
USACE / NAVFAC / AFCEA UFGS-07612N (September 1999)

Preparing Activity: NAVFAC Replacing without revision
NFGS of same number and date

UNIFIED FACILITIES GUIDE SPECIFICATIONS

References are in agreement with UMRL dated 25 June 2004

SECTION TABLE OF CONTENTS

DIVISION 07 - THERMAL AND MOISTURE PROTECTION

SECTION 07612N

ALUMINUM STANDING SEAM ROOFING

09/99

PART 1 GENERAL

- 1.1 REFERENCES
- 1.2 DEFINITIONS
 - 1.2.1 Field-Formed Seam
 - 1.2.2 Snap Together Seam
 - 1.2.3 Pre-Formed
 - 1.2.4 Field-Formed
 - 1.2.5 Roofing System
- 1.3 SYSTEM DESCRIPTION
 - 1.3.1 Design Requirements
 - 1.3.2 Performance Requirements
 - 1.3.2.1 Wind Loads
 - 1.3.2.2 Resistance to Water Infiltration
 - 1.3.2.3 Thermal Movement
 - 1.3.2.4 Deflection
 - 1.3.2.5 Structural Performance
- 1.4 SUBMITTALS
- 1.5 LOAD CALCULATIONS
- 1.6 QUALITY ASSURANCE
 - 1.6.1 Preroofing Conference
 - 1.6.2 Manufacturer's Technical Representative
 - 1.6.3 Qualification of Installer
 - 1.6.4 Single Source
 - 1.6.5 Manufacturer
- 1.7 DELIVERY, STORAGE, AND HANDLING
 - 1.7.1 Delivery
 - 1.7.2 Handling
 - 1.7.3 Storage
- 1.8 Warranty

PART 2 PRODUCTS

- 2.1 ROOFING PANELS
 - 2.1.1 Material
 - 2.1.1.1 Thickness

- 2.1.1.2 Finish
- 2.1.1.3 Texture
- 2.1.1.4 Color
- 2.1.1.5 Configuration
- 2.1.1.6 Prefinished Coating System
- 2.2 ATTACHMENT CLIPS
- 2.3 ACCESSORIES
 - 2.3.1 Closures
 - 2.3.1.1 Ridge Closure
 - 2.3.1.2 Rib Closure
 - 2.3.2 Fasteners
 - 2.3.2.1 Screws
 - 2.3.2.2 Bolts
 - 2.3.2.3 Automatic End-Welded Studs
 - 2.3.2.4 Explosive Driven Fasteners
 - 2.3.2.5 Rivets
 - 2.3.3 Sealant
 - 2.3.4 Sealant Tape
- 2.4 UNDERLAYMENT FOR WOOD SUBSTRATES
- 2.5 LABORATORY TESTS FOR PANEL FINISH
 - 2.5.1 Salt Spray Test
 - 2.5.2 Formability Test
 - 2.5.3 Accelerated Weathering Test
 - 2.5.4 Chalking Resistance
 - 2.5.5 Abrasion Resistance Test for Color Coating
 - 2.5.6 Humidity Test
 - 2.5.7 Fire Hazard
 - 2.5.8 Gloss
 - 2.5.9 Glare Resistance
- 2.6 LINER PANELS

PART 3 EXECUTION

- 3.1 EXAMINATION
- 3.2 PROTECTION OF DISSIMILAR METALS
 - 3.2.1 Contact with Masonry
 - 3.2.2 Contact with Wood
- 3.3 INSTALLATION
 - 3.3.1 Roof Panels
 - 3.3.2 Flashings
 - 3.3.3 Flashing Fasteners
 - 3.3.4 Closure/Closure Strips
- 3.4 CLEANING
- 3.5 MANUFACTURER'S FIELD INSPECTION
- 3.6 COMPLETED WORK
- 3.7 INFORMATION CARD
- 3.8 SCHEDULE
- 3.9 FORM ONE

-- End of Section Table of Contents --

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SECTION 07612N

ALUMINUM STANDING SEAM ROOFING 09/99

NOTE: This guide specification covers the requirements for aluminum standing seam roofing.

