ES REPORT™

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Filing Category: INSULATION

CELCORE LIGHTWEIGHT INSULATING CONCRETE

CELCORE INC.
775 U.S. HIGHWAY 70 WEST
BLACK MOUNTAIN, NORTH CAROLINA 28711

1.0 SUBJECT

Celcore Lightweight Insulating Concrete.

2.0 DESCRIPTION

2.1 General:

Celcore Lightweight Insulating Concrete is a cellular insulating concrete intended for application over steel or concrete structural roof decks. It may be used with polystyrene insulation board and must be covered with a roof covering system complying with the code.

2.2 Materials:

2.2.1 Celcore Foam Concentrate: Celcore, a hydrolyzed protein liquid foam concentrate, complying with ASTM C 869. Packaged in 5-gallon (18.9 L) pails, the product has a one-year shelf life.

2.2.2 Cement: Type I portland cement, complying with ASTM C 150-94.

2.2.3 Insulation Board: Expanded polystyrene insulation board, 1 to 8 inches (25 to 203 mm) thick with a minimum 1-pcf (16 kg/m^3) density. The boards measure 2 feet (610 mm) wide by 4 feet (1219 mm) long and have eight $2^1/_2$-inch-diameter (63.5 mm) holes. The boards must be recognized in a current ICBO ES evaluation report.

2.2.4 Steel Deck: The steel deck is minimum No. 28 gage [0.0129 inch (0.328 mm)], with a corrugated or fluted shape, and has a G 60 galvanized finish. The deck must be approved by the building official for the loads and spans considered.

2.2.5 Welded-wire Fabric: Keydeck Type 2160-2-1619 with galvanized finish, shall comply with ASTM A 185.

2.2.6 Celcore Curing Compound: Celcore polyvinyl alcohol (PVA) membrane-forming curing compound, shall comply with ASTM C 309, Type 1, Class A. Packaged in 55-gallon (208 L) drums, the product has a one-year shelf life and must be protected from freezing and be sealed during storage to prevent skinning of the air-exposed surface.

2.3 Thermal Barrier:

Systems with foam plastic insulation installed in accordance with this evaluation report do not require a thermal barrier.

2.4 Wind Uplift:

The wind uplift resistance of roof covering assemblies described in this report is limited to Exposure B areas with a basic wind speed of 80 mph (129 km/h), on roofs up to 40 feet (12 192 mm) above ground.

2.5 Preparation:

Celcore liquid foam concentrate is mixed with water at a ratio of one part concentrate to 40 parts water by volume, and is expanded under pressure in a foam generator. Celcore Lightweight Insulating Concrete is proportioned using 19 cubic feet (0.5 m^3) foam, 7.9 sacks Type I portland cement and 32 gallons (121 L) water to produce a slurry with a 40 ± 3 pcf (640 ± 48 kg/m^3) wet density. The concrete must have a cast dry density of 29 ± 1 pcf (464 ± 16 kg/m^3); a 28-day minimum compressive strength of 275 psi (13 167 Pa), as determined by ASTM C 495; a minimum 28-day splitting tensile strength of 25 psi (1197 Pa), as determined by ASTM C 496; a maximum 25 percent (by volume) water absorption, as determined by ASTM C 796; and a maximum 4.5 percent (by volume) loss of air during pumping, as determined by ASTM C 796.

Celcore Curing Compound is mixed at a ratio of three parts compound to one part water, by volume.

2.6 Application:

The concrete or steel roof deck is cleaned and water is removed. All roof drains and penetrations must be covered. The Celcore cellular insulating concrete is placed at a minimum 40°F (4.4°C) ambient temperature. When the temperature is expected to fall below 40°F (4.4°C) within 24 hours after placement, mixing water is heated up to 120°F (49°C).

