

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

SPEC WRITER NOTES:

1. 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.
2. 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.
3. 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.
4. For Gulf Coast areas check for non-venting in ASHRAE criteria.
5. Use this section for roof decks and interstitial decks.
6. Use cellular insulating concrete for adhesively applied single ply roofing.
7. Define as "Insulating Concrete" on drawings. Do not use term "Light Weight Insulating Concrete".
8. Allow options specified except for adhered roof membrane; use cellular concrete.
9. Use section with options as written and with Section 03 51 16, GYPSUM CONCRETE ROOF DECKS, Section 03 55 11, GYPSUM CONCRETE FLOOR DECKS.
10. Coordinate with Section 05 12 00, STRUCTURAL STEEL FRAMING, and Section 05 31 00, STEEL DECKING.

PART 1 - GENERAL

1.1 DESCRIPTION:

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

1.2 RELATED WORK:

- //A. Insulating concrete for interstitial decks: Section 03 55 11, GYPSUM CONCRETE FLOOR DECKS.//
- //B. Roof decks: Section 03 51 16, GYPSUM CONCRETE ROOF DECKS.//
- //C. Steel Framing: Section 05 12 00, STRUCTURAL STEEL FRAMING.//

//D. Steel Roof Deck: Section 05 31 00, STEEL DECKING.//

1.3 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. Performance Requirements: Submit indicating compressive strength, oven dry, density (except at cellular insulating concrete), and coefficient of heat transmission.
- C. Certificates:
 - 1. Fabricator's Compatibility Certificates.
 - 2. Applicator's Experience Certificates.
- D. Test Reports: Submit certified test reports on laboratory testing of insulating concrete samples, taken at time of placement.

1.4 QUALITY ASSURANCE:

- A. Approval by Contracting Officer Representative (COR) is required of products of proposed manufacturer or supplier.
- B. Submit certificate from the insulating concrete fabricator certifying that materials for this project are chemically and physically compatible.
- C. Submit certificate that the work will be performed by or under the supervision of personnel specializing in insulating concrete application and having not less than three (3) years' experience.

1.5 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 NOTE: Update the applicable publications at the time of the project specification preparation.

1.6 APPLICABLE PUBLICATIONS:

- A. Publications listed below form a part of this specification to extent referenced. Publications are referenced in text by basic designation only.
- B. American Concrete Institute (ACI):

- 305R-10.....Guide to Hot Weather Concreting
- 306R-10.....Guide to Cold Weather Concreting
- 308R-01(R2008).....Guide to Curing Concrete
- 523.1R-06.....Guide for Cast-in-Place Low-Density Concrete

C. ASTM International (ASTM):

- A1064/A1064M-14.....Carbon-Steel Wire and Welded Wire Reinforcement
Plain and Deformed, for Concrete
- C150/C150M-12.....Portland Cement
- C260/C260M-10a.....Air-Entraining Admixtures for Concrete
- C309-11.....Liquid Membrane Forming Compounds for Curing
Concrete
- C332-09.....Lightweight Aggregates for Insulating Concrete
- C494/C494M-13.....Chemical Admixtures for Concrete
- C495/C495M-12.....Compressive Strength of Lightweight Insulating
Concrete
- C578-14.....Rigid Cellular Polystyrene Thermal Insulation
- C665-12.....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.....Foaming Agents Used in Making Preformed Foam
for Cellular Concrete

PART 2 - PRODUCTS

SPEC WRITER NOTE: 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/C150M, Type I or Type III.
- B. Lightweight Aggregate: Vermiculite or Perlite conforming to ASTM C332, Group I.
- C. Foaming Agent: ASTM C869/C869M.
- D. Air-Entrainment Agent:
 - 1. ASTM C260/C260M type recommended by the aggregate manufacturer.
 - 2. Admixtures with chloride salts or regenerated foam types are 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 NOTE: Use wire mesh reinforcing when roof deck slopes exceed 101 mm in 305 mm (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 A1064/A1064M, 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 457 mm (18 inches) apart.
2. Welded wire fabric: ASTM A1064/A1064M, 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. Accelerating, Retarding, and Water Reducing: ASTM C494/C494M, 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:

A. Roof Deck

1. Mix insulating concrete in accordance with ACI 523.1R or manufacturer's printed specifications where more demanding.
2. Design Mix:
 - a. Compressive strength: Minimum 862 kPa (125 psi) when tested in accordance with ASTM C495 except do not oven dry cellular concrete samples.

