UNIFIED FACILITIES GUIDE SPECIFICATIONS

References are in agreement with UMRL dated January 2021
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DIVISION 07 - THERMAL AND MOISTURE PROTECTION

SECTION 07 61 14.00 20

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08/16, CHG 1: 08/18

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-- End of Section Table of Contents --

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USACE / NAVFAC / AFCEC / NASA	**UFGS-07 61 14.00 20 (August 2016)** **Change 1 - 08/18**
Preparing Activity: NAVFAC	**Superseding** **UFGS-07 61 14.00 20 (May 2011)**

UNIFIED FACILITIES GUIDE SPECIFICATIONS

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SECTION 07 61 14.00 20

STEEL STANDING SEAM ROOFING
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****
NOTE: This guide specification covers the requirements for steel standing seam roofing.

Adhere to UFC 1-300-02 Unified Facilities Guide Specifications (UFGS) Format Standard when editing this guide specification or preparing new project specification sections. Edit this guide specification for project specific requirements by adding, deleting, or revising text. For bracketed items, choose applicable item(s) or insert appropriate information.

Remove information and requirements not required in respective project, whether or not brackets are present.

Comments, suggestions and recommended changes for this guide specification are welcome and should be submitted as a Criteria Change Request (CCR).
****

****
NOTE: This guide specification is primarily for Structural Standing Seam Metal Roofing Systems (SSMRS), i.e. Self-Supporting Systems designed to span from purlin to purlin at slopes as low as 1 in 24 1/2 inch per foot versus architectural cladding systems that require continuous support, secondary moisture protection and slopes no less than 1 in 4 3 inches per foot. Structural systems may be used for architectural applications whereas architectural systems cannot be used for structural applications. If an SSMRS system is desired primarily for architectural purposes use Section 07 41 13 METAL ROOF PANELS; otherwise use this section.
****

****
NOTE: Design exterior envelope to meet the requirements of UFC 1-200-02, "High Performance and

Sustainable Building Requirements" which invokes the requirements within UFC 3-101-01, "Architecture". UFC 1-200-02 and UFC 3-101-01 make references throughout to various ASHRAE documents governing energy efficiency and requirements for the components of building envelope design including moisture control and thermal performance.

****

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NOTE: On the drawings, show:

1. Roof slope

2. Supporting structural framework.

3. Intermediate support and attachment details, when applicable.

4. Attachment clip spacing.

5. Flashing support and fastening spacing.

6. Roof venting. (Pay particular attention to preventing infiltration of wind-driven rain.)

7. Sealant and closure locations.

8. Locations for dissimilar metal protection.

9. Details of accessories such as ladders, walkways, antenna mounts, guy wire fastening, ventilation equipment, and lightning rods.

10. Details of flashing at all roof penetrations. On roof plan add note to offset penetrations so center of penetrations coincide with mid-point of panel seams.

11. Design loads including stress diagram.

12. Location and attachment of permanent fall protection devices.

****

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NOTE: When designing standing seam roofs, consider:

1. Consult with manufacturers early in design stage to obtain current manuals, specific guidance, and structural information regarding roof attachment. Early contact will reduce need for corrections and changes during review process and construction phase. Ensure that system detailed and specified can be provided by three separate manufacturers.

2. Calculate wind uplift forces in accordance with UFC 1-200-01, "General Building Requirements". Submit calculations and stress diagram with design

review package.

3. Minimum guidelines are 1 in 24 1/2 inch per foot for roof slopes. Provide greater slope if possible. In renovation of existing buildings, adequate slope must often be obtained by imaginative solutions. Prefabricated steel systems, sleepers, and stub walls have been used successfully, but attachment and structural stability of these must be assured. In some existing structures it will be difficult to design strong connections to structural system unless modifications are made to resist wind forces adequately.

4. Flashing presents a particular design problem in preventing wind and water infiltration. High winds and thermal movement create stresses in flashing which must be resisted by careful detailing of attachment.

While standing seam roofing presents continuous, sealed surface to the elements, flashing transitions are often the cause of serious problems. Overhangs are especially susceptible to high wind forces, and attachment at the edges should be carefully designed. Copious use of sealants and closure pieces molded to conform to the roof panels is imperative.

5. Building may require equipment such as antennae, ladders or lightning rods installed on roof. Access to roof-mounted mechanical equipment is often required. Provide walking surfaces and attachment accessories which do not compromise integrity of roof system. These accessories should provide support without penetrating roofing panels. Usually this is done with clamps attached to standing seam, or specially designed clips. Provide curbs or structural supports for mechanical equipment. Where condensate or other piping will be attached to or come in contact with roofing panels, ensure that the piping and anchorage materials are compatible with roof panel base metal to avoid corrosion from galvanic action. Ensure that condensate or other discharge of liquid onto roof panels will not stain or corrode panel finish and/or base metal.

****

PART 1 GENERAL

1.1 REFERENCES

****

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 Reference Identifier (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.

****

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.

