
USACE / NAVFAC / AFCEA / NASA UFGS-07 41 63 (May 2009)

Preparing Activity: NASA

Superseding
UFGS-07 41 63 (January 2008)

UNIFIED FACILITIES GUIDE SPECIFICATION

References are in agreement with UMRL dated July 2011

SECTION TABLE OF CONTENTS

DIVISION 07 - THERMAL AND MOISTURE PROTECTION

SECTION 07 41 63

FABRICATED ROOF PANEL ASSEMBLIES

05/09

PART 1 GENERAL

- 1.1 REFERENCES
- 1.2 PERFORMANCE REQUIREMENTS
- 1.3 DEFINITIONS
- 1.4 SUBMITTALS
- 1.5 QUALITY ASSURANCE
 - 1.5.1 Pre-roofing Conference
 - 1.5.2 Manufacturer's Technical Representative
 - 1.5.3 Qualification of Manufacturer
 - 1.5.4 Qualification of Installation Contractor
 - 1.5.5 Single Source
 - 1.5.6 Surface-Burning Characteristics
 - 1.5.7 Fire-Resistance Ratings
 - 1.5.8 Fabrication
 - 1.5.9 Finishes
- 1.6 DELIVERY, HANDLING, AND STORAGE
- 1.7 PROJECT CONDITIONS
- 1.8 WARRANTY
 - 1.8.1 Manufacturer's Finish Warranty
 - 1.8.2 Metal Roof System Installer Warranty
 - 1.8.3 Continuance of Warranty
- 1.9 CONFORMANCE AND COMPATIBILITY
- 1.10 SCHEDULE

PART 2 PRODUCTS

- 2.1 PANEL MATERIALS
 - 2.1.1 Aluminum Sheet
 - 2.1.2 Steel Sheet
 - 2.1.3 Foam-Insulation Core Roof Panel
 - 2.1.4 Insulated Panel Construction
 - 2.1.5 Finish
- 2.2 MISCELLANEOUS METAL FRAMING
 - 2.2.1 General
 - 2.2.2 Fasteners for Miscellaneous Metal Framing

- 2.3 FASTENERS
 - 2.3.1 General
 - 2.3.2 Exposed Fasteners
 - 2.3.3 Screws
 - 2.3.4 Rivets
 - 2.3.5 Attachment Clips
- 2.4 ACCESSORIES
 - 2.4.1 General
 - 2.4.2 Rubber Closure Strips
 - 2.4.3 Metal Closure Strips
 - 2.4.4 Joint Sealants
 - 2.4.4.1 Sealants
- 2.5 SHEET METAL FLASHING AND TRIM
 - 2.5.1 Fabrication, General
 - 2.5.2 Roof Drainage Sheet Metal Fabrications
- 2.6 REPAIR OF FINISH PROTECTION

PART 3 EXECUTION

- 3.1 EXAMINATION
- 3.2 PREPARATION
- 3.3 ROOF PANEL INSTALLATION
- 3.4 FASTENER INSTALLATION
- 3.5 FLASHING, TRIM AND CLOSURE INSTALLATION
 - 3.5.1 General Requirements
 - 3.5.2 Metal Flashing
 - 3.5.3 Closures
- 3.6 WORKMANSHIP
- 3.7 ACCEPTANCE PROVISIONS
 - 3.7.1 Erection Tolerances
 - 3.7.2 Leakage Tests
 - 3.7.3 Repairs to Finish
 - 3.7.4 Paint-Finish Metal Roofing
- 3.8 CLEAN-UP AND DISPOSAL
- 3.9 FIELD QUALITY CONTROL
 - 3.9.1 Manufacturer's Inspection
- 3.10 INFORMATION FORM AND PLACARD
- 3.11 FORM ONE
- 3.12 DATE OF INSTALLATION WALL-MOUNTED PLACARD
- 3.13 USACE WARRANTY

-- End of Section Table of Contents --

USACE / NAVFAC / AFCEA / NASA UFGS-07 41 63 (May 2009)

Preparing Activity: NASA Superseding
UFGS-07 41 63 (January 2008)

UNIFIED FACILITIES GUIDE SPECIFICATION

References are in agreement with UMRL dated July 2011

SECTION 07 41 63

FABRICATED ROOF PANEL ASSEMBLIES

05/09

NOTE: This guide specification covers the requirements for both factory color and mill finish aluminum or steel fabricated roof panel assemblies.

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 items(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 section includes structural standing seam panels, insulated sandwich panels and special fabricated roof panel systems.

Coordinate this section with other system components specifications such as framing, decking, insulation and sheet metal flashing. Also coordinate with the criteria of Unified Facilities Criteria (UFC) 3-110-06, "Design: Roofing" as it relates to the specific project and Service Exceptions indicated therein. For Army projects also refer to TI 809-29, "Structural Considerations for Metal Roofing".

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 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.

ALUMINUM ASSOCIATION (AA)

AA ADM (2010) Aluminum Design Manual

AMERICAN INSTITUTE OF STEEL CONSTRUCTION (AISC)

ANSI/AISC 341 (2005; Suppl No. 1 2005) Seismic Provisions for Structural Steel Buildings

AMERICAN IRON AND STEEL INSTITUTE (AISI)

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

AMERICAN SOCIETY OF CIVIL ENGINEERS (ASCE)

ASCE 7-10 (2010) Minimum Design Loads for Buildings and Other Structures

AMERICAN WELDING SOCIETY (AWS)

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

AWS D1.1/D1.1M (2010) Structural Welding Code - Steel

ASTM INTERNATIONAL (ASTM)

ASTM A1008/A1008M (2011) Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural,

	High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardened
ASTM A123/A123M	(2009) Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
ASTM A36/A36M	(2008) Standard Specification for Carbon Structural Steel
ASTM A424/A424M	(2009a) Standard Specification for Steel Sheet for Porcelain Enameling
ASTM A463/A463M	(2010) Standard Specification for Steel Sheet, Aluminum-Coated, by the Hot-Dip Process
ASTM A606/A606M	(2009a) Standard Specification for Steel Sheet and Strip, High-Strength, Low-Alloy, Hot-Rolled and Cold-Rolled, with Improved Atmospheric Corrosion Resistance
ASTM A653/A653M	(2010) Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
ASTM A780/A780M	(2009) Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings
ASTM A792/A792M	(2010) Standard Specification for Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process
ASTM A924/A924M	(2010a) Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process
ASTM B117	(2009) Standard Practice for Operating Salt Spray (Fog) Apparatus
ASTM B209	(2010) Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate
ASTM B209M	(2007) Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate (Metric)
ASTM B659	(1990; R 2008e1) Standard Guide for Measuring Thickness of Metallic and Inorganic Coatings
ASTM C 273/C 273M	(2007a) Shear Properties of Sandwich Core Materials
ASTM C 286	(1999; R 2009) Standard Terminology Relating to Porcelain Enamel and Ceramic-Metal Systems

ASTM C 553	(2008) Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications
ASTM C 612	(2010) Mineral Fiber Block and Board Thermal Insulation
ASTM C 920	(2011) Standard Specification for Elastomeric Joint Sealants
ASTM D 1056	(2007) Standard Specification for Flexible Cellular Materials - Sponge or Expanded Rubber
ASTM D 1308	(2002; R 2007) Effect of Household Chemicals on Clear and Pigmented Organic Finishes
ASTM D 1621	(2010) Compressive Properties of Rigid Cellular Plastics
ASTM D 1622	(2008) Apparent Density of Rigid Cellular Plastics
ASTM D 1667	(2005; R 2011) Flexible Cellular Materials - Poly (Vinyl Chloride) Foam (Closed-Cell)
ASTM D 2244	(2009b) Calculation of Color Tolerances and Color Differences from Instrumentally Measured Color Coordinates
ASTM D 2247	(2011) Testing Water Resistance of Coatings in 100% Relative Humidity
ASTM D 2794	(1993; R 2010) Resistance of Organic Coatings to the Effects of Rapid Deformation (Impact)
ASTM D 2856	(1994; R 1998) Open-Cell Content of Rigid Cellular Plastics by the Air Pycnometer
ASTM D 333	(2001; R 2007) Standard Guide for Clear and Pigmented Lacquers
ASTM D 3363	(2005) Film Hardness by Pencil Test
ASTM D 4214	(2007) Standard Test Method for Evaluating the Degree of Chalking of Exterior Paint Films
ASTM D 522	(1993a; R 2008) Mandrel Bend Test of Attached Organic Coatings
ASTM D 523	(2008) Standard Test Method for Specular Gloss
ASTM D 714	(2002; R 2009) Evaluating Degree of Blistering of Paints

