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Evaluation #

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Safety & Buildings Division
201 West Washington Avenue
P.O. Box 2658
Madison, WI 53701-2658

Wisconsin Building Products Evaluation

Material

Celbox[®] Insulating Concrete Forms (ICFs)

Manufacturer

Cellox, LLC
1200 Industrial St.
Reedsburg, WI 53959

SCOPE OF EVALUATION

GENERAL: This report evaluates the use of the Celbox[®] insulated concrete form wall system, manufactured by Cellox, LLC, evaluated as permanent structural concrete form work and insulation system for plain and reinforced exterior and interior walls, and foundation walls. The Celbox[®] insulated concrete form wall system was also evaluated as permanent structural concrete form work and insulation system for load-bearing and nonload-bearing, below-grade and above-grade walls. The Celbox[®] insulated concrete form wall system was evaluated for safety requirements of the foam plastic and structural requirements for the codes listed below.

The **Comm** requirements below in accordance with the current **Wisconsin Uniform Dwelling Code for 1- and 2-family dwellings:**

- **Foam Plastic:** The Celbox[®] insulated concrete form wall system was evaluated in accordance with the fire safety requirements of **s. Comm 21.11**.
- **Structural:** The Celbox[®] insulated concrete form wall system was evaluated in accordance with the structural requirements of **ss. Comm 21.02, and 21.02(3)(c)**.

The **IBC** requirements below in accordance with the current **Wisconsin Amended ICC Code:**

- **Foam Plastic:** The Celbox[®] insulated concrete form wall system was evaluated in accordance with the fire safety requirements **ss. IBC 2603.1, 2603.2, and 2603.3**.
- **Structural:** The Celbox[®] insulated concrete form wall system was evaluated in accordance with the requirements of **IBC Chapter 16**.
- **Fire Endurance:** The Celbox[®] insulated concrete form wall system was evaluated in accordance with the requirements of **ss. IBC 2603.4, 2603.5.1, and 2603.5.2**.

Note: Structural calculations shall be submitted (job-to-job basis) in accordance with IBC Chapter 16 for Live, Ground Snow, Roof, Wind, and Seismic Loads.

DESCRIPTION AND USE

Celbox[®] insulated concrete form wall system consist of two expanded polystyrene (EPS) foam plastic face panels connected with plastic cross-ties. The cross-ties are attached to plastic flanges molded into the EPS panels. The flanges are used to attach interior and exterior wall finishes.

Celbox[®] insulated concrete forms are stay-in-place forming for cast-in-place concrete walls. The ICF forming system has no final structural value for the wall. It is the concrete wall that is cast between the inner faces of the panels of extruded or expanded polystyrene foam that is the structural component.

The forms are available in a standard length of 48 inches, a height of 16 inches and a panel face thickness of 2.5 inches, with standard cavity widths of 4, 6, 8, 10 and 12 inches.

Vertical and horizontal reinforcing steel shall be placed inside the forms and is supported by cross-ties. The top and bottom edges of the forms have a 1/2-inch-thick tooth and keyhole design for interlocking of the forms. The forms shall be filled with concrete to produce a solid, monolithic, flat concrete wall.

Materials consist of:

- **Polystyrene: Nominal density of 2.00 pcf, and a thickness of 2.5 inches.**
- **Plastic Cross-Ties:** The cross-ties consist of flanges that are 1-1/2 inches wide, molded into each panel at 8 inches on center and connected with plastic hinges. The location of the flanges is located on the exterior surface of the ICF by a 1/4-inch-wide vertical line molded into the ICF.
- **Concrete:** Standard applications use minimum 3000 psi at 28 days. Concrete of higher strength may also be used. The concrete can be poured from a truck, by hand, bucket or concrete pump. The concrete shall comply with **s. Comm 21.02(3)(b)** and **s. IBC 1903.1**.
- **Reinforcement:** All steel reinforcement shall be in accordance with **s. IBC 1903.5**.
- **Other Components:** Wood members in contact with concrete for plates or windows and door framing shall be preservative-treated with an approved wood preservative or be of a naturally durable species, shall be attached with galvanized steel anchor bolts complying with the applicable code.

TESTS AND RESULTS

- Surface Burning Characteristics of Celbox[®] insulated concrete form wall system, EPS, in accordance with **ASTM E84**, "Standard Test Method for Surface Burning Characteristics of Building Materials".

ASTM E84 Test Results:

Foam Plastic Mfg.	Density (Maximum Thickness 5 inches)	
Huntsman Type Grade 40		2.0 pcf
	Flame Spread	25
	Smoke Development	450
Huntsman Type Grade 54		1.75 pcf
	Flame Spread	25
	Smoke Development	450

- Thermal Resistance testing in accordance with **ASTM C 518** was conducted by the ETL SEMKO, Report No. 3057555-006, June 2, 2004.