AMERICAN IRON AND STEEL INSTITUTE (AISI)

AISI SG03-3	(2002; Suppl 2001-2004; R 2008) Cold-Formed Steel Design Manual Set

ASTM INTERNATIONAL (ASTM)

ASTM A36/A36M	(2019) Standard Specification for Carbon Structural Steel
ASTM A653/A653M	(2020) Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
ASTM A792/A792M	(2010; R 2015) Standard Specification for Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process
ASTM A1008/A1008M	(2020) Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable
ASTM A1011/A1011M	(2018a) Standard Specification for Steel Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength
ASTM B117	(2019) Standard Practice for Operating Salt Spray (Fog) Apparatus
ASTM D226/D226M	(2017) Standard Specification for Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing
ASTM D522/D522M	(2017) Mandrel Bend Test of Attached Organic Coatings

ASTM D523	(2014; R 2018) Standard Test Method for Specular Gloss
ASTM D714	(2002; R 2017) Standard Test Method for Evaluating Degree of Blistering of Paints
ASTM D968	(2017) Standard Test Methods for Abrasion Resistance of Organic Coatings by Falling Abrasive
ASTM D1654	(2008; R 2016; E 2017) Standard Test Method for Evaluation of Painted or Coated Specimens Subjected to Corrosive Environments
ASTM D2244	(2016) Standard Practice for Calculation of Color Tolerances and Color Differences from Instrumentally Measured Color Coordinates
ASTM D2247	(2015) Testing Water Resistance of Coatings in 100% Relative Humidity
ASTM D4214	(2007; R 2015) Standard Test Method for Evaluating the Degree of Chalking of Exterior Paint Films
ASTM E84	(2020) Standard Test Method for Surface Burning Characteristics of Building Materials
ASTM E1592	(2017) Standard Test Method for Structural Performance of Sheet Metal Roof and Siding Systems by Uniform Static Air Pressure Difference
ASTM G152	(2013) Operating Open Flame Carbon Arc Light Apparatus for Exposure of Nonmetallic Materials
ASTM G153	(2013) Operating Enclosed Carbon Arc Light Apparatus for Exposure of Nonmetallic Materials

SHEET METAL AND AIR CONDITIONING CONTRACTORS' NATIONAL ASSOCIATION (SMACNA)

SMACNA 1793	(2012) Architectural Sheet Metal Manual, 7th Edition

U.S. DEPARTMENT OF ENERGY (DOE)

Energy Star	(1992; R 2006) Energy Star Energy Efficiency Labeling System (FEMP)

1.2 DEFINITIONS

1.2.1 Field-Formed Seam

Seams of panels so configured that when adjacent sheets are installed the seam is sealed utilizing mechanical or hand seamers. Crimped (45 degree bend), roll formed (180 degree bend), double roll formed (2 - 180 degree bends), and roll and lock systems are types of field-formed seam systems.

1.2.2 Snap Together Seam

Panels so configured that the male and female portions of the seam interlock through the application of foot pressure or tamping with a mallet. Snap-on cap configurations are a type of snap together system.

1.2.3 Pre-Formed

Formed to the final, less field-formed seam, profile and configuration in the factory.

1.2.4 Field-Formed

Formed to the final, less field-formed seam, profile and configuration at the site of work prior to installation.

1.2.5 Roofing System

The roofing system is defined as the assembly of roofing components, including roofing panels, flashing, fasteners, and accessories which, when assembled properly result in a watertight installation.

1.2.6 SSMRS

Standing Seam Metal Roof System (SSMRS) is abbreviation of the entire roof system specified herein with all components and parts coming from a single manufacturer's system.

1.3 SYSTEM DESCRIPTION

1.3.1 Design Requirements

a. Panels must be continuous lengths up to manufacturer's standard longest lengths, with no joints or seams, except where indicated or specified. Ribs of adjoining sheets must be in continuous contact from eave to ridge. Individual panels of snap together type systems must be removable for replacement of damaged material.

b. There must be no exposed or penetrating fasteners except where shown on approved shop drawings. Fasteners into steel must be stainless steel, zinc cast head, or cadmium plated steel screws inserted into predrilled holes. There must be a minimum of two fasteners per clip. Single fasteners will be allowed when supporting structural members are prepunched or predrilled.

c. Snap together type systems must have a capillary break and a positive side lap locking device. Field-formed seam type systems must be mechanically locked closed by the manufacturer's locking tool. The seam must include a continuous factory applied sealant when required by the manufacturer to withstand the wind loads specified.

d. Roof panel anchor clips must be concealed and designed to allow for longitudinal thermal movement of the panels, except where specific fixed points are indicated. Provide for lateral thermal movement in panel configuration or with clips designed for lateral and longitudinal movement.

1.3.2 Design Conditions

Design the system to resist positive and negative loads specified herein in accordance with the AISI SG03-3. Panels must support walking loads without permanent distortion or telegraphing of the structural supports.

1.3.2.1 Wind Uplift

****

NOTE: Determine appropriate pressures that apply to various portions of roof using UFC 3-301-01 "Structural Engineering" for structural design and wind load information. Use criteria of local building code when their provisions exceed NAVFAC/AF criteria. Insert calculated pressures in table; regardless of calculated value, use 2.25 kPa 45 psf minimum for Class 90 systems.

****

Compute and apply the design uplift pressures for the roof system using a basic wind speed of [_____] kilometers per hour (km/h) miles per hour (mph). Roof system and attachments must resist the following wind loads, in kilopascals (kPa) pounds per square foot (psf):

	Negative
a. At eaves	[_____]
b. At rakes	[_____]
c. At ridge	[_____]
d. At building corners	[_____]
e. At central areas	[_____]

The design uplift force for each connection assembly must be that pressure given for the area under consideration, multiplied by the tributary load area of the connection assembly, and multiplied by the appropriate factor of safety, as follows:

a. Single fastener in a connection: 3.0

b. Two or more fasteners in each connection: 2.25

1.3.2.2 Roof Live Loads

****

NOTE: Refer to UFC 3-301-01 "Structural Engineering" for additional requirements.

****

Loads must be applied on the horizontal projection of the roof structure. The minimum roof design live load must be 1 kPa 20 psf.

1.3.2.3 Thermal Movement

****

NOTE: Insert design low temperature for the project location as obtained from UFC 3-400-02 "Design: Engineering Weather Data." Select first bracketed option for unpainted finish and light colors, select second bracketed option for dark colors.

