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USACE / NAVFAC / AFCEA / NASA UFGS-07 61 01 (April 2006)  
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Preparing Activity: USACE Replacing without change  
UFGS-07610 (January 2004)

## UNIFIED FACILITIES GUIDE SPECIFICATIONS

References are in agreement with UML dated 1 April 2006

Latest change indicated by CHG tags

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### SECTION TABLE OF CONTENTS

#### DIVISION 07 - THERMAL AND MOISTURE PROTECTION

##### SECTION 07 61 01

##### COPPER ROOF SYSTEM

04/06

#### PART 1 GENERAL

- 1.1 REFERENCES
- 1.2 SUBMITTALS
- 1.3 DESIGN REQUIREMENTS
  - 1.3.1 Wind Uplift Loads
  - 1.3.2 Panel and Clip Design
  - 1.3.3 Provisions for Expansion
- 1.4 QUALIFICATIONS
  - 1.4.1 Manufacturer
  - 1.4.2 Installer
  - 1.4.3 Manufacturer's Representative
- 1.5 MOCK-UPS
- 1.6 DELIVERY, STORAGE AND HANDLING
- 1.7 WARRANTY

#### PART 2 PRODUCTS

- 2.1 ROOF PANELS
- 2.2 ACCESSORIES
- 2.3 SOLDER AND FLUX
- 2.4 SLIP SHEETS
- 2.5 VAPOR RETARDER
- 2.6 BITUMINOUS COATING
- 2.7 SEALANT
- 2.8 FASTENERS

#### PART 3 EXECUTION

- 3.1 INSTALLATION
  - 3.1.1 Tolerances
  - 3.1.2 Substrates
  - 3.1.3 Vapor Retarder
  - 3.1.4 Slip Sheets

- 3.2 FIELD TESTING
- 3.3 CLEANING
- 3.4 PROTECTION

-- End of Section Table of Contents --

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# UNIFIED FACILITIES GUIDE SPECIFICATIONS

References are in agreement with UMRL dated 1 April 2006

Latest change indicated by CHG tags

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## SECTION 07 61 01

### COPPER ROOF SYSTEM 04/06

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

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

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

Use of electronic communication is encouraged.

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

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## PART 1 GENERAL

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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. The structural adequacy of the supporting system will be established prior to design of copper roof system.

Drawings will show 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, drawing details of

proven reliability and SMACNA recommended guidelines should be used and specified.

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

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## 1.1 REFERENCES

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

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

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

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

### ASTM INTERNATIONAL (ASTM)

ASTM B 32	(2004) Solder Metal
ASTM B 370	(2003) Copper Sheet and Strip for Building Construction
ASTM D 226	(2005) Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing
ASTM D 4397	(2002) Polyethylene Sheeting for Construction, Industrial, and Agricultural Applications
ASTM E 72	(2004) Conducting Strength Tests of Panels for Building Construction

### COPPER DEVELOPMENT ASSOCIATION (CDA)

CDA 4115	(online) Copper in Architecture
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## 1.2 SUBMITTALS

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

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

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

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

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Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for [Contractor Quality Control approval.] [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 01 33 00 SUBMITTAL PROCEDURES:

### SD-02 Shop Drawings

Copper Roof System[; G][; G, [\_\_\_\_\_]]

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.

### SD-03 Product Data

#### Sealant

Descriptive information.

## Qualifications

Qualifications of the manufacturer, installer, and field representative.

## SD-04 Samples

### Accessories[; G][; G, [\_\_\_\_\_]]

One sample of each type of flashing, trim, closure, cap and similar items. Size shall be sufficient to show construction and configuration.

### Roof Panels

One piece 225 mm 9 inches long, full width.

### Fasteners[; G][; G, [\_\_\_\_\_]]

Two samples of each type to be used, with statement regarding intended use. If so requested, random samples of each type of fastener, as delivered to the project site shall be taken in the presence of the Contracting Officer and provided to the Contracting Officer.

### Concealed anchor clips[; G][; G, [\_\_\_\_\_]]

Two samples of each type.

## SD-06 Test Reports

### Field Testing[; G][; G, [\_\_\_\_\_]]

Test reports for uplift resistance of the copper roof system.

