

# ICC-ES Evaluation Report

**ESR-1479**

Issued July 1, 2009

*This report is subject to re-examination in one year.*
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**DIVISION: 03—CONCRETE**  
**Section: 03130—Permanent Forms**

**REPORT HOLDER:**

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**EVALUATION SUBJECT**
**GREENBLOCK INSULATING CONCRETE FORMS**
**1.0 EVALUATION SCOPE**
**Compliance with the following codes:**

- 2006 *International Building Code*® (IBC)
- 2006 *International Residential Code*® (IRC)

**Properties evaluated**

- Structural
- Surface-burning characteristics
- Crawl space fire evaluation
- Fire resistance

**2.0 USES**

Greenblock Fixed-web, GBLOX and 2-4-2 insulating concrete forms (ICFs) are used as stay-in-place formwork for structural concrete, load-bearing and nonload-bearing, below-grade and above-grade walls. The forms are used in construction of plain and reinforced concrete beams, lintels, exterior and interior walls, and foundation and retaining walls. The forms remain in place after placement and curing of concrete and must be covered with approved interior and exterior finish material. Greenblock ICFs are limited to use in buildings of Type V construction (IBC) and dwellings under the IRC.

**3.0 DESCRIPTION**
**3.1 General:**

Greenblock ICFs consist of expanded polystyrene (EPS) interlocking foam plastic panels and polypropylene (PP) cross ties and are classified as flat ICF wall systems in accordance with Section R611.3 of the IRC. The EPS foam plastic used to produce Greenblock Fixed-web, GBLOX and 2-4-2 insulating concrete forms has a flame-spread rating of 25 or less and a smoke-density of 450 or less at a nominal 1.5 pcf (24 kg/m<sup>3</sup>) density when tested in

accordance with ASTM E 84. The foam plastic complies as a Type II product in accordance with ASTM C 578. The EPS panels have a preformed interlocking connection mechanism on the top and bottom edges which facilitate stacking, horizontally locking in each course. In addition to standard straight forms, 45-degree angle forms, 90-degree angle corner forms, taper top blocks, brick ledge blocks, end caps and spacers are also available. The 45- and 90-degree forms are used to construct wall intersections. The taper top blocks are used for the top course of a wall and may also be used to provide a brick ledge or joist ledger. The brick ledge forms are used to construct concrete corbels that serve as ledges to support exterior brick/stone veneers and interior floor construction. Refer to Figure 1 for details.

**3.2 Materials:**

**3.2.1 Greenblock Fixed-web ICF:** The Greenblock fixed-web ICF consists of two EPS foam plastic panels measuring 12 inches (305 mm) high, 48 inches (1220 mm) long and 2<sup>5</sup>/<sub>8</sub> inches (67 mm) thick, separated by high-impact PP cross ties that are spaced 6 inches (152 mm) on center along the length of the form. The cross ties are pre-inserted into the form mold prior to molding and are embedded in the EPS panels during the molding process. The PP cross ties retain the opposing EPS panels at a fixed clear distance of either 6 or 8 inches (152 or 203 mm). When stacked in a running bond pattern, the Fixed-web ICFs form a cavity where steel reinforcement bars and concrete are placed to create a 6- or 8-inch (152 or 203 mm) concrete wall. See Figure 1 for typical dimensions.

**3.2.2 Greenblock GBLOX ICF:** The Greenblock GBLOX ICF consists of two EPS foam plastic panels measuring 12 inches (305 mm) high, 48 inches (1220 mm) long and 2<sup>5</sup>/<sub>8</sub> inches (67 mm) thick, separated by high-impact PP cross ties that are spaced 6 inches (152 mm) on center along the length of the form. The cross ties are inserted into the EPS foam plastic panels either in a factory or on a jobsite after molding, so that they are embedded in the EPS panels. The PP cross ties retain the opposing panels at a fixed clear distance of 6, 8, 10 or 12 inches (152, 203, 254 or 306 mm). When stacked in a running bond pattern, the GBLOX ICFs form a cavity where steel reinforcement bars and concrete are placed to create a 6-, 8-, 10- or 12-inch-thick (152, 203, 254 or 306 mm) concrete wall. See Figure 2 for typical dimensions.

**3.2.3 Greenblock 2-4-2 ICF:** The Greenblock 2-4-2 ICF consists of two EPS foam plastic panels measuring 12 inches (305 mm) high, 48 inches (1220 mm) long and 2 inches (51 mm) thick, separated by high-impact PP cross ties that are spaced 6 inches (152 mm) on center along the

length of the form. The cross ties are inserted into the EPS foam plastic panels after molding either in a factory setting or on a jobsite, so that they are embedded in the EPS panels. The PP cross ties keep the opposing panels at a fixed clear distance of 4 inches (102 mm). When stacked in a running bond pattern, the 2-4-2 ICFs form a cavity where steel reinforcement bars and concrete are placed to create a 4-inch (102 mm) concrete wall. See Figure 3 for typical dimensions.

**3.2.4 Cross Ties:** The PP cross ties are embedded and/or placed at 6 inches (152 mm) on center in all Greenblock products, and have attachment flanges measuring nominally 11 inches high by  $1\frac{1}{2}$  inches (279 by 38 mm) wide (Fixed-web ICF); 8 inches high by  $1\frac{1}{2}$  inches (203 by 38 mm) wide (GBLOX); and  $9\frac{1}{2}$  inches high by  $1\frac{1}{2}$  inches (241 by 38 mm) wide (2-4-2 ICF). The cross ties are embedded  $\frac{1}{4}$  inch (6.5 mm) beneath the outer surface of the EPS foam panels. The flange provides a mechanism for attaching interior and exterior wall covering. The cross ties also serve as a seat to support horizontal steel reinforcing bars. The cross ties connect the two foam panels to form 4-, 6-, 8-, 10- or 12-inch-thick (102, 152, 203, 254 or 306 mm) concrete walls. The cross ties have openings to permit concrete to pass through.