ASTM D 822	(2001; R 2006) Filtered Open-Flame Carbon-Arc Exposures of Paint and Related Coatings
ASTM D 968	(2005; R 2010) Abrasion Resistance of Organic Coatings by Falling Abrasive
ASTM E 119	(2011) Standard Test Methods for Fire Tests of Building Construction and Materials
ASTM E 136	(2011) Behavior of Materials in a Vertical Tube Furnace at 750 Degrees C
ASTM E 1592	(2005) Structural Performance of Sheet Metal Roof and Siding Systems by Uniform Static Air Pressure Difference
ASTM E 2140	(2001; R 2009) Standard Test Method for Water Penetration of Metal Roof Panel Systems by Static Water Pressure Head
ASTM E 84	(2010b) Standard Test Method for Surface Burning Characteristics of Building Materials
ASTM G 152	(2006) Operating Open Flame Carbon Arc Light Apparatus for Exposure of Nonmetallic Materials
ASTM G 153	(2004; R 2010) Operating Enclosed Carbon Arc Light Apparatus for Exposure of Nonmetallic Materials
FM GLOBAL (FM)	
FM 4471	(2010) Class I Panel Roofs
METAL BUILDING MANUFACTURERS ASSOCIATION (MBMA)	
MBMA RSDM	(2000) Metal Roofing Systems Design Manual
NATIONAL ASSOCIATION OF ARCHITECTURAL METAL MANUFACTURERS (NAAMM)	
NAAMM AMP 500	(2006) Metal Finishes Manual
NATIONAL ROOFING CONTRACTORS ASSOCIATION (NRCA)	
NRCA 0405	(2001; 5th Ed) Roofing and Waterproofing Manual
NRCA 0409	(2006) Architectural Sheet Metal and Metal Roofing Manual
PORCELAIN ENAMEL INSTITUTE (PEI)	
PEI 1001	(1996) Specification for Architectural Porcelain Enamel (ALS-100)

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

SMACNA 1793 (2003) Architectural Sheet Metal Manual,
6th Edition

THE SOCIETY FOR PROTECTIVE COATINGS (SSPC)

SSPC PS 9.01 (1982; E 2004) Cold-Applied Asphalt Mastic
Painting System with Extra-Thick Film

U.S. GENERAL SERVICES ADMINISTRATION (GSA)

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

U.S. NAVAL FACILITIES ENGINEERING COMMAND (NAVFAC)

NAVFAC A-A-50570 (1997) Paint, Water-Borne, Acrylic Or
Modified Acrylic, Semigloss, For Metal
Surfaces

UNDERWRITERS LABORATORIES (UL)

UL 580 (2006; Reprint Jul 2009) Tests for Uplift
Resistance of Roof Assemblies

UL Bld Mat Dir (2011) Building Materials Directory

1.2 PERFORMANCE REQUIREMENTS

- a. Hydrostatic-Head Resistance: No water penetration when tested according to ASTM E 2140.
- b. Wind-Uplift Resistance: Provide roof panel assemblies that comply with the requirements of the roof systems and attachments in accordance with ASTM E 1592 and UL 580. Uplifting force due to wind action governs the design for panels.
 - (1) Roof systems and attachments are to resist the wind loads as determined by ASCE 7-10 in pounds per square foot.
- c. FMG Listing: Provide FRP roof panels and component materials that comply with requirements in FM 4471 as part of a panel roofing system and that are listed in FMG "Approval Guide" for Class 1 or noncombustible construction, as applicable. Identify materials with FMG markings.
- d. Structural Performance: Provide roof panel assemblies capable of withstanding the effects of gravity loads and stresses within limits and under conditions indicated, based on testing according to ASTM E 1592.

NOTE: Include bracketed reference for seismic
conditions.

[e. Seismic Performance: Provide fabricated roof panel assemblies conforming to and ANSI/AISC 341 with test data.

]

1.3 DEFINITIONS

Fabricated Roof Panel Assembly: Metal roof and liner panels, attachment system components, miscellaneous metal framing, thermal insulation, and accessories shop fabricated or field assembled for a complete weather-tight roofing system.

1.4 SUBMITTALS

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

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

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

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

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

SD-01 Preconstruction Submittals

Qualification of Manufacturer[; G][; G, [____]]

Qualification of Installer[; G][; G, [____]]

Qualifications for Welding

SD-02 Shop Drawings

Roofing Panels[; G][; G, [____]]

Flashing and Accessories[; G][; G, [____]]

Gutter/Downspout Assembly[; G][; G, [____]]

SD-03 Product Data

Sustainable acquisition[; G][; G, [____]].

Submit Manufacturer's catalog data for the following items:

Coil Stock[; G][; G, [____]]

Factory Color Finish[; G][; G, [____]]

Sub-girts and Formed Shapes[; G][; G, [____]]

Closure Materials[; G][; G, [____]]

Insulation[; G][; G, [____]]

Pressure Sensitive Tape[; G][; G, [____]]

Sealants and Caulking[; G][; G, [____]]

Rated Wall Assembly[; G][; G, [____]]

Galvanizing Repair Paint[; G][; G, [____]]

Enamel Repair Paint[; G][; G, [____]]

Aluminized Steel Repair Paint[; G][; G, [____]]

Accessories[; G][; G, [____]]

SD-04 Samples

Submit as required each of the following samples:

Coil Stock[; G][; G, [____]], sample
30.5 cm 12 inches long by the actual panel width

Roofing Panels[; G][; G, [____]], sample 30.5 cm 12 inches long
by actual panel width

Fasteners[; G][; G, [____]]

Metal Closure Strips[; G][; G, [____]], 25.4 cm 10 inches long of
each type

Insulation[; G][; G, [____]], approximately 20 by 28 cm 8 by 11
inches

Manufacturer s color charts and chips[; G][; G, [____]]

SD-05 Design Data

As applicable submit the following:

Wind design analysis[; G][; G, [_____]]

Seismic design analysis[; G][; G, [_____]]

SD-06 Test Reports

Submit test reports[; G][; G, [_____]] for the following in accordance with the requirements in this section.

Leakage Tests[; G][; G, [_____]]

Fire Rating Test Report[; G][; G, [_____]]

Coatings and base metals of metal roofing[; G][; G, [_____]] test as specified and in various referenced standards in this section.

Factory Finish and Color Performance Requirements[; G][; G, [_____]]

Wind Uplift Test Report[; G][; G, [_____]]

Seismic Test Report[; G][; G, [_____]]

SD-07 Certificates

Submit certificates for the following items showing conformance with referenced standards contained in this section:

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

Fasteners[; G][; G, [_____]]

Galvanizing Repair Paint[; G][; G, [_____]]

Enamel Repair Paint[; G][; G, [_____]]

SD-08 Manufacturer's Instructions

Installation of Roof panel assemblies[; G][; G, [_____]]

SD-11 Closeout Submittals

Warranty[; G][; G, [_____]]

Information Form and Placard[; G][; G, [_____]]

Manufacturer's field inspection reports[; G][; G, [_____]]

Instructions[; G][; G, [_____]]

Government and/or Contractor Personnel; Include copies of Material Safety Data Sheets[; G][; G, [_____]] for maintenance/repair materials.