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.

NOTE: On the drawings, show:

1. Design loads.
2. Roof slope (minimum one in 24 1/2 inch per foot).
3. Line(s) of fixity.
4. Supporting structural framework.
5. Track spacing and attachment details, when applicable.
6. Attachment clip spacing (list capacity of each type in spec).
7. Flashing support and fastening spacing.
8. Roof venting. (Pay particular attention to preventing infiltration of wind-driven rain).

9. Sealant and closure locations.

10. Locations for dissimilar metal protection.

11. Details of accessories such as ladders, walkways, antenna mounts, guy wire fastening, ventilation equipment and lighting.

12. Details of flashing at all roof penetrations.

NOTE: When designing standing seam roofs, consider:

1. Consult with manufacturers early in design stage to obtain current design manuals and structural information regarding roof attachments. Early contact will reduce need for corrections and changes during review process and construction phase.

2. Calculate wind uplift forces in accordance with Unified Facilities Criteria (UFC) 1-200-01 Design: General Building Requirements.

3. NAVFAC minimum guidelines are one 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. Sleepers and stub walls have been successfully used, 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, or modifications to existing structural shimming system will be necessary to resist wind forces adequately.

4. It will be necessary to diagram a number of attachment clips for varying roof conditions. Each type should be individually designated on the drawings with spacing shown. Spacing will be a function of allowable panel span and holding capability assumed for the clip(s). Minimum holding force for each type should be specified as subparagraphs under paragraph entitled "Attachment Clips." Assure that fasteners used to attach clips to structure develop full capacity of clip. Check existing structures to assure that the forces can be resisted by existing structural system. Make provisions for thermal expansion of roof structure.

5. Flashing presents a particular design problem in preventing wind and water infiltration. High winds 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, especially, are susceptible to high wind forces and

attachment should be at much closer spacing than usual. Copious use of sealants and closure pieces molded to conform to roof panels is imperative.

6. Building may require equipment such as antennae, ladders, or lighting 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 other specially designed clips. Provide curbs for mechanical equipment.

7. Specify insulation in appropriate Division 07 section.

PART 1 GENERAL

1.1 REFERENCES

NOTE: Issue (date) of references included in project specifications need not be more current than provided by the latest guide specification. Use of SpecsIntact automated reference checking is recommended for projects based on older guide specifications.

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 ADM1	(2000) Aluminum Design Manual
AA ASM-35	(2000) Specifications for Aluminum Sheet Metal Work in Building Construction, Section 5

AMERICAN FOREST & PAPER ASSOCIATION (AF&PA)

AF&PA T101	(2001) National Design Specification (NDS) for Wood Construction
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AMERICAN IRON AND STEEL INSTITUTE (AISI)

AISI SG-973	(1996) Cold-Formed Steel Design Manual
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ASTM INTERNATIONAL (ASTM)

ASTM B 117	(2002) Operating Salt Spray (Fog) Apparatus
ASTM B 209	(2002a) Aluminum and Aluminum-Alloy Sheet and Plate

ASTM B 209M	(2002a) Aluminum and Aluminum-Alloy Sheet and Plate (Metric)
ASTM D 1654	(1992; R 2000) Evaluation of Painted or Coated Specimens Subjected to Corrosive Environments
ASTM D 2247	(2002) Testing Water Resistance of Coatings in 100% Relative Humidity
ASTM D 226	(1997a) Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing
ASTM D 2565	(1999) Xenon Arc Exposure of Plastics Intended for Outdoor Applications
ASTM D 4214	(1998) Evaluating the Degree of Chalking of Exterior Paint Films
ASTM D 522	(1993a; R 2001) Mandrel Bend Test of Attached Organic Coatings
ASTM D 523	(1989; R 1999) Specular Gloss
ASTM D 714	(2002) Evaluating Degree of Blistering of Paints
ASTM D 968	(1993; R 2001) Abrasion Resistance of Organic Coatings by Falling Abrasive
ASTM E 1592	(2001) Structural Performance of Sheet Metal Roof and Siding Systems by Uniform Static Air Pressure Difference
ASTM E 330	(2002) Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference
ASTM E 84	(2003) Surface Burning Characteristics of Building Materials
ASTM G 23	(1996) Operating Light-Exposure Apparatus (Carbon-Arc Type) With and Without Water for Exposure of Nonmetallic Materials

