
USACE / NAVFAC / AFCEC UFGS-07 41 13.16 (August 2025)

Preparing Activity: USACE

Superseding
UFGS-07 41 13.16(August 2009)

UNIFIED FACILITIES GUIDE SPECIFICATIONS

References are in agreement with UMRL dated July 2025

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COPPER ROOF PANELS

08/25

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sign

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COPPER ROOF PANELS 08/25

NOTE: This guide specification covers the requirements for copper roof system applied to solid roof decking.

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

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

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

PART 1 GENERAL

NOTE: This guide specification will be used in the preparation of project specifications for flat-seam, standing-seam, batten-seam, or custom-design type copper roofing installed over a substrate. Establish the structural adequacy of the supporting system prior to design of copper roof system.

Ensure drawings indicate scope of sheet metalwork and structural framing system, including type of decking and blocking, type of fire-retardant materials (if used), type and details of seams, and design requirements. When this specification is used for onsite fabricated copper roof, the Contractor may not be able to verify performance

criteria such as wind uplift. In such cases, use and specify drawing details of proven reliability and in accordance with SMACNA recommended guidelines.

For copper roof systems in cold climates subjected to high snow accumulation, include snow guards, steep slopes (generally 6 on 12), and other approved details.

1.1 REFERENCES

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

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

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

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

ASTM INTERNATIONAL (ASTM)

ASTM B32	(2020) Standard Specification for Solder Metal
ASTM B370	(2022) Standard Specification for Copper Sheet and Strip for Building Construction
ASTM D226/D226M	(2017) Standard Specification for Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing
ASTM D1970/D1970M	(2021) Standard Specification for Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection
ASTM D2523/D2523M	(2013; E 2019; R 2019) Standard Practice for Testing Load-Strain Properties of Roofing Membranes
ASTM D4397	(2016; R 2023) Standard Specification for

Polyethylene Sheeting for Construction,
Industrial, and Agricultural Applications

ASTM D5147/D5147M

(2018; R 2024) Standard Test Methods for
Sampling and Testing Modified Bituminous
Sheet Material

ASTM D8257/D8257M

(2022) Standard Specification for
Mechanically Attached Polymeric Roof
Underlayment Used in Steep Slope Roofing

ASTM E28

(2018; R 2022) Softening Point of Resins
Derived from Naval Stores by Ring and Ball
Apparatus

ASTM E72

(2022) Conducting Strength Tests of Panels
for Building Construction

COPPER DEVELOPMENT ASSOCIATION (CDA)

CDA A4050

(2016) Copper in Architecture - Design
Handbook

ICC EVALUATION SERVICE, INC. (ICC-ES)

ICC-ES AC48

(2012; R 2015) Acceptance Criteria for
Self-adhered Roof Underlayment for Use as
Ice Barriers

1.2 DESIGN REQUIREMENTS

Form copper to provide proper installation of elastomeric sealants. Form
expansion joints of intermeshing hooked flanges not less than 25 mm 1 inch
deep in accordance with CDA A4050.

1.2.1 Wind Uplift Loads

NOTE: Select the basic wind speed value as outlined
in UFC 3-301-01, section titled "Section 1609 - WIND
LOADS"; also obtain the importance factors from UFC
3-301-01. Obtain the exposure factors from ASCE
7-16.

Compute the design uplift pressures for the roof system and apply using a
basic wind speed of [_____] km miles per hour (fastest km mile), an
importance factor of [_____] , and an exposure factor of [_____] . The
design uplift force for each connection assembly must be that pressure
given for the area under consideration, multiplied by the tributary load
area of the connection assembly, and multiplied by the appropriate factor
of safety, as follows:

Single fastener in each connection	3.0
Two or more fasteners in each connection	2.25

1.2.2 Panel and Clip Design

Panel and clip strength characteristics such as panel buckling strength, panel stiffness, side joint strength and clip/side joint must meet requirements of **ASTM E72**. For the clip-to-substrate fastener selection, incorporate a safety factor of 3.0 based on ultimate pull-out strength. Consider the pry effect which the outstanding leg of clip exerts on the fastener. Design end-laps for thermal movement. Use **concealed anchor clips**, and submit two samples of each type.