Date Of Installation Wall-Mounted Placard[; G][; G, [_____]]

[Submit 20 year "No-Dollar-Limit" warranty for labor and materials
[; G][; G, [_____]].
]

1.5 QUALITY ASSURANCE

1.5.1 Pre-roofing Conference

After submittals are received and approved but before roofing and insulation work, including associated work, is performed, the Contracting Officer will hold a pre-roofing conference to review the following:

a. The drawings and specifications:

- (1) Fabrication and Installation drawings for the following items are to indicate completely dimensioned structural frame and erection layouts, openings in roof, special framing details and construction details at corners, ridges, eaves, building intersections, curbs and flashing, location and type of mastic and metal filler strips, location and erection of flashing and gutter/downspout assembly:
- (2) Installation of Roof panel assemblies
- (3) Roofing Panels
- (4) Flashing and Accessories
- (5) Gutter/Downspout Assembly

Submit certification from coil stock manufacturer or supplier that the machinery used will form the provided coil stock without warping, waviness, or rippling that is not a part of the panel profile, and without damage, abrasion or marring of the finish coating.

Submit manufacturer's color charts and chips, approximately 10.2 by 10.2 cm 4 by 4 inches, showing full range of colors, textures and patterns available for roof panels with Factory Color Finish.

Submit Factory Finish and Color Performance Requirements verified by an independent testing agency.

Submit a wind design analysis from the manufacturer including, but not limited to, wind speed, exposure category, co-efficient, importance factor, designate type of facility, negative pressures for each zone, methods and requirements of attachment. Include a roof plan delineating dimensions and attachment patterns for each zone. Prepare signed and sealed wind design analysis with a Licensed Project Engineer, in the geographic area where the construction will take place.

- [(6) Wind Uplift Test Report
][(7) Seismic design analysis
][(8) Seismic Test Report
] (9) Fire Rating Test Report

b. Qualifications including:

(1) Qualification of Manufacturer

Certify that the manufacturer of the metal roofing system meets requirements specified.

(2) Qualification of Installer

Certify that the applicator meets requirements specified, and provide evidence that products used within this specification are manufactured in the United States.

(3) Qualifications for Welding

Provide certification of welding procedures conforming to AWS A5.1/A5.1M and AWS D1.1/D1.1M

c. Submit procedure for on site inspection and acceptance of the roofing substrate and pertinent structural details relating to the roofing system, including; but not limited to:

(1) Material Safety Data Sheets

(2) Sub-girts and Formed Shapes

(3) Closure Materials

(4) Insulation

(5) Pressure Sensitive Tape

(6) Sealants and Caulking

(7) Rated Wall Assembly

[(8) Galvanizing Repair Paint

] [(9) Enamel Repair Paint

] [(10) Aluminized Steel Repair Paint

] (11) Accessories

d. Submit plan for coordination of the work of the various trades involved in providing the roofing system and other components secured to the roofing.

Include detailed application instructions and standard manufacturer drawings altered as required by these specifications. Explicitly identify in writing, differences between manufacturer's instructions and the specified requirements.

e. Safety requirements

f. Submit Manufacturer's data indicating percentage of recycle material in roofing panels to verify sustainable acquisition compliance.

1.5.2 Manufacturer's Technical Representative

Ensure the representative has authorization from manufacturer to approve field changes and is thoroughly familiar with the products and installations in the geographical area where construction will take place.

1.5.3 Qualification of Manufacturer

Guarantee the metal roof panel system manufacturer possesses the following:

- a. A minimum of five years experience in manufacturing metal roof system and accessory products.
- b. Engineering services of an authorized engineer; currently licensed in the geographical area where construction will take place, having a minimum of four years experience as an engineer knowledgeable in roof wind design analysis, protocols and procedures for the MBMA Metal Roofing System Design Manual; [ASCE 7-10](#), [UL 580](#) and FM wind design guide for metal roof systems.
- c. Certified engineering calculations using the products submitted for:

Wind uplift requirements in accordance with FM Wind Design Guide and [ASCE 7-10](#).

1.5.4 Qualification of Installation Contractor

Confirm that the installation contractor is approved and certified by the roofing panel manufacturer prior to beginning the installation of the metal roofing system.

1.5.5 Single Source

Obtain each type of metal roof and liner panels, clips, closures and other accessories from the standard products of the single source from a single manufacturer to operate as a complete system for the intended use.

1.5.6 Surface-Burning Characteristics

Provide metal roof panels having insulation core material with the following surface-burning characteristics as determined by testing identical products according to [ASTM E 84](#) by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

Flame-Spread Index: [25] [_____] or less.

Smoke-Developed Index: [450] [_____] or less.

1.5.7 Fire-Resistance Ratings

Where indicated, provide metal roof panels identical to those of assemblies tested for fire resistance per [ASTM E 119](#) by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

Indicate design designations from UL's "Fire Resistance Directory" or from the listings of another qualified testing agency.

Combustion Characteristics: [ASTM E 136](#).

1.5.8 Fabrication

Fabricate and finish metal roof panels and accessories at the factory to greatest extent possible, by manufacturer's standard procedures and processes and as necessary to fulfill indicated performance requirements. Comply with indicated profiles, dimensional and structural requirements conforming to [AISI SG03-3](#).

Provide panel profile, including major ribs and intermediate stiffening ribs, if any, for full length of panel.

Fabricate metal roof panel side laps with factory-installed captive gaskets or separator strips that provide a tight seal and prevent metal-to-metal contact, in a manner that will seal weather-tight and minimize noise from movements within panel assembly.

Sheet Metal Accessories: Fabricate flashing and trim to comply with recommendations in [SMACNA 1793](#) that apply to the design, dimensions, metal, and other characteristics of item indicated.

Form exposed sheet metal accessories that are without excessive oil canning, buckling, and tool marks and that are true to line and levels indicated, with exposed edges folded back to form hems.

End Seams: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with epoxy seam sealer. Rivet joints for additional strength.

Sealed Joints: Form non-expansion but movable joints in metal to accommodate elastomeric sealant to comply with [SMACNA 1793](#).

Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces of accessories exposed to view.

Fabricate cleats and attachment devices of size and metal thickness recommended by [SMACNA 1793](#) or by metal roof panel manufacturer for application, but not less than thickness of metal being secured.

1.5.9 Finishes

Comply with [NAAMM AMP 500](#) for recommendations for applying and designating finishes.

Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

1.6 DELIVERY, HANDLING, AND STORAGE

Deliver components, sheets, metal roof panels, and other manufactured items to prevent damage or deformation; package metal roof panels for protection during transportation and handling.

Unload, store, and erect metal roof panels in a manner to prevent bending, warping, twisting, and surface damage.

Stack metal roof panels on platforms or pallets, covered with suitable weather-tight and ventilated covering; store metal roof panels to ensure dryness. Do not store metal roof panels in contact with other materials

that might cause staining, denting, or other surface damage.

Protect strippable protective covering on metal roof panels from exposure to sunlight and high humidity, except to extent necessary for period of metal roof panel installation.

Protect foam-plastic insulation as follows:

- a. Do not expose to sunlight, except to extent necessary for period of installation and concealment.
- b. Protect against ignition at all times. Do not deliver foam-plastic insulation materials to Project site before installation time.

Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

1.7 PROJECT CONDITIONS

Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit metal roof panel work to be performed according to manufacturer's written instructions and warranty requirements.

Field Measurements: Verify actual dimensions of construction contiguous with metal roof panels by field measurements before fabrication.

1.8 WARRANTY

Furnish the metal roof panel manufacturer's [5] [10] [_____] [20] [30]-year [no dollar limit] roof system materials and installation workmanship warranty, including flashing, [insulation,] components, trim, and accessories necessary for a watertight roof system construction. Make warranty directly to the Government, commencing at time of Government's acceptance of the roof work. Provide a warranty with the following conditions:

- a. If within the warranty period, the metal roof system, as installed for its intended use in the normal climatic and environmental conditions of the facility, becomes non-watertight, shows evidence of moisture intrusion within the assembly, displaces, corrodes, perforates, separates at the seams, or shows evidence of excessive weathering due to defective materials or installation workmanship, the repair or replacement of the defective and damaged materials of the metal roof system and correction of defective workmanship is the responsibility of the metal roof panel manufacturer. All costs associated with the repair or replacement work are the responsibility of the metal roof panel manufacturer. Conform galvanized repairs to ASTM A780/A780M.
- b. If the manufacturer or his approved applicator fail to perform the repairs within [24] [48] [72] hours of notification, emergency temporary repairs performed by others does not void the warranty.