NATIONAL ROOFING CONTRACTORS ASSOCIATION (NRCA)

NRCA CD	(2001, 5th Ed) Construction Details
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SHEET METAL AND AIR CONDITIONING CONTRACTORS' NATIONAL ASSOCIATION (SMACNA)

SMACNA Arch. Manual	(2003, 6th Ed) Architectural Sheet Metal Manual
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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 bend), 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.

1.3 SYSTEM DESCRIPTION

1.3.1 Design Requirements

- a. Provide continuous length panels with no joints or seams, except where indicated. Individual panels shall be removable for replacement of damaged material.
- b. There shall be no exposed or penetrating fasteners except where shown on the approved shop drawings. Fasteners into wood shall be stainless steel sheet metal screws with full length threads. Fasteners into steel shall be stainless steel or cadmium plated stainless steel screws inserted into predrilled holes. Length and diameter of screws shall be sufficient to meet the design loads with a suitable factor of safety for the material to which the roofing components are attached. Calculate fastener capacity in accordance with AISI SG-973, AA ADM1 or AF&PA T101 as applicable.
- c. Roof panel standing seam shall include a capillary break and be mechanically locked closed by the manufacturer's locking tool. The seam shall include a continuous sealant when required by the manufacturer to withstand the rainfall and wind specified in paragraph entitled "Manufacturer's Requirements."
- d. Roof panel anchor clips shall be concealed and designed to allow for thermal movement of the panels, except where specific fixed points are indicated.

- e. The system shall resist the positive and negative loads specified herein in accordance with "Sheet Building Sheathing Design Guide" of the AA ADM1. Determine capacity in accordance with principles of ASTM E 330 modified as follows:

(1) Test panels shall be production material of the type proposed for use. Use either full length or partial length panels with attachment representative of the main part of the roof.

(2) Test specimens shall be five panels wide, span one or more supports, and shall have no end or edge attachment or seals that will restrict crosswise movement of the panels under load. Do not bridge longitudinal seams with tape or film that can restrict separation.

(3) Panels shall be tested to failure. Report load at failure.

- f. Panels shall support walking loads without excessive distortion or telegraphing of the structural supports. Panels shall support a 115 kilogram 250 pound load concentrated on a 2500 square millimeter (mm) four square inch area at the center of the panel without buckling or permanent distortion.

1.3.2 Performance Requirements

1.3.2.1 Wind Loads

NOTE: Determine the appropriate pressures, positive and negative, that apply to the various portions of the roof using current engineering technology that takes into account the height, shape, and location of the structure. See NAVFAC Military Handbook MIL-HDBK-1002/2, "Structural Engineering-Loads," for structural design and wind load information.

Resistance to wind uplift generated by winds of [200] [_____] km/h [124] [_____] mph. The roof system and attachments shall resist the following wind loads (kPa psf) with a factor of safety appropriate for the material holding the anchor:

	Positive	Negative
At eaves	[_____]	[_____]
At rakes	[_____]	[_____]
At ridge	[_____]	[_____]
At building corners	[_____]	[_____]
At central areas	[_____]	[_____]

1.3.2.2 Resistance to Water Infiltration

Roofing system shall show no infiltration at seams, edges, flashings, counterflashings and penetrations when subjected to a rainfall of [125] [_____] mm [5] [_____] inches per hour with [200] [_____] km/h [124]

[_____] mph wind.

1.3.2.3 Thermal Movement

NOTE: Select the temperature range appropriate for
the finish and color specified.