1.2.3 Provisions for Expansion

NOTE: Select appropriate temperature range based on effects of direct sun and general climatic conditions of the project site.

Provide copper roof panels that are free to move in response to the expansion and contraction forces resulting from a total **[110][_____]** **degrees C [200][_____]** **degrees F** temperature range during the life of the structure.

1.3 SUBMITTALS

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

For Army projects, fill in the empty brackets following the "G" classification, with a code of up to three characters to indicate the approving authority. Codes for Army projects using the Resident Management System (RMS) are: "AE" for Architect-Engineer; "DO" for District Office (Engineering Division or other organization in the District Office); "AO" for Area Office; "RO" for Resident Office; and "PO" for Project Office. Codes following the "G" typically are not used for Navy and Air Force projects.

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

Government approval is required for submittals with a "G" or "S"

classification. Submittals not having a "G" or "S" classification are for Contractor Quality Control approval. Submittals not having a "G" or "S" classification are for information only. When used, a code following the "G" classification identifies the office that will review the submittal for the Government. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Design and Erection drawings; G, [_____]

SD-03 Product Data

Roof Panels; G, [_____]

Sealant

Sample Warranty Certificate; G, [_____]

SD-04 Samples

Accessories; G, [_____]

Roof Panel sample

Fasteners; G, [_____]

Concealed Anchor Clips; G, [_____]

SD-06 Test Reports

Field Testing; G, [_____]

SD-07 Certificates

Manufacturer's Qualifications

Installer's Qualifications

SD-11 Closeout Submittals

Warranty

1.4 QUALITY ASSURANCE

Submit Qualifications for the following, as specified:

1.4.1 Manufacturer's Qualifications

Copper roof system must be the product of a recognized copper roof system manufacturer who has been in the practice of manufacturing copper roof systems for a period of not less than [10][_____] years and has been involved in at least five projects similar in size and complexity to this project. Submit [design and erection drawings](#) containing data necessary to clearly describe design, materials, sizes, layouts, seam configuration, construction details, provisions for thermal movement, line of panels, fastener sizes and spacings, sealants and installation procedures. Also submit certification that materials used in the copper roof system meet specified requirements.

1.4.2 Installer's Qualifications

The installer must be skilled in the installation of the type of copper roof system required for this project, have a minimum of [10][_____] years of experience, and involved in installing at least three projects of comparable size, scope and complexity as this project for the particular roof system specified.

1.4.3 Manufacturer's Representative

A representative of the copper roof system manufacturer, who is familiar with the design of the roof system supplied and experienced in the erection of roof systems similar in size to the one required under this Contract, must be present at the project site during installation of the copper roof to ensure that the roof system meets the Contract requirements.

1.4.4 Mock-Ups

**NOTE: Consider complexity of work and scope of
quality control before requiring Contractor to
construct a mock-up. Delete paragraph if mock-up is
not required.**

Before proceeding with final purchase of materials and fabrication of copper roofing components, construct a mock-up of the work at the site in the size and location directed, including at least one example of each critical detail (such as ridge, hip, and valley) as required in the project. The approved mock-up will establish the minimum standard of quality required for copper roofing work.

1.5 DELIVERY, STORAGE AND HANDLING

Deliver materials to the project site in a dry and undamaged condition and store them out of contact with the ground. Cover materials with weathertight coverings and keep dry. Provide storage accommodations for materials with good air circulation and protection from twisting, bending, abrasion, discoloration or staining.

1.6 WARRANTY

Warrant the copper roofing installation for a period of 20 years against blow-off and leakage arising out of or caused by ordinary wear and tear by the elements. Permanently attach a sign to the building at the most likely roof access point advising of the existence of the warranty. Write warranty directly to the Government, commencing upon final acceptance of the roof work by the Government. The warranty must guarantee that the design, detailing, materials, and accessories used for roofing work are approved by the roofing manufacturer and installed in accordance with specifications, drawings and other documents approved by manufacturer prior to installation. Submit a [sample warranty certificate](#) during the pre-construction phase to prove all warranty requirements, including the panel finish warranty, will be achieved.