**3.2.5 Concrete:** The concrete must be normal-weight concrete complying with the applicable code, having a maximum aggregate size of  $\frac{3}{4}$  inch (19 mm); a maximum slump of 6 inches (152 mm) unless otherwise approved by the code official; and a minimum compressive strength of 2500 psi (17.2 MPa) at 28 days, except as noted in Table 2 for fire-resistance-rated assemblies. Under the IRC, the concrete must comply with Sections R404.4 and R611.6.1.

**3.2.6 Reinforcement:** Walls must be reinforced with deformed steel bars having a minimum yield stress of 40 ksi (275 MPa). The deformed steel bars must comply with Section 3.5.3.1 of ACI 318. If construction is based on the IRC, reinforcement must comply with IRC Sections R404.4.6 and R611.6.2.

**3.2.7 Other Components:** Wood members in contact with concrete must be protected from decay in accordance with IRC Section R319.3, or the applicable code, and attached with compatible corrosion-resistant fasteners complying with IBC Section 2304.9.5 or IRC Section R319.3, as applicable.

## 4.0 DESIGN AND INSTALLATION

### 4.1 Design:

**4.1.1 IBC Design:** Concrete walls formed by Greenblock ICFs must be designed and constructed in accordance with IBC Chapters 16 and 19. Footings and foundations must be designed and constructed in accordance with IBC Chapter 18.

**4.1.2 IRC Design:** Concrete walls formed by the Greenblock ICFs must comply with IRC Figure R611.3 as flat insulating concrete wall forms. Wall design, construction and materials must comply with IRC Sections R404.4 and R611, as applicable, for flat ICF wall systems.

### 4.2 Installation:

**4.2.1 General:** The ICFs and resulting concrete walls must be supported on concrete footings complying with IBC Chapter 18 and 19, or IRC Chapter 4, as applicable. Greenblock ICF is placed in corners first, and then stacked alternating to create a staggered stack. There are five different thicknesses of ICF available, allowing formation of 4-inch, 6-inch, 8-inch, 10-inch or 12-inch (102 mm, 152 mm, 203 mm, 254 mm or 306 mm) concrete core walls. The wall is constructed around the perimeter or per design to the configurations and heights required.

Vertical reinforcement bars, embedded in the footing, must extend into the base of the wall system the minimum development length necessary for compliance with Chapter 12 of ACI 318. Additional reinforcement around windows and doors must be described in the approved plans, or comply with IRC Section 404.4.6.3. The Greenblock ICFs must be stacked in a running bond pattern such that the PP cross ties, which are spaced 6 inches (152 mm) on center, align vertically. The PP cross ties provide support for concrete placement and interior and exterior wall finish material. Vertical and horizontal reinforcement bars must be placed as required by the approved plans and the applicable code.

When regulation is under the IRC, reinforcing steel for Greenblock walls used above grade must comply with Section R611 of the IRC.

Wood ledgers must be decay-resistant in accordance with the applicable code and must be attached to the concrete wall in compliance with engineering or local code requirements. If anchor bolts are used, the spacing and embedment depth of the anchor bolts must comply with design requirements and the applicable code.

### 4.2.2 Interior Finish:

**4.2.2.1 General:** Greenblock ICFs exposed to the interior of the building must be finished with an approved 15-minute thermal barrier, such as minimum  $\frac{1}{2}$ -inch-thick (13 mm) regular gypsum wallboard complying with ASTM C 36 or C 1396 installed vertically or horizontally and attached to the flanges of the PP cross ties with minimum  $1\frac{7}{8}$ -inch-long (47.6 mm), Type W, coarse-thread, corrosion-resistant drywall screws spaced a maximum of 24 inches (610 mm) horizontally and a maximum of 12 inches (305 mm) on center vertically. Gypsum wallboard joints must be taped and filled with joint compound in accordance with GA-216 or ASTM C 840. See Section 4.2.2.2 for installation details when use is as walls of crawl spaces without a covering on the interior face.

**4.2.2.2 Crawl Space Installation:** Greenblock ICFs may be installed without an ignition barrier separating the foam plastic from the crawl space, subject to the following conditions:

- Entry to the crawl space is limited to servicing of utilities, and heat-producing appliances are not permitted.
- There are no interconnected basement areas.
- Air in the crawl space is not circulated to other parts of the building.
- Ventilation of the crawl space is provided in accordance with the applicable code.

### 4.2.3 Exterior Finish:

**4.2.3.1 Above Grade:** The Greenblock ICF wall system must be covered on the exterior with an approved wall covering in accordance with the applicable code or a current evaluation report. Under the IRC, the walls must be flashed in accordance with IRC Section R703.8. The approved exterior wall covering must be attached to the cross ties with minimum No. 6, Type W corrosion-resistant screws, having sufficient length to penetrate through the cross-tie flange a minimum of  $\frac{9}{16}$  inch (14 mm). The fasteners have the allowable pull-out and lateral capacities as shown in Table 1. The fastener spacing must be designed to support the gravity loads of the wall covering and negative wind pressures. The negative wind pressure capacity of the exterior finish material must be the same as that recognized in the applicable code for generic materials, or that recognized in a current evaluation report for proprietary materials.

**4.2.3.2 Below Grade:** Materials used to dampproof or waterproof basement walls must comply with IBC Section 1807 or IRC Section R406, or a current evaluation report, and must be compatible with foam plastic forms. Compliance is required with the drainage requirements in IBC Section 1807.4 or IRC Section R405, as applicable. No backfill is permitted to be applied against the wall until the complete floor system is in place, unless the wall is designed as a freestanding wall that does not rely on the floor system for structural support.

**4.2.4 Foundation Walls:** The Greenblock ICFs may be used to build foundation stem walls when the structure complies with IRC Section R403 or applicable codes. Design and installation of the Greenblock ICF systems used as stem walls must comply with Section 1805.5 of the IBC or Section R404.4 of the IRC, as applicable. The 2-4-2 ICF wall is not permitted to be used as a stem wall under the IRC.