The system shall be capable of withstanding thermal movement based on a temperature range of 5 degrees C 10 degrees F below design low air temperature and [60 degrees C140 degrees F for mill finish and light colors.] [82 degrees C180 degrees F for dark colors.]

1.3.2.4 Deflection

Panel deflection shall not exceed L/140.

1.3.2.5 Structural Performance

The structural performance test methods and requirements shall be in accordance with ASTM E 1592.

1.4 SUBMITTALS

NOTE: Submittals must be limited to those necessary for adequate quality control. The importance of an item in the project should be one of the primary factors in determining if a submittal for the item should be required.

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 projects.

Submittal items not designated with a "G" are considered as being for information only for Army projects and for Contractor Quality Control approval for Navy projects.

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.] The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Roofing panels; G

Submit drawings as necessary to supplement the instructions and diagrams. Drawings shall 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. Show typical and special conditions including flashings, accessory installation, materials and thicknesses, all dimensions, anchoring methods, sealant locations, sealant tape locations, fastener layout, sizes, spacing, provisions for thermal movement, terminations, penetrations, and attachments. Details of installation shall be in accordance with the manufacturer's Standard Instructions and details or the SMACNA Arch. Manual. The manufacturer's technical engineering department shall approve the drawings before they are submitted.

SD-03 Product Data

Roofing panels; G

Attachment clips

Closures

Accessories

Underlayment

Sample warranty certificate; G

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

SD-04 Samples

Roofing panels

Submit a 300 mm 12 inch long section of typical panel [in color specified] [in color 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, closures, fasteners and leg clamps.

SD-05 Design Data

Load calculations; G

SD-06 Test Reports

Structural performance; G

Panel finish; G

Submit reports of the tests required by this section.

Manufacturer's field inspection; G

Submit manufacturer's technical representative's inspection reports as required in paragraph entitled "Manufacturer's Field Inspection."

SD-07 Certificates

Technical representative

Qualification of Installer

Submit documentation proving the installer is factory-trained, has the specified experience and is 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

Sealant

Submit manufacturer's sealant requirements for making the standing seam watertight when subjected to 125 mm 5 inches of rainfall per hour simultaneous with [160] [200] [_____] km/h [100] [124] [_____] mph winds.

Installation manual; G

Submit manufacturer's 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.

1.5 LOAD CALCULATIONS

NOTE: Ensure that appropriate design loads are
specified in paragraph entitled "Wind Loads."

NOTE: Use 200 km/h 124 mph at Adak, Alaska.

Submit load calculations for the following by a structural engineer registered as a Professional Engineer in any jurisdiction verifying that the system supplied meets the design loads indicated. Coordinate calculations with manufacturer's test results.

- a. Wind load uplift design pressure at roof locations specified in paragraph entitled "Wind Loads."
- b. Clip spacing and allowable load per clip calculations.
- c. The fastening of clips to structure or intermediate support spacing.
- d. Intermediate support spacing and fastening to structure when required.
- e. Allowable panel span at anchorage spacing indicated.
- f. Safety factor used in determining loading.

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 SOUTHNAVFACENGCOM 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 shall] 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 prerooting conference shall 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 prerooting conference shall be resolved and confirmed in writing before roofing work, including associated work, is begun. [Prepare written minutes of the prerooting conference and submit to the Contracting Officer.]

1.6.2 Manufacturer's Technical Representative

The representative shall 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 shall be an employee of the manufacturer with at least 5 years experience in installing the roof system. The representative shall be available to perform field inspections and attend meetings as required herein, and as requested by the Contracting Officer.

1.6.3 Qualification of Installer

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

1.6.4 Single Source

Provide roofing panels, clips, closures and other accessories from a single manufacturer.

1.6.5 Manufacturer

The SSMRS shall be the product of a metal roofing industry recognized SSMRS 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.

1.7 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.