Mean Temperature (°F)	ΔX (inch)	Thermal Conductivity, k (Btu • in • h ⁻¹ • ft ⁻² • °F ⁻¹)	Thermal Resistance, R (h • ft ² • °F • Btu ⁻¹)	Thermal Resistance, R per inch (h • ft ² • °F • Btu ⁻¹)
73.89	*6.688	0.352	3.11	3.13

*The overall thickness of the test sample measured 6.688-inches (foam section, air space w/plastic connectors, foam section).

- **ASTM E119** Fire Test of Building Construction and Materials, a **4-hour full-scale vertical fire test** conducted on a load-bearing 8 inch Celbox[®] insulated concrete form wall assembly with a load of 3,500 lbs per linear foot. Intertek Test Report #3057555-B Rev. See test construction below.

Fire-Resistance-Rated Wall Assembly: The 8-inch-thick concrete walls constructed with Celbox[®] ICFs have a four-hour fire-resistance rating and are rated for exposure to fire from both sides. The normal-weight concrete must have a minimum 28-day compressive strength of 3,000 psi. The walls are reinforced with No. 4 steel reinforcements at 16 inches on center vertically and horizontally. The interior finish wall finish is 5/8-inch-thick gypsum wall board installed either vertically or horizontally, and shall be attached to the flanges with minimum 0.136-inch-diameter-by-1 5/8-inch-long, Type W, coarse-threaded gypsum wallboard screws spaced 12 inches on center vertically and a maximum of 16 inches on center horizontally in the field. Gypsum wallboard joints and screws heads shall be taped and filled with joint compound.

The exterior wall covering is 1/4-inch-thick Hardi Backerboard attached with 1 1/4-inch-long, corrosion resistant (galvanized or stainless steel) roofing nails or minimum 1-inch-long, No. 8 by 0.323-inch HD self-drilling, corrosion-resistant, ribbed buglehead screws. Fasteners must be a maximum of 8 inches on center around the perimeter and in the field. Fasteners must be located a minimum of 3/8-inch and a maximum of 3/4-inch from the backerboard edges. The allowable design axial load capacity of the bearing wall is 3,500 lbf/ft per 10-foot wall height.

In lieu of 1/4-inch-thick Hardi Backerboard, the Celbox[®] ICFs may be covered with any exterior cladding material having a minimum 1/4-inch-thickness. Vinyl siding must be applied over minimum 1/4-inch-thick plywood or OSB.

- Radco conducted a spontaneous ignition test on the cross-ties in accordance with **ASTM D 1929**, “Standard Test Method for Determining Ignition Temperature of Plastics”: Flash Ignition Temperature 698°F and Self Ignition Temperature 752°F.

LIMITATIONS OF APPROVAL

The **Comm** limitations below are in accordance with the current **Wisconsin Uniform Dwelling Code, for 1 & 2 family dwellings:**

- **Foam Plastic:** The Celbox[®] insulated concrete form wall system is approved for use with a thermal barrier to separate the blocks from interior spaces in accordance with **s. Comm 21.11(1)**. Where a 1-inch thickness of masonry does not separate the polystyrene blocks from the building interior, including at the top of the wall, a thermal barrier, that has a finish rating of at least 15 minutes, shall be provided.
 1. Celbox[®] form blocks are approved for use in combustible non-rated construction in accordance with **s. Comm 21.11**. In one- or two-family dwellings, thermal barriers shall be provided to separate the forms from the occupied space of the dwellings per **s. Comm 21.11**.
 2. The exterior face of the blocks shall be finished with an approved weather covering and must be protected from ultraviolet light.
- **Structural:** The Celbox[®] form blocks are approved as structural building elements.
 1. The units are approved for use as concrete forms for basement walls and exterior walls when the resulting concrete core thickness satisfies **Table 21.18-A** for one- or two-family dwellings, or when structural calculations for the product are submitted for review.
 2. Walls shall be anchored to all floors and roofs. Walls shall be interconnected at corners by embedding and lapping the reinforcement.

3. Structures are **limited** to two stories in height.
4. The forms are approved for use as concrete forms for basement walls, exterior walls and retaining walls when structural calculations are submitted to the department by a Wisconsin registered professional engineer or architect.
5. Below grade walls shall be damp-proofed when required by the local building department.
6. Damp-proofing and water-proofing materials shall be approved by Cellox and the local building official, and shall be free of solvents that will adversely affect the EPS foam.

NOTE: The Celbox[®] ICF wall system was **not** evaluated for compliance with the thermal requirements of **Subchapter VI, ss. Comm 22.20, 22.21, 22.23, 22.25, 22.27, 22.28, and 22.31** of the current **Wisconsin Uniform Dwelling Code, for 1 & 2 family dwellings**.