**4.2.5 Retaining Walls:** Greenblock ICF systems may be used as retaining walls with reinforcement designed in accordance with accepted engineering principles and Section 4.1 of this report.

**4.2.6 Protection Against Termites:** Where the probability of termite infestation is defined as "very heavy" by the code official, the foam plastic must be installed in accordance with IBC Section 2603.8 or IRC Section R320.5, as applicable. Areas of very heavy termite infestation must be determined in accordance with IBC Figure 2603.8 or IRC Figure R301.2(6), as applicable.

#### **4.3 Fire-resistance-rated Construction:**

Walls constructed with Greenblock Fixed-web, GBLOX and 2-4-2 ICF forms have fire-resistance-ratings for bearing and nonbearing wall assemblies as shown in Table 2.

#### **4.4 Special Inspection:**

**4.4.1 IBC:** Special inspection is required as noted in IBC Section 1704 for placement of reinforcing steel and concrete, and for concrete cylinder testing.

**4.4.2 IRC:** For walls designed and constructed in accordance with Section 4.1.2 of this report, special inspection is not required. For walls designed in accordance with the IBC, as permitted by IRC Sections 104.11 and R301.1.3, special inspections in accordance with Section 4.4.1 of this report are required.

### **5.0 CONDITIONS OF USE**

The Greenblock Fixed-web, GBLOX and 2-4-2 insulated concrete forms described in this report comply with, or are suitable alternatives to what is specified in, those codes listed in Section 1.0 of this report, subject to the following conditions:

**5.1** Forms are manufactured, identified and installed in accordance with this report and Greenblock's published installation instructions. If there is a conflict

between the manufacturer's published installation instructions and this report, this report governs.

**5.2** The forms must be separated from the building interior as described in Section 4.2.2.1, except as noted for crawl space construction in Section 4.2.2.2.

**5.3** Greenblock ICFs are limited to use in buildings of Type V construction (IBC) and dwellings under the IRC.

**5.4** When required by the code official, calculations showing compliance with the general design requirements of Chapter 16 of the IBC must be submitted to the code official for approval, except that calculations are not required when the building design is based on Section 4.1.2 of this report. The calculations and details must be prepared by a registered design professional where required by the statutes of the jurisdiction in which the project is to be constructed.

**5.5** Concrete quality, mixing and placement must comply with Section 1905 of the IBC or Section R611.6.1 of the IRC, as applicable.

**5.6** Special inspections must be provided in accordance with Section 4.4.

**5.7** Greenblock ICFs are manufactured for Greenblock Worldwide Corporation by Tegrant Packaging, located in Colorado Springs, Colorado; Diversified Plastics Corporation, Nixa, Missouri; Cellofoam, Inc., Orlando, Florida; and FMI-EPS, LLC, Post Falls, Idaho. Greenblock ICFs are produced under a quality control program with inspections conducted by Intertek Testing Services NA, Inc. (AA-690).

### **6.0 EVIDENCE SUBMITTED**

**6.1** Data in accordance with the ICC-ES Acceptance Criteria for Stay-in-place Foam Plastic Insulating Concrete Form (ICF) Systems for Solid Concrete Walls (AC353), dated October 2007 (editorially revised April 2008).

**6.2** Reports of fire-resistance tests in accordance with ASTM E 119.

### **7.0 IDENTIFICATION**

Each bundle of ICF panels and cross ties is labeled with the product name (Greenblock Fixed-web, Greenblock GBLOX or Greenblock 2-4-2) and the report holder's name (Greenblock Worldwide Corporation) and address; manufacturing location; the date of production; the evaluation report number (ESR-1479); and the name or logo of the inspection agency (Intertek Testing Services NA, Inc.).

**TABLE 1—ALLOWABLE PULL-OUT AND LATERAL CAPACITIES OF SCREWS<sup>1</sup>**

PRODUCT	SCREW TYPE	ALLOWABLE CAPACITY (POUNDS)	
		Pull-out Capacity	Lateral Capacity
2-4-2 ICF and 6-, 8-, 10-, and 12-inch GBLOX ICF	No. 6, Type W, coarse thread corrosion-resistant screw	36	52
6- and 8-inch Fixed-web ICF	No. 6, Type W, coarse thread corrosion-resistant screw	34	70

For **SI**: 1 pound = 4.45N.

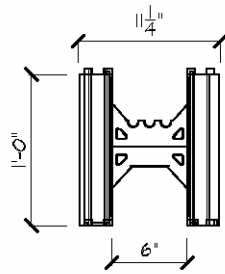
Screws must have sufficient length to penetrate the flanges of the cross ties at least <sup>9</sup>/<sub>16</sub> inch (14 mm).

