



CELCORE ROOF DECK INSULATION

By **CELCORE INCORPORATED**

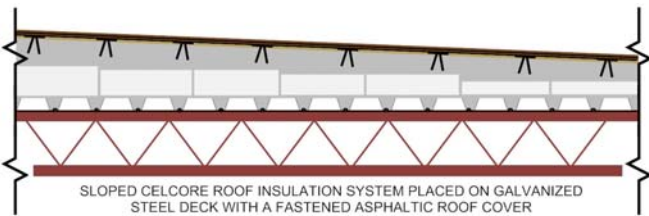


THE PRODUCTS: Celcore is a manufacturer of proprietary foaming agents used for making cellular concrete. Celcore concentrates are used to make aerosol “pre-formed foam” which is added in defined proportion to specially designed concrete mixtures, creating a “closed cell” cellular concrete of specific density. Cast density measurements are used to predict many of the resulting hardened properties of cellular concrete. Cast densities common to roof deck construction range from 36-48 lbs/ft³.

Cellular Insulating Concrete is a key component for constructing a Celcore Roof Deck Insulation System. The Cellular Insulating Concrete is used in conjunction with specially designed expanded polystyrene (EPS) insulation panels to produce a durable, monolithic, thermally efficient, fire resistant roofing substrate. Celcore Roof Deck Insulation Systems are Underwriters Laboratories (UL), FM Global (FM), Miami-Dade County and Florida Building Code (FBC) Approved.

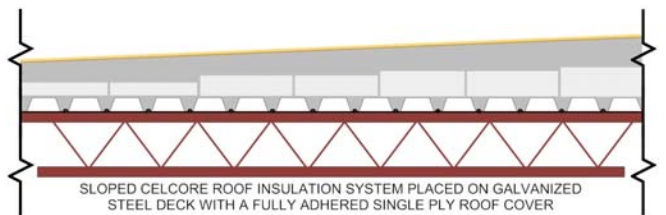
Celcore and Celcore MF foam concentrates are non-hazardous, non-corrosive compounds packaged in (5) gallon pails that are clearly identifiable by manufacturers labeling. Celcore products are only available to manufacturer Approved contractors. These speciality contractors are skilled, equipped and routinely engaged in the production and placement of insulating concrete for roof deck construction.

ROOF COVER COMPATIBILITY: Celcore Roof Deck Insulation Systems have a many decades long history of successful service as an insulating substrate for many types of roofing materials and their many means of attachment. Asphaltic Built-up and Multi-ply Modified Bitumen roof covers can be adhered directly to the insulating concrete or secured using embedded base sheet fasteners. Single Ply membranes may be partially or fully adhered to the deck using various types of roofing

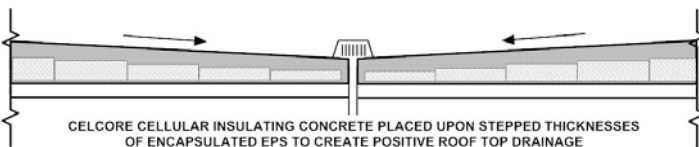


adhesive. Single Ply membranes can be smooth or fleeced back types and may be adhered using water based, solvent based or low rise urethane adhesives.

Where enhanced roof cover wind uplift resistance is required, which is sometimes the case in corner and perimeter roof zones, standard mechanical driller screw fasteners can be installed through the insulating concrete deck and engaged into the structural deck below. Celcore Roof Deck Insulation Systems have also demonstrated compatibility when used in conjunction with approved fluid applied membrane systems.



NEW APPLICATIONS: Celcore Roof Deck Insulation Systems can be placed upon various structural deck types. For new construction, galvanized corrugated steel deck, cementitious panel decks, cast-in-place or precast concrete decks are common. When the structural roof deck is designed flat, the Celcore Roof Deck Insulation System can be placed in a manner which provides positive slope for roof top drainage. Placement slopes are created by stair stepping the encapsulated EPS panels placed within



the insulating concrete deck. The thicker sections of EPS insulation used to provide slope, reduce weight and increase the systems thermal efficiency. Celcore Roof Deck Insulation Systems are considered “re-roof-able” and therefore provide a long term value to the building owner.



