Division of Industry Services
1400 East Washington Ave.
Madison, WI 53703

Approval # **201403-I**

Replaces 200718-I

Wisconsin Building Product Evaluation

Material: Fox Blocks Insulated Concrete Forms

Manufacturer:
Airlite Plastics
6110 Abbott Drive
Omaha, NE 68110

SCOPE OF EVALUATION

GENERAL: This report evaluates the use of the Fox Blocks insulated concrete form wall system, manufactured by Airlite Plastics, as permanent structural concrete form work and insulation system for plain and reinforced exterior and interior walls, and foundation walls. The Fox Blocks 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 Fox Blocks insulated concrete form wall system was evaluated for safety requirements of the foam plastic and structural requirements for the codes listed below.

In accordance with the current **Wisconsin Uniform Dwelling Code for 1- and 2-family dwellings:**

- **Foam Plastic:** The Fox Blocks insulated concrete form wall system was evaluated in accordance with the fire safety requirements of **s. SPS 321.11**.
- **Structural:** The Fox Blocks insulated concrete form wall system was evaluated in accordance with the structural requirements of **ss. SPS 321.02,** and **321.02 (3) (c)**.

In accordance with the current **Wisconsin Commercial Building Code:**

- **Foam Plastic:** The Fox Blocks insulated concrete form wall system was evaluated in accordance with the fire safety requirements **s. IBC 2603**.
- **Structural:** The Fox Blocks insulated concrete form wall system was evaluated in accordance with the requirements of **chapter IBC 16**.
- **Fire Endurance:** The Fox Blocks 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

Fox Blocks insulated concrete forms are stay-in-place forming for cast-in-place concrete walls. Fox Blocks insulated concrete form wall system consists of two expanded polystyrene (EPS) foam plastic face panels connected with polypropylene plastic cross-ties, partially embedded into the EPS panels. The flanges are used to attach interior and exterior wall finishes.

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.

Materials consist of:

- **Fox Blocks Wall System Form Units:** The forms are available in five standard sizes: nominal 4-, 6-, 8-, 10-, and 12-inch inch core-width units. The **4**-inch core-width standard size unit is 9 1/4 inches wide, 16 inches high and 48 inches long, with nominal 2 5/8-inch-thick EPS shells interconnected with six plastic web members spaced 8 inches on center. The **6**-inch core-width standard size unit is 11 1/4 inches wide, 16 inches high and 48 inches long, with nominal 2 5/8-inch-thick EPS shells interconnected with six plastic web members spaced 8 inches on center. The **8**-inch core width standard size unit is 13 1/4 inches wide, 16 inches high and 48 inches long, with nominal 2 5/8-inch-thick EPS shells interconnected with six plastic web members spaced 8 inches on center. The **10**-inch core width standard size unit is 15 1/4 inches wide, 16 inches high and 48 inches long, with nominal 2 5/8-inch-thick EPS shells interconnected with six plastic web members spaced 8 inches on center. The **12**-inch core width standard size unit is 17 1/4 inches wide, 16 inches high and 48 inches long, with nominal 2 5/8-inch-thick EPS shells interconnected with six plastic web members spaced 8 inches on center. In addition to the standard block units, there are also corner units, angle units, tapered top units, corbel ledge units T-Block Short Leg and Long Leg units and end caps.
- **Polystyrene:** EPS material, Type II, rigid, nominal density of 1.50 pcf, and a thickness of 2-5/8 inches.
- **Plastic Cross-Ties:** The cross-ties consist of flanges that are 1-1/2 inches wide 16 inches high by 0.230-inch thick, molded into each panel at 8 inches on center.
- **Concrete:** Standard applications use minimum 3000 psi at 28 days. Concrete of higher strength may also be used. Maximum aggregate size is ¾-inch. The concrete can be

poured from a truck, by hand, bucket or concrete pump. The concrete shall comply with **s. SPS 321.02 (3) (d)** or **s. IBC 1903.1,** as applicable.

- **Reinforcement:** All steel reinforcement shall be in accordance with **s. IBC 1907**.
- **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.

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 ½-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.

TESTS AND RESULTS

- Surface Burning Characteristics of Fox Blocks insulated concrete form wall system, EPS, in accordance with **ASTM E84**, "Standard Test Method for Surface Burning Characteristics of Building Materials".
- **ASTM E119** Fire Test of Building Construction and Materials, a 2-hour full-scale vertical fire test conducted on a load-bearing 4-inch concrete core, 3-hour full scale vertical fire test conducted on a load-bearing 6-inch concrete core and a 4-hour full scale vertical fire test conducted on a load-bearing 8-inch concrete core. Fox Blocks tested their insulated concrete form wall assemblies with a load of 3,000 lbs per linear foot. See test construction below. The 10- and 12-inch concrete forms were not directly tested but would also achieve a 4-hour rating, using the “thickness design strategy” under section 3.3 of Resource A under the IEBC.