**TABLE 2—GREENBLOCK INSULATING CONCRETE FORMS IN FIRE-RESISTANCE-RATED ASSEMBLIES<sup>1</sup>**

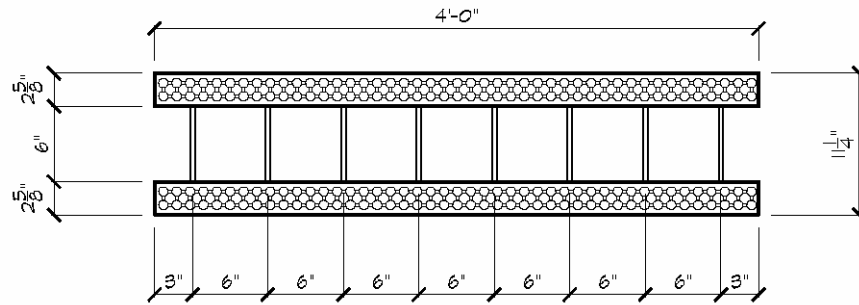
TYPE AND RATING	FORM TYPE	INETRIOR WALL COVERING	EXTERIOR WALL COVERING	STEEL REINFORCEMENT
Bearing wall: 4 hours. Allowable axial load 5000 lb/ft per 10-foot wall height	Fixed-web ICF 6-inch core 8-inch core	<sup>1</sup> / <sub>2</sub> -inch gypsum wallboard, fastened using <sup>1</sup> / <sub>8</sub> -inch drywall screws 12 inches o.c. vertically and 24 inches o.c. horizontally	<sup>1</sup> / <sub>2</sub> -inch gypsum wallboard, fastened using <sup>1</sup> / <sub>8</sub> -inch drywall screws 12 inches o.c. vertically and 24 inches o.c. horizontally	Vertical: No. 4, Grade 60 at 24 inches o.c. Horizontal: No. 4 at 24 inches o.c.
Bearing wall: 4 hours. Allowable axial load 5000 lb/ft per 10-foot wall height	GBLOX ICF 6-, 8-, 10-, and 12-inch core			
Bearing wall: 2 hours. Allowable axial load 5000 lb/ft per 10-foot wall height	2-4-2 ICF 4-inch core			

For **SI**: 1 Inch = 25.4 mm; 1 lb/ft = 14.59 N/m.

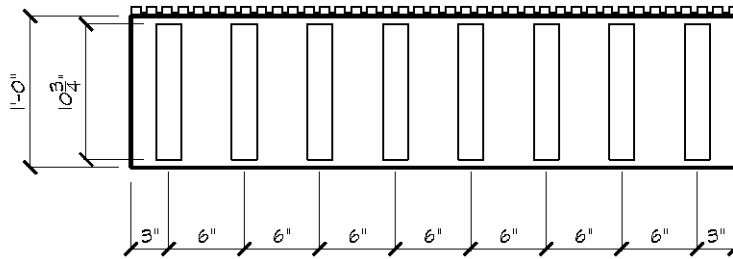
<sup>1</sup>Concrete must be normal-weight concrete (150-155 lb/ft<sup>3</sup>) (2403-2483 kg/m<sup>3</sup>) with a 3000 psi (20.7 Mpa) compressive strength.



6" STANDARD BLOCK (END VIEW)



6" PLAN OF STANDARD BLOCK



6" SIDE VIEW OF STANDARD BLOCK

FIGURE 1—GREENBLOCK FIXED-WEB INSULATING CONCRETE FORMS

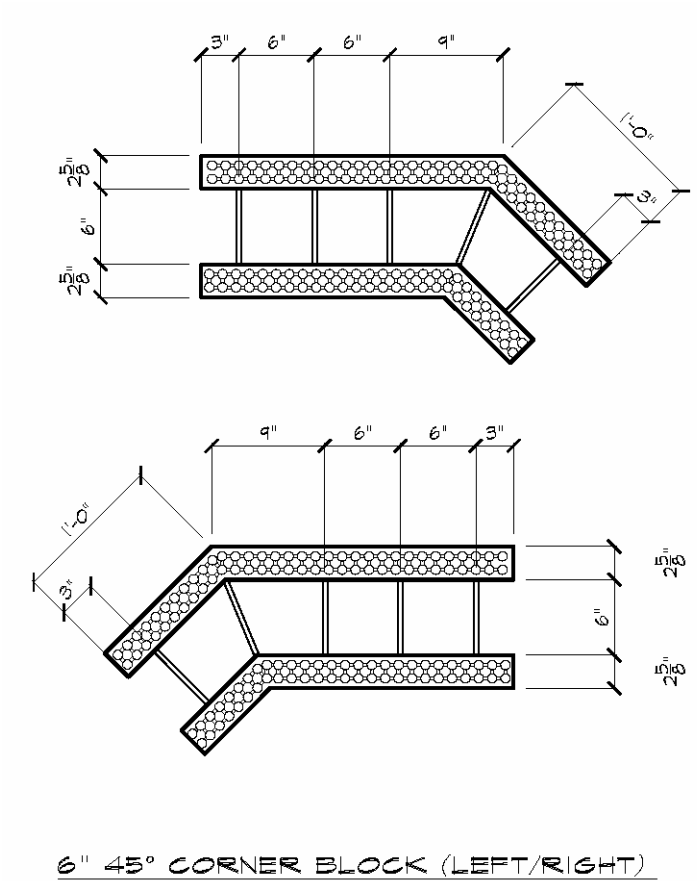


FIGURE 1—GREENBLOCK FIXED-WEB INSULATING CONCRETE FORMS (Continued)

