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DIVISION: 03—CONCRETE
Section: 03130—Permanent Forms

REPORT HOLDER:

ECO-BLOCK, LLC
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EVALUATION SUBJECT:

ECO-BLOCK INSULATED CONCRETE FORMS (ICFs)

1.0 EVALUATION SCOPE

Compliance with the following codes:

- 2006 *International Building Code*® (IBC)
- 2006 *International Residential Code*® (IRC)
- 1997 *Uniform Building Code*™ (UBC)
- BOCA® *National Building Code*/1999 (BNBC)
- 1999 *Standard Building Code*® (SBC)

Properties evaluated:

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

2.0 USES

ECO-Block insulated 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. For use in buildings of Types I, II, III and IV (noncombustible) construction, installation must be in accordance with Section 4.9 of this report.

3.0 DESCRIPTION

3.1 General:

ECO-Block ICFs consist of expanded polystyrene (EPS) foam plastic panels and plastic webs. These forms are classified as a flat ICF wall system in accordance with IRC Section R611.3.

3.2 Material:

3.2.1 ECO-Block Standard Forms: The EPS panels of the ECO-Block Standard forms are 16 inches (406 mm) high, 48 inches (1219 mm) long and 2.5 inches (64 mm) thick. The panels are manufactured by injecting and expanding polystyrene beads into molds, as described in the approved quality control manual. The resulting expanded polystyrene foam plastic complies with ASTM C 578 as Type II. The polystyrene has a flame-spread index of 25 or less and a smoke-developed index of 450 or less at a 1.5 pcf (24 kg/m³) density when tested in accordance with ASTM E 84. Plastic webs embedded in the EPS panels are spaced at 8 inches (203 mm) on center and recessed 1/4 inch (6.4 mm) from the EPS panel surface. The plastic connectors, of one of four different lengths, connect the webs of two panels to form 4-inch-, 6-inch-, 8-inch- or 10-inch-thick (102 mm, 152 mm, 203 mm or 254 mm) concrete walls. Splice connectors are used to join the connectors to form 12-inch- to 24-inch-thick (305 mm to 610 mm) concrete walls. The webs, connectors and splice connectors are high-density polypropylene, manufactured by Fourmark Manufacturing. The forms have a preformed interlocking mechanism on their top and bottom edges, to facilitate stacking. In addition to standard forms, 45-degree angle forms, 90-degree angle corner forms and ledge blocks are also available. See Figure 1 of this report for descriptions of the forms.

The 45-degree angle forms and 90-degree angle corner forms are used to construct wall intersections. The ledge blocks are used to construct concrete corbels that serve as ledges, for supporting exterior brick veneers and interior floor construction.

3.2.2 ECO-Block 24-inch Forms: ECO-Block 24-inch Forms are similar to ECO-Block Standard Forms, except the EPS panels measure 24 inches (610 mm) high, 48 inches (1219 mm) long, and 2 inches (51 mm) thick, and the EPS panels comply with ASTM C 578 as Type II, with a nominal density of 1.7 pcf (27.2 kg/m³).

3.2.3 Concrete: Concrete must be normal-weight concrete, complying with the applicable code, having a maximum aggregate size of 3/4 inch (19.1 mm) and a minimum compressive strength of 2,500 psi (17 MPa) at 28 days, except as noted in Section 4.8 of this report for fire-resistance-rated construction. Under the IRC, concrete must comply with IRC Sections R404.4 and R611.6.1; under the SBC, concrete must comply with SBC Section 1916.6.1.

3.2.4 Reinforcement: Walls must be reinforced with deformed steel bars, having a minimum yield stress of either 40 ksi (275MPa) or 60 ksi (413MPa), depending on the structural design. The deformed steel bars must comply with Section 3.5.3.1 of ACI 318-05 (IBC), UBC Section 1903.5, Section 3.5.3.1 of ACI 318-95 (BNBC) or SBC Section 1916.6.2, as applicable. If construction is based on the IRC,

reinforcement must comply with IRC Sections R404.4.6 and R611.6.2.