1.7.1 Delivery

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

1.7.2 Handling

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

1.7.3 Storage

Stack materials stored on the site on platforms or pallets and cover with tarpaulins or other suitable weathertight coverings which prevent water trapping or condensation. Store panels 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 Warranty

Furnish manufacturer's no dollar limit materials and workmanship warranty for the roofing system. The warranty period shall be not less than 20 years from the date of Government acceptance of the work. The warranty shall be issued directly to the Government. The warranty shall provide that if within the warranty period the metal roofing system becomes non-watertight or shows evidence of corrosion, perforation, peeling paint, rupture or excess weathering due to deterioration of the roofing system resulting from defective materials or workmanship the repair or replacement of the defective materials and correction of the defective workmanship shall be the responsibility of the roofing system manufacturer. Repairs that become necessary because of defective materials and workmanship while roofing is under warranty shall 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. Contractor shall also provide a 2 year contractor installation warranty.

PART 2 PRODUCTS

2.1 ROOFING PANELS

2.1.1 Material

3004 aluminum, ASTM B 209M ASTM B 209.

2.1.1.1 Thickness

1.0 mm0.040 inch minimum.

2.1.1.2 Finish

NOTE: Choose the finish appropriate for the project. In general, hangars, warehouses, and other utilitarian structures may use mill finish to reduce cost. Mill finish Alclad is more economical than fluorocarbon painted finish. Some colors in the painted finish are substantially more costly than others, due to the scarcity of certain pigments.

[Alclad mill finish, unpainted] [Alclad fluorocarbon baked enamel exterior and neutral washcoat interior].

2.1.1.3 Texture

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

2.1.1.4 Color

NOTE: Check with the facility regarding color selection. Use only manufacturer's standard colors. Delete this paragraph if mill finish has been selected.

[As selected.] [Blue] [Red] [[____], No. [____]] exterior.

2.1.1.5 Configuration

NOTE: The height of vertical legs should not be less than 50 mm 2 inches on roofs having a slope less than 2 in 12. The occurrence of ice dams or other water flow obstructions should be considered when determining the vertical leg height.

Provide panels of continuous lengths from ridge to eaves or from top to eaves on shed roof designs. Panels shall be [300] [____] mm [12] [____] inches wide with a minimum [50] [____] mm [2.0] [____] inch high vertical legs and two [9.4 mm0.37 inch] [____] stiffening ribs at 100 mm 4 inches on center between the legs to minimize oil-canning and telegraphing of structural members. Leading vertical leg shall have a continuous groove in the rib top for anti-siphon protection when hook-rib top of next panel is locked over leading vertical leg to form the standing seam. Panels from coil stock shall be formed without warping, waviness or ripples not a part of the panel profile, and shall be free of damage to the finish coating system.

[2.1.1.6 Prefinished Coating System

NOTE: Delete this paragraph if mill finish has been selected.

Fluorocarbon baked enamel, factory-applied, minimum total dry film nominal thickness of [0.0175] [0.050] [____] mm [0.7] [2.0] [____] mils, and conforming to test requirements specified herein. Provide prefinished coating system on [both faces.] [the exterior face.] Interior face shall receive same coating system, or, at the manufacturer's option, receive a coat of acrylic wash coat applied to a minimum total dry film nominal thickness of 0.005 mm 0.20 mil. Color shall be [as specified] [as selected from the manufacturer's standard colors].

]2.2 ATTACHMENT CLIPS

NOTE: Add the appropriate choice(s) for the attachment clip(s) used in the design. Insert

design value for minimum load capacity.

Series 300 non-magnetic stainless steel.

- a. Type 1: [_____] clip, minimum capacity [_____] kgs lbs.
- b. Type 2: [_____] clip, minimum capacity [_____] kgs lbs.
- c. Type 3: [_____] clip, minimum capacity [_____] kgs lbs.