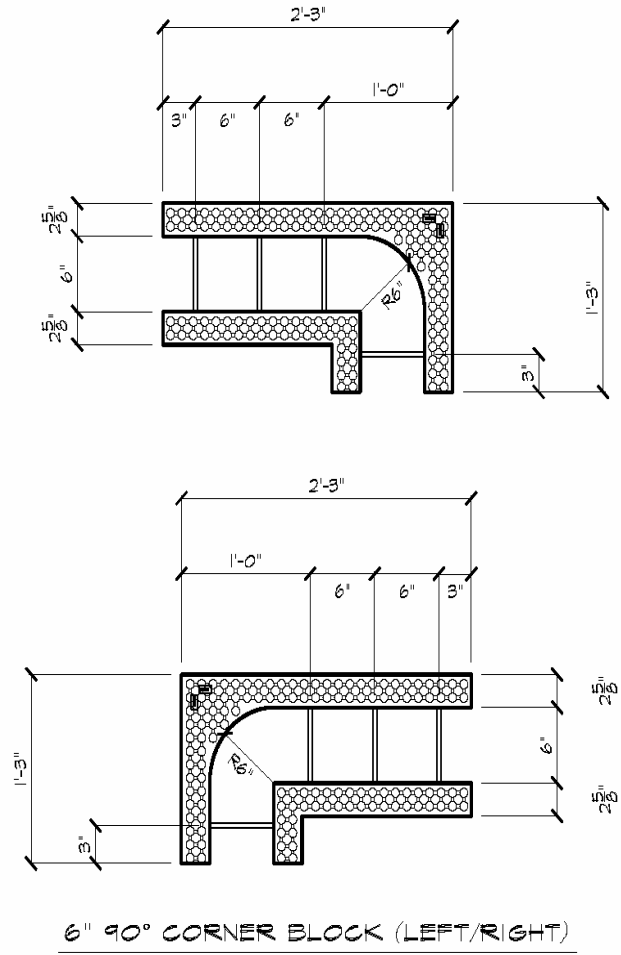
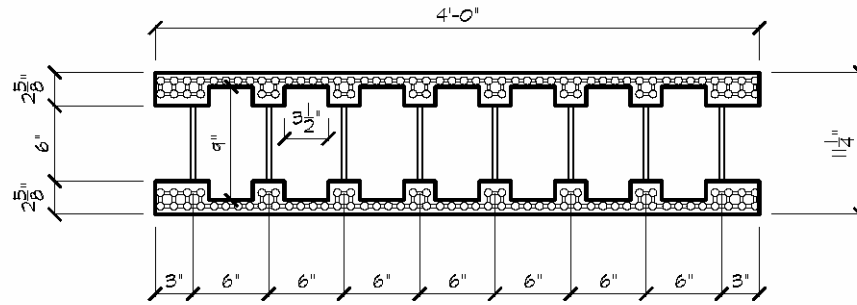
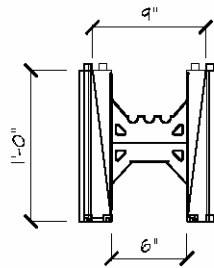


FIGURE 1—GREENBLOCK FIXED-WEB INSULATING CONCRETE FORMS (Continued)



6" STANDARD TAPER TOP (PLAN VIEW)



6" STANDARD TAPER TOP

FIGURE 1—GREENBLOCK FIXED-WEB INSULATING CONCRETE FORMS (Continued)

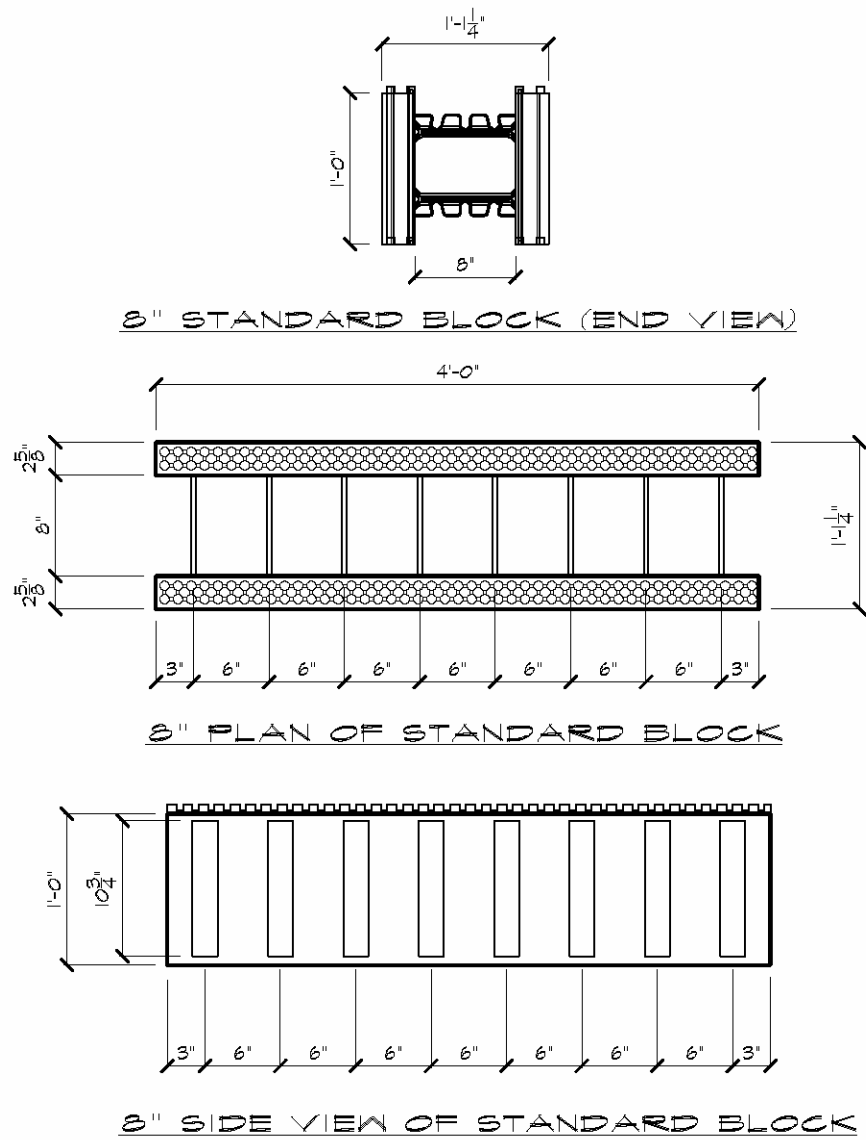
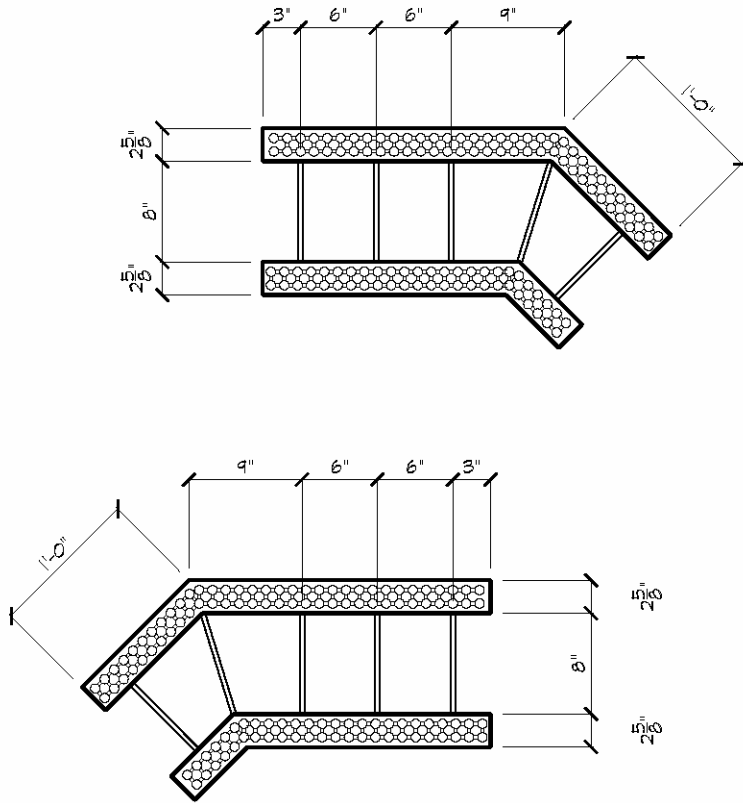