The metal deck is welded to structural supports using $^1/_2$-inch-diameter (13 mm) arc-spot welds through weld washers. Washers are omitted on decks less than No. 22 gage in thickness. Welds are placed 12 inches (305 mm) on center at every deck support. At roof discontinuities, defined in Footnote 4 of Table 16-H of the 1997 *Uniform Building Code*™ (UBC), weld spacing is decreased to 6 inches (152 mm) on center. Other welding requirements must comply with AWS D 1.3-89.

When foam plastic insulation board is used, the concrete is placed over steel deck, to a minimum of $^1/_8$ inch (3.2 mm) over the top of the corrugations. The insulation board is set, with staggered end joints, into the wet concrete. Figure 1 shows details. The welded-wire fabric is centered in the fill above flutes or insulation board, lapped 6 inches (152 mm) at ends, 2 inches (51 mm) at sides. The Celcore insulating concrete is placed to a minimum 2-inch (51 mm) depth over the substrate or insulation board, filling the deck valleys or

the keying holes in the insulation board. After concrete has sufficiently cured to permit foot traffic, but under no circumstances less than 24 hours after concrete placement, diluted Celcore Curing Compound is spray-, brush-, or roll-applied at a rate of 200 to 400 square feet per gallon (5 to 10 m^2/L) over the surface and allowed to cure 48 hours before applying the roof covering.

A glass felt built-up roof covering may be directly applied to the Celcore insulating concrete or to mechanically fastened, asphalt-coated, glass-reinforced base sheets. The base sheets, either Schuller PermaPly R or Celotex Vapor Bar, up to 36 inches (914 mm) wide, are laid with minimum 3-inch (76 mm) overlaps. Base sheets are secured to the concrete with ES Products FM-90 Base Ply Fasteners or Olympic C-R Base Felt Fasteners spaced a maximum of 8 inches (203 mm) on center along laps and 16 inches (406 mm) on center along two intermediate rows in each sheet. Fasteners are staggered from adjacent fastener rows. The built-up roof covering is then applied in accordance with Chapter 15 of the UBC. Perimeter details are shown in Figure 2.

2.7 Special Inspection:

All welding requires continuous or periodic special inspection per Section 1701.5.5 of the UBC. Prior to installation, the welder must demonstrate his ability to produce the prescribed welds, to the welding inspector's satisfaction. The inspector's other duties include verification of materials, weld preparation, welding procedures and welding processes. Continuous special inspection for insulating concrete fill and concrete reinforcement is in accordance with Sections 1701.5.9 and 1701.5.4 of the UBC. The inspector's duties include sampling, testing, and verification of concrete mixes; reinforcement types and placement; and concrete placement.

Cylinders for ASTM C 495 and ASTM C 496 must be 6 inches (152 mm) in diameter by 12 inches (305 mm) in length. Concrete is placed in two layers. Each layer is consolidated by raising cylinders 1 inch (25 mm) and dropping on a hard surface. Rodding is not recommended. After molding, the cylinder is stored for at least 16 hours before moving. The cylinder surface is unsealed. Specimens must cure at least 7 days before demolding.

2.8 Identification:

Each installation must have a job card, presented to the building official, reporting the installation date and the name of the installer. The insulation board is identified in accordance with its evaluation report. The Celcore Foam Concentrate and Celcore Curing Compound are labeled with the Celcore Inc. name and address and the product name, mixing instructions, expiration date, and label of the quality control agency (Underwriters Laboratories Inc.).

3.0 EVIDENCE SUBMITTED

Descriptive information and reports of fire tests and wind resistance tests.

4.0 FINDINGS

That the Celcore Lightweight Insulating Concrete described in this report complies with the 1997 *Uniform Building Code*™, subject to the following conditions:

4.1 The Celcore cellular concrete is applied in accordance with this report and the manufacturer's instructions.

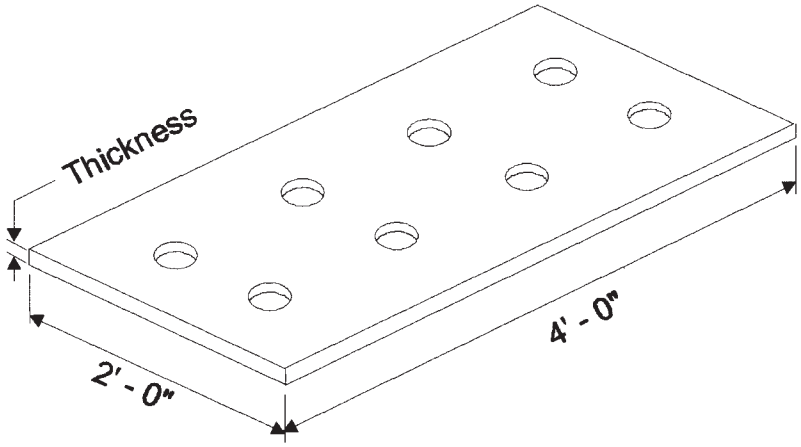
4.2 The cellular concrete is applied only by applicators approved by Celcore Inc.

4.3 The products are produced in Black Mountain, North Carolina, with quality control inspections by Underwriters Laboratories Inc. (AA-668).

This report is subject to re-examination in two years.

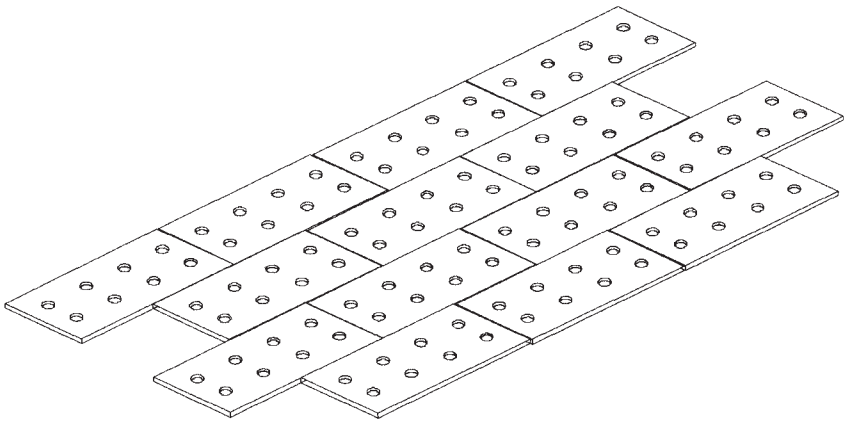
Requirements:

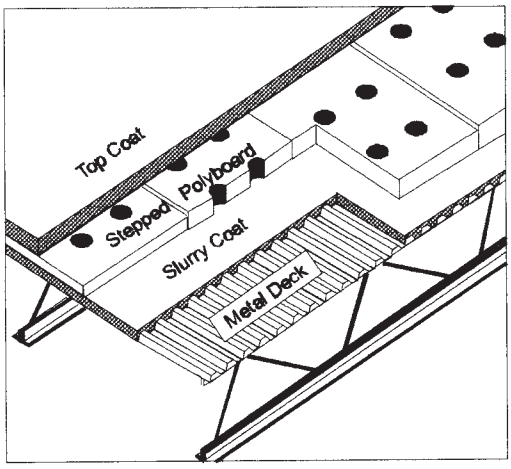
1. Minimum nominal density of 1 pcf (Meeting ASTM C 578)
2. Minimum thickness of 1 inch.
3. (8) 2 1/2" (+/- 1/2") keying holes.
4. Board Dimensions; 2 ft. width by 4 ft. length.



Placement:

1. Boards shall be placed in a staggered brick-like pattern.
2. The boards shall be placed immediately into a base layer of fresh cellular concrete. The boards shall be placed in such a manner as to cause full contact of the boards under surface with the plastic cellular concrete.
3. The board shall be allowed to adequately bond to the substrate prior to the placement of the topping pour.





In place EPS in a **Celcore Cellular Roof Deck System** over structural concrete (right) and metal form deck (left).