2.3 ACCESSORIES

Sheet metal flashings, trim, moldings, closure strips, caps, preformed crickets, equipment curbs, [gutters,] [down spouts,] and other similar sheet metal accessories provided in conjunction with preformed metal panels shall be of the same material and finish as panels, except that such items which will be concealed after installation may be provided without the finish if they are aluminum or stainless steel. Provide ridge and rib closures, as specified. Metal shall be of thickness not less than that of panels. Molded closure strips shall be closed-cell synthetic rubber, neoprene, or polyvinyl chloride premolded to match configurations of preformed metal panels. Thermal spacer blocks and other thermal barriers at concealed fasteners shall be as recommended by the roofing panel manufacturer.

2.3.1 Closures

2.3.1.1 Ridge Closure

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 shall not absorb water.

2.3.1.2 Rib Closure

Aluminum, closed-cell or solid-cell synthetic rubber, neoprene or polyvinyl chloride pre-molded to match configuration of rib opening. Material for closures shall not absorb water.

2.3.2 Fasteners

NOTE: In the 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 50 to 200 mm 6 to 8 inches on center is customary. Flashing should not extend a significant distance more than 25 mm one inch beyond a support or fastener.

Series 300 stainless steel with composite metal and neoprene composition washers. Fasteners for attachment to structural supports and fasteners for attachment of panels shall be as approved and in accordance with manufacturer's recommendation. Unless specified otherwise herein, fasteners shall be either self-tapping screws, bolts and nuts, or self-locking bolts. Design fastening system to withstand design loads

indicated. Fasteners shall not be over-torqued and shall develop full capacity of attachment clips.

2.3.2.1 Screws

Provide not less than 0.242 mm No. 14 diameter for self-tapping type and not less than 0.216 mm No. 12 diameter for self-drilling and self-tapping.

2.3.2.2 Bolts

Provide not less than 6 mm 1/4 inch diameter, shouldered or plain shank as required, with proper nuts.

2.3.2.3 Automatic End-Welded Studs

Provide shouldered type with a shank diameter of not less than 5 mm 3/16 inch and cap or nut for holding covering against the shoulder.

2.3.2.4 Explosive Driven Fasteners

Provide fasteners to be driven with explosive actuated tools and with a shank diameter of not less than 13 mm 1/2 inch for fastening to steel and not less than 25 mm one inch for fastening to concrete.

2.3.2.5 Rivets

Blind rivets shall be aluminum with 5 mm 3/16 inch nominal diameter shank or stainless steel with 3 mm 1/8 inch nominal diameter shank. Rivets shall be threaded stem type if used for other than fastening trim. Rivets with hollow stems shall have closed ends.

2.3.3 Sealant

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

2.3.4 Sealant Tape

Polyvinyl chloride closed cell foam tape or composed of 99 percent solids in a base of butyl polyisobutylene rubber with the following properties and characteristics:

- a. Webbing and Elongation: 100% minimum at 25 degrees C 77 degrees F
- b. Adhesion: Excellent to surfaces used
- c. U-V light exposure: No effect
- d. Ozone: No effect
- e. Weathering: 1000 hours in QUV Test Apparatus - Excellent, no cracking, bleeding, or significant changes.
- f. Moisture Transmission: 0.05 to 0.15 grams per 62500 square mm 100 square inches in 24 hours.

g. Service Temperature Tests: Bending over 13 mm 1/2 inch mandrel at -50 degrees C -60 degrees F with no cracking. Expose sealed typical metal lap joint to +176 degrees C +350 degrees F for 24 hours with no significant loss of original properties.

h. Reaction to Metals: Non-corrosive to metals

2.4 UNDERLAYMENT FOR WOOD SUBSTRATES

**NOTE: Include the following paragraph where
standing seam metal roof is applied directly to a
wood deck.**

Provide underlayment ASTM D 226, Type I perforated, covered by water-resistant rosin sized building paper.

2.5 LABORATORY TESTS FOR PANEL FINISH

Previously manufactured panels of the same type and finish as proposed for the project shall have been tested by an approved testing laboratory to ensure conformance to specifications. The term "appearance of base metal" refers to the aluminum base metal. Panels shall meet the following test requirements.