PART 2 PRODUCTS

2.1 ROOF PANELS

Provide cold-rolled copper roofing sheets conforming to ASTM B370 temper designation, H00, minimum 4.9 kg per square meter 16 ounces per square foot containing 99.9 percent copper. Copper roof panels must be factory-fabricated in accordance with approved drawings and CDA A4050 recommendations. Form sections true to shape in the longest practical lengths, accurate in size and free of distortion and defects. Hem exposed edges on underside. Fabricate exposed copper work without excessive oil-canning, buckling, and tool marks. Submit roof panel sample consisting of one piece 225 mm 9 inches long, full width.

2.2 ACCESSORIES

Factory fabricate components required for a complete roofing system, including [trim,] [copings,] [fascias,] [corner units,] [ridge closures,] [clips,] [gutters,] [closure strips,] and similar items. Provide clip bases that have factory punched or drilled holes for attachment. Make clips used with panel width greater than 305 mm 12 inches from multiple pieces with the allowance for the total thermal movement required to take place within the clip. Provide cleats which are interlockable with the panels and of type and size to meet design requirements. Accessories must be fabricated of type and thickness of sheet copper complying with CDA A4050. Submit one sample of each type of flashing, trim, closure, cap and similar items. Size must be sufficient to show construction and configuration.

2.3 SOLDER AND FLUX

Copper solder must conform to ASTM B32. Flux must be rosin, muriatic acid neutralized with zinc or an approved soldering paste.

2.4 SLIP SHEETS

Slip sheets must be smooth rosin-sized unsaturated building paper weighing a minimum of 295 grams per square meter 6 pounds per 100 square feet. Attach sheets with approved fasteners. Apply slip sheets over vapor retarder, where applicable.

2.5 VAPOR RETARDER

NOTE: Include vapor retarder requirements on the drawings when required for local climatic conditions. In northern climates, where ice and snow are considerations, specify a waterproof secondary membrane. Delete this paragraph if not required.

Vapor retarder must be [non-perforated asphalt-saturated organic roofing felts conforming to ASTM D226/D226M, Type II (No. 30).] [polyethylene sheeting conforming to ASTM D4397. Provide a fully compatible tape which has equal or better water vapor control characteristics than the vapor retarder material.] Add a non-asphaltic underlayment meeting ASTM D8257/D8257M as follows: Post consumer recycled content-35 percent; Thickness ASTM D5147/D5147M-30 mils 0.030 inch min; Tensile strength

ASTM D2523/D2523M -25 lbF/in min; Slip resistance ASTM D1970/D1970M; pass elongation ASTM D2523/D2523M 20 percent min; UV resistance ICC-ES AC48-210 hours at 57-60 degrees C 135-140 degrees F; tensile strength after UV resistance ASTM D2523/D2523M-25 lbF/in min. Also add a non-asphaltic self-adhered membrane as follows: Pass all ASTM D1970/D1970M tests plus: Post consumer recycled content-35; percent UV resistance ICC-ES AC48-210 hours at 57-60 degrees C 135-140 degrees F; tensile strength after UV resistance ASTM D2523/D2523M-25 lbF/in min; thermal stability in accordance with ASTM E28- 127 degrees C 260 degrees F.

2.6 BITUMINOUS COATING

Bituminous coating must be cold-applied inert-type noncorrosive compound, nominally free of sulfur components and other deleterious impurities.

2.7 SEALANT

Provide sealant in accordance with CDA A4050 and manufacturer's recommendations. Submit descriptive information.

2.8 FASTENERS

NOTE: Select copper or series 304 stainless steel for humid project locations or locations with Environmental Severity Classifications (ESC) of C3 thru C5; use series 410 stainless steel for copper roofing at project locations with ESC C1 or C2. Humid locations are those in ASHRAE climate zones 0A, 1A, 2A, 3A, 3C, 4C and 5C (as identified in ASHRAE 90.1). See UFC 1-200-01 for determination of ESC for project locations.

Provide fasteners in contact with copper of [copper,] or [Series 304 stainless steel][Series 410 stainless steel] capable of resisting the specified wind uplift and allowing for movement of roof panel system. Exposed fasteners must be copper and only used at batten caps and closures. Submit two samples of each type to be used, with statement regarding intended use. If requested, take random samples of each type of fastener delivered to the project site in the presence of the Contracting Officer and provide to the Contracting Officer.