FIGURE 1—GREENBLOCK FIXED-WEB INSULATING CONCRETE FORMS (Continued)



8" 45° CORNER BLOCK (LEFT/RIGHT)

FIGURE 1—GREENBLOCK FIXED-WEB INSULATING CONCRETE FORMS (Continued)

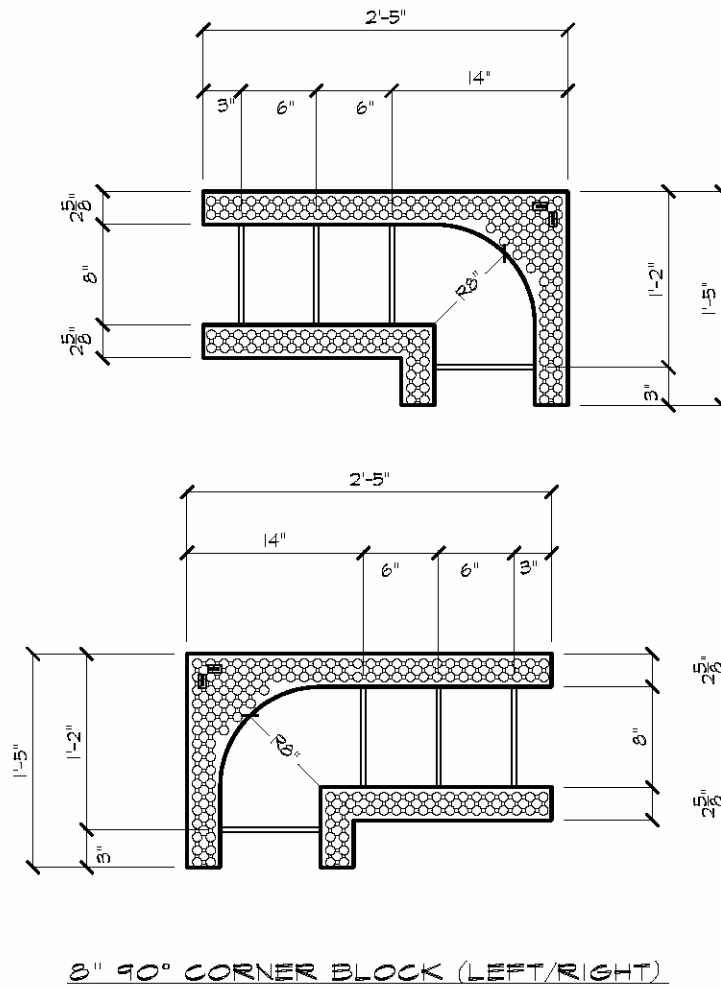


FIGURE 1—GREENBLOCK FIXED-WEB INSULATING CONCRETE FORMS (Continued)

