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USACE / NAVFAC / AFCEA / NASA

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Superseding

UFGS-03520N (September 1999)

## UNIFIED FACILITIES GUIDE SPECIFICATIONS

References are in agreement with UMRL dated 23 June 2005

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# UNIFIED FACILITIES GUIDE SPECIFICATIONS

References are in agreement with UMRL dated 23 June 2005

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## SECTION 03520

### LIGHTWEIGHT CONCRETE ROOF INSULATION

08/04

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NOTE: This guide specification covers the requirements for insulating concrete roof deck systems with embedded insulation board only.

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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NOTE: The following information should be included on the project drawings:

1. High points and valleys on roof plan
2. Specific slope requirements
3. Roof drain details
4. Reinforcement locations and details.
5. Location of roof projections.
6. Moisture venting details and locations for insulating concrete over cast-in-place or precast structural concrete substrates.
7. Location of corrugated steel form decking sections with slots for moisture venting.

8. Insulation board thickness.

9. Vented flashing details and a mechanical fastening base sheet for built-up roof.

10. Seismic design details. Include diaphragm shear values, steel form deck design, and welding patterns if Section 05310, "Steel Decks" is not in contract.

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NOTE: Insulating concrete could be applied over structural or precast concrete, or corrugated steel form decking. Provide design details to meet minimum roof slope of 1/24.

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## PART 1 GENERAL

### 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.

AMERICAN SOCIETY OF HEATING, REFRIGERATING AND AIR-CONDITIONING ENGINEERS (ASHRAE)

ASHRAE Hdbk-IP (2001) Fundamentals Handbook, I-P Edition

ASTM INTERNATIONAL (ASTM)

ASTM A 185 (2002) Steel Welded Wire Reinforcement, Plain, for Concrete

ASTM C 150 (2004a) Portland Cement

ASTM C 332	(1999) Lightweight Aggregates for Insulating Concrete
ASTM C 495	(1999a) Compressive Strength of Lightweight Insulating Concrete
ASTM C 513	(1989; R 1995) Obtaining and Testing Specimens of Hardened Lightweight Insulating Concrete for Compressive Strength
ASTM C 578	(2004) Rigid, Cellular Polystyrene Thermal Insulation
ASTM C 612	(2004) Mineral Fiber Block and Board Thermal Insulation
ASTM C 796	(1997) Foaming Agents for Use in Producing Cellular Concrete Using Preformed Foam

## 1.2 QUALIFICATIONS OF APPLICATOR

Perform work by or under the supervision of personnel specializing in insulating concrete application and having not less than 2 years experience.

## 1.3 SUBMITTALS

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NOTE: Review submittal description (SD) definitions in Section 01330 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.] [for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government.] The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-03 Product Data

Performance requirements

Submit, indicating compressive strength, oven dry density, and coefficient of heat transmission.

SD-06 Test Reports

Performance requirements

Submit certified test reports on laboratory testing of insulating concrete samples taken at time of placement.

SD-07 Certificates

Fabricator's Compatibility Certificates

SD-08 Manufacturer's Instructions

Application

1.4 DELIVERY AND STORAGE

Deliver all materials to the building site in original unopened, undamaged packages or containers, or approved bulk handling equipment, with manufacturer's brand name and contents clearly identified. Protect materials against dampness. Store materials under cover and off the ground, in well-ventilated areas, not exposed to extreme changes of temperature and humidity. Prevent deterioration or intrusion of foreign substances. Keep materials dry until ready for use. Protect metal components from rusting.

1.5 ENVIRONMENTAL CONDITIONS

1.5.1 Normal Conditions

When ambient air temperatures of 3 degrees C 40 degrees F or above are predicted for the initial 24 to 72 hours after placement of insulating concrete, the use of hot water and other cold weather protection measures are not required.

1.5.2 Cold Weather Conditions

When ambient air temperature at time of placing insulating concrete is between 3 and 0 degrees C 40 and 32 degrees F, use hot water in temperature range of 32 and 39 degrees C 90 to 120 degrees F at the point of placement.

When ambient air temperatures of 0 degrees C 32 degrees F or below are predicted for the initial 24 to 72 hours after placement of insulating

concrete, provide additional protection measures as recommended by the aggregate manufacturer.

#### 1.6 SAFETY AND HEALTH REQUIREMENTS

Comply with manufacturer's protective measures in the safe installation of the insulation board.

#### 1.7 QUALITY ASSURANCE

##### 1.7.1 Fabricator's Compatibility Certificates

Submit a written statement from the insulating concrete fabricator certifying that materials for this project are chemically and physically compatible.

### PART 2 PRODUCTS

#### 2.1 PORTLAND CEMENT

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NOTE: Uses of Types I, II, and III portland cement are as follows:

Type I - For use when the special properties specified for other types are not required

Type II - For general use, more especially when moderate resistance or moderate heat of hydration is desired

Type III - For use when high early strength is desired.