3.2.5 Other: Wood members in contact with concrete for plates of window and door framing must be treated with an approved wood preservative in accordance with the applicable code, and attached with hot-dipped galvanized steel fasteners complying with IBC Section 2304.9.5, IRC Section R319.3, UBC Section 2304.3, BNBC Section 2311.3.3, or SBC Section 2306.3, as applicable.

4.0 DESIGN AND INSTALLATION

4.1 Design:

4.1.1 IBC, UBC or BNBC Method: Concrete walls formed by the ECO-Block and ECO-Block 24-inch forms must be designed and constructed in accordance with IBC, UBC or BNBC Chapters 16 and 19, as applicable. Footings and foundations must be designed and constructed in accordance with IBC, UBC or BNBC Chapter 18, as applicable.

4.1.2 Alternative UBC Design Method: For walls limited to a maximum of two stories plus a basement, and a maximum unsupported wall span of 10 feet (3048 mm), walls may be designed in accordance with Publication No. EB118, Prescriptive Method for Insulating Concrete Forms in Residential Construction, dated May 1998, published by the Portland Cement Association, subject to all applicability limits in Table 1.1 of that document.

4.1.3 IRC or SBC Method: Insulated concrete walls formed by ECO-Block Standard or 24-inch Forms comply with IRC Figure R611.3 and SBC Figure 1916.3 as flat insulating concrete wall forms. Wall design, construction and materials must comply with IRC Sections R404.4 and R611, or with SBC Sections 1804.6.2 and 1916, as applicable, for flat insulating concrete form wall systems.

When the ECO-Block Standard or 24-inch Forms are used to construct buildings that do not conform to the applicability limits of IRC Sections R404.4.1 and R611.2 or SBC Sections 1916.2 and 1804.6.2.1, the structural analysis and design of the concrete must be in accordance with ACI 318 and Chapter 19 of the IBC, BNBC, SBC or UBC, as applicable.

4.2 Installation:

The ICFs and resulting concrete walls must be supported on concrete footings complying with IBC or UBC Chapters 18 and 19, IRC Chapter 4, or BNBC or SBC Chapter 18, as applicable. The ICFs must be assembled by connecting two side panels with connectors of the appropriate length, to form the required wall thickness. Placement of the forms must begin at a corner and proceed around the building perimeter. The amount, placement and spacing of reinforcing required must be determined for each project, based on the approved plans and the applicable code. Vertical rebars 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 318-05 (IBC and IRC), UBC Section 1912, or Chapter 12 of ACI 318-95 (BNBC and SBC). Additional reinforcement around doors and windows must be described in the approved plans. Concrete quality, mixing and placement must comply with IBC Section 1905, IRC Section R611.6.1, UBC Section 1905, Chapter 5 of ACI 318-95 (BNBC) or SBC Section 1916.6.1, as applicable. Window and door openings must be built into the forms, with wood or polyvinyl chloride plastic frames of the same dimensions as the "rough stud opening" specified by the window or door manufacturer, prior to the placement of the concrete. Wood ledgers must be attached to the concrete wall by removing the face shell of the forms, with the height of the removed portion being equal to the depth of the wood ledger. Wood plates must be anchored to the top of the wall. Anchor bolts

used to connect the wood ledgers or plates to the concrete must be cast in place, with the bolts sized and spaced as required by design and the applicable code.

4.3 Interior Finish:

4.3.1 General: The installation details in this section (Section 4.3.1) address compliance with the thermal barrier and interior finish requirements of the codes. Forms exposed to the building interior must be finished with minimum 1/2-inch-thick (12.7 mm) gypsum wallboard complying with ASTM C 36 or ASTM C 1396, placed with the long side vertical. The wallboard must be attached to the plastic webs of the forms with minimum 1 1/2-inch-long (38 mm), No. 6, coarse-thread, gypsum wallboard screws, spaced 16 inches (406 mm) on center horizontally and vertically in the field, and 8 inches (203 mm) on center along wallboard edges. The screws must penetrate through the web 1/4 inch (6.4 mm). Gypsum wallboard joints must be taped and filled with joint compound. See Section 4.3.2 of this report for installation details when used as walls of crawl spaces without a covering on the interior face.

4.3.2 