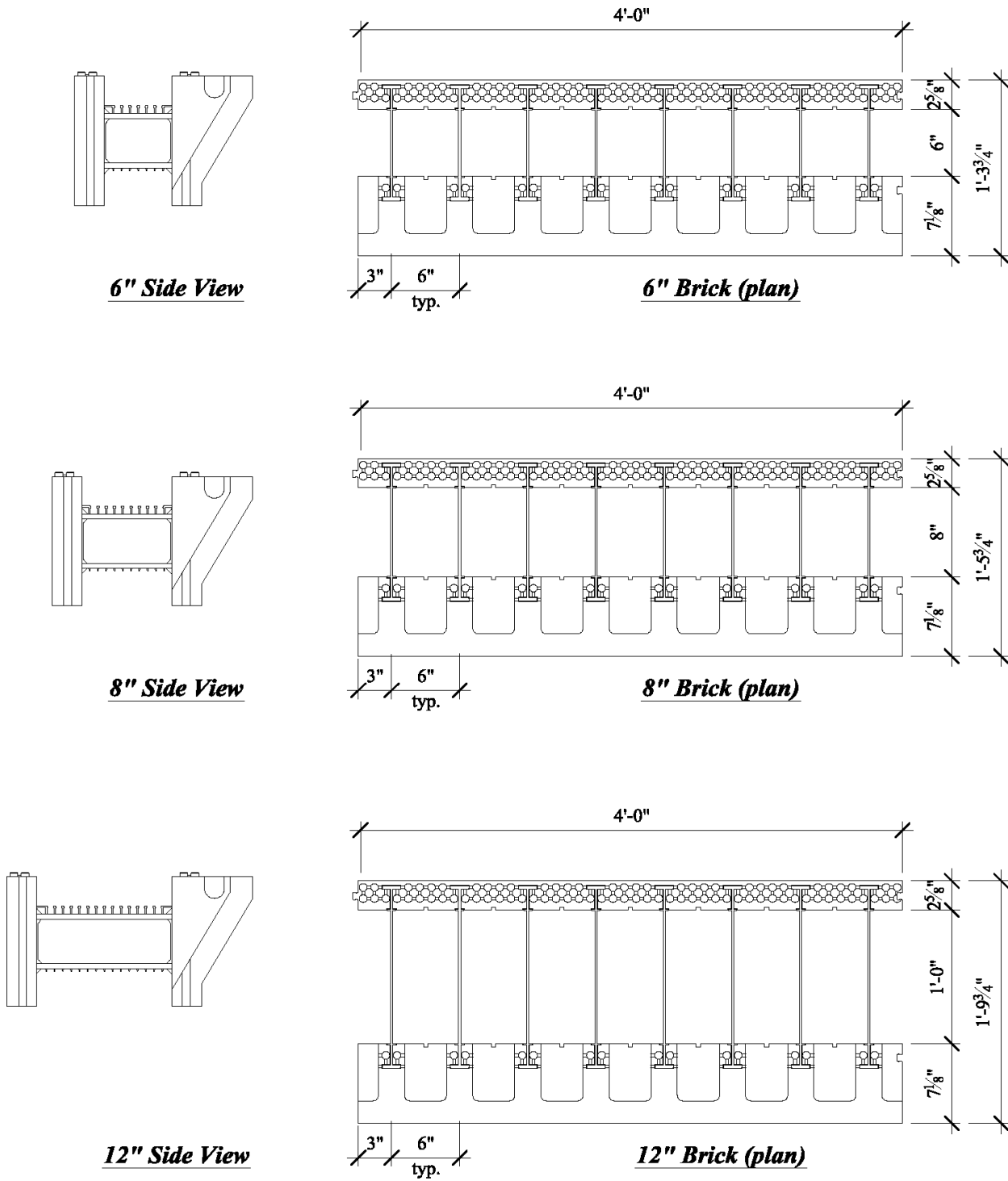


FIGURE 2—GREENBLOCK GBLOX INSULATING CONCRETE FORMS

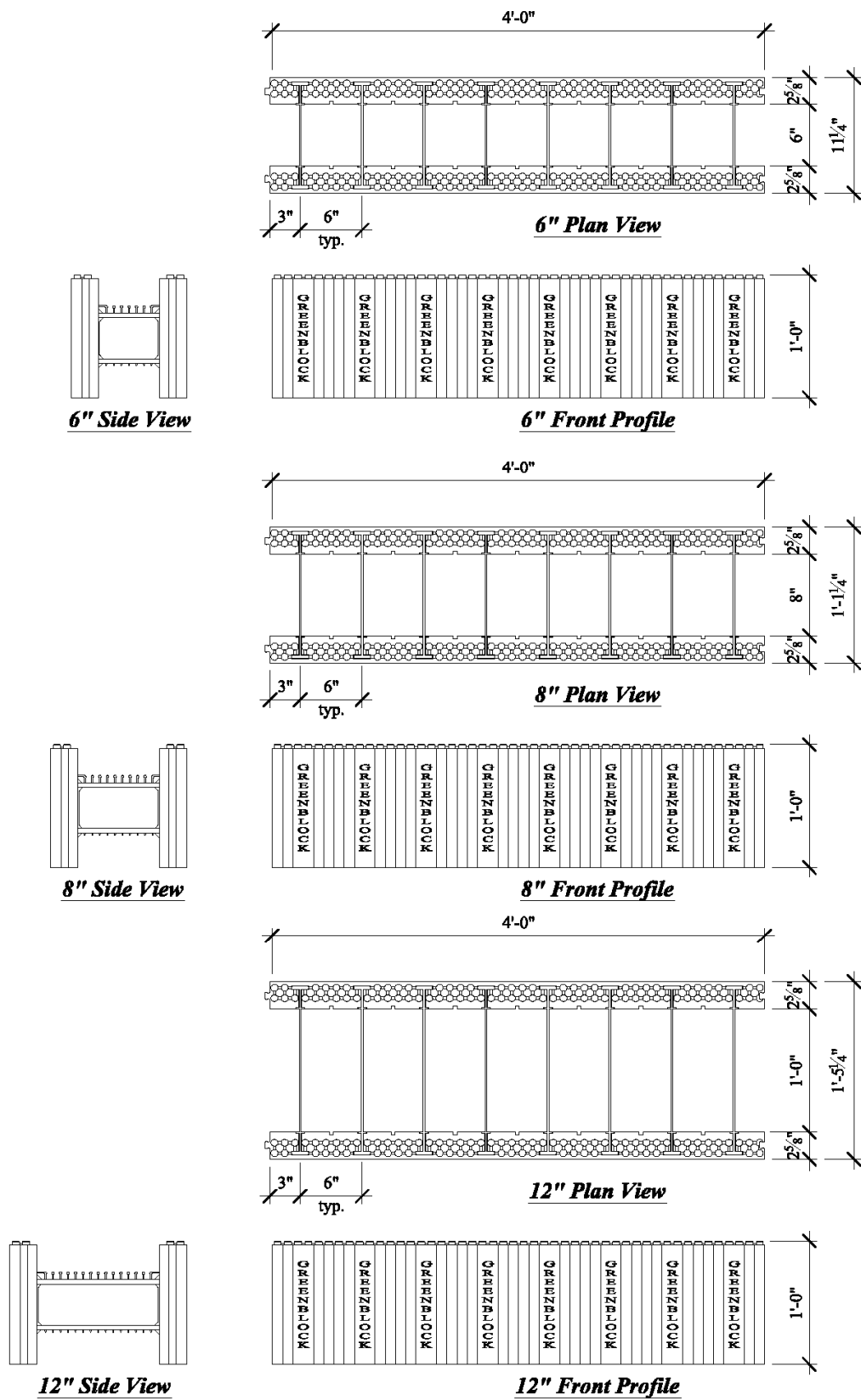
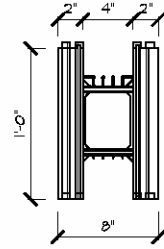
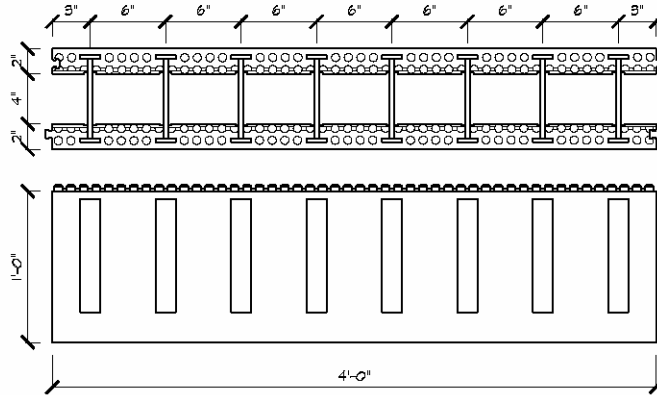