****

System must be capable of withstanding thermal movement based on a temperature range of 5 degrees C 10 degrees F below [_____] degrees C F and[60 degrees C140 degrees F.] [80 degrees C180 degrees F.]

1.3.2.4 Deflection

Panels must be capable of supporting design loads between unsupported spans with deflection of not greater than L/180 of the span.

1.3.3 Structural Performance

****

NOTE: Full scale testing is required to certify the adequacy of the SSMRS. Once a SSMRS is certified for a specific loading condition, that certification may be used for future projects.

****

The structural performance test methods and requirements of the Standing Seam Roofing Systems (SSRS) must be in accordance with ASTM E1592.

1.4 SUBMITTALS

****

NOTE: Review Submittal Description (SD) definitions in Section 01 33 00 SUBMITTAL PROCEDURES and edit the following list, and corresponding submittal items in the text, to reflect only the submittals required for the project. The Guide Specification technical editors have classified those items that require Government approval, due to their complexity or criticality, with a "G." Generally, other submittal items can be reviewed by the Contractor's Quality Control System. Only add a "G" to an item if the submittal is sufficiently important or complex in context of the project.

For Army projects, fill in the empty brackets following the "G" classification, with a code of up to three characters 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.**

The "S" classification indicates submittals required as proof of compliance for sustainability Guiding Principles Validation or Third Party Certification and as described in Section 01 33 00 SUBMITTAL PROCEDURES.

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

****

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are [for Contractor Quality Control approval.][for information only. When used, a code following the "G" classification 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

Roofing; G[, [_____]]

SD-03 Product Data

Roofing Panels; G[, [_____]]

Energy Star Label for Steel Roofing Product; S

Recycled Content for Steel Roofing Product; S

[Heat Island Reduction; S

] Attachment Clips

Closures

Accessories

Fasteners

Sealants

[Insulation, including Joint Sealing Measures for Vapor Barrier Facing

] Sample Warranty Certificate; G[, [_____]]

Submit for materials to be provided. Submit data sufficient to indicate conformance to specified requirements.

SD-04 Samples

Roofing Panel

Submit a 300 mm 12 inch long by full width section of typical panel.

[For color selection, submit 50 by 100 mm 2 by 4 inch metal samples in color, finish and texture [specified] [selected]. [When colors are not indicated, submit samples of not less than six different manufacturer's standard colors for selection.]

] Accessories

Submit each type of accessory item used in the project including, but not limited to each type of anchor clip, closure, fastener, and leg clamp.

Sealants

Intermediate Support Section

Submit full size samples of each intermediate support section, 300 mm 12 inches long.

SD-05 Design Data

Design Calculations

SD-06 Test Reports

Field Inspection; G

Submit manufacturer's technical representative's field inspection reports as specified in paragraph MANUFACTURER'S FIELD INSPECTION.

****
NOTE: This paragraph requires certified test reports for structural and finish tests. If there is reason to require a factory test report for other tests, modify this paragraph accordingly.
****

Structural Performance Tests

Finish Tests

SD-07 Certificates

Manufacturer's Technical Representative's Qualifications

Statement of Installer's Qualifications

Submit documentation from roofing manufacturer proving the manufacturer's technical representative meets below specified requirements. Include name, address, telephone number, and experience record.

Submit documentation proving the installer is factory-trained, has the specified experience, and authorized by the manufacturer to install the products specified.

[Coil Stock Compatibility; G[, [_____]]

Provide certification of coil compatibility with roll forming machinery to be used for forming panels without warping, waviness, and rippling not part of panel profile; to be done without damage, abrasion or marking of finish coating.

] SD-08 Manufacturer's Instructions

Installation Manual; G[, [_____]]

Submit manufacturers printed installation manual, instructions, and standard details.

SD-11 Closeout Submittals

Information Card

For each roofing installation, submit a typewritten card or photoengraved aluminum card containing the information listed on Form 1 located at the end of this section.

Warranty

1.5 DESIGN CALCULATIONS

****
NOTE: Ensure that appropriate design loads are specified in paragraph WIND UPLIFT.
****

Provide design calculations prepared by a professional engineer specializing in structural engineering verifying that system supplied and any additional framing meets design load criteria indicated. Coordinate calculations with manufacturer's test results. Include calculations for:

Wind load uplift design pressure at roof locations specified in paragraph WIND UPLIFT.

Clip spacing and allowable load per clip.

Fastening of clips to structure or intermediate supports.

Intermediate support spacing and framing and fastening to structure when required.

Allowable panel span at anchorage spacing indicated.

Safety factor used in design loading.

Governing code requirements or criteria.

Edge and termination details.

1.6 QUALITY ASSURANCE

1.6.1 Preroofing Conference

****

NOTE: Consult with the Contracting Officer responsible for construction of the project to determine who should conduct the conference. For NAVFAC SE administered projects, delete the option of Contractor conducting the conference and delete the last sentence.
****

After submittals are received and approved but before roofing [and insulation] work, including associated work, is preformed, the [Contracting Officer will] [Contractor must] hold a preroofing conference to review the following:

a. The drawings and specifications

b. Procedure for on site inspection and acceptance of the roofing substrate and pertinent structural details relating to the roofing system

c. Contractor's plan for coordination of the work of the various trades involved in providing the roofing system and other components secured to the roofing

d. Safety requirements

The preroofing conference must be attended by the Contractor and personnel directly responsible for the roofing [and insulation] installation, [[mechanical] [and] [electrical] work], and the roofing manufacturer's technical representative. Conflicts among those attending the preroofing conference must be resolved and confirmed in writing before roofing work, including associated work, is begun. [Prepare written minutes of the preroofing conference and submit to the Contracting Officer.]