  Fire-Resistance-Rated Wall Assembly: The concrete core walls constructed with Fox Blocks ICF's 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 minimum size reinforcement shall be No. 5 steel reinforcements spaced as required by ACI 318, at a minimum; 16 inches on center vertically and horizontally, and shall be staggered on either side of the vertical bars, from row to row. The maximum axial compressive load shall be 7 % of the load determined in accordance with **Chapter 19** of the IBC.

  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 ¼-inch-thick Hardi Backerboard attached with 1 ¼-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 bugle head

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 ¾-inch from the backer board edges. The allowable design axial load capacity of the bearing wall is 3,000 lbf/ft per 10-foot wall height.

In lieu of ¼-inch-thick Hardi Backerboard, the Fox Blocks ICF's may be covered with any exterior cladding material having a minimum ¼-inch-thickness. Vinyl siding must be applied over minimum ¼-inch-thick plywood or OSB.

Table 1 – MAXIMUM ALLOWABLE CAPACITIES OF FASTENERS IN CROSS-TIE FLANGES

FASTENERS	ALLOWABLE LOAD CAPACITY (lbf)	
	Lateral	Withdrawal
#10 wood screw by 1-1/2 inches	92	27
Course thread drywall screw by 1-5/8 inches	36	25
Fine thread drywall screw by 1-5/8 inches	33	24
Ring shank nail by 1-1/4 inches	23	14
#8 exterior deck screw by 2 inches	70	27

Additional testing in accordance with **ASTM C578**, EPS Thermal Insulation Testing Criteria: Density, **ASTM C303**; Compressive Resistance, **ASTM C165, Proc. A**; Flexural Strength, **ASTM C203**; Water Vapor Permeability, **ASTM E96**; Water Absorption, **ASTM C272**; Dimensional Stability, **ASTM D2126**; Fire Burning Characteristics of Plastic Ties, **ASTM D1929**, Flash Ignition Temp 350º (C), 662 º (F); **ASTM D1929,** Spontaneous Ignition Temp 400º (C), 752 º (F); **ASTM D635**, Burn Rating Average Time 17.7 mm / min.; **ASTM D2843**, Smoke Density Rating 7.3; and Room Fire Test, UL 1715 / UBC 26 – 3, Passed with 1/2" gypsum board.

WISCONSIN COMMERCIAL BUILDING CODE COMPLIANCE

The **IBC** limitations below are in accordance with the current **Wisconsin Commercial Building Code:**

- **Foam Plastic:** The Fox Blocks 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 Fox Blocks 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 ¼" 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 Fox Blocks 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. SPS 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 1907**. 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 Fox Blocks and the local building official, and shall be free of solvents that will adversely affect the EPS foam.
11. 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 Fox Blocks.
    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 Fox Blocks 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 Fox Blocks forms are recognized for use in buildings of **Type VA Construction**.

NOTE: The Fox Blocks Insulated Concrete Form wall system was **not** evaluated for compliance with the thermal requirements of **s. SPS 363.1018**.

Identification: Each package bears a label specifying the name and address of the manufacturer Fox Blocks ICF. Additionally, product labels indicate the Wisconsin Building Product Evaluation Number (**201403-I**), and the name and logo of the quality control agency.

WISCONSIN UNIFORM DWELLING CODE (1-2 FAMILY) COMPLIANCE

- **Foam Plastic:** The Fox Blocks insulated concrete form wall system is approved for use with a thermal barrier to separate the blocks from interior spaces in accordance with **s. SPS 321.11 (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. Fox Blocks form blocks are approved for use in combustible non-rated construction in accordance with **s. SPS 321.11**. In one- or two-family dwellings, thermal barriers shall be provided to separate the forms from the occupied space of the dwellings per **s. SPS 321.11**.
2. The exterior face of the blocks shall be finished with an approved weather covering and must be protected from ultraviolet light.

- **Structural:** The Fox Blocks 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 321.18-B**, 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. Damp-proofing and water-proofing materials shall be approved by Fox Blocks and the local building official, and shall be free of solvents that will adversely affect the EPS foam.

NOTE: The Fox Blocks ICF wall system was **not** evaluated for compliance with the dwelling thermal envelope requirements of **Subchapter IV** 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 Fox Blocks Insulated Concrete Form wall system for residential construction is permitted to comply with the *Prescriptive Design of Exterior Concrete Walls for One- and 2-Family Dwellings* (PCA 100), published by the Portland Cement Association (PCA). Buildings constructed with the Fox Blocks 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.

DISCLAIMER

The department is not endorsing or advertising this product. This approval addresses only the specified applications for the product and does not waive or modify any code requirement not specified in this document.

EXPIRATION

This approval will be valid through December 31, 2019, 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.

Approval Date: 4/1/2014	By: Duane Hubeler, PE Bureau of Technical Services