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ASTM C 150, Type [I] [II] [III].

#### 2.2 AGGREGATE

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NOTE: Lightweight perlite and vermiculite aggregate or cellular concrete, without embedded insulation, should be specified in Section 03300, "Cast-In-Place Concrete." Insulation board applied over lightweight perlite and vermiculite aggregate or cellular concrete should be specified Section 07220, "Roof and Deck Insulation."

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ASTM C 332, Group I.

#### 2.3 AIR-ENTRAINMENT

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NOTE: Air-entraining agent is not required with cellular concrete.

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The air-entrainment agent shall be prepackaged or added at the mixer.

Provide amount and type of air-entrainment in accordance with the aggregate manufacturer's recommendations. Do not use calcium chloride.

#### 2.4 FOAMING AGENTS

ASTM C 796.

#### 2.5 WATER

Water shall be clean and free from injurious amounts of acids, alkali, organic matter, or other deleterious substances.

#### 2.6 EXPANSION JOINT FILLER MATERIAL

ASTM C 612, Class 1, semi-rigid, modified for maximum density of 96 kg per cubic meter 6.0 pounds per cubic foot.

#### 2.7 WELDED WIRE FABRIC

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NOTE: Insulating concrete requires reinforcement  
where slope substrate exceeds 1/3, and for achieving  
specific fire rated systems for metal deck systems,  
not over structural concrete.  
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Galvanized steel welded wire fabric shall conform to ASTM A 185.

#### 2.8 INSULATION BOARD

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NOTE: Design and specify insulating concrete with  
embedded insulation board to obtain contract U value  
requirements. Insulation board applied over  
insulating concrete is specified in Section 07220,  
"Roof and Deck Insulation."  
\*\*\*\*\*

Polystyrene insulation board conforming to ASTM C 578 RCPS Type [I], [II], [III], [IV], or [V], 600 by 1200 mm 24 by 48 inches, and of thickness [indicated] [necessary to provide a "C" value not greater than [\_\_\_\_]]. Boards shall be factory fabricated and slotted or perforated for keying the insulation board into the insulating concrete.

### PART 3 EXECUTION

#### 3.1 PERFORMANCE REQUIREMENTS

Provide insulating concrete design mix to shall meet the following performance requirements. Test as specified.

##### 3.1.1 Minimum Compressive Strength

[9 MPa] [\_\_\_\_] [125] [\_\_\_\_] pounds per square inch in 28 days as tested with ASTM C 495.

##### 3.1.2 Minimum Oven Dry Density

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NOTE: Oven dry density should not be less than 350  
kg per cubic meter 22 pcf.

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[350 kg] [\_\_\_\_\_] per cubic meter [22] [\_\_\_\_\_] pounds per cubic foot as  
determined by ASTM C 495.

### 3.1.3 Coefficient of Heat Transmission

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NOTE: Meet contract U value requirements. Specify  
insulation board applied over insulating concrete in  
Section 07220, "Roof and Deck Insulation."

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U value of [0.28] [\_\_\_\_\_] watt/sq. ft/degree C [0.05] [\_\_\_\_\_] Btu/hr/sq.  
ft/degree F, as determined in accordance with ASHRAE Hdbk-IP. The U value  
shall incorporate the total roof deck and roofing system design and  
represent the average U value for the total roof area.

### 3.2 SURFACE PREPARATION

Clean surfaces to receive insulating concrete of dirt, debris, and other  
foreign materials that would affect bonding. Deck shall be free of  
standing water, snow, and ice.

### 3.3 STEEL ROOF DECKING

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NOTE: Select the applicable paragraph(s) from the  
following:

NOTE: Insert the appropriate Section number and  
title in the blank below using format per UFC  
1-300-02.

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As specified in Section [05310 STEEL DECKS].

[[CAST-IN-PLACE] [PRECAST] STRUCTURAL CONCRETE DECK

As specified in [\_\_\_\_\_.]

### 3.4 REINFORCING MESH OR WELDED WIRE FABRIC

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NOTE: Insulating concrete requires reinforcement  
where slope on substrate exceeds 1 to 3, and for  
achieving specific fire rated systems for metal deck  
systems, not over structural concrete.  
Reinforcement size and spacing should be indicated  
on drawings.

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Install reinforcing mesh or welded wire fabric with a minimum end lap of  
150 mm 6 inches and no side lap. Cut mesh or fabric to fit at all [walls,]  
[curbs,] [roof drains,] and [openings]. [Mesh not required over structural  
concrete decks.]

### 3.5 APPLICATION OF INSULATING CONCRETE AND INSULATION BOARD

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NOTE: Use Section 07511, "Built-Up Asphalt Roofing (Aggregate Surfaced)" or Section 07536, "Ethylene Propylene Diene Monomer (EPDM) Roofing," as guidance in developing details and specifications for venting, roof expansion joints, and application of roofing materials. In addition to providing expansion joints in the structure, provide expansion joints in roofing membrane at all expansion joints in the insulating concrete roof deck except those located at the perimeter of the roof deck and where the roof deck abuts vertical surfaces.