1.6.2 Manufacturer

The SSMRS must be the product of a metal roofing industry - recognized manufacturer who has been in the practice of manufacturing SSMRS for a period of not less than 5 years and who has been involved in at least 5 projects similar in size and complexity to this project.

1.6.3 Manufacturer's Technical Representative

The representative must have authorization from manufacturer to approve field changes and be thoroughly familiar with the products and with installations in the geographical area where construction will take place. The manufacturer's representative must be an employee of the manufacturer with at least 5 years experience in installing the roof system. The representative must be available to perform field inspections and attend meetings as required herein, and as requested by the Contracting Officer.

1.6.4 Installer's Qualifications

The roofing system installer must be factory-trained, approved by the steel roofing system manufacturer to install the system, and must have a minimum of three years experience as an approved applicator with that manufacturer. The applicator must have applied five installations of similar size and scope as this project within the previous 3 years.

1.6.5 Single Source

Roofing panels, clips, closures, and other accessories must be standard products of the same manufacturer; must be the latest design by the manufacturer; and must have been designed by the manufacturer to operate as a complete system for the intended use.

1.6.6 Laboratory Tests For Panel Finish

The term "appearance of base metal" refers to the metal coating on steel. Panels must meet the following test requirements:

a. Formability Test: When subjected to a 180 degree bend over a 3 mm 1/8 inch diameter mandrel in accordance with ASTM D522/D522M, exterior coating film may show only slight microchecking and no loss of adhesion.

b. Accelerated Weathering Test: Withstand a weathering test for a minimum of 2000 hours in accordance with ASTM G152 and ASTM G153, Method 1 without cracking, peeling, blistering, loss of adhesion of the protective coating, or corrosion of the base metal. Protective coating that can be readily removed from the base metal with a penknife blade or similar instrument will be considered to indicate loss of adhesion.

c. Chalking Resistance: After the 2000-hour weatherometer test, exterior coating may not chalk greater than No. 8 rating when measured in accordance with ASTM D4214 test procedures.

d. Color Change Test:

****

NOTE: In general, only colors such as white, beige, and tan will not exceed the 2 NBS units requirement. To allow for heavier pigmented colors, specify color change not to exceed 5 NBS units for a 3000-hour weatherometer test.

****

After the [2000] [_____]-hour weatherometer test, exterior coating color change must not exceed [2] [_____] NBS units when measured in accordance with ASTM D2244 test procedure.

****

NOTE: For projects located in high temperature and humidity or corrosive atmospheres or where premium finish would be justified, use:

Salt spray test: Rating of 10, no blisters in field Rating of 7, 2 mm 1/16 inch edge creep

Abrasion Resistance Test: 100 liters

****

e. Salt Spray Test: Withstand a salt spray test for a minimum of 1000 hours in accordance with ASTM B117, including the scribe requirement in the test. Immediately upon removal of the panel from the test, the coating must receive a rating of [8, few blisters] [10, no blisters] in field as determined by ASTM D714; and an average rating of [6, 3

mm] [7, 2 mm] [6, 1/8 inch] [7, 1/16 inch] failure at scribe, as determined by ASTM D1654. Rating Schedule No. 1.

f. Abrasion Resistance Test for Color Coating: When subjected to the falling sand test in accordance with ASTM D968, coating system must withstand a minimum of [50][100][_____] liters of sand per mil thickness before appearance of base metal.

g. Humidity Test: When subjected to a humidity cabinet test in accordance with ASTM D2247 for 1000 hours, a scored panel must show no signs of blistering, cracking, creepage, or corrosion.

h. Gloss Test: The gloss of the finish must be 30 plus or minus 5 at an angle of 60 degrees, when measured in accordance with ASTM D523.

[i. Glare Resistance Test:

****

NOTE: The requirements for glare resistance should be included only when specifically required by the facility for critical glare areas such as control towers or other structures where glare can be an operational hazard. Refer to UFC 4-211-01N, "Aircraft Maintenance Hangars" for assistance in determining critical glare areas. Delete gloss test above if this paragraph is included.

****

Surfaces of panels that will be exposed to the exterior must have a specular reflectance of not more than 10 when measured in accordance with ASTM D523 at an angle of 85 degrees. Specular reflectance may be obtained with striations or embossing. Requirements specified under FORMABILITY TEST will be waived if necessary to conform to this requirement.

]1.6.7 Shop Drawing Requirements

Submit roofing drawings to supplement the instructions and diagrams. Include design and erection drawings containing an isometric view of the roof showing the design uplift pressures and dimensions of edge, ridge and corner zones; and show typical and special conditions including flashings, materials and thickness, dimensions, fixing lines, anchoring methods, sealant locations, sealant tape locations, fastener layout, sizes, and spacing, terminations, penetrations, attachments, and provisions for thermal movement. Details of installation must be in accordance with the manufacturer's Standard Instructions and details or the SMACNA 1793. Prior to submitting shop drawings, have drawings reviewed and approved by the manufacturer's technical engineering department.

1.7 WARRANTY

****

NOTE: This warranty paragraph may be used with this guide specification without special authorization.

****

Furnish manufacturer's no-dollar-limit materials and workmanship warranty for the roofing system. The warranty period must be not less than 20 years from the date of Government acceptance of the work. The warranty

must be issued directly to the Government. The warranty must provide that if within the warranty period the metal roofing system becomes non-watertight or shows evidence of corrosion, perforation, rupture or excess weathering due to deterioration of the roofing system resulting from defective materials or installed workmanship the repair or replacement of the defective materials and correction of the defective workmanship must be the responsibility of the roofing system manufacturer. Repairs that become necessary because of defective materials and workmanship while roofing is under warranty must be performed within 7 days after notification, unless additional time is approved by the Contracting Officer. Failure to perform repairs within the specified period of time will constitute grounds for having the repairs performed by others and the cost billed to the manufacturer. In addition, provide a 2 year contractor installation warranty.