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DIAPHRAGM DESIGN: Shear diaphragms are essentially horizontal flat assemblies of structural and fill elements, which are able to resist shear forces developed in their own plane. Shear forces imposed upon a structure may arise from wind loads or seismic activity. During these imposed forces, the diaphragm assembly must serve as bracing to maintain the shape of the area they cover. A diaphragm depends on two major properties, strength and stiffness. These properties are used to determine what portion of the acting force imposed into the diaphragm system can be transferred to other parts of the structure.

The cellular insulating concrete of a Celcore Roof Deck Insulation System is placed upon properly secured corrugated galvanized steel deck panels, filling the deck corrugation voids. As the concrete in the corrugations cures and hardens, it bonds with the decking, strengthening and stiffening the plane of the shear diaphragm. Celcore Roof Deck Insulation Systems have been tested in the Major Units Laboratory at West Virginia University using full scale roof assemblies. The test results are given in the West Virginia University Report, The Celcore Roofing System by Larry D. Luttrell, PE, PhD. Additional information may be obtained at www.celcoreinc.com/pdfs/diaphragm.pdf.

WINDSTORM RESISTANCE: Celcore Roof Deck Insulation Systems can be placed upon various structural decks and covered with a wide range of roof covers designed to meet wind uplift forces. Numerous third party tested assemblies can be found in web design databases such as FM Global's RoofNav www.roofnav.com and Miami-Dade County's Product Control Notices of Acceptance (NOA). www.miamidade.gov/building/pc-search_app.asp. Celcore Roof Deck assemblies are Approved for use in areas designated as High Velocity Hurricane Zones (HVHZ). FM windstorm ratings range from 1-60 to 1-225 over steel deck and up to 1-735 on structural concrete. In hail prone regions, numerous FM Approved assemblies can be found meeting moderate (MH) and severe hailstorm (SH) ratings.

FIRE RESISTANT DESIGNS: FM Approved Celcore Roof Deck Insulation System assemblies meet Class 1 fire ratings when placed on steel deck and are considered Non-Combustible constructions when placed atop structural concrete. Class A, B or C external fire ratings may be met depending on the roof cover selected for the assembly. Celcore Roof Decks are also UL Classified and listed in Category CCOX, Floor and Roof Topping Mixtures. Following are applicable UL Fire Resistant Design Designations:

| UL FIRE RESISTANT DESIGN DESIGNATIONS | | | | | | | | | |
|---------------------------------------|------|------|------|------|------|--|------|------|------|
| D303 | D902 | D916 | D922 | D923 | D925 | D927 | D929 | D943 | D949 |
| D957 | D958 | D975 | G559 | P214 | P215 | P216 | P231 | P241 | P246 |
| P251 | P261 | P264 | P269 | P405 | P406 | P407 | P410 | P509 | P511 |
| P513 | P678 | P708 | P737 | P810 | P812 | P834 | P836 | P902 | P905 |
| P907 | P908 | P910 | P913 | P916 | P919 | P920 | P921 | P922 | P923 |
| P925 | P926 | P927 | P928 | P929 | P930 | P936 | P937 | P938 | P939 |
| P940 | P942 | P943 | P944 | P945 | P947 | www.celcoreinc.com/ul_linked.htm | | | |

The web address shown in the table links to a tool that can be used to obtain the complete listing associated with each Fire Resistant Design Designation from the UL Fire Resistance Design Directory.



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CELCORE CELLULAR CONCRETE THEORETICAL MIX DESIGNS:

| | | | | | |
|--|----------------|----------------|----------------|----------------|------------------|
| CAST DENSITY lbs/ft³ | 36 | 38 | 40 | 42 | 40 |
| Cement (lbs) | 660 | 684 | 724 | 765 | 770 |
| Water (gals) | 32 | 33 | 35 | 37 | 30 |
| Celcore Foam (ft³) | 19.4 | 19.1 | 18.7 | 18.2 | 19.1 |
| Celcore HS (fl/oz) | None | None | None | None | 14 - 20 |
| Compressive Strength | 180 psi | 230 psi | 280 psi | 300 psi | 350 + psi |

Note: As with all concrete mixtures, actual tests should be conducted using the intended component materials to verify all theoretical physical property predictions. The cementitious component used to contemplate the physical properties shown is Type I portland cement meeting ASTM C150. The minimum compressive strength values shown are determined at age 28 days tested in accordance with ASTM C495. Celcore Foam meets ASTM C869 when tested in accordance with ASTM C796.