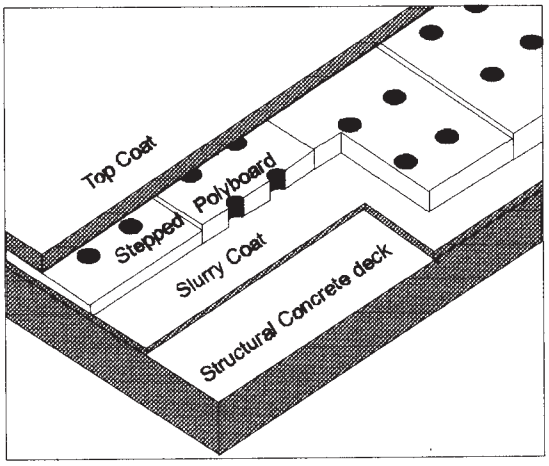
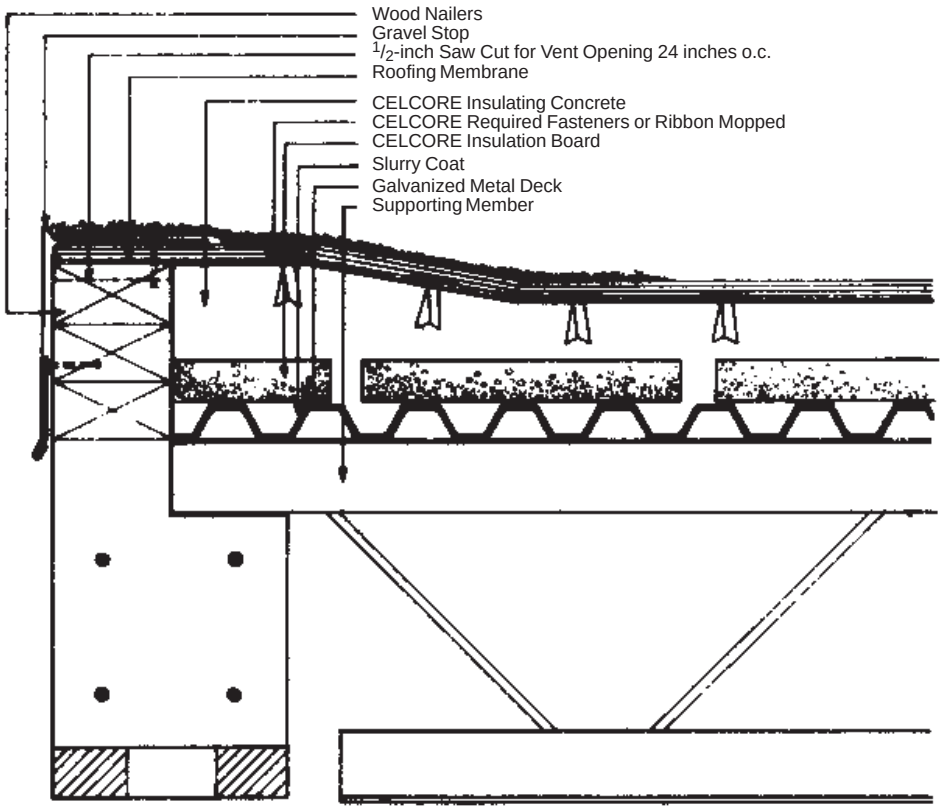


FIGURE 1—CELCORE POLYSTYRENE BOARD CONFIGURATION AND INSTALLATION



Wood Nailers:	Minimum 2-by-6 Douglas fir or southern pine.
Bolts:	Nailers fastened to concrete with $^1/_2$-inch-diameter-by-12-inch-embedment galvanized bolts spaced 48 inches on center.
Nails:	Nailer layers fastened with two rows of 60d galvanized nails spaced 12 inches on center up to 8 feet away from corners, and spaced 24 inches on center elsewhere.
Gravel Stop:	Secured with No. 8 by 1-inch-long galvanized screws spaced 16 inches on center.

For **SI:** 1 inch = 25.4 mm.

FIGURE 2—CELCORE INSULATING CONCRETE PLUS POLYBOARD OVER CORRUGATED METAL