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NOTE: Edit application procedures for concrete requirements. When the roof deck is designed for resistance to seismic or other lateral forces, the aggregate manufacturer should be consulted for specific criteria. Expansion joints other than those located at expansion joints in the structure shall not be provided when the roof deck is designed as a diaphragm to resist horizontal forces.

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Apply insulating concrete, insulation board and related materials in accordance with respective specifications and manufacturer's instructions, except as modified herein.

#### 3.5.1 Mixing

Mix insulating concrete materials mechanically to produce a uniform distribution.

#### 3.5.2 Conveying

Convey insulating concrete from the mixer to place of final deposit by methods that prevent segregation or loss of materials. Convey the concrete without material separation or loss of air content.

#### 3.5.3 Expansion Joints

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NOTE: Provide specifications for expansion joints in this or other sections. Normally expansion joints are specified in Section 03300, "Cast-In-Place Concrete." When Section 03300 is included in the project specification, coordinate the requirements for expansion joints and construction joints with this section.

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NOTE: Locations and dimensions of expansion joints: Expansion joints in the lightweight insulating concrete should be 32 mm 1 1/2 inch wide or 25 mm one inch wide as required. Expansion joints greater

than 32 mm 1 1/2 inch wide should be located at expansion joints in the structure. Expansion joints not less than one inch wide should be located at the perimeter of the roof deck, where the roof deck abuts vertical surfaces and at the following locations:

1. On cast-in-place structural concrete substrates, expansion joints in the light weight insulating concrete should be located at expansion joints in the building.
2. On precast concrete and steel form decking substrates, expansion joints in the light weight insulating concrete should be placed as they correspond with the structure and where the direction of the metal deck changes.

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Provide expansion joints through the depth of the light-weight insulating concrete at the perimeters of the roof deck, where the roof deck abuts vertical surfaces and where indicated. [Perimeter expansion joints are not required with cellular concrete.]

#### 3.5.4 Slurry Coat and Insulation Board

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NOTE: Insulation board applied over insulating concrete should be installed in accordance with Section 07220, "Roof and Deck Insulation."

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Bond the insulation board to the structural deck with a slurry coat of the same insulating concrete mix ratio as used for fill over the insulation board. Screed the slurry of concrete to an even surface, to a minimum of 3 mm 1/8 inch over the top of the structural deck. [Fill corrugations of steel decking with insulating concrete and screed even with the slurry coat.]

#### 3.5.5 Insulating Concrete Fill

Place the insulating concrete on the insulation board and screed to an even surface in a continuous operation until placement of a section is completed. Provide slopes as indicated for high points, valleys and positive drainage [to roof drains] and to eliminate ponding. At no place shall the minimum and maximum thickness of the insulating concrete be less than 50 mm or greater than 200 mm 2 inches or greater than 8 inches respectively over the top of insulation board.

##### 3.5.5.1 Compacting

Rodding, tamping, or vibrating are not permitted.

##### 3.5.5.2 Curing

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NOTE: The insulating concrete should be covered with subsequent roofing materials soon after being allowed to cure for a minimum of 10 days.

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Minimize traffic on the surface during the curing period. Under normal conditions, roofing may begin in 3 days. When the insulating concrete is placed during extremely dry conditions, sprinkle additional water on the concrete for hydration of the cement and to minimize shrinkage cracking. After a freezing or heavy rainfall or minor scaling of less than 6 mm 1/4 inch depth, broom the surface immediately prior to installation of roofing.

#### 3.5.5.3 Patching

Remove portions of the insulating concrete deck with excessive scaling of more than 6 mm 1/4 inch depth to sound concrete. Patch the surface with portland cement concrete slurry.

### 3.6 FIELD TESTS

During progress of work, insulating concrete specimens shall be taken for laboratory testing as specified herein.

#### 3.6.1 Test Specimens

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**NOTE: A minimum of one test should be required for  
each 40 to 60 cubic meters 50 to 75 cubic yards of  
insulating concrete.**

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Take test cylinder specimens for compressive strength in the presence of the Contracting Officer. Notify the Contracting Officer one day prior to the date of taking specimens. A minimum of [four] [\_\_\_\_\_] test specimens shall be made for each day's concreting, with at least one test required for each [57] [\_\_\_\_\_] cubic meters [75] [\_\_\_\_\_] cubic yards of insulating concrete. Label specimens to indicate the location at which they were taken. Store specimens in an undisturbed place which will not be exposed to rain and extreme changes of temperature and humidity until ready for testing.

#### 3.6.2 Rejections

If the specified laboratory requirements are not met, the rejected insulating concrete shall be field tested for the compressive strength. Determine oven-dry unit weight with ASTM C 513. Remove and replace insulating concrete which does not meet the requirements specified with new insulating concrete roof deck materials.

-- End of Section --