FIGURE 2—GREENBLOCK GBLOX INSULATING CONCRETE FORMS (Continued)



END VIEW 2-4-2



2-4-2 STANDARD (PLAN/SIDE)

FIGURE 3—GREENBLOCK 2-4-2 INSULATING CONCRETE FORMS

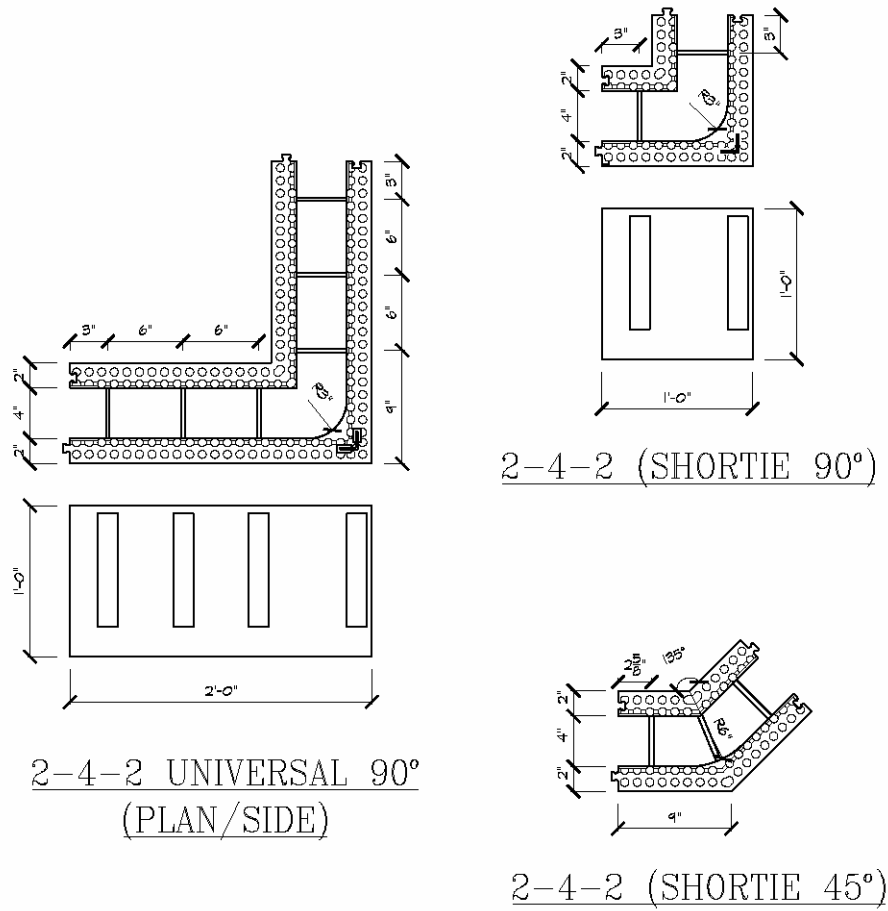


FIGURE 3—GREENBLOCK 2-4-2 INSULATING CONCRETE FORMS (Continued)

**ICC-ES Evaluation Report****ESR-1479 Supplement\***

Issued July 1, 2009

*This report is subject to re-examination in one year.*[www.icc-es.org](http://www.icc-es.org) | (800) 423-6587 | (562) 699-0543

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**DIVISION: 03—CONCRETE**  
**Section: 03130—Permanent Forms****REPORT HOLDER:****GREENBLOCK WORLDWIDE CORPORATION**  
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[www.greenblock.com](http://www.greenblock.com)**EVALUATION SUBJECT:****GREENBLOCK INSULATING CONCRETE FORMS****1.0 EVALUATION SCOPE****Compliance with the following codes:**

- 2007 Florida Building Code—Residential
- 2007 Florida Building Code—Building

**Properties Evaluated:**

- Structural
- Surface-burning characteristics
- Crawl space fire evaluation
- Fire resistance

**2.0 PURPOSE OF THIS SUPPLEMENT**

This supplement is issued to indicate that the Greenblock Fixed-web, GBLOX and 2-4-2 insulating concrete forms (ICFs) described in Sections 2.0 through 7.0 of the master report comply with the 2007 Florida Building Code—Building and the 2007 Florida Building Code—Residential, when designed and installed in accordance with the master evaluation report.

For products falling under Florida Rule 9B-72, verification that the report holder's quality assurance program is audited by a quality assurance entity approved by the Florida Building Commission for the type of inspections being conducted is the responsibility of an approved validation entity (or the code official when the report holder does not possess an approval by the Commission).

This supplement expires concurrently with the master report issued July 1, 2009.

**\*Revised November 2009**