

**SECTION 03 52 00
LIGHTWEIGHT CONCRETE ROOF INSULATION**

SPEC WRITER NOTES:

1. Use this section only for NCA projects.
2. Delete between //_____// if not applicable to the project. Also delete any other item or paragraph not applicable in this section and renumber the Articles and paragraphs.
3. Vent insulating concrete placed on steel deck at underside through slotted holes formed in metal deck, combined with topside edge venting and roof relief vents unless ASHRAE recommends no topside roof venting.
4. Vent insulating concrete placed over cast-in-place concrete or precast concrete substrates, through topside roof relief vents combined with edge venting unless ASHRAE recommends no roof venting.
5. For Gulf Coast areas check for non-venting in ASHRAE criteria.
6. Use this section for roof decks.
7. Use cellular insulating concrete for adhesively applied single ply roofing.
8. Define as "Insulating Concrete" on drawings. Do not use term "Light Weight Insulating Concrete".

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Section specifies insulating concrete placed on a prepared structural deck // and // integral insulating board composite construction //.

1.2 RELATED WORK

- A. Coordinate with Section 05 12 00, STRUCTURAL STEEL FRAMING, and Section 05 31 00, STEEL DECKING.

1.3 SUSTAINABILITY REQUIREMENTS

- A. Materials in this section may contribute towards contract compliance with sustainability requirements. See Section 01 81 11, SUSTAINABLE DESIGN REQUIREMENTS, for project // local/regional materials, // low-emitting materials, // recycled content, // _____// requirements.

1.4 REGULATORY REQUIREMENTS FOR RECYCLED CONTENT

- A. Products and Materials with Post-Consumer Content and Recovered Materials Content:
1. Contractor is obligated by contract to satisfy Federal mandates for procurement of products and materials meeting recommendations for

- post-consumer content and recovered materials content; the list of designated product categories with recommendations has been compiled by the EPA - refer to <http://www.epa.gov/wastes/consERVE/tools/cpg/products/>.
2. Materials or products specified by this section may be obligated to satisfy this Federal mandate and Comprehensive Procurement Guidelines program.
 3. The EPA website also provides tools such as a Product Supplier Directory search engine and product resource guides.
- B. Fulfillment of regulatory requirements does not relieve the Contractor of satisfying sustainability requirements stipulated by Section 01 81 11, SUSTAINABLE DESIGN REQUIREMENTS, as it relates to recycled content; additional product and material selections with recycled content may be required, as determined by Contractor's Sustainability Action Plan.

1.5 SUBMITTALS

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA AND SAMPLES.
- B. Manufacturer's Literature and Data:
 1. Description of material.
 2. Specifications for mixing, placing, curing and protection of insulating concrete.
 3. Interstitial deck: Test specimens' reports.
- C. Product Certificates: For the following, from manufacturer:
 1. Cementitious materials.
 2. Foaming agents.
 3. Molded-polystyrene insulation board.
- D. Material Test Reports: For lightweight aggregates, from a qualified testing agency, indicating compliance with requirements.
- E. Qualification Data: Aggregate or foam manufacturer's written certification that applicator has equipment and training to provide a satisfactory installation.

1.6 PROJECT CONDITIONS

- A. Do not place lightweight insulating concrete unless ambient temperature is at least 40-degree F (4.4 degree C) and rising.
 1. When air temperature has fallen or is expected to fall below 40 degree F (4.4 degree C), heat water to a maximum 120 degree F (49 degree C) before mixing so lightweight insulating concrete, at point

- of placement, reaches a temperature of 50 degree F (10 degree C) minimum and 80 degree F (27 degree C) maximum.
- B. Do not place lightweight insulating concrete during rain or snow or on surfaces covered with standing water, snow, or ice.

1.7 DELIVERY, STORAGE AND HANDLING

- A. Deliver and store packaged materials in original containers with seals unbroken and labels intact.
- B. Store in dry and watertight facilities. Do not store materials on ground.

SPEC WRITER NOTES:

1. Update the applicable publications at the time of the project specification preparation.

1.8 APPLICABLE PUBLICATIONS

- A. Publications listed below form a part of this specification to extent referenced. Publications are referenced in text by the basic designation only. Comply with applicable provisions and recommendations of the following, except as otherwise shown or specified.

SPEC WRITER NOTES:

1. Remove reference citations that do not remain in Part 2 or Part 3 of edited specification.
2. Verify and make dates indicated for remaining citations the most current at date of submittal; determine changes from date indicated on the TIL download of the section and modify requirements impacted by the changes.

