UNIFIED FACILITIES GUIDE SPECIFICATIONS

References are in agreement with UMRL dated July 2023
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SECTION 03 52 00

LIGHTWEIGHT CONCRETE ROOF INSULATION

08/11

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USACE / NAVFAC / AFCEC / NASA	**UFGS-03 52 00 (August 2011)**

Preparing Activity: NAVFAC	**Superseding**
	UFGS-03 52 00 (April 2006)

UNIFIED FACILITIES GUIDE SPECIFICATIONS

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SECTION 03 52 00

LIGHTWEIGHT CONCRETE ROOF INSULATION
08/11

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

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).
****

****
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 05 30 00 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.

****

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 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.

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

ASHRAE FUN IP	(2021) Fundamentals Handbook, I-P Edition
ASHRAE FUN SI	(2021) Fundamentals Handbook, SI Edition

ASTM INTERNATIONAL (ASTM)

ASTM A1064/A1064M	(2022) Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete
ASTM C150/C150M	(2022) Standard Specification for Portland Cement
ASTM C332	(2017) Standard Specification for Lightweight Aggregates for Insulating Concrete
ASTM C495/C495M	(2012; R 2019) Standard Test Method for Compressive Strength of Lightweight Insulating Concrete
ASTM C578	(2022) Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation
ASTM C612	(2014; R 2019) Standard Specification for Mineral Fiber Block and Board Thermal Insulation
ASTM C796/C796M	(2012) Standard Test Method for 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

****

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, Air Force, and NASA 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.

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" or "S" classification. Submittals not having a "G" or "S" classification are [for Contractor Quality Control approval.][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-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

****

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.

****

ASTM C150/C150M, Type [I] [II] [III].

2.2 AGGREGATE

****

NOTE: Lightweight perlite and vermiculite aggregate or cellular concrete, without embedded insulation, should be specified in Section 03 30 00

CAST-IN-PLACE CONCRETE. Insulation board applied over lightweight perlite and vermiculite aggregate or cellular concrete should be specified Section 07 22 00, ROOF AND DECK INSULATION.
****

ASTM C332, Group I.

2.3 AIR-ENTRAINMENT

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

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 C796/C796M.

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 C612, 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

****
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.
****

Galvanized steel welded wire fabric shall conform to ASTM A1064/A1064M.

2.8 INSULATION BOARD

****
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 07 22 00 ROOF AND DECK INSULATION.
****

Polystyrene insulation board conforming to ASTM C578 RCPS Type [I], [II], [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 C495/C495M.

3.1.2 Minimum Oven Dry Density

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

[350] [_____] kg per cubic meter [22] [_____] pounds per cubic foot as determined by ASTM C495/C495M.

3.1.3 Coefficient of Heat Transmission

****
NOTE: Meet contract U value requirements. Specify insulation board applied over insulating concrete in Section 07 22 00 ROOF AND DECK INSULATION.
****

U value of [0.28] [_____] watt/square foot/degrees C [0.05] [_____] Btu/hr/square foot/degrees F, as determined in accordance with ASHRAE FUN SI ASHRAE FUN 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

****
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.
****

As specified in Section [05 30 00 STEEL DECKS].

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

As specified in [_____].]

3.4 REINFORCING MESH OR WELDED WIRE FABRIC

****

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.

****

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

****

NOTE: Use Section 07 51 13BUILT-UP ASPHALTROOFING or Section 07 53 23 ETHYLENE-PROPYLENE-DIENE-MONOMER 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.

****

****

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.

****

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

****
NOTE: Provide specifications for expansion joints in this or other sections. Normally expansion joints are specified in Section 03 30 00 CAST-IN-PLACE CONCRETE. When one of these sections is included in the project specification, coordinate the requirements for expansion joints and construction joints with this section.
****

****
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.
****

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

****
NOTE: Insulation board applied over insulating concrete should be installed in accordance with Section 07 22 00 ROOF AND DECK INSULATION.
****

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

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

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

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

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.

-- End of Section --