CELCORE CELLULAR CONCRETE NOMINAL PHYSICAL PROPERTIES:

| Cast Density (lbs/ft³) | Dry Density (lbs/ft³) | Compressive Strength (psi) | Thermal "R" 1" Nominal | Air Dry Dead Load Per Inch of Thickness |
|--|---|-----------------------------------|-------------------------------|--|
| 36 - 40 | 26 - 32 | 180 - 280 | 1.3 - 1.2 | 2.5 - 2.8 lbs/ft² |
| 40 - 48 | 32 - 40 | 280 - 350 + | 1.2 - 0.9 | 2.8 - 3.5 lbs/ft² |

Note: As with all concrete mixtures, actual tests should be conducted using the intended component materials to verify all theoretical physical property predictions. The cementitious component used to contemplate the properties shown is Type I portland cement meeting ASTM C150. Compressive strength values are determined at age 28 days and tested in accordance with ASTM C495. The nominal thermal values shown are determined in accordance with ASTM C518 based upon a minimum dry density at a mean temperature of 75° F. In-situ dead load values are nominal and consider only the insulating concrete fill.

CORRUGATED GALVANIZED STEEL DECK: Celcore Roof Deck Insulation Systems do not require the use of vented steel deck panels. Should however, slotted or perforated steel deck be a requirement of local governing building code or a design preference, Celcore recommends the use of decking having an open area of perforation equaling 0.5% or less. All decking shall be 26 gauge or greater. Sheets shall be minimum G-60 galvanized and manufactured from steel meeting ASTM A653. Approved framing attachment methods include welding, driller screws and/or powder driven fasteners. Deck panels are typically required to be installed having a minimum (3) span framing condition. The decking shall be attached to properly spaced framing in accordance with the requirements of the manufacturer, governing building code and the specifications of the Architect and/or the project Engineer. Deck section properties shall be obtained by consulting the deck manufacturers technical information. Installed decking shall be inspected prior to receiving a Celcore Roof Deck System for proper installation and adequate framing attachment. The decking shall be clean, dry and free of any substance that would interfere with the bond of the insulating concrete to the galvanized deck surface. Where applicable, bundles of decking shall illustrate appropriate Approval marks on the product labeling.



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EXPANDED POLYSTYRENE (EPS) HOLEY BOARD: Encapsulated EPS is a key component of a Celcore Roof Deck Insulation System. Celcore EPS holey board insulation is manufactured by molders Approved by Celcore for use in these assemblies. The EPS used to fabricate the holey boards shall be manufactured to meet ASTM C578. The boards are typically fabricated as 2 ft. by 4 ft. panels of varying thickness, having (6) or (8) keying holes of nominal diameter, equaling approximately 3% of each panels surface area. A list of Celcore Approved EPS holey board fabricators, can be viewed by visiting: www.celcoreinc.com/approved_eps.htm Celcore's EPS holey board specification may be downloaded at: www.celcoreinc.com/pdfs/celcore_eps_holeyboard.pdf The encapsulated EPS insulation used within these roof deck systems provides “**long term and stable thermal resistance values that do not drift with age**”. The following Table provides nominal insulating values for EPS at various thicknesses and densities. When determining total system “R” value for a Celcore Roof Deck System, the values shown in the table below shall be considered in conjunction with the insulating values applicable to the designed thickness(es) of the insulating concrete fill.