2.5.1 Salt Spray Test

**NOTE: Use 2000-hour test for products to be
installed in marine environments such as at Adak,
Alaska.**

Panels shall withstand a salt spray test for a minimum of [1000] [2000] hours in accordance with ASTM B 117, including the scribe requirement in the test. Immediately upon removal of the panel from the test, coating shall receive a rating of 10, no blistering, as determined by ASTM D 714; and a rating of 7, 2 mm 1/16 inch failure at scribe, as determined by ASTM D 1654, Rating Schedule No. 1.

2.5.2 Formability Test

For formability test, when subjected to a 180 degree bend over a 3 mm 1/8 inch diameter mandrel in accordance with ASTM D 522, exterior coating film shall show only microchecking of the exterior film and there shall be no loss of adhesion.

2.5.3 Accelerated Weathering Test

Panels shall withstand an accelerated weathering test for a minimum of 2000 hours in accordance with ASTM G 23 or ASTM D 2565 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 shall be considered to indicate loss of adhesion.

2.5.4 Chalking Resistance

After the 2000-hour weatherometer test, exterior coating shall not chalk greater than No. 8 rating when measured in accordance with ASTM D 4214 test procedures.

2.5.5 Abrasion Resistance Test for Color Coating

When subjected to the falling sand test in accordance with ASTM D 968, coating system shall withstand a minimum of 100 liters of sand per 0.025 mm mil of coating thickness before appearance of base metal.

2.5.6 Humidity Test

When subjected to a humidity cabinet test in accordance with ASTM D 2247 for 1000 hours, a scored panel shall show no signs of blistering, cracking, creepage, or corrosion.

2.5.7 Fire Hazard

NOTE: Delete this paragraph if mill finish has been selected. If roofing is exposed in exit areas, use a flame spread of 25; if exposed in non-exit areas, use flame spread of 75; otherwise delete the paragraph.

The finish on factory-fabricated panels shall have a flame spread rating of not more than [25] [75] when tested in accordance with ASTM E 84.

2.5.8 Gloss

The gloss of the finish shall be 30 plus or minus 5 at an angle of 60 degrees, when measured in accordance with ASTM D 523.

2.5.9 Glare Resistance

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.

Surfaces of panels that will be exposed to the exterior shall have a specular reflectance of not more than 10 when measured in accordance with ASTM D 523 at an angle of 85 degrees. Requirements specified under "Formability Test" will be waived if necessary to conform to this requirement.

2.6 LINER PANELS

Fabricate liner panels of the same material as roof panels, and formed or patterned to prevent waviness and distortion. Liner panels shall have a factory applied, 0.025 mm one mil thick minimum painted coating on the inside face, and a prime coat on the liner side.

PART 3 EXECUTION

3.1 EXAMINATION

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

3.2 PROTECTION OF DISSIMILAR METALS

NOTE: Galvanized steel will deteriorate in humid conditions, coastal areas and should be considered a dissimilar metal unless it is known that the contact surface will remain dry and free from condensation. Wood which has been pressure treated will also react with aluminum. Provide protection if aluminum could contact treated wood.

Where an aluminum component is in contact with, fastened to, or contacted by drainage from dissimilar metals other than stainless steel, give such dissimilar metals one of the following treatments:

- a. A heavy brush coat of primer followed by two coats of aluminum metal and masonry paint.
- b. A heavy coat of alkali-resistant bituminous paint.
- c. Separate contact surfaces with non-absorptive tape or gasket.

3.2.1 Contact with Masonry

Where aluminum is in contact with masonry, concrete, or plaster, apply a heavy coat of alkali-resistant bituminous paint.

3.2.2 Contact with Wood

Where aluminum is in contact with wood or other absorptive material subject to wetting, or with wood treated with a preservative not compatible with aluminum, seal joints with sealing compound and apply one heavy brushcoat of aluminum pigmented bituminous paint.