Alternate Design: In lieu of calculations, the structural design of reinforced concrete formed by Celbox[®] Insulated Concrete Form wall system for residential construction is permitted to comply with the *Prescriptive Method for Insulating Concrete Forms in Residential Construction* (publication No. EB118), dated May1998, published by the Portland Cement Association (PCA). Buildings constructed with the Celbox[®] Insulated Concrete Form wall system and designed in accordance with the alternate design, will not exceed a height of two stories plus a basement, where the maximum unsupported wall height is 10 feet.

The **IBC** limitations below are in accordance with the current **Wisconsin Amended ICC Code:**

- **Foam Plastic:** The Celbox[®] ICF wall system is approved for use with a thermal barrier to separate the blocks from interior spaces in accordance with **s. IBC 2603.4**.
 1. In accordance with **s. IBC 2603.4.1.6**, when Celbox[®] ICF is used within the attic or crawl space where entry is made only for service utilities, the foam plastic insulation shall be protected against ignition by 1-1/2" thick mineral fiber insulation, a 1/4" thick wood structural panel, particleboard or hardboard, gypsum wallboard, corrosion-resistant steel or other approved material installed so that the foam plastic is not exposed.
 2. The protective covering shall be consistent with the requirements for the type of construction.
 3. The exterior face of the blocks shall be finished with an approved weather covering and must be protected from ultraviolet light.
 4. The crawl space shall not be used for storage or air handling purposes, there are no interconnected basement areas and entry to the crawl space is only for service of utilities.
- **Structural:** Design of concrete formed by Celbox[®] ICF forms must comply with **IBC Chapter 19** with the following requirements:
 1. The forms are approved for use as concrete forms for basement walls, exterior walls and retaining walls when structural calculations are submitted to the department by a Wisconsin registered professional engineer or architect.
 2. Design calculations of walls must comply with **s. IBC 1901.2**. Use of the empirical design approach specified in **s. 2109.1 [Comm 62.2109(1)]** is prohibited.
 3. Design of lintels shall comply with the applicable provisions of **IBC Chapter 16**.
 4. Wall loading shall be in accordance with **IBC Chapter 16**.
 5. Minimum wall reinforcement shall conform to **s. IBC 1901.2**. When the code requires that vertical and horizontal reinforcement be spaced no further apart than 18 inches or three times the wall thickness, whichever is less, the maximum concrete wall thickness along the length of the wall is permitted to be used to determine rebar spacing.
 6. Walls shall be anchored to floors and roofs in accordance with **s. IBC 1604.8.2**. Walls shall be interconnected at corners by embedding and lapping reinforcement in accordance with the code.
 7. Design of shear walls shall be in accordance with **ss. IBC 1901.2 and 1910**.
 8. Structures are **limited** to two stories in height plus a basement.
 9. Below grade walls shall be damp-proofed when required by the local building department, water-proofed in accordance with **s. IBC 1806**.
 10. Damp-proofing and water-proofing materials shall be approved by Cellox and the local building official, and shall be free of solvents that will adversely affect the EPS foam.

11. Special inspection is required as noted in **s. IBC 1704**, for placement of reinforcing steel and concrete, and for concrete cylinder testing, except that special inspection is not required for foundation stem walls conforming to **Table 1805.4.2** of the **IBC**. Additionally, when the building official approves, special inspection is not required when all of the following conditions are met:
 - a) Wall systems are a maximum of 8 feet high and are limited to use in single-story construction of Group R-3, or Group U Occupancies.
 - b) Maximum height of a concrete pour is 48 inches. Succeeding lifts must be placed in accordance with **s. IBC 1905.10**.
 - c) Installation is by properly trained installers approved by Cellox.
 - d) All steel reinforcement shall be in accordance with **s. IBC 1903.5**.
 - e) The installation instructions indicate methods used to verify proper placement of concrete.
12. Walls constructed with Celbox[®] insulated concrete form blocks are considered **Type VB Construction**. When constructed in accordance with the fire-resistance-rated wall assembly detailed in the **TEST AND RESULTS** section of this approval the Celbox[®] forms are recognized for use in buildings of **Type VA Construction**.

NOTE: The Celbox[®] Insulated Concrete Form wall system was **not** evaluated for compliance with the thermal requirements of **s. Comm 63.1018**.

Identification: Each package bears a label specifying the name and address of the manufacturer Celbox[®] ICF. Additionally, product labels indicate the Wisconsin Building Product Evaluation Number (200710-I), and the name and logo of the quality control agency.

This approval will be valid through December 31, 2012, unless manufacturing modifications are made to the product or a re-examination is deemed necessary by the department. The product approval is applicable to projects approved under the current edition of the applicable codes. This approval may be void for project approvals made under future applicable editions. The Wisconsin Building Product Evaluation number must be provided when plans that include this product are submitted for review.

DISCLAIMER

The department is in no way endorsing or advertising this product. This approval addresses only the specified applications for the product and does not waive any code requirement not specified in this document.

Revision Date:

Approval Date: August 20, 2007 By: _____

Lee E. Finley, Jr.
Product & Material Review
Integrated Services Bureau