| ASTM C578 EPS | | Type I | | Type VIII | | Type II | | Type IX | | Lbs/Ft ³ |
|--------------------|-------|--------|-------|-----------|-------|---------|-------|---------|-------|---------------------|
| NOMINAL DENSITY | | 1.00 | | 1.25 | | 1.50 | | 2.00 | | |
| Thermal Resistance | | R | u | R | u | R | u | R | u | Thickness |
| @ Mean Temp. °F | 40° F | 4.17 | 0.240 | 4.25 | 0.235 | 4.55 | 0.220 | 4.76 | 0.210 | 1 inch |
| | 75° F | 3.85 | 0.260 | 3.92 | 0.255 | 4.17 | 0.240 | 4.35 | 0.230 | |
| | 40° F | 8.34 | 0.120 | 8.50 | 0.118 | 9.10 | 0.110 | 9.52 | 0.105 | 2 inches |
| | 75° F | 7.70 | 0.130 | 7.84 | 0.128 | 8.34 | 0.120 | 8.70 | 0.115 | |
| | 40° F | 12.51 | 0.080 | 12.75 | 0.078 | 13.65 | 0.073 | 14.28 | 0.070 | 3 inches |
| | 75° F | 11.55 | 0.087 | 11.76 | 0.085 | 12.51 | 0.080 | 13.05 | 0.077 | |
| | 40° F | 16.68 | 0.060 | 17.00 | 0.059 | 18.20 | 0.055 | 19.04 | 0.053 | 4 inches |
| | 75° F | 15.40 | 0.065 | 15.68 | 0.064 | 16.68 | 0.060 | 17.40 | 0.057 | |
| | 40° F | 20.85 | 0.048 | 21.25 | 0.047 | 22.75 | 0.044 | 23.80 | 0.042 | 5 inches |
| | 75° F | 19.25 | 0.052 | 19.60 | 0.051 | 20.85 | 0.048 | 21.75 | 0.046 | |
| | 40° F | 25.02 | 0.040 | 25.50 | 0.039 | 27.30 | 0.037 | 28.56 | 0.035 | 6 inches |
| | 75° F | 23.10 | 0.043 | 23.52 | 0.043 | 25.02 | 0.040 | 26.10 | 0.038 | |
| | 40° F | 29.19 | 0.034 | 29.75 | 0.034 | 31.85 | 0.031 | 33.32 | 0.030 | 7 inches |
| | 75° F | 26.95 | 0.037 | 27.44 | 0.036 | 29.19 | 0.034 | 30.45 | 0.033 | |
| | 40° F | 33.36 | 0.030 | 34.00 | 0.029 | 36.40 | 0.027 | 38.08 | 0.026 | 8 inches |
| | 75° F | 30.80 | 0.032 | 31.36 | 0.032 | 33.36 | 0.030 | 34.80 | 0.029 | |

Note: R values are from manufacturers data and are determined in accordance with ASTM C177 or ASTM C518.



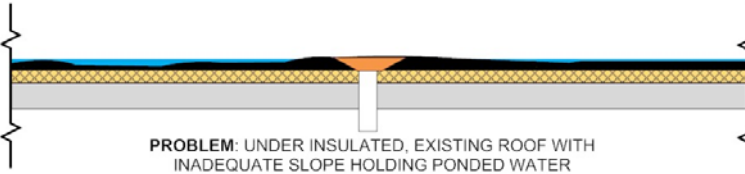
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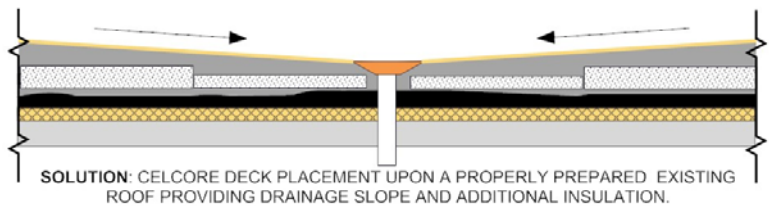


RE-ROOFING APPLICATIONS: Celcore Roof Deck Insulation Systems can also be used in re-roofing situations and may be considered to encapsulate a properly prepared existing roof cover. When a tear

off of the existing roof is required, placement may be made upon an asphaltic dry-in moisture barrier applied to the structural deck. The roof deck may be placed in a manner that will eliminate all roof top ponding water issues and can be designed to bring an under-insulated structure into energy code compliance. When



designing roof top drainage, stepped EPS insulation is used within the deck as a means for achieving the desired slope elevations. The encapsulated EPS also allows the placement to impose generally uniform, high-point and low-point, dead loads upon the existing structure. Celcore Roof Deck Insulation Systems are cast-in-place, therefore designers may utilize the advantage of “placement flexibility” when designing to accommodate a structures existing rooftop conditions. Placement flexibility may further be



used to overcome areas in an existing structure having negative drainage or structural deflection, conditions that could otherwise be telegraphed through an installation of tapered rigid insulation.