1.8 DELIVERY, STORAGE AND HANDLING

Deliver, store, and handle preformed panels, bulk roofing products and other manufactured items in a manner to prevent damage or deformation.

1.8.1 Delivery

Provide adequate packaging to protect materials during shipment. Crated materials must not be uncrated until ready for use, except for inspection. Immediately upon arrival of materials at the jobsite, inspect materials for damage, dampness, and staining. Replace damaged or permanently stained materials that cannot be restored to like-new condition with satisfactory material. If materials are wet, remove the moisture and re-stack and protect the panels until used.

1.8.2 Storage

Stack materials on platforms or pallets and cover with tarpaulins or other suitable weathertight covering which prevents water trapping or condensation. Store materials so that water which might have accumulated during transit or storage will drain off. Do not store the panels in contact with materials that might cause staining, such as mud, lime, cement, fresh concrete or chemicals. Protect stored panels from wind damage.

1.8.3 Handling

Handle material carefully to avoid damage to surfaces, edges and ends.

PART 2 PRODUCTS

2.1 ROOFING PANELS

****

NOTE: Certain roofing products are required to conform to public law (PL) 109-58 - Energy Policy Act of 2005 (EPAct05) by meeting or exceeding Energy Star or FEMP efficiency requirements at "energy-efficient products" at http://energy.gov/eere/femp/energy-and-water-efficient-products.

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****

NOTE: Facilities with dominant cooling loads and/or

in mild or warm climate zones are required to meet "cool roofing" requirements of FEMP. Cool roof design must follow the requirements in UFC 3-110-03 Roofing, Appendix B and ASHRAE 90.1 Chapter 5, for the design of insulation and energy performance of the building. The roofing system will need to include a top surface layer that meets the Energy Star criteria for Cool Roof Products see http://www.energystar.gov/products/certified-products/detail/roof-products.

NOTE: If a cool roof is not selected in ASHRAE zones 1 thru 3, design must meet one of the exception requirements listed in ASHRAE 90.1 Chapter 5 or provide thermal insulation above the deck with an R value of 33 or greater. Coordinate these requirements with insulation design and specifications.

Retain the next to last bracketed sentence for project with cool roof requirement. Retain the last bracketed sentence for project with sustainable third party certification credit requirement for reduced heat island effect.

****

Provide panels with interlocking ribs for securing adjacent sheets and with concealed clip fastening system for securing the roof covering to structural framing members. Fasteners must not penetrate the panels except at the ridge, eave, rakes, penetrations, and end laps. Backing plates and ends of panels at end laps must be predrilled or prepunched. Factory prepare ends of panels to be lapped by trimming part of seam, die-setting, or swaging ends of panels. Individual sheets must be sufficiently long to cover the entire length of any unbroken roof slope when such slope is 9 meters 30 feet or less. Provide panels that extend over two or more spans when length of run exceeds 9 meters 30 feet. Obtain Contracting Officer (KO) approval for sheets longer than 9 meters 30 feet before submitting shop drawings. Sheets must provide not less than 300 mm 12 inches of coverage (width) in place. Provide panels with a minimum corrugation height of [45] [57] [76] mm [1.75] [2.25] [3.0] inches (nominal). Make provisions for expansion and contraction at either ridge or eave, consistent with the type of system to be used. Form panels from coil stock without warping, waviness or ripples not part of the panel profile, and free of damage to the finish coating system.

Provide steel roofing product that is Energy Star labeled. Provide data identifying Energy Star label for steel roofing product.[Provide solar reflectance product with an initial solar reflectance greater than or equal to 0.25 and a solar reflectance greater than or equal to 0.15 three years after installation under normal conditions.][Provide emittance and reflectance percentages, solar reflectance index values, [and] slopes [_____], to meet sustainable third party certification requirements for Heat Island Reduction.]

2.1.1 Material

****

NOTE: Research shows the product is available from US national manufacturers above the minimum recycled content stated. Some manufacturers and regions have

higher percentages.
****

Zinc-coated steel conforming to ASTM A653/A653M, Z275 G90 coating designation or aluminum-zinc alloy coated steel conforming to ASTM A792/A792M, AZ 165 AZ 55 coating. Provide material with a minimum thickness of 0.6 mm 0.023 inch thick (24 gage) minimum except when mid field of roof is subject to design wind uplift pressures of 3 kPa 60 psf or greater, entire roof system must have a minimum thickness of 0.8 mm 0.030 inch (22 gage). Steel roofing materials must contain a minimum of 30 percent total recycled content. Provide data identifying percentage of recycled content for steel roofing product.[Prior to shipment, treat mill finish panels with a passivating chemical and oil to inhibit the formation of oxide corrosion products. Dry, retreat, and re-oil panels that have become wet during shipment or storage but have not started to oxidize.]

2.1.2 Texture

****
NOTE: Stucco embossing is a mechanical process that imparts some structural strength to the steel and reduces the visual effect of oil-canning. Embossed texture is slightly more expensive than smooth texture but should be considered for use on high visibility projects.
****

[Stucco embossed.][Smooth.][Smooth with raised intermediate ribs for added stiffness.]