## SD-07 Certificates

### Copper Roof System

Certification that materials used in the copper roof system meet specified requirements.

## 1.3 DESIGN REQUIREMENTS

Copper shall be formed to provide proper installation of elastomeric sealants. Expansion joints shall be formed of intermeshing hooked flanges not less than 25 mm 1 inch deep in accordance with CDA 4115.

### 1.3.1 Wind Uplift Loads

\*\*\*\*\*  
NOTE: Select the basic wind speed value from TM  
5-809-1. The importance and exposure factors will  
be obtained from ASCE 7.  
\*\*\*\*\*

The design uplift pressures for the roof system shall be computed and applied 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 shall be that pressure given for the area under consideration, multiplied by the tributary load area of the connection assembly, and multiplied by the appropriate factor of safety, as follows:

- a. Single fastener in each connection .....3.0
- b. Two or more fasteners in each connection ...2.25

#### 1.3.2 Panel and Clip Design

Panel and clip strength characteristics such as panel buckling strength, panel stiffness, side joint strength and clip/side joint shall meet requirements of [ASTM E 72](#). The clip-to-substrate fastener selection shall incorporate a safety factor of 3.0 based on ultimate pull-out strength. Selection must consider the pry effect which the outstanding leg of clip exerts on the fastener. End-laps shall be designed for thermal movement. [Concealed anchor clips](#) shall be used.

#### 1.3.3 Provisions for Expansion

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

Copper roof panels shall be 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.

#### 1.4 [QUALIFICATIONS](#)

##### 1.4.1 Manufacturer

[Copper roof system](#) shall 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 5 projects similar in size and complexity to this project.

##### 1.4.2 Installer

The installer shall be skilled in the installation of the type of copper roof system required for this project, shall have a minimum of [\[10\]](#) [\[\\_\\_\\_\\_\\_\]](#) years of experience, and shall have been involved in installing at least 3 projects that are of comparable size, scope and complexity as this project for the particular roof system furnished.

##### 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, shall be present at the project site during installation of the copper roof to ensure that the roof system meets the contract requirements.

## 1.5 MOCK-UPS

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NOTE: Complexity of work and scope of quality control should be carefully evaluated 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, a mock-up of the work shall be constructed at the site. Roof mock-up shall be constructed in the size and location directed, and shall include at least one example of each critical detail (ridge, hip, valley, etc.) included in the project. The approved mock-up will establish the minimum standard of quality required for copper roofing work.

## 1.6 DELIVERY, STORAGE AND HANDLING

Materials shall be delivered to the project site in a dry and undamaged condition and shall be stored out of contact with the ground. Materials shall be covered with weathertight coverings and kept dry. Storage accommodations for materials shall provide good air circulation and protection from twisting, bending, abrasion, discoloration or staining.

## 1.7 WARRANTY

The copper roofing installation shall be warranted for a period of 20 years against blow-off and leakage arising out of or caused by ordinary wear and tear by the elements. A sign shall be permanently attached to the building at the most likely roof access point advising of the existence of the warranty. The warranty shall start upon final acceptance of the work or the date the Government takes possession, whichever is earlier. The warranty shall 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.

## PART 2 PRODUCTS

### 2.1 ROOF PANELS

Roofing sheets shall be cold-rolled copper sheets conforming to ASTM B 370 temper designation, H00, minimum 4.9 kg per square meter 16 ounces per square foot containing 99.9 percent copper. Copper roof panels shall be factory-fabricated in accordance with approved drawings and CDA 4115 recommendations. Sections shall be formed true to shape in the longest practical lengths, accurate in size and free of distortion and defects. Exposed edges shall be hemmed on underside. Exposed copper work shall be fabricated without excessive oil-canning, buckling, and tool marks.

### 2.2 ACCESSORIES

Components required for a complete roofing system, including [trim,] [copings,] [fascias,] [corner units,] [ridge closures,] [clips,] [gutters,] [closure strips,] and similar items shall be factory fabricated. Clip bases shall have factory punched or drilled holes for attachment. Clips used with panel width greater than 305 mm 12 inches shall be made from multiple pieces with the allowance for the total thermal movement required



to take place within the clip. Cleats shall be interlockable with the panels and shall be of type and size to meet design requirements. Accessories shall be fabricated of type and thickness of sheet copper complying with CDA 4115.