WARRANTY: Celcore Roof Deck Insulation Systems installed by manufacturer Approved contractors are eligible for warranty by the manufacturer. Celcore’s Cellular Lightweight Concrete (CLC) Limited Warranty may be obtained when a Warranty Request is submitted to Celcore by the Approved installation contractor. Where applicable, Celcore Roof Deck Insulation may be included as part of a Single Source Warranty product from the roof membrane manufacturer as part of its warranty to the owner. CLC warranties are commonly issued with terms coextensive to the term of the roof cover, to a maximum term of 20 years. Warranty requests are subject to review by Celcore and standard fees for issuance shall apply.

CELCORE INCORPORATED: For more than 40 years, Celcore Incorporated has been in the business of producing foam concentrate used in the production of cellular concrete. Nationally, Celcore Incorporated is a primary supplier of foaming agents to the cellular concrete industry. Its manufacturing facility is located in Black Mountain, North Carolina. The facility has a current capability of producing 100 thousand gallons of foam concentrate annually. Manufacturer Approved contractors have used Celcore foam to produce upwards of 150 thousand cubic yards of Celcore Cellular Concrete for roof deck construction each year. Celcore also produces performance admixtures that are specifically designed to be used in conjunction with cellular concrete mixtures using Celcore foam. Standardization of the use of its foam products and customer service has been a key part of the companies decades long success.

CELCORE INCORPORATED

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CELCORE ROOF DECK INSULATION

MANUFACTURERS INSTALLATION INSTRUCTIONS

SCOPE: The placement contractor shall be Approved by Celcore Incorporated. The Approved contractor shall furnish all equipment, materials, labor and supervision required for the complete installation of the roof deck system. This work may include the installation of corrugated steel deck when used.

GENERAL CONDITIONS: The surface to receive the insulating concrete placement shall be dry, clean and free of any substance that could interfere with the bonding of the insulating concrete to the parent deck. The Approved contractor shall inspect the deck prior to placement and report any deficiencies. Expansion joints, curbs, wood blocking, perimeter blocking or any other framing required to boundary the insulating concrete placement shall be work provided by other trades.

MATERIALS:

1) Foam Concentrate shall be that manufacturer by Celcore Incorporated. The foam concentrate shall be used at the jobsite from original manufacturers containers and shall be clearly identifiable by product labeling. Each container shall bear the manufacturer's name and required approval marks such as FM and UL.

2) Cement may be from suppliers of bulk Type I, I/II, II or III portland meeting ASTM C150. Delivery slips shall indicate the cement supplier and ASTM compliance.

3) Water shall be clean, fresh and free of injurious quantities of impurities. Supply source shall be adequate to allow uninterrupted operation of the insulating concrete batch plant.

4) Admixtures if used, shall only be those supplied or approved by Celcore Incorporated. Admixture(s) shall not contain chlorides.

5) Steel Deck when used shall be corrugated galvanized steel intended by its manufacturer for use in conjunction with cementitious materials. Decking shall be of a gauge thickness, profile, and shall be attached according to the designers structural requirements. Celcore does not require the use of perforated steel deck, however should venting be a requirement of governing building code or a design preference, the use of decking having 0.5% open area or less is recommended. The attachment of the steel deck to the framing shall be inspected and approved prior to placing the insulating concrete.

6) Holey Board Insulation shall be a product of EPS having a minimum nominal density of 1 lb.ft³. The EPS boards shall be fabricated in 2 ft by 4 ft panels with 6 or 8 keying holes comprising approx. 3% of the panels surface area. The EPS product shall meet the requirements of ASTM C578. When using stepped thickness(es), the maximum allowable step shall be 1 inch.

7) Reinforcing Mesh, when required, shall be equal to keydeck wire fabric Type 21602-1619.

8) Fibers if used, shall be monofilament type and should not exceed a dosage of 1.5 lbs/yd³.