2.1.3 Finish

****
NOTE: Choose finish appropriate for the project. In general, hangars, warehouses, and other utilitarian structures may use unpainted finish to reduce cost. ASTM A792/A792M (Galvalume) should be specified only for corrosive environments when unpainted finish is required. Delete paragraph LABORATORY TESTS FOR PANEL FINISH and reference to finishes when unpainted finish is specified. Some paint colors are substantially more costly than others, due to scarcity of pigments.
****

[Unpainted][Factory color finish].

[2.1.3.1 Factory Color Finish

****
NOTE: Provide clear edge coating on all metal panels for projects within the salt spray area of the ocean (within 300 feet of the water).
****

****
NOTE: Check with the facility regarding color selection. Use only manufacturer's standard

colors. Delete this subparagraph if unpainted finish has been selected. Specify 0.050 mm 0.2 mil prime coat if undersides of panels are to be field painted, the same coating as exterior if undersides of panels are to be exposed and a premium coating is desired, otherwise use 0.0125 mm 0.5 mil wash coat.
****

Provide factory applied, thermally cured coating to exterior and interior of metal roof and wall panels and metal accessories. Provide exterior finish top coat of [70 percent resin polyvinylidene fluoride][_____] with not less than [0.005 mm][0.020 mm][_____] [0.2 mil][0.8 mil][_____] dry film thickness. Provide exterior primer [standard with panel manufacturer][_____] with not less than [0.005 mm][0.020 mm] [0.2 mil][0.8 mil] dry film thickness. Interior finish must consist of [[0.005 mm][0.2 mil]dry film thickness prime coat][[0.0125 mm][0.5 mil] dry film thickness backer coat][the same coating and dry film thickness as the exterior coating][_____]. Provide exterior [and interior]coating meeting test requirements specified below. Tests must have been performed on the same factory finish and thickness provided.[Provide clear factory edge coating on all factory cut or unfinished edges.]

]2.2 INTERMEDIATE SUPPORTS

Fabricate panel subgirts, subpurlins, T-bars, Z-bars and tracks from galvanized steel conforming to ASTM A653/A653M, Z275 G90, Grade D (1.6 mm thick 16 gage and heavier), Grade A (1.3 mm thick 18 gage and lighter); or steel conforming to ASTM A36/A36M, ASTM A1011/A1011M , or ASTM A1008/A1008M prime painted with zinc-rich primer. Size, shape, thickness and capacity as required to meet the load[, insulation thickness] and deflection criteria specified.

2.3 ATTACHMENT CLIPS

Fabricate clips from ASTM A1011/A1011M, or ASTM A1008/A1008M steel hot-dip galvanized in accordance with ASTM A653/A653M, Z275 G 90, or Series 300 stainless steel. Size, shape, thickness and capacity as required to meet the load, insulation thickness and deflection criteria specified.

2.4 ACCESSORIES

Sheet metal flashings, [gutters,] [downspouts,] trim, moldings, closure strips, pre-formed crickets, caps, equipment curbs, and other similar sheet metal accessories used in conjunction with preformed metal panels must be of the same material as used for the panels. Provide metal accessories with a factory color finish to match the roofing panels, except that such items which will be concealed after installation may be provided without the finish if they are stainless steel. Metal must be of a thickness not less than that used for the panels. Thermal spacer blocks and other thermal barriers at concealed clip fasteners must be as recommended by the manufacturer except that wood spacer blocks are not allowed.

2.4.1 Closures

2.4.1.1 Rib Closures

Corrosion resisting steel, closed-cell or solid-cell synthetic rubber, neoprene or polyvinyl chloride pre-molded to match configuration of rib

opening. Material for closures must not absorb water.

2.4.1.2 Ridge Closures

Metal-clad foam or metal closure with foam secondary closure matching panel configuration for installation on surface of roof panel between panel ribs at ridge and headwall roof panel flashing conditions and terminations. Foam material must not absorb water.

2.4.2 Fasteners

Zinc-coated steel, corrosion resisting steel, zinc cast head, or nylon capped steel, type and size specified below or as otherwise approved for the applicable requirements. Design the fastening system to withstand the design loads specified. Exposed fasteners must be gasketed or have gasketed washers on the exterior side of the covering to waterproof the penetration. Washer material must be compatible with the covering; have a minimum diameter of 10 mm 3/8 inch for structural connections; and gasketed portion of fasteners or washers must be neoprene or other equally durable elastomeric material approximately 3 mm 1/8 inch thick.

2.4.2.1 Screws

Not smaller than 4.75 mm No. 14 diameter if self-tapping type and not smaller than 4 mm No. 12 diameter if self-drilling and self-tapping.

2.4.2.2 Bolts

Not smaller than 6 mm 1/4 inch diameter, shouldered or plain shank as required, with proper nuts.

2.4.2.3 Automatic End-Welded Studs

Automatic end-welded studs must be shouldered type with a shank diameter of not smaller than 5 mm 3/16 inch and cap or nut for holding covering against the shoulder.

2.4.2.4 Explosive Driven Fasteners

Fasteners for use with explosive actuated tools must have a shank diameter of not smaller than 4 mm 0.145 inch with a shank length of not smaller than 13 mm 1/2 inch for fastening to steel and not smaller than 25 mm 1 inch for fastening to concrete.

2.4.2.5 Rivets

Blind rivets must be stainless steel with 3 mm 1/8 inch nominal diameter shank. Rivets must be threaded stem type if used for other than the fastening of trim. Rivets with hollow stems must have closed ends.

2.4.3 Sealants

Elastomeric type containing no oil or asphalt. Exposed sealant must cure to a rubberlike consistency. Concealed sealant must be the non-hardening type. Seam sealant must be factory-applied, non-skinning, non-drying, and must conform to the roofing manufacturer's recommendations. Silicone-based sealants must not be used in contact with finished metal panels and components unless approved otherwise by the Contracting Officer.