[1.8.1 Manufacturer's Finish Warranty

NOTE: Include the following paragraph when factory color finish panels are specified.

For NAVFAC projects, delete this paragraph and use the appropriate warranty forms included in the

paragraph titled "FORM ONE".

Provide a manufacturer's 20 year "No-Dollar-Limit" warranty for labor and materials for the roofing system. Issue the warranty directly to the Government at the date of Government acceptance warranting that the factory color finish, under normal atmospheric conditions at the site, will not crack, peel, or delaminate; chalk in excess of a numerical rating of 8 when measured in accordance with ASTM D 4214; or fade or change colors in excess of 5 NBS units as measured in accordance with ASTM D 2244.

]1.8.2 Metal Roof System Installer Warranty

NOTE: For Army projects use the first bracketed paragraph and delete the remainder of the installer warranty requirements.

For all other projects, delete the first bracketed paragraph, and use the second paragraph.

[Provide the "Contractors [Five] [Ten] [Twenty] [5] [10] [20]) Year No Penal Sum Warranty for Non-Structural Metal Roof System" attached at the end of this section. [Provide a separate bond in an amount equal to the installed total material and installation roofing system cost in favor of the Government covering the installer's warranty responsibilities effective throughout the [five] [ten] [twenty] [5] [10] [20]) year warranty period.]]

[Provide roof system installer warranty for a period of not less than [two] [five] years that the roof system, as installed, is free from defects in installation workmanship, to include the roof panel installation, flashing, [insulation,] accessories, attachments, and sheet metal installation integral to a complete watertight roof system assembly. Issue warranty directly to the Government. Correction of defective workmanship and replacement of damaged or affected materials is the responsibility of the metal roof system installer. All costs associated with the repair or replacement work are the responsibility of the installer.]

1.8.3 Continuance of Warranty

Approve and accomplish required repair or replacement work that becomes necessary within the warranty period in a manner so as to restore the integrity of the roof system assembly and maintain the validity of the metal roof system manufacturer warranty for the remainder of the manufacturer warranty period.

1.9 CONFORMANCE AND COMPATIBILITY

Provide an entire roofing and flashing system in accordance with specified and indicated requirements, including wind resistance [and seismic per ANSI/AISC 341]requirements. Perform any work not specifically addressed, or any deviation from specified requirements in general accordance with recommendations of the MBMA RSDM, NRCA 0405, the metal panel manufacturer's published recommendations and details, and compatible with surrounding components and construction. Submit any deviation from specified or indicated requirements to the Contracting Officer for approval prior to installation.

1.10 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>METRIC UNITS</u>
a. Sheet Aluminum	1.0 mm
b. Panels	300 mm
- vertical legs	50 mm
- stiffening ribs	100 mm
c. Screws	0.242 mm 0.216 mm
d. Bolts	6 mm
e. Studs	5 mm
f. Fasteners	13 mm 25 mm
g. Rivets	5 mm 3 mm

<u>PRODUCTS</u>	<u>ENGLISH UNITS</u>
a. Sheet Aluminum	0.040 inch
b. Panels	12 inches
- vertical legs	2 inches
- stiffening ribs	4 inches
c. Screws	No. 14 No. 12
d. Bolts	1/4 inch
e. Studs	3/16 inch
f. Fasteners	1/2 inch One inch
g. Rivets	1/16 inch 1/8 inch

PART 2 PRODUCTS

2.1 PANEL MATERIALS

[2.1.1 Aluminum Sheet

Roll-form aluminum roof and liner panels to the specified profile, with fy equals [2.12] [2.81] [3.52] [5.63] kscm [30] [40] [50] [80] ksi, [0.81] [1.02] [1.27] mm [.032] [.040] [.050] inch thickness and depth as indicated. Ensure the material is plumb and true, and within the

tolerances listed:

- a. Aluminum Sheet conforming to ASTM B209, ASTM B209M, and AA ADM.
- b. Individual panels to have continuous length to cover the entire length of any unbroken roof slope with no joints or seams and formed without warping, waviness, or ripples that are not part of the panel profile and free of damage to the finish coating system.
- c. Provide panels with thermal expansion and contraction consistent with the type of system specified.
 - (1) [Provide profile and coverage of minimum height and width from manufacturer s standard for the indicated roof slope.]
 - (2) [Provide a profile of 3.8 cm 1-1/2 inch high rib at 30.5 cm 12 inches o.c. with small stiffening ribs, 96.5 cm 38 inch overall width with 91.5 cm 36 inch coverage and exposed fasteners.]
 - (3) [Provide a profile of 3.8 cm 1-1/2 inch high rib at 18.3 cm 7.2 inches o.c., 98.75 cm 38-7/8 inch overall width with 91.5 cm 36 inch coverage and exposed fasteners.]
 - (4) [Provide a profile of 2.54 cm 1 inch high rib at 10.2 cm 4 inches o.c., 126 cm 49-5/8 inch overall width with [122] [112] cm [48] [44] inch coverage and exposed fasteners.]
 - (5) [Provide a profile of 2.54 cm 1 inch high rib at 20.3 cm 8 inches o.c., 106 cm 41-5/8 inch overall width with 102 cm 40 inch coverage and exposed fasteners.]
 - (6) [Provide a profile of 4.45 cm 1-3/4 inch high V-beam rib at 12.7 cm 5 inches o.c., 114 cm 44-7/8 inch overall width with 107 cm 42 inch coverage and exposed fasteners.]
 - (7) [Provide a profile of 2.22 cm 7/8 inch high corrugated rib at 5.08 cm 2 inches o.c., 98.74 cm 38-7/8 inch overall width with 91.44 cm 36 inch coverage and exposed fasteners.]
 - (8) [Provide a profile of 7.6 cm 3 inch high standing seam, 61 cm 24 inch coverage, factory-caulked and mechanical crimping or snap-together seams with concealed clips and fasteners.]
 - (9) [Provide a profile of [2.54] [4.45] [5.08] [6.35] cm [1] [1-3/4] [2] [2-1/2] inch high standing seam, [30.5] [40.6] [46] cm [12] [16] [18] inch coverage, with mechanical crimping or snap-together seams with concealed clips and fasteners.]
 - (10) Provide [smooth, flat] [embossed] Surface Texture.

] [2.1.2 Steel Sheet

Provide roll-form steel roof and liner panels to the specified profile, with [2.12] [2.81] [3.52] [5.63] kscm fy equals [30] [40] [50] [80] ksi, [26] [24] [22] [20] [18] gauge and depth as indicated, conforming to ASTM A1008/A1008M, ASTM A36/A36M. Ensure the material is plumb and true, and within the tolerances listed:

- [a. Galvanized/Galvannealed Steel Sheet conforming to ASTM A123/A123M,

ASTM A653/A653M, ASTM A653/A653M, ASTM A653/A653M, ASTM A792/A792M, and AISI SG03-3.]