PART 3 EXECUTION

3.1 INSTALLATION

NOTE: Lumber and plywood in contact with copper will be non-treated or have a "non-corrosive" fire-retardant treatment.

Separate copper from noncompatible metal and corrosive substrates with permanent type separators recommended by manufacturer. Install roofing panels, flashings and related accessories with approved fasteners in accordance with approved drawings and CDA A4050. Set roofing components true to line and accurately fit together to form leak-proof joints. Fold panels back to form a hem on concealed side of exposed edges. Form

exposed surfaces flat and free of buckles, waves, and tool marks. Make provision for thermal expansion and contraction. Make seams uniform and neat with minimum of solder, welds and sealant. Conceal fasteners and expansion provisions where possible in exposed work. Field-cutting of panels by torch is not permitted.

3.1.1 Tolerances

Shim panels and align within a tolerance of 9 mm in 12 meters 3/8 inch in 40 feet vertically and horizontally and within 3 mm 1/8 inch offset of adjoining surfaces and of vertical alignment of matching profiles.

3.1.2 Substrates

Make concrete substrates smooth with a wash of neat cement or with a heavy application of bituminous coating. If concrete is not nailable, set nailable inserts into the concrete. Substrates must be clean, smooth, sound, dry, and free of defects and projections which might affect the installation. Secure projecting nails and other types of fasteners and make flush with substrate. Securely set roof openings, pipes, vents, and other roof penetrations in place.

3.1.3 Vapor Retarder

NOTE: Delete this paragraph if vapor retarder is not required. If vapor retarder is required, select the appropriate bracketed sentences for roofing felts or polyethylene.

[Install roofing felts in accordance with manufacturer's recommendations.]
[Install a single ply of 0.254 mm 10 mil polyethylene sheet or, at the Contractor's option, a double-ply of 0.152 mm 6 mil polyethylene sheet over the entire support surface. Use tape to seal the edges of the sheets to the support surface, or to the sheet below. Lap sheet edges no less than 150 mm 6 inches. Provide sufficient material to avoid inducing stresses in the sheets due to stretching or binding. Seal all tears or punctures that are visible in the finished surface with the tape.]

3.1.4 Slip Sheets

NOTE: Slip sheets are required for all installations. Install slip sheets over vapor retarder when vapor retarder is specified.

Install slip sheets with joints overlapped a minimum of 50 mm 2 inches, and secure with approved fasteners.

3.2 FIELD TESTING

NOTE: Field testing may not be required for all projects. Delete if not required.

Conduct [_____] random fastener pull tests in areas designated by the

Contracting Officer. Tensile and shear strength for structural connections less than 3.3 kN 750 pounds per fastener is not permitted. Submit test reports for uplift resistance of the copper roof system.

3.3 CLEANING

Upon completion of copper roofing work, remove grease and oil films, excess sealants and handling marks and clean the work in accordance with manufacturer's recommendations. Clean substances from copper surfaces that would interfere with uniform oxidation and weathering. Exposed copper surfaces must be free of dents, creases, waves, scratch marks, and solder or weld marks.

3.4 PROTECTION

Protect copper roofing work to ensure the roof is without damage or deterioration. Replace roof panels and other components, which have been damaged or have deteriorated beyond successful repair with new copper sheet metalwork. Storing, walking, wheeling or trucking directly on completed copper roofing work is not permitted. When required, use temporary walkways, runways and platforms fabricated of smooth clean boards to avoid damage to completed copper work. Maintain copper roofing work in a clean condition until final acceptance.

3.5 INFORMATION CARD

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 following information at a minimum (as applicable): facility name and number; location; contract number; approximate roof area; detailed roof system description (as applicable), including deck type, [membrane][surfacing], number of plies, method of application, manufacturer, insulation and cover board system and thickness; presence of tapered insulation for primary drainage, date of completion; installing contractor identification and contact information; membrane manufacturer warranty expiration, warranty reference number, and contact information.

-- End of Section --