2.4.4 GASKETS AND INSULATING COMPOUNDS

Nonabsorptive and suitable for insulating contact points of incompatible materials. Insulating compounds must be nonrunning after drying.

[2.5 THERMAL INSULATION

****
NOTE: Insulation should be included in appropriate section. Most manufacturers recommend batts with minimum thickness of 38 mm 1 1/2 inches for standing seam systems to minimize condensation on underside of roofing sheets and for sound attenuation. Spacer blocks should be required with insulation. 100 mm 4 inches (R 25) is the recommended maximum thickness.
****

Flexible blanket, rigid, or semi-rigid faced with a flexible vapor retarder. Insulation and facing must have a flame-spread rating of 50 or less in accordance with ASTM E84. Vapor retarder facing must have a permeance rating of 0.05 perm or less. Provide a thermal resistance "R" value of [_____] or more. [Exposed insulation must have a white nondusting and nonshedding finish.] Facings [and finishes] must be factory-applied.

][2.6 UNDERLAYMENT FOR WOOD SUBSTRATES

****
NOTE: Include this article where roof coverings are applied to wood decks.
****

ASTM D226/D226M, Type I perforated, covered by water-resistant rosin sized building paper.

]2.7 LINER PANELS

Fabricate liner panels of the same material as roof panels, and formed or patterned to prevent waviness and distortion. Liner panels must have a factory applied, one mil thick minimum painted coating on the inside face and a prime coat on the liner side.

PART 3 EXECUTION

Do not install building construction materials that show visible evidence of biological growth.

3.1 EXAMINATION

Examine surfaces to receive standing seam metal roofing and flashing. Ensure that surfaces are plumb and true, clean, even, smooth, as dry and free from defects and projections which might affect the installation.

3.2 PROTECTION FROM CONTACT WITH DISSIMILAR MATERIALS

3.2.1 Cementitious Materials

Paint metal surfaces which will be in contact with mortar, concrete, or other masonry materials with one coat of alkali-resistant coating such as

heavy-bodied bituminous paint.

3.2.2 Contact with Wood

Where metal will be in contact with wood or other absorbent material subject to wetting, seal joints with sealing compound and apply one coat of heavy-bodied bituminous paint.

3.3 INSTALLATION

****
NOTE: Include bracketed sentences where roof coverings are applied directly to wood decks.
****

Install in accordance with the approved manufacturer's erection instructions, shop drawings, and diagrams. Panels must be in full and firm contact with attachment clips. Where prefinished panels are cut in the field, or where any of the factory applied coverings or coatings are abraded or damaged in handling or installation, they must, after necessary repairs have been made with material of the same color as the weather coating, be approved before being installed. Seal completely openings through panels. Correct defects or errors in the materials. Replace materials which cannot be corrected in an approved manner with nondefective materials. Provide molded closure strips where indicated and where necessary to provide weathertight construction. Use shims as required to ensure attachment clip line is true. Use a spacing gage at each row of panels to ensure that panel width is not stretched or shortened.[Provide one layer of asphalt-saturated felt placed perpendicular to roof slope, covered by one layer of rosin-sized building paper placed parallel to roof slope with side laps down slope and attached with roofing nails. Overlap side and end laps 75 mm 3 inches, offset seams in building paper with seams in felt.]

3.3.1 Roof Panels

Apply roofing panels with the standing seams parallel to the slope of the roof. Provide roofing panels in longest practical lengths from ridge to eaves (top to eaves on shed roofs), with no transverse joints except at the junction of ventilators, curbs, skylights, chimneys, and similar openings. Install flashing to assure positive water drainage away from roof penetrations. Locate panel end laps such that fasteners do not engage supports or otherwise restrain the longitudinal thermal movement of panels. Form field-formed seam type system seams in the field with an automatic mechanical seamer approved by the manufacturer. Attach panels to the structure with concealed clips incorporated into panel seams. Clip attachment must allow roof to move independently of the structure, except at fixed points as indicated.

[3.3.2 Insulation Installation

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NOTE: For applications where permeability is a critical consideration, sealing of the insulation joints or other methods of providing continuity of the vapor retarder must be specified. Overall roof construction should be reviewed to assure permeability is consistent with requirements specified for the vapor retarder.

****

Install between covering and supporting members to present a neat appearance. Fold and staple [and tape] seams unless approved otherwise by the Contracting Officer.

3.3.2.1 Rigid or Semi-Rigid Insulation

Install in areas where insulation is exposed to view. Fasten securely without loose joints or unsightly sags.

3.3.2.2 Blanket Insulation

May be used in concealed locations. Lap facing at joints and fasten in a manner that will provide tight joints.

]3.3.3 Flashings

****

NOTE: In high winds, metal will vibrate and fatigue at fasteners on "normal" spacings. For this reason, cleated (blind fastened) flashings are not acceptable, and attachment at 150 to 200 mm 6 to 8 inches on center is customary. Flashing should not extend any significant distance more than one inch beyond a support or fastener.

****

Provide flashing, related closures and accessories as indicated and as necessary to provide a weathertight installation. Install flashing to ensure positive water drainage away from roof penetrations. Flash and seal the roof at the ridge, eaves and rakes, and projections through the roof. Place closure strips, flashing, and sealing material in an approved manner that will assure complete weathertightness. Details of installation which are not indicated must be in accordance with the SMACNA 1793, panel manufacturer's approved printed instructions and details, or the approved shop drawings. Allow for expansion and contraction of flashing.