- b. Metallic coated steel sheet conforming to ASTM A924/A924M.
- [c. Aluminum-Zinc Alloy-coated Steel Sheet conforming to ASTM A463/A463M, ASTM A792/A792M and AISI SG03-3.]
- [d. Steel sheet with porcelain coating conforming to ASTM A424/A424M, ASTM C 286, and PEI 1001, or ASTM A606/A606M for improved atmospheric corrosion resistance.]
- e. Individual panels to have continuous length to cover the entire length of any unbroken roof slope with no joints or seams and formed without warping, waviness, or ripples that are not part of the panel profile and free of damage to the finish coating system.
- f. Provide panels with thermal expansion and contraction consistent with the type of system specified.
 - (1) [Profile and coverage: a minimum height and width from manufacturer's standard for the indicated roof slope.]
 - (2) [Profile: a 3.8 cm 1-1/2 inch high rib at 30.5 cm 12 inches o.c. with small stiffening ribs, 96.5 cm 38 inch overall width with 91.5 cm 36 inch coverage and exposed fasteners.]
 - (3) [Profile: a 3.8 cm 1-1/2 inch high rib at 18.3 cm 7.2 inches o.c., 98.75 cm 38-7/8 inch overall width with 91.5 cm 36 inch coverage and exposed fasteners.]
 - (4) [Profile: a 2.54 cm 1 inch high rib at 10.2 cm 4 inches o.c., 126 cm 49-5/8 inch overall width with [122] [112] cm [48] [44] inch coverage and exposed fasteners.]
 - (5) [Profile: a 2.54 cm 1 inch high rib at 20.3 cm 8 inches o.c., 106 cm 41-5/8 inch overall width with 102 cm 40 inch coverage and exposed fasteners.]
 - (6) [Profile: a 2.22 cm 7/8 inch high corrugated rib at 5.08 cm 2 inches o.c., 98.74 cm 38-7/8 inch overall width with 91.44 cm 36 inch coverage and exposed fasteners.]
 - (7) [Profile: a 7.6 cm 3 inch high standing seam, 61 cm 24 inch coverage, factory-caulked and mechanical crimping or snap-together seams with concealed clips and fasteners.]
 - (8) [Profile: a [2.54] [4.45] [5.08] [6.35] cm [1] [1-3/4] [2] [2-1/2] inch high standing seam, [30.5] [40.6] [46] cm [12] [16] [18] inch coverage, with mechanical crimping or snap-together seams with concealed clips and fasteners.]
 - (9) Provide [smooth, flat] [embossed] surface texture.

] 2.1.3 Foam-Insulation Core Roof Panel

Provide factory-formed [aluminum] [steel] roof panel assembly fabricated from two sheets of metal with modified polyisocyanurate or polyurethane foam insulation core [foamed-in-place] [board] during fabrication with

joints between panels designed to form weather-tight seals. Include accessories required for weather-tight installation.

- a. Closed-Cell Content: 90 percent when tested according to ASTM D 2856.
- b. Density: 32 to 42 kg/cu. m 2.0 to 2.6 lb/cu. ft. when tested according to ASTM D 1622.
- c. Compressive Strength: Minimum 140 kPa 20 psi when tested according to ASTM D 1621.
- d. Shear Strength: 179 kPa 26 psi when tested according to ASTM C 273/C 273M.

]2.1.4 Insulated Panel Construction

Shop fabricate or field assemble insulated panel construction with specified exterior and interior [aluminum] [steel] sheet in accordance with manufacturer's printed instructions.

Provide pre-finished interior lath or board finished interior surface for panel assemblies conforming to FS SS-L-30 and UL Bld Mat Dir.

Provide [glass-fiber] [slag-wool-fiber] [rock-wool-fiber] insulation conforming to ASTM C 553 and ASTM C 612 of thickness and density as required for the geographical area where construction will take place. Glass-Fiber and Mineral-Wool-Fiber are materials listed in the EPA's Comprehensive Procurement Guidelines (CPG) (<http://www.epa.gov/cpg/>)

Provide insulation fasteners of adhesively attached type, plate welded to projecting spindle anchors; capable of holding insulation of thickness indicated, secured in position with self-locking washer and complying with the following requirements:

- a. Plate: Perforated galvanized carbon-steel sheet, 0.762 mm 0.030 inch thick by 50 m 2 inches square.
- b. Spindle: Copper-coated, low carbon steel; fully annealed; 2.67 mm 0.105 inch in diameter; length to suit depth of insulation indicated.
- c. Insulation-Retaining Washers: Self-locking washers formed from 0.41-mm 0.016-inch thick galvanized steel sheet, with beveled edge for increased stiffness, sized as required to hold insulation securely in place, but not less than 38 mm 1-1/2 inches square or in diameter.
- d. Provide anchor adhesive with demonstrated capability to bond insulation anchors securely to substrates indicated without damaging insulation, fasteners, and substrates.

2.1.5 Finish

All panels are to receive a factory-applied [polyvinylidene fluoride] [Kynar 500/Hylar 5000] [_____] finish consisting of a baked-on top-coat with a manufacturer s recommended prime coat conforming to the following:

- a. Metal Preparation: All metal is to have the surfaces carefully prepared for painting on a continuous process coil coating line by alkali cleaning, hot water rinsing, application of chemical conversion coating, cold water rinsing, sealing with acid rinse, and thorough

drying.

- b. Prime Coating: Apply a base coat of epoxy paint, specifically formulated to interact with the top-coat, to the prepared surfaces by roll coating to a dry film thickness of 0.20 plus 0.05 mils. Ensure the prime coat is oven cured prior to application of finish coat.
- c. Exterior Finish Coating: Apply the finish coating over the primer by roll coating to dry film thickness of 0.80 plus 5 mils (3.80 plus 0.50 mils for Vinyl Plastisol) for a total dry film thickness of 1.00 plus 0.10 mils (4.00 plus 0.10 mils for Vinyl Plastisol). Ensure the finish coat is oven-cured.
- d. Interior Finish Coating: Apply a wash-coat on the reverse side over the primer by roll coating to a dry film thickness of 0.30 plus 0.05 mils for a total dry film thickness of 0.50 plus 0.10 mils. Ensure the wash-coat is oven-cured.
- e. Color: The exterior finish chosen from the manufacturer's standard color chart.
- f. Physical Properties: Provide coating conforming to the industry and manufacturer s standard performance criteria as listed by the following certified [test reports](#):
 - (1) Chalking: [ASTM D 333](#)
 - (2) Coating Thickness: [ASTM B659](#)
 - (3) Color Change and Conformity: [ASTM D 2244](#)
 - (4) Weatherometer: [ASTM G 152](#), [ASTM G 153](#) and [ASTM D 822](#)
 - (5) Humidity: [ASTM D 2247](#) and [ASTM D 714](#)
 - (6) Salt Spray: [ASTM B117](#)
 - (7) Chemical Pollution: [ASTM D 1308](#)
 - (8) Gloss at 60: [ASTM D 523](#)
 - (9) Pencil Hardness: [ASTM D 3363](#)
 - (10) Reverse Impact: [ASTM D 2794](#)
 - (11) Flexibility: [ASTM D 522](#)
 - (12) Abrasion: [ASTM D 968](#)
 - (13) Flame Spread: [ASTM E 84](#)

2.2 MISCELLANEOUS METAL FRAMING

2.2.1 General

Cold-formed metallic-coated steel sheet conforming to [AISI SG03-3](#) and [ASTM A653/A653M](#) and specified in Section [05 40 00](#) COLD-FORMED METAL FRAMING unless other wise indicated.

2.2.2 Fasteners for Miscellaneous Metal Framing

Type, material, corrosion resistance, size and sufficient length to penetrate the supporting member a minimum of 2.54 cm 1 inch with other properties required to fasten miscellaneous metal framing members to substrates in accordance with the roof panel manufacturer's and ASCE 7-10 requirements.

2.3 FASTENERS

2.3.1 General

Type, material, corrosion resistance, size and sufficient length to penetrate the supporting member a minimum of 2.54 cm 1 inch with other properties required to fasten miscellaneous metal framing members to substrates in accordance with the roof panel manufacturer's and ASCE 7-10 requirements.

2.3.2 Exposed Fasteners

Provide corrosion resistant coated steel, aluminum, stainless steel, or nylon capped, steel compatible, exposed fasteners with the sheet panel or flashing and of a type and size recommended by the manufacturer to meet the performance requirements and design loads. Provide manufacturer's standard fasteners for accessories. Provide an integral metal washer matching the color of attached material with compressible sealing EPDM gasket approximately .238 cm 3/32 inch thick.

2.3.3 Screws

Provide corrosion resistant coated steel, aluminum and/or stainless steel screws of the type and size recommended by the manufacturer to meet the performance requirements.

2.3.4 Rivets

Provide closed-end type rivets, made of corrosion resistant coated steel, aluminum or stainless steel where watertight connections are required.

2.3.5 Attachment Clips

Fabricate clips from steel hot-dipped galvanized in accordance with ASTM A653/A653M Z275 G 90 or Series 300 stainless steel. Size, shape, thickness and capacity as required meeting the insulation thickness and design load criteria specified.