### 2.3 SOLDER AND FLUX

Copper solder shall conform to ASTM B 32. Flux shall be rosin, muriatic acid neutralized with zinc or an approved soldering paste.

### 2.4 SLIP SHEETS

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

### 2.5 VAPOR RETARDER

\*\*\*\*\*  
NOTE: Vapor retarder requirements will be shown on the drawings when required for local climatic conditions. In northern climates, where ice and snow are considerations, a waterproof secondary membrane may be specified. Delete this paragraph if not required.  
\*\*\*\*\*

Vapor retarder shall be [non-perforated asphalt-saturated organic roofing felts conforming to ASTM D 226, Type II (No. 30).] [polyethylene sheeting conforming to ASTM D 4397. A fully compatible tape shall be provided which has equal or better water vapor control characteristics than the vapor retarder material.]

### 2.6 BITUMINOUS COATING

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

### 2.7 SEALANT

Sealant shall be in accordance with CDA 4115 and manufacturer's recommendations.

### 2.8 FASTENERS

\*\*\*\*\*  
NOTE: For projects in hurricane areas, edit this paragraph to provide the higher quality fastener types recommended.  
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Fasteners in contact with copper shall be copper, brass or Series 300 stainless steel. Fasteners shall be capable of resisting the specified wind uplift and shall allow for movement of roof panel system. Exposed fasteners shall be copper and shall only be used at batten caps and closures.

## 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.**  
\*\*\*\*\*

Copper shall be separated from noncompatible metal and corrosive substrates with permanent type separators recommended by manufacturer. Roofing panels, flashings and related accessories shall be installed with approved fasteners in accordance with approved drawings and CDA 4115. Roofing components shall be set true to line and shall accurately fit together to form leak-proof joints. Panels shall be folded back to form a hem on concealed side of exposed edges. Exposed surfaces shall be formed flat and free of buckles, waves, and tool marks. Provision shall be made for thermal expansion and contraction. Seams shall be uniform and neat with minimum of solder, welds and sealant. Fasteners and expansion provisions shall be concealed where possible in exposed work. Field-cutting of panels by torch is not permitted.

#### 3.1.1 Tolerances

Panels shall be shimmed and aligned 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

Concrete substrates shall be made smooth with a wash of neat cement or with a heavy application of bituminous coating. If concrete is not nailable, nailable inserts shall be set into the concrete. Substrates shall be clean, smooth, sound, dry, and free of defects and projections which might affect the installation. Projecting nails and other types of fasteners shall be secure and flush with substrate. Roof openings, pipes, vents, and other roof penetrations shall be securely set in place.

#### 3.1.3 Vapor Retarder

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**NOTE: Delete this paragraph if vapor retarder is  
not required. If vapor retarder is required keep  
the appropriate brackets for roofing felts or  
polyethylene.**  
\*\*\*\*\*

[Roofing felts shall be installed in accordance with manufacturer's recommendations.] [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 shall be installed over the entire support surface. Tape shall be used to seal the edges of the sheets to the support surface, or to the sheet below. Sheet edges shall be lapped not less than 150 mm 6 inches. Sufficient material shall be provided to avoid inducing stresses in the sheets due to stretching or binding. All tears or punctures that are visible in the finished surface at any time during the construction process shall be sealed with the tape.]

#### 3.1.4 Slip Sheets

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NOTE: Slip sheets are required for all  
installations. Slip sheets must be installed over  
vapor retarder when vapor retarder is specified.  
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Slip sheets shall be installed with joints overlapped a minimum of 50 mm 2 inches, and shall be secured with approved fasteners.

#### 3.2 FIELD TESTING

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NOTE: Field testing may not be required for all  
projects. Delete if not required.  
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[\_\_\_\_\_] random fastener pull tests shall be conducted in areas designated by the Contracting Officer. Fasteners for structural connections shall provide tensile and shear strength of not less than 3.3 kN 750 pounds per fastener.

#### 3.3 CLEANING

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

#### 3.4 PROTECTION

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

-- End of Section --