3.3.4 Flashing Fasteners

Fastener spacings must be in accordance with the panel manufacturer's recommendations and as necessary to withstand the design loads indicated. Install fasteners in roof valleys as recommended by the manufacturer of the panels. Install fasteners in straight lines within a tolerance of 13 mm 1/2 inch in the length of a bay. Drive exposed penetrating type fasteners normal to the surface and to a uniform depth to seat gasketed washers properly and drive so as not to damage factory applied coating. Exercise extreme care in drilling pilot holes for fastenings to keep drills perpendicular and centered. Do not drill through sealant tape. After drilling, remove metal filings and burrs from holes prior to installing fasteners and washers. Torque used in applying fasteners must not exceed that recommended by the manufacturer. Remove panels deformed or otherwise damaged by over-torqued fastenings, and provide new panels.

3.3.5 Rib and Ridge Closure/Closure Strips

Set closure/closure strips in joint sealant material and apply sealant to mating surfaces prior to adding panel.

3.4 PROTECTION OF APPLIED ROOFING

Do not permit storing, walking, wheeling, and trucking directly on applied roofing materials. Provide temporary walkways, runways, and platforms of smooth clean boards or planks as necessary to avoid damage to applied roofing materials, and to distribute weight to conform to indicated live load limits of roof construction.

3.5 CLEANING

Clean exposed sheet metal work at completion of installation. Remove metal shavings, filings, nails, bolts, and wires from roofs. Remove grease and oil films, excess sealants, handling marks, contamination from steel wool, fittings and drilling debris and scrub the work clean. Exposed metal surfaces must be free of dents, creases, waves, scratch marks, solder or weld marks and damage to the finish coating.

3.6 MANUFACTURER'S FIELD INSPECTION

Manufacturer's technical representative must visit the site as necessary during the installation process to assure panels, flashings, and other components are being installed in a satisfactory manner. Manufacturer's technical representative must perform a field inspection during the first [20] [_____] squares of roof panel installation and at substantial completion prior to issuance of warranty, as a minimum, and as otherwise requested by the Contracting Officer. Additional inspections must not exceed one for [100] [_____] squares of total roof area with the exception that follow-up inspections of previously noted deficiencies or application errors must be performed as requested by the Contracting Officer. Each inspection visit must include a review of the entire installation to date. After each inspection, submit a report, signed by the manufacturer's technical representative, to the Contracting Officer noting the overall quality of work, deficiencies and any other concerns, and recommended corrective actions in detail. Notify Contracting Officer a minimum of 2 working days prior to site visit by manufacturer's technical representative.

3.7 COMPLETED WORK

Completed work must be plumb and true without oil canning, dents, ripples, abrasion, rust, staining, or other damage detrimental to the performance or aesthetics of the completed roof assembly.

3.8 INFORMATION CARD

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NOTE: Include only the applicable EFD.
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For each roof, provide a typewritten card, laminated in plastic and framed for interior display or a photoengraved 0.8 mm thick 0.032 inch thick aluminum card for exterior display. Card to be 220 by 280 mm 8 1/2 by 11 inches minimum and contain the information listed on Form 1 at end of this section. Install card near point of access to roof, or where indicated. Send a photostatic paper copy to [NAVFAC Washington, Building 2, Washington Navy Yard, Washington, DC 20374-2121] [LANTNAVFACENGCOM, Code 1613, 1510 Gilbert Street, Norfolk, VA 23511-2699] [NORTHNAVFACENGCOM, Code 103A, 10 Industrial Highway, Mail Stop #82, Lester, PA 19113-2090]

[PACNAVFACENGCOM, Code 102, Pearl Harbor, HI 96860-7300] [SOUTHNAVFACENGCOM, Code 0535, P.O. Box 190010, North Charleston, SC 29419-9010] [SOUTHWESTNAVFACENGCOM, Code 133SB, 1220 Pacific Highway, San Diego, CA 92132-5190].

3.9 SCHEDULE

Some metric measurements in this section are based on mathematical conversion of English unit measurements, and not on metric measurement commonly agreed to by the manufacturers or other parties. The English and metric units for the measurements shown are as follows:

PRODUCTS	ENGLISH UNITS	METRIC UNITS
a. Steel sheets	0.023 inch	0.6 mm
	0.030 inch	0.8 mm
b. Gasket washers	3/8 inch	10 mm
	1/8 inch	3 mm
c. Screws	No. 14	4.75 mm
	No. 12	4 mm
d. Bolts	1/4 inch	6 mm
e. Studs	3/16 inch	5 mm
f. Fasteners	0.145 inch by 1/2 inch	4 mm by 13 mm
	One inch	25 mm
g. Rivets	1/8 inch	3 mm

3.10 FORM ONE

FORM 1 - PREFORMED STEEL STANDING SEAM ROOFING SYSTEM COMPONENTS

1. Contract Number:

2. Building Number & Location:

3. NAVFAC Specification Number:

4. Deck/Substrate Type:

5. Slopes of Deck/Roof Structure:

6. Insulation Type & Thickness:

7. Insulation Manufacturer:

8. Vapor Retarder: ( )Yes ( )No

9. Vapor Retarder Type:

10. Preformed Steel Standing Seam Roofing Description:

a. Manufacturer (Name, Address, & Phone No.):
b. Product Name: c. Width: d. Gage:
e. Base Metal: f. Method of Attachment:

11. Repair of Color Coating:

a. Coating Manufacturer (Name, Address & Phone No.):
b. Product Name:
c. Surface Preparation:
d. Recoating Formula:
e. Application Method:

12. Statement of Compliance or Exception:_____
_____
_____

13. Date Roof Completed:

14. Warranty Period: From_____ To_____

15. Roofing Contractor (Name & Address):

16. Prime Contractor (Name & Address):

Contractor's Signature _____ Date:

Inspector's Signature _____ Date:

-- End of Section --