MIXING:

1) Mix Proportions shall be combined in accordance with manufacturers requirements to yield proper hardened physical properties, i.e. compressive strength, density and thermal conductivity.

2) Insulating concrete shall be mixed and pumped into place using properly configured equipment. It shall be the responsibility of the Approved applicator to maintain the foam generating, batching and pumping equipment in good condition and in a configuration acceptable to the foam manufacturer.

3) Water and cement shall first be added to the mixer in proper proportions, followed by the preformed foam. Mix water shall be the minimum required to make a good pump-able, work-able mixture. The rheology of the cellular concrete shall be such to provide a material that can be screeded to the required thickness and finished smooth.

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MANUFACTURERS INSTALLATION INSTRUCTIONS

EPS INSULATION HOLEY BOARD PLACEMENT:

- 1) A **base layer** of cellular concrete is placed upon the structural deck in a thickness sufficient to receive the EPS holey boards plus minimum 1/8" above deck thickness, without voids. The holey boards shall be placed in a **manner that causes the boards underside to make full contact** with the fresh cellular concrete. Properly placed EPS will show some insulating concrete entered into the boards holes from below. The holey boards shall be placed in a brick-like pattern of staggered joints.
- 2) The installed **EPS** layer shall be allowed to set overnight, **undisturbed**, prior to the placement of the deck topping.

TOPPING PLACEMENT:

- 1) The installed **EPS** layer shall be firmly set and hardened. Any loose boards shall be removed and re-placed into a fresh layer of cellular concrete. The installed holey board layer shall be dry, free from water, dew or frost prior to topping.
- 2) **Cellular concrete topping** shall be pumped into place in a mostly continuous manner. Screed placement is recommended to assure a minimum finished topping thickness of not less than 2 inches. Finishing shall occur promptly following deposit.
- 3) **Protect the roof deck** from unnecessary work traffic for 24 hours following topping placement. Schedule in a timely manner, subsequent roof cover installation. An installed roof deck shall not be used as a work platform for other trades.
- 4) **During temperatures 40° and above**, normal placement shall apply. When temperature are at 40° and expected to fall within 12 hours following placement, application should be postponed to avoid possible freezing.

CURING AND ROOF COVER:

- 1) **Celcore Curing** shall be applied to the roof deck as early as is practical once the deck topping has developed strength sufficient to support foot traffic. Curing is most effective when applied within 24 hours following topping placement. Wetting the deck prior to application of curing is recommended. Timely curing is an effective means to minimize drying shrinkage. An installed roof deck shall be considered adequately cured to receive roof cover within 3 - 5 days following topping placement.

QUALITY ASSURANCE:

- 1) **Foam density** shall be tested at the beginning of each days placement.
- 2) **End-of-hose** wet density sampling of the cellular concrete shall be conducted at the point of placement at regular intervals. Sampling shall be conducted in accordance with the applicable sections of ASTM C495. Celcore recommends that density determinations are field logged and maintained as a written project record.

TESTING:

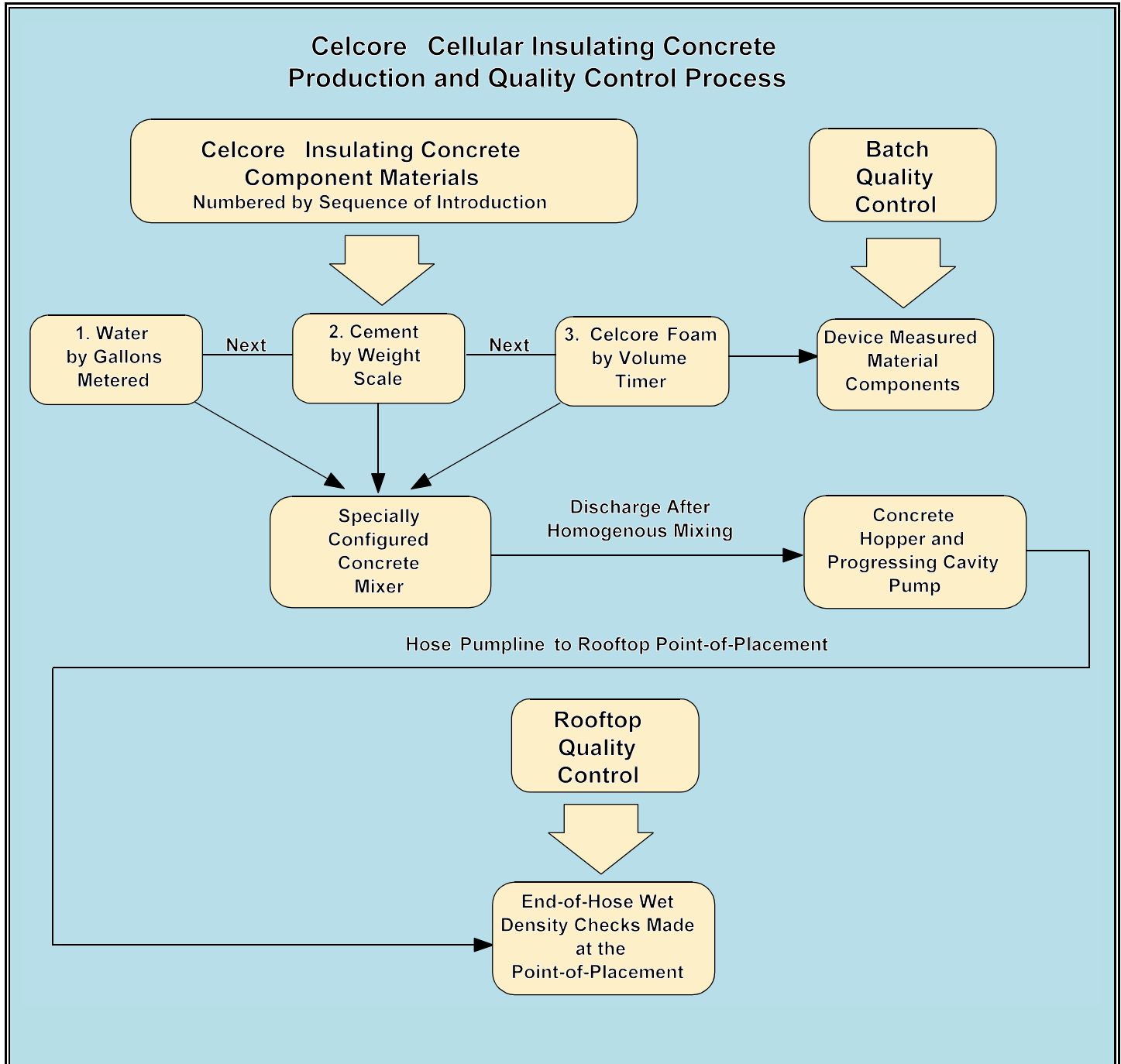
- 1) **Cellular concrete** specimens shall be made and tested in accordance with ASTM C495. A set of specimens for compressive strength testing shall consist of a minimum (4) 3x6 cylinders from a single sampling. Dry density determinations, if required, shall be from companion cylinders cast in addition to those required for compressive strength.
- 2) **Molding specimens.** The concrete shall be placed into the molds in approximately two equal layers. The cylinders shall be raised and dropped one inch, three times after placing each layer. **DO NOT RE- MIX OR ROD SAMPLES.** Specimens shall be protected from being disturbed during initial set. The use of a placement site cure box is recommended.
- 3) **Retesting**, if required, shall be conducted in accordance with ASTM C513.

END OF SECTION

CELCORE ROOF DECK INSULATION

MANUFACTURERS INSTALLATION INSTRUCTIONS

MANUFACTURERS GUIDANCE FOR BATCH AND POINT-OF-PLACEMENT QUALITY CONTROL



Note: End-of-hose density checks should be conducted at a minimum of (1) every (30) minutes during placement. Quality control density logs may be downloaded at www.celcoreinc.com/pdfs/density_log_formatted.pdf.

Celcore Incorporated seeks to present reliable information concerning the production, composition, properties and use of its products. The information offered in this set of documents is provided for a users design consideration, investigation and verification. Questions should be directed to Celcore Incorporated. This information is provided at no charge and offers NO WARRANTY, EXPRESSED OR IMPLIED.