- B. American Concrete Institute (ACI):

| | |
|----------|------------------------------------|
| 301-20 | Structural Concrete |
| 305R-20 | Hot Weather Concreting |
| 306R-16 | Cold Weather Concreting |
| 308-16 | Curing Concrete |
| 523.1-06 | Cast-in-Place Low-Density Concrete |

- C. American Society for Testing and Materials (ASTM):

| | |
|-----------------------|---|
| ASTM A1064/A1064M-18a | Steel Wire, Plain, for Concrete Reinforcement |
| A185/A185M-07 | Steel Welded Wire Reinforcement, Plain, for Concrete |
| C150/C150M-12 | Portland Cement |
| C260/C260M-10a 2016 | Air-Entraining Admixtures for Concrete |
| C309-19 | Liquid Membrane Forming Compounds for Curing Concrete |

| | |
|----------------------|--|
| C332-09 | Lightweight Aggregates for Insulating Concrete |
| C494/C494M-08 | Chemical Admixtures in Concrete |
| C495/C495M-12 (2019) | Compressive Strength of Lightweight Insulating Concrete |
| C578-22 | Rigid, Cellular Polystyrene Thermal Insulation |
| C665-17 | Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing |
| C796/C796M-12 | Foaming Agents For Use in Producing Cellular Concrete Using Preformed Foam |
| C869/C869M-11 (2016) | Foaming Agents Used in Making Preformed Foam for Cellular Concrete |

PART 2 - PRODUCTS

SPEC WRITER NOTES:

1. Update material requirements to agree with the applicable requirements (types, grades, classes) specified in the referenced Applicable Publications.

2.1 MATERIALS

- A. Portland Cement: ASTM C150, Type I or Type III.
- B. Lightweight Aggregate: Vermiculite or Perlite conforming to ASTM C332, Group I.
- C. Foaming Agent: ASTM C869.
- D. Air-Entrainment Agent:
 1. ASTM C260 type recommended by the aggregate manufacturer.
 2. Admixtures with chloride salts or regenerated foam types not acceptable.
- E. Water: Clean and potable, free from impurities detrimental to the concrete.
- F. Insulation and Control Joint Filler:
 1. Control Joint Filler: Glass fiber or similar vapor permeable highly compressible material which will compress to one-half its thickness under a load of 172 kPa (25 psi) or less.
 2. Insulation: ASTM C665, unfaced for relief vents.

SPEC WRITER NOTES:

1. Use wire mesh reinforcing when roof deck slopes exceed 4 inches in 12 inches and for fire rated roof assemblies using metal decking and in seismic areas.

3. Insulation Board:

- a. Polystyrene: ASTM C578, Type I.
- b. Board with evenly distributed holes or slots for bonding; approximately 3 percent open area.

G. Wire Mesh Reinforcing:

1. Hexagonal Mesh: Fabricated of ASTM A82, galvanized steel wire 0.9 mm (0.0359-inch) diameter twisted to form 50 mm (2-inch) hexagons with W0.5 galvanized steel wire woven into mesh spaced 200 mm (18-inches) apart.
2. Welded wire fabric: ASTM A185, 102 x 204 mm (4 by 8-inches) - W1.2/W05 - or 50 x 50 mm (2 by 2-inches) - W05/W0.5.

H. Admixtures:

1. Limit water-soluble chloride ions to the maximum percentage by weight of cement or cementitious material permitted by ACI 301 (ACI 301M).
2. Air Entraining: ASTM C260, type recommended by the aggregate manufacturer. Admixtures with chloride salts or pre-generated foam types are not acceptable for vermiculite or perlite concrete.
3. Accelerating, Retarding, and Water Reducing: ASTM C494, type as recommended by insulating concrete manufacturer.

- I. Concrete Sealer: ASTM C309, Type 2, white, pigmented, curing, sealing, hardening and dustproofing concrete, and compatible with latex paint or acrylic paint, not acting as a bond breaker for the paint.

2.2 MIXES AND MIXING

Roof Deck:

- A. Mix insulating concrete in accordance with ACI 523.1R or manufacturer's printed specifications where more demanding.
- B. Place in accordance with chapter 5 of ACI 523.1R, or manufacturer's specifications where more demanding.
 1. Cold Weather Concreting: ACI 306R and ACI 523.1R. Remove and replace frozen concrete.
 2. Hot Weather Concreting ACI 305R.
 3. Place insulating concrete to not less than 90 mm (3-1/2 inches) over the top of the steel deck crests.
 4. Smooth the placed material to a uniform finish following the screeding operation.
 5. Free surface of loose material, finish smooth to receive sealer.
- C. Design Mix:

1. Compressive strength: Minimum 862 kPa (125 psi) when tested in accordance with ASTM C495 except do not oven dry cellular concrete samples.
 2. Dry density: Maximum 450 Kg/cubic meter (28 pcf).
- D. Vermiculite or Perlite Aggregate Mix:
1. Mix proportions as recommended by aggregate manufacturer for specified strength and density.
 2. Approximate proportions:
 - a. Ratio of 0.17 cubic meters (6 cubic feet) of aggregate to 42 Kg (94 pounds) of Portland cement.
 - b. Air entraining agent approximately 8 Kg (0.11 pound) per 95 L (25 gallons) of water.
 - c. Slump approximately 70 mm (2.7 inches).
 - d. Water to assure uniform and consistent mix.
- E. Cellular Concrete Mix:
1. Mix proportions as recommended by foam manufacture for specified strength and cast density.
 2. Preformed foam concentrate diluted at approximately 40 parts water to one part concentrate.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Clean deck of debris, oil, and other contaminants that will prevent bond.
- B. Do not start until curbs, sleeves, edge venting, or other penetration forms are completed.

3.2 PLACING INSULATING CONCRETE

- A. Place in accordance with ACI 523.1R or manufacturer's specifications where more demanding.
- B. Cold Weather Concreting: ACI 306R.
 1. If ambient temperature falls below 32 deg F, protect lightweight insulating concrete from freezing and maintain temperature recommended by manufacturer for 72 hours after placement.
 2. Remove and replace frozen concrete.
- C. Hot Weather Concreting: ACI 305R.
- D. Place reinforcement as required for fire rating and for seismic areas.
 1. Lap the edges of the reinforcement 150 mm (6-inches) and the ends 150 mm (6-inches).
 2. Locate at mid-height of insulating concrete.

3. Place reinforcement without attachment approximately 13mm (1/2 inch) above steel deck crests in insulating concrete.
- E. Place for thickness and profiles shown.
- F. Place concrete not less than 50 mm (2-inches), or more than 200 mm (8-inches) in thickness.
- G. Slope insulating concrete uniformly, 1 in 50 (1/4-inch per foot) minimum, to drains or scuppers.
- H. Depressions that create ponding are not acceptable.
- I. Finish top surface smooth, free of loose material, ridges and depressions, and maintain surface in condition to receive subsequent roofing system.
- J. Roof Relief Vents for Vermiculite or Perlite Concrete:
 1. Under roof relief vents, remove insulating concrete to structural deck and fill with ASTM C665 insulating material.
 2. Coordinate with roofing and sheet metal work to space vents minimum 152 mm (6-inches) in diameter, a maximum distance of 9 m (30 feet) from adjacent vent and from vented edge.
- K. Control Joints for Perlite Concrete:
 1. Install minimum 25 mm (1-inch) wide control joint through thickness of perlite concrete around perimeter of roof deck and at junction of roof penetrations.
 2. Fill control joints with control joint filler specified.

3.3 PLACING INSULATION BOARD FOR COMPOSITE CONSTRUCTION

- A. Coat concrete roof deck with a slurry of the insulating concrete, minimum 3 mm (1/8-inch) thick.
- B. Fill the corrugations of metal decking with insulating concrete to a minimum depth of 3 mm (1/8-inch) over top of flutes.
- C. Set insulation boards to key into slurry. Install insulation in a stair stepped configuration to form base for slope-to-drain capability.
- D. Place for thickness and profiles shown. Thickness of concrete over insulation board not less than 2 inches.

3.4 CURING, PROTECTION AND TESTING

- A. Roof Deck: Cure in accordance with ACI 308, or manufacturer's specification where more demanding.
- B. Do not permit traffic on insulating concrete for 72 hours after placing.
- //C. Testing:

1. Fasteners pull-out test for roofing: Resist a 14 kg (30 pound) pull-out when driven into cured insulating concrete.
2. Perform roof fastener pull-out test for each 160 square meters (10 squares) or not less than 3 tests whichever is greater.
3. Patch test pull out areas after fastener is removed.
4. Selection of test location and witness of tests by RE/COR//.
5. Take a minimum of 4 test specimens at the point of placement for 75 m3 cum (100 cubic yards) of material placed and each day's pour.
6. Use 75 mm x 150 mm (3 inch by 6 inch) cylinders for specimens.
7. Test for compressive strength in accordance with ASTM C495, except do not oven dry cellular insulating concrete prior to compressive testing as indicated by ASTM C796.

3.3 DEFECTIVE WORK

- A. Refinish, or remove and replace, lightweight insulating concrete if surfaces are excessively scaled or too rough to receive roofing according to roofing membrane manufacturer's written instructions.
- B. Remove and replace lightweight insulating concrete that fails to comply with requirements.

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