- b. Dry density: Maximum 450 Kg per cubic meter (28 lbs. per cubic foot).
 - 3. Vermiculite or Perlite aggregate mix.
 - a. Mix proportions as recommended by aggregate manufacturer for specified strength and density.
 - b. Approximate proportions:
 - 1) Ratio of 0.17 cubic meter (6 cubic feet) of aggregate to 42 Kg (94 pounds) of Portland cement.
 - 2) Air entraining agent approximately 0.05 Kg (0.11 pound) per 95 L (25 gallons) of water.
 - 3) Slump approximately 69 mm (2.7 inches).
 - 4) Water to assure uniform and consistent mix.
 - 4. Cellular concrete mix:
 - a. Mix proportions as recommended by foam manufacture for specified strength and cast density.
 - b. Preformed foam concentrate diluted at not more than 40 parts water to one (1) part concentrate.
- B. Interstitial Deck:
 - 1. Compressive Strength:
 - Minimum 1550 kPa (225 psi). Test in accordance with ASTM C495/C495M.
 - 2. Dry density when tested in accordance with ASTM C495/C495M.
 - //a. 600 Kg per cubic meter (36 lbs. per cubic foot).//
 - //b. 450 Kg per cubic meter (28 lbs. per cubic foot).//
 - 3. Vermiculite or Perlite aggregate mix.
 - a. Mix proportions as recommended by aggregate manufacturer for specified strength and density.
 - b. Approximate proportions: Ratio of 0.12 cubic meters (4 cubic feet) of aggregate to 42 Kg (94 pounds) of portland cement with air entraining agent.
 - 4. Cellular concrete mix:
 - UL design No.P902.

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, and 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 and ACI 523.1R.
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 152 mm (6 inches) and the ends 150 mm (6 inches).
 - 2. Locate at mid-height of insulating concrete. Provide minimum coverage of reinforcement as recommended by manufacturer.
 - 3. Place reinforcement without attachment minimum 13 mm (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 203 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. Leave surface free of loose material and finish smooth to receive roofing material specified.
- 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 9.14 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 insulating concrete, minimum 3 mm (1/8-inch) thick.
- B. Fill 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 to be not less than 50 mm (2 inches).

3.4 CURING, PROTECTION AND TESTING:

- A. Roof Deck: Cure in accordance with ACI 308R.
- B. Interstitial Deck: Cure in accordance with ACI 523.1R.
- C. Interstitial Deck: After curing for not less than 30 days, for vermiculite and perlite concrete, apply one (1) coat of sealer at a rate not less than 11.6 square meters per litre (125 square feet per gallon) to insulating concrete in accordance with sealer manufacturer's specification.
- D. Do not permit traffic on insulating concrete for 72 hours after placing.
- E. Testing:
 - 1. Insulating Concrete Samples:
 - a. Take a minimum of four (4) test specimens at the point of placement for 76.5 cubic meters (100 cubic yards) of material placed and each days pour. Submit test reports.
 - b. Use 75 x 152 mm (3 x 6 inch) cylinders for specimens.
 - c. Test for compressive strength in accordance with ASTM C495/C495M, except do not oven dry cellular insulating concrete prior to compressive testing. See ASTM C796/C796M, Section 8.9.
 - // 2. Fasteners Pull-out Test for Roofing
 - a. Resist a 14 kg (30 pound) pull-out when driven into cured insulated concrete.
 - b. Perform roof fastener pull-out test for each 160 square meters (1722 square feet) or not less than three (3) tests whichever is greater.
 - c. Patch test pull-out areas after fastener is removed.
 - d. Selection of test location(s) and witness of tests to be by COR.//

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