3.3 INSTALLATION

Install in accordance with approved manufacturer's erection instructions shop drawings, and diagrams, except as specified otherwise herein. Provide panels in full and firm contact with clips. Obtain approval prior to installation on prefinished panels cut in the field, and factory applied coverings or coatings that were repaired after being abraded or damaged during handling or installation. Make repairs with material of same color as weather coating. Completely seal openings through panels. Correct defects or errors in materials in an approved manner. Replace materials which cannot be corrected in an approved manner with new materials. Provide molded closure strips where indicated and where necessary for weathertight construction. [Use shims as required to ensure 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 end laps 75 mm 3 inches, offset seams in building paper with seams in felt.]

3.3.1 Roof Panels

Apply roofing panels with standing seams parallel to slope of roof. Provide roofing panels in full 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. Form interlocking rib type panel seams in the field with an automatic mechanical seamer approved by the manufacturer. Attach panels to structure with concealed clips which are incorporated into the panel seams. Clip attachment shall allow roof to move freely and independently of the structure, except at fixed points as indicated.

3.3.2 Flashings

NOTE: In the 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 100 to 150 mm 4 to 6 inches on center is customary. Flashing should not extend a significant distance more than 25 mm one inch beyond a support or fastener.

Provide flashing and related closures and accessories in connection with preformed metal panels [as indicated] and as necessary to provide a weathertight installation. Install flashing to ensure positive water drainage away from roof penetrations. Flash and seal roof at ridge, eaves and rakes, at projections through roof, and elsewhere as necessary. Accomplish placement of closure strips, flashing, and sealing material in an approved manner that will ensure complete weathertightness. Details of installation which are not indicated shall be in accordance with the NRCA CD, SMACNA Arch. Manual, AA ASM-35, panel manufacturer's printed instructions and details of the approved shop drawings. Installation shall allow for expansion and contraction of flashing.

3.3.3 Flashing Fasteners

NOTE: In the 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 100 to 150 mm 4 to 6 inches on center is customary. Flashing should not extend any significant distance more than 25 mm one inch beyond a support or fastener.

Fastener spacings shall be in accordance with the panel manufacturer's recommendations and as necessary to withstand the indicated design loads. 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 tapes. After drilling, remove metal filings and burrs from holes prior to installing fasteners and washers. Torque used in applying fasteners shall not exceed that recommended by the manufacturer. Remove panels deformed or otherwise damaged by over-torqued fastenings, and provide new panels.

3.3.4 Closure/Closure Strips

Set closure/closure strips in joint sealant material.

3.4 CLEANING

Clean exposed sheet metal work at completion of installation. Remove metal shavings, filings, nails, bolts, and wires from roofs on completion to prevent discoloration and harm to the panels and flashing. 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 shall be free of dents, creases, waves, scratch marks, and solder or weld marks.

3.5 MANUFACTURER'S FIELD INSPECTION

Manufacturer's technical representative shall 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 shall 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 shall not exceed one for each [100] [_____] squares of total roof area with the exception that follow-up inspections of previously noted deficiencies or application errors shall be performed as requested by the Contracting Officer. Each inspection visit shall include a review of the entire installation to date. After each inspection, a report, signed by the manufacturer's technical representative, shall be submitted 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.

3.6 COMPLETED WORK

Completed work shall 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.

3.7 INFORMATION CARD

NOTE: Include only the applicable EFD.

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 [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].

3.8 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:

<u>PRODUCTS</u>	<u>ENGLISH UNITS</u>	<u>METRIC UNITS</u>
a. Sheet Aluminum	0.040 inch	1.0 mm
b. Panels	12 inches	300 mm
- vertical legs	2 inches	50 mm
- stiffening ribs	4 inches	100 mm
c. Screws	No. 14	0.242 mm
	No. 12	0.216 mm
d. Bolts	1/4 inch	6 mm
e. Studs	3/16 inch	5 mm
f. Fasteners	1/2 inch	13 mm
	One inch	25 mm
g. Rivets	1/16 inch	5 mm
	1/8 inch	3 mm

3.9 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 --