2.4 ACCESSORIES

2.4.1 General

Provide only accessories which are compatible with the metal roof panels. Sheet metal flashing, trim, metal closure strips, caps and similar metal accessories can not be less than the minimum thickness specified for the roof panels. Exposed metal accessories/finishes to match the panels furnished, except as otherwise indicated. Provide molded foam rib, ridge and other closure strips which are non-absorbent closed-cell or solid-cell synthetic rubber or pre-molded neoprene to match configuration of the panels.

2.4.2 Rubber Closure Strips

Closed-cell, expanded cellular rubber conforming to ASTM D 1056 and ASTM D 1667; extruded or molded to the configuration of the specified roof panel and in lengths supplied by the roof panel manufacturer.

2.4.3 Metal Closure Strips

Factory fabricated [aluminum] [steel] closure strips to be the same [gauge] [thickness], color, finish and profile of the specified roof panel.

2.4.4 Joint Sealants

2.4.4.1 Sealants

Provide an approved gun type sealant for use in hand- or air-pressure caulking guns at temperatures above 4 degrees C 40 degrees F (or frost-free application at temperatures above minus 12 degrees C 10 degrees F with minimum solid content of 85 percent of the total volume. Provide sealant that has a tough, durable dry surface skin which permits it to remain soft and pliable underneath, providing a weather-tight joint. No migratory staining is permitted on painted or unpainted metal, stone, glass, vinyl, or wood.

Prime all joints to receive sealants with a compatible one-component or two-component primer as recommended by the roof panel manufacturer.

- a. Shop Applied Caulking: An approved gun grade, non-sag one component polysulfide or silicone conforming to ASTM C 920, Type II, with a curing time to ensure the sealant s plasticity at the time of field erection.
- b. Field Applied Caulking: An approved gun grade, non-sag one component polysulfide or two-component polyurethane with an initial maximum Shore A durometer hardness of 25, conforming to ASTM C 920, Type II. Match color to panel colors.
- c. Tape Sealant: Pressure sensitive, 100% solid with a release paper backing; permanently elastic, non-sagging, non-toxic and non-staining as approved by the roof panel manufacturer.

2.5 SHEET METAL FLASHING AND TRIM

2.5.1 Fabrication, General

Custom fabricate sheet metal flashing and trim to comply with recommendations in SMACNA 1793 that apply to the design, dimensions, metal and other characteristics of the items indicated. Shop fabricated items where practicable. Obtain field measurements for accurate fit before shop fabrication.

2.5.2 Roof Drainage Sheet Metal Fabrications

- a. Gutters: Fabricate to cross section indicated, with riveted and soldered joints, complete with end pieces, outlet tubes, and other special accessories as required. Fabricate in minimum 243.8 cm 96-inch long sections. Fabricate expansion joints and accessories from same metal as gutters, unless otherwise indicated.

- b. Downspouts: Fabricate [circular] [rectangular] downspouts complete with mitered elbows. Furnish with metal hangers, from same material as downspouts and anchors.

2.6 REPAIR OF FINISH PROTECTION

Provide repair paint for color finish enameled roofing that is compatible with the paint of the same formula and color as the specified finish furnished by the roofing manufacturer. Conform acrylic or modified acrylic to NAVFAC A-A-50570.

PART 3 EXECUTION

3.1 EXAMINATION

Contracting Officer may request verification and certification testing of coatings and base metals of metal roofing prior to installation.

- a. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, metal roof panel supports, and other conditions affecting performance of the work.
- b. Examine primary and secondary roof framing to verify that rafters, purlins, angles, channels, and other structural panel support members and anchorages have been installed within alignment tolerances required by metal roof panel manufacturer, UL, ASTM, ASCE 7-10 and as required for the geographical area where construction will take place.
- c. Examine solid roof sheathing to verify that sheathing joints are supported by framing or blocking and that installation is within flatness tolerances required by metal roof panel manufacturer.
- d. Examine roughing-in for components and systems penetrating metal roof panels to verify actual locations of penetrations relative to seam locations of metal roof panels before metal roof panel installation.
- e. Submit to the Contracting Officer a written report, endorsed by Installer, listing conditions detrimental to performance of the work.
- f. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- a. Clean substrates of substances harmful to insulation, including removing projections capable of interfering with insulation attachment.
- b. Miscellaneous Framing: Install sub-purlins, eave angles, furring, and other miscellaneous roof panel support members and anchorage according to metal roof panel manufacturer's written instructions.

3.3 ROOF PANEL INSTALLATION

Provide metal roof panels of full length from eave to ridge or eave to wall as indicated, unless otherwise indicated or restricted by shipping limitations. Anchor metal roof panels and other components of the Work securely in place, with provisions for thermal and structural movement in accordance with NRCA 0409.

- [Steel Roof Panels: Use stainless-steel fasteners for exterior surfaces and galvanized steel fasteners for interior surfaces.]
- [Aluminum Roof Panels: Use aluminum or stainless-steel fasteners for exterior surfaces and aluminum or galvanized steel fasteners for interior surfaces.]
- [Anchor Clips: Anchor metal roof panels and other components of the work securely in place, using manufacturer's approved fasteners according to manufacturers' written instructions.]

Metal Protection: Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with bituminous coating conforming to [SSPC PS 9.01](#), by applying rubberized-asphalt underlayment to each contact surface, or by other permanent separation as recommended by metal roof panel manufacturer.

Joint Sealers: Install gaskets, joint fillers, and sealants where indicated and where required for weatherproof performance of metal roof panel assemblies. Provide types of gaskets, fillers, and sealants indicated or, if not indicated, types recommended by metal roof panel manufacturer.

Erect roofing system in accordance with the approved erection drawings, the printed instructions and safety precautions of the manufacturer.

Do not subject sheets to overloading, abuse, or undue impact. Do not apply bent, chipped, or defective sheets.

Erect sheets true and plumb and in exact alignment with the horizontal and vertical edges of the building, securely anchored, and with the indicated rake, eave, and curb overhang.

Allow for thermal movement of the roofing, movement of the building structure, and provide permanent freedom from noise due to wind pressure.

Field cutting metal roof panels by torch is not permitted.

Lay roofing sheets with corrugations in the direction of the roof slope. End laps of exterior roofing can not be less than [20.3 cm 8 inches](#); the side laps of standard exterior corrugated sheets can not be not less than 2-1/2 corrugations.

Do not permit storage, 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 the installed roofing materials, and to distribute weight to conform to the indicated live load limits of roof construction.

3.4 FASTENER INSTALLATION

Anchor metal roof panels and other components of the Work securely in place, using manufacturer's approved fasteners according to manufacturers' written instructions.

3.5 FLASHING, TRIM AND CLOSURE INSTALLATION

3.5.1 General Requirements

Comply with performance requirements, manufacturer's written installation instructions, and [SMACNA 1793](#). Provide concealed fasteners where possible, and set units true to line and level as indicated. Install work with laps, joints, and seams that will be permanently watertight and weather resistant.

Install sheet metalwork to form weather-tight construction without waves, warps, buckles, fastening stresses or distortion, and allow for expansion and contraction. Perform cutting, fitting, drilling, and other operations in connection with sheet metal required to accommodate the work of other trades by sheet metal mechanics.

3.5.2 Metal Flashing

Install metal flashing at building corners, rakes and eaves, junctions between metal siding and roofing, valleys and changes of slope or direction in metal roofing, and building expansion joints and gutters.

Provide exposed metal flashing that is the same material, color, and finish as the specified metal roofing.

Fasten flashing at not more than [20.8 cm 8 inches](#) on center for roofs, except where flashing are held in place by the same screws that secure covering sheets.

Furnish flashing in at least [2.44 m 8-foot](#) lengths. Provide exposed flashing that has [2.54 cm one inch](#) locked and blind-soldered end joints, and expansion joints at intervals of not more than [4.88 m 16 feet](#).

Bed exposed flashing and flashing subject to rain penetration in the specified joint sealant.

Isolate flashing which is in contact with dissimilar metals by means of the specified asphalt mastic material to prevent electrolytic deterioration.

Form drips to the profile indicated, with the edge folded back [1.27 cm 1/2 inch](#) to form a reinforced drip edge.

3.5.3 Closures

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

Install mastic closure strips at intersection of the wall with metal roofing; top and bottom of metal siding; heads of wall openings; and in other required locations.

