastic.

#### 3.6 JOINT SEALANTS

Joints shall be made weathertight. Joints of metal roofing shall be sealed. End joints of metal siding, flashing at corners, ridges, eaves, rakes, curbs, and openings in walls and roofs shall be sealed with the specified joint sealant.

Sealing beads shall be continuous, not less than 13 millimeter 1/2 inch in

diameter, and applied to ensure a weathertight joint.

### 3.7 FLASHING AND CLOSURE INSTALLATION

#### 3.7.1 Metal Flashing

Concealed metal flashing shall be installed at heads and sills of openings as indicated, at curbs and holders for closure and filler strips, and formed to the proper profile and thickness.

Exposed metal flashing shall be installed at building corners, jambs and sills, rakes and eaves, junctions between metal siding and roofing, valleys and changes of slope or direction in metal roofing, and building expansion joints and gutters. Flashing shall be of thickness and profile shown.

Exposed metal flashing shall be the same material, color, and finish as the specified metal roofing and siding.

Flashing shall be fastened at not more than 200 millimeter 8 inches on center for roofs, and not more than 300 millimeter 12 inches on center for walls, except where flashings are held in place by the same screws that secure covering sheets.

Flashing shall be furnished in at least 2.5 meter 8-foot lengths. Exposed flashing shall have 25 millimeter 1 inch locked and blind-soldered end joints, and expansion joints at intervals of not more than 5 meter 16 feet.

Expansion joints shall be formed to the profile indicated with end joints flat-seamed, locked, and soldered, and with free-sliding, sleeve type slip joints at 5 meter 16-foot intervals, designed to allow expansion and contraction and remain weathertight.

Lead flashing shall be installed at openings and pipe projections through metal surfaces, and hammer-formed to the corrugation profile to form an exposed flashing a maximum 150 millimeter 6 inches wide.

Pipe sleeves of the specified metal flashing material shall be installed for pipe and vent projections through metal roofing. Sleeves shall be fastened to roofing with the specified fasteners and flashed with lead flashing.

Exposed flashing and flashing subject to rain penetration shall be bedded in the specified joint sealant.

Flashing in contact with dissimilar metal shall be insulated by means of the specified asphalt mastic material to prevent electrolytic deterioration.

Valley flashing shall have the following minimum widths and joints:

<u>ROOF SLOPE</u>	<u>FLASHING WIDTH</u>	<u>JOINT</u>
Under 100 in 300 millimeter	600 millimeter	Clinch lock
100 in 300 millimeter to 180 in 300 millimeter	460 millimeter	Clinch lock
180 in 300 millimeter and over	300 millimeter	100 millimeter lap joint

<u>ROOF SLOPE</u>	<u>FLASHING WIDTH</u>	<u>JOINT</u>
<u>ROOF SLOPE</u>	<u>FLASHING WIDTH</u>	<u>JOINT</u>
Under 4 inches in 12 inches	24 inches	Clinch lock
4 inches in 12 inches to 7 inches in 12 inches	18 inches	Clinch lock
7 inches in 12 inches and over	12 inches	4 inch lap joint

Open-valley flashing shall be at least 100 millimeter 4 inches wide at the top, and width shall increase 3 in 300 millimeter 1/8 inch for each foot of length. Flashing shall be fastened at edges only. Open ends of the metal corrugations shall be sealed with the specified mastic closure strips.

Drips shall be formed to the profile indicated, with the edge folded back 13 millimeter 1/2 inch to form a reinforced drip edge.

#### 3.7.2 Closures

Metal closure strips shall be installed at open ends of metal ridge rolls; open ends of corrugated or ribbed pattern roofs, and at intersection of wall and roof unless open ends are concealed with formed eave flashing; rake of metal roof unless open end has a formed flashing member; and in other required areas.

Mastic closure strips shall be installed at intersection of ridge roll with metal roofing; top and bottom of metal siding; heads of wall openings; and in other required locations.

#### 3.8 METAL WAINSCOT

Flat sheet metal wainscot facing shall be provided over exposed sidewall insulation, extended from the floor to height as indicated, and shall connect to girt and finish with a metal closure strip.

Metal sheet shall be fitted between the insulation and behind flanges of the T-bars, and secured in place with the specified sheet metal fasteners spaced at approximately 1200 millimeter 48 inches on center.

#### 3.9 ACCEPTANCE PROVISIONS

##### 3.9.1 Erection Tolerances

Metal roofing and siding shall be erected straight and true with plumb vertical lines correctly lapped and secured in accordance with the manufacturer's written instructions. Horizontal lines shall not vary more than 3 millimeter in 12 meter. 1/8 inch in 40 feet.

##### 3.9.2 Leakage Tests

Finished application of metal roofing and siding shall be subject to inspection and test for leakage by the Contracting Officer. Inspection and

tests will be conducted without cost to the Contractor.

Inspection and testing will be made promptly after erection to permit correction of defects and the removal and replacement of defective materials.

#### 3.9.3 Repairs to Finish

Scratches, abrasions, and minor surface defects of finish may be repaired with the specified repair materials. Finished repaired surfaces shall be uniform and free from variations of color and surface texture.

Repaired metal surfaces that are not acceptable to the Contracting Officer shall be immediately removed and replaced with new material.

#### 3.9.4 Paint-Finish Metal Roofing and Siding

Paint-finish metal roofing and siding will be tested for color stability by the Contracting Officer during the manufacturer's specified guarantee period. Tests will be performed by means of groups of 50 millimeter 2 inch metal disks, fastened in exposed areas on all elevations of the building.

Panels that indicate color changes, fading, or surface degradation, determined by visual examination of the test areas after removal of the disks, shall be removed and replaced with new panels at no expense to the Government.

New panels will be subject to the specified tests for an additional year from the date of their installation.

-- End of Section --