3.6 WORKMANSHIP

Ensure lines, arises, and angles are sharp and true. Free exposed surfaces from visible wave, warp, buckle, and tool marks. Fold back exposed edges neatly to form a [1.27 cm 1/2 inch](#) hem on the concealed side. Ensure that sheet metal that is exposed to the weather is watertight with provisions

for expansion and contraction.

Ensure surfaces that are to receive sheet metal are plumb and true, clean, even, smooth, dry, and free of defects and projections which might affect the application. For installation of items not shown in detail or not covered by specifications conform to the applicable requirements of [SMACNA 1793](#). Provide sheet metal flashing in the angles formed where roof decks abut walls, curbs, ventilators, pipes, or other vertical surfaces and wherever indicated and necessary to make the work watertight.

3.7 ACCEPTANCE PROVISIONS

3.7.1 Erection Tolerances

Erect metal roofing straight and true with plumb vertical lines correctly lapped and secured in accordance with the manufacturer's written instructions. Do not vary horizontal lines more than [0.32 cm in 12.2 m](#) [1/8 inch in 40 feet](#).

3.7.2 Leakage Tests

Finished application of metal roofing is subject to inspection and test for leakage by the Contracting Officer, Architect/Engineer. Conduct inspections and tests without cost to the Government.

Perform inspections and tests promptly after erection to permit correction of defects and the removal and replacement of defective materials.

3.7.3 Repairs to Finish

Repair scratches, abrasions, and minor surface defects of finish with the specified repair materials. Ensure finished repaired surfaces are uniform and free from variations of color and surface texture.

Immediately remove and replace repaired metal surfaces that are not acceptable to the project requirements with new material.

3.7.4 Paint-Finish Metal Roofing

Test paint-finish metal roofing for color stability by the Contracting Officer during the manufacturer's specified guarantee period.

Remove and replace panels that indicate color changes, fading, or surface degradation, determined by visual examination, with new panels at no expense to the Government.

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

3.8 CLEAN-UP AND DISPOSAL

Clean all 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. Ensure exposed metal surfaces are free of dents, creases, waves, scratch marks, solder or weld marks, and damage to the finish coating.

Collect and place scrap/waste materials in containers. Promptly dispose of

demolished materials. Do not allow demolished materials to accumulate on-site; transport demolished materials from government property and legally dispose of them.

3.9 FIELD QUALITY CONTROL

[3.9.1 Manufacturer's Inspection

NOTE: Include this paragraph when manufacturer's inspection of work is required. Select desired frequency of manufacturer inspection and coordinate with text of optional 2nd and 3rd bracketed sentences.

Ensure manufacturer's technical representative visits the site a minimum of [[three][_____] times][once per week] during the installation for purposes of reviewing materials installation practices and adequacy of work in place.[Make inspections during the first 20 squares of roof panel installation, at mid-point of the installation, and at substantial completion, at a minimum. Additional inspections are required for each 100 squares of total roof area, with the exception that follow-up inspections of previously noted deficiencies or application errors are performed as requested by the Contracting Officer.] After each inspection, submit a report, signed by the manufacturer's technical representative to the Contracting Officer within 3 working days. Note in the report overall quality of work, deficiencies and any other concerns, and recommended corrective action.

Submit three [_____] signed copies of the [manufacturer's field inspection reports](#) to the Contracting Officer within one week of substantial completion.

]3.10 INFORMATION FORM AND PLACARD

For each roof, furnish a typewritten information card for facility records and a card laminated in plastic and framed for interior display at roof access point, or a photoengraved 1 mm 0.032 inch thick aluminum card for exterior display. [Format as directed in paragraph titled "Form One"](#).

Provide an information card 215 mm by 275 mm 8 1/2 by 11 inches minimum, identifying the facility name and number; location; contract number; approximate roof area; detailed roof system description, including deck type, roof panel manufacturer and product name, type underlayment(s), date of completion; installing contractor identification and contact information; manufacturer warranty expiration, warranty reference number, and contact information. Install card at [interior roof top access point][location as directed by the Contracting Officer] and provide a paper copy to the Contracting Officer.

3.11 FORM ONE

FORM 1 - PREFORMED [STEEL] [ALUMINUM] PANEL ROOFING SYSTEM AND 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:

[3.12 DATE OF INSTALLATION WALL-MOUNTED PLACARD

For each metal roof panel installation, furnish an exterior "Date of Installation Placard", 0.032 inch thick [aluminum] [_____], 21.6 cm 8-1/2 inches high by 28 cm 11 inches wide, with mounting accessories, photoengraved to include the following information:

Facility Name and Number
Approximate Roof Area Newly Installed and Date of Completion
Manufacturer, Type of Roof Panel and Name
Underlayment and Insulation System, R value
Installing Contractor and Contact Information
Warranty Expiration Date
Warranty Reference Number and Contact Information

Install placard as directed by the Contracting Officer.

] 3.13 USACE WARRANTY

NOTE: Include the attached four page warranty
document for Army projects only. Coordinate with
the warranty text in Part 1 of this specification.

CONTRACTOR'S [FIVE (5)] [TEN (10)] [TWENTY (20)] YEAR NO PENAL SUM WARRANTY
FOR
NON-STRUCTURAL METAL ROOF SYSTEM

FACILITY DESCRIPTION _____

BUILDING NUMBER: _____

CORPS OF ENGINEERS CONTRACT NUMBER: _____

CONTRACTOR

CONTRACTOR: _____

ADDRESS: _____

POINT OF CONTACT: _____

TELEPHONE NUMBER: _____

OWNER

OWNER: _____

ADDRESS: _____

POINT OF CONTACT: _____

TELEPHONE NUMBER: _____

CONSTRUCTION AGENT

CONSTRUCTION AGENT: _____

ADDRESS: _____

POINT OF CONTACT: _____

TELEPHONE NUMBER: _____

CONTRACTOR'S [FIVE (5)][TEN (10)][TWENTY (20)] YEAR NO PENAL SUM WARRANTY
FOR
NON-STRUCTURAL METAL ROOF SYSTEM
(continued)

THE NON-STRUCTURAL METAL ROOF SYSTEM INSTALLED ON THE ABOVE NAMED BUILDING IS WARRANTED BY _____ FOR A PERIOD OF FIVE (5) YEARS AGAINST WORKMANSHIP AND MATERIAL DEFICIENCIES, WIND DAMAGE, STRUCTURAL FAILURE, AND LEAKAGE. FOR THE NON-STRUCTURAL METAL ROOFING SYSTEM COVERED UNDER THIS WARRANTY INCLUDE, BUT DO NOT LIMIT TO, THE FOLLOWING: THE ENTIRE ROOFING SYSTEM, MANUFACTURER SUPPLIED FRAMING AND STRUCTURAL MEMBERS, METAL ROOF PANELS, FASTENERS, CONNECTORS, ROOF SECUREMENT COMPONENTS, AND ASSEMBLIES TESTED AND APPROVED IN ACCORDANCE WITH UL 580. IN ADDITION, THE SYSTEM PANEL FINISHES, SLIP SHEET, INSULATION, VAPOR RETARDER, ALL ACCESSORIES, COMPONENTS, AND TRIM AND ALL CONNECTIONS ARE INCLUDED. THIS INCLUDES ROOF PENETRATION ITEMS SUCH AS VENTS, CURBS, SKYLIGHTS; INTERIOR OR EXTERIOR GUTTERS AND DOWNSPOUTS; EAVES, RIDGE, HIP, VALLEY, RAKE, GABLE, WALL, OR OTHER ROOF SYSTEM FLASHING INSTALLED AND ANY OTHER COMPONENTS SPECIFIED WITHIN THIS CONTRACT TO PROVIDE A WEATHERTIGHT ROOF SYSTEM; AND ITEMS SPECIFIED IN OTHER SECTIONS OF THE SPECIFICATIONS THAT ARE PART OF THE NON-STRUCTURAL METAL ROOFING SYSTEM.

REPAIR ALL MATERIAL DEFICIENCIES, WIND DAMAGE, STRUCTURAL FAILURE, AND LEAKAGE ASSOCIATED WITH THE NON-STRUCTURAL METAL ROOF SYSTEM COVERED UNDER THIS WARRANTY AS APPROVED BY THE CONTRACTING OFFICER. IN THIS WARRANTY COVER THE ENTIRE COST OF REPAIR OR REPLACEMENT, INCLUDING ALL MATERIAL, LABOR, AND RELATED MARKUPS. THE ABOVE REFERENCED WARRANTY COMMENCED ON THE DATE OF FINAL ACCEPTANCE ON _____ AND WILL REMAIN IN EFFECT FOR STATED DURATION FROM THIS DATE.

SIGNED, DATED, AND NOTARIZED (BY COMPANY PRESIDENT)

(Company President)

(Date)

CONTRACTOR'S [FIVE (5)][TEN (10)][TWENTY (20)] YEAR NO PENAL SUM WARRANTY
FOR
NON-STRUCTURAL METAL ROOFING SYSTEM
(continued)

ENSURE THE CONTRACTOR SUPPLEMENTS THIS WARRANTY WITH WRITTEN WARRANTIES FROM THE MANUFACTURER AND/OR INSTALLER OF THE NON-STRUCTURAL METAL ROOFING SYSTEM. SUBMIT ALONG WITH THE CONTRACTOR'S WARRANTY. HOWEVER, THE CONTRACTOR IS ULTIMATELY RESPONSIBLE FOR THIS WARRANTY AS OUTLINED IN THE SPECIFICATIONS AND AS INDICATED IN THIS WARRANTY EXAMPLE.

EXCLUSIONS FROM COVERAGE

1. NATURAL DISASTERS, ACTS OF GOD (LIGHTNING, FIRE, EXPLOSIONS, SUSTAINED WIND FORCES IN EXCESS OF THE DESIGN CRITERIA, EARTHQUAKES, AND HAIL).
2. ACTS OF NEGLIGENCE OR ABUSE OR MISUSE BY GOVERNMENT OR OTHER PERSONNEL, INCLUDING ACCIDENTS, VANDALISM, CIVIL DISOBEDIENCE, WAR, OR DAMAGE CAUSED BY FALLING OBJECTS.
3. DAMAGE BY STRUCTURAL FAILURE, SETTLEMENT, MOVEMENT, DISTORTION, WARPAGE, OR DISPLACEMENT OF THE BUILDING STRUCTURE OR ALTERATIONS MADE TO THE BUILDING.
4. CORROSION CAUSED BY EXPOSURE TO CORROSIVE CHEMICALS, ASH OR FUMES GENERATED OR RELEASED INSIDE OR OUTSIDE THE BUILDING FROM CHEMICAL PLANTS, FOUNDRIES, PLATING WORKS, KILNS, FERTILIZER FACTORIES, PAPER PLANTS, AND THE LIKE.
5. FAILURE OF ANY PART OF THE NON-STRUCTURAL METAL ROOF DUE TO ACTIONS BY THE OWNER TO INHIBIT FREE DRAINAGE OF WATER FROM THE ROOF AND GUTTERS AND DOWNSPOUTS OR ALLOW PONDING WATER TO COLLECT ON THE ROOF SURFACE. IN CONTRACTOR'S DESIGN ENSURE FREE DRAINAGE FROM THE ROOF AND DO NOT ALLOW PONDING WATER.
6. THIS WARRANTY APPLIES TO THE NON-STRUCTURAL METAL ROOFING SYSTEM. IT DOES NOT INCLUDE ANY CONSEQUENTIAL DAMAGE TO THE BUILDING INTERIOR OR CONTENTS WHICH IS COVERED BY THE WARRANTY OF CONSTRUCTION CLAUSE INCLUDED IN THIS CONTRACT.
7. THIS WARRANTY CANNOT BE TRANSFERRED TO ANOTHER OWNER WITHOUT WRITTEN CONSENT OF THE CONTRACTOR; AND THIS WARRANTY AND THE CONTRACT PROVISIONS WILL TAKE PRECEDENCE OVER ANY CONFLICTS WITH STATE STATUTES.

CONTRACTOR'S [FIVE (5)][TEN (10)][TWENTY (20)] YEAR NO PENAL SUM WARRANTY
FOR
NON-STRUCTURAL METAL ROOF SYSTEM
(continued)

**RESPOND TO REPORTS OF LEAKS AND ROOF SYSTEM DEFICIENCIES WITHIN 48 HOURS OF RECEIPT OF NOTICE, BY TELEPHONE OR IN WRITING, FROM EITHER THE OWNER OR CONTRACTING OFFICER. INITIATE EMERGENCY REPAIRS TO PREVENT FURTHER ROOF LEAKS IMMEDIATELY; SUBMIT A WRITTEN PLAN FOR APPROVAL TO REPAIR OR REPLACE THIS ROOF SYSTEM WITHIN SEVEN (7) CALENDAR DAYS. COMMENCE ACTUAL WORK FOR PERMANENT REPAIRS OR REPLACEMENT WITHIN 30 DAYS AFTER RECEIPT OF NOTICE, AND COMPLETED WITHIN A REASONABLE TIME FRAME. IF THE CONTRACTOR FAILS TO ADEQUATELY RESPOND TO THE WARRANTY PROVISIONS, AS STATED IN THE CONTRACT AND AS CONTAINED HEREIN, THE CONTRACTING OFFICER MAY HAVE THE NON-STRUCTURAL METAL ROOF SYSTEM REPAIRED OR REPLACED BY OTHERS AND CHARGE THE COST TO THE CONTRACTOR.

IN THE EVENT THE CONTRACTOR DISPUTES THE EXISTENCE OF A WARRANTABLE DEFECT, THE CONTRACTOR MAY CHALLENGE THE OWNER'S DEMAND FOR REPAIRS AND/OR REPLACEMENT DIRECTED BY THE OWNER OR CONTRACTING OFFICER EITHER BY REQUESTING A CONTRACTING OFFICER'S DECISION UNDER THE CONTRACT DISPUTES ACT, OR BY REQUESTING THAT AN ARBITRATOR RESOLVE THE ISSUE. MAKE THE REQUEST FOR AN ARBITRATOR WITHIN 48 HOURS OF BEING NOTIFIED OF THE DISPUTED DEFECTS. UPON BEING INVOKED, WITHIN TEN (10) DAYS, ENSURE THE PARTIES JOINTLY REQUEST A LIST OF FIVE (5) ARBITRATORS FROM THE FEDERAL MEDIATION AND CONCILIATION SERVICE. THE PARTIES TEN (10) DAYS AFTER RECEIPT OF THE LIST TO SEEK AGREEMENT ON AN ARBITRATOR TO CONFER. IF THE PARTIES CANNOT AGREE ON AN ARBITRATOR, THE CONTRACTING OFFICER AND THE PRESIDENT OF THE CONTRACTOR'S COMPANY WILL STRIKE ONE (1) NAME FROM THE LIST ALTERNATIVELY UNTIL ONE (1) NAME REMAINS. THE REMAINING PERSON IS THE DULY SELECTED ARBITRATOR. THE COSTS OF THE ARBITRATION, INCLUDING THE ARBITRATOR'S FEE AND EXPENSES, COURT REPORTER, COURTROOM OR SITE SELECTED, ETC., WILL BE BORNE EQUALLY BETWEEN THE PARTIES. EITHER PARTY DESIRING A COPY OF THE TRANSCRIPT PAYS FOR THE TRANSCRIPT. A HEARING WILL BE HELD AS SOON AS THE PARTIES CAN MUTUALLY AGREE. REQUEST A WRITTEN ARBITRATOR'S DECISION NO LATER THAN 30 DAYS FOLLOWING THE HEARING. THE DECISION OF THE ARBITRATOR WILL NOT BE BINDING; HOWEVER, IT WILL BE ADMISSIBLE IN ANY SUBSEQUENT APPEAL UNDER THE CONTRACT DISPUTES ACT.

POST A FRAMED COPY OF THIS WARRANTY IN THE MECHANICAL ROOM OR OTHER APPROVED LOCATION DURING THE ENTIRE WARRANTY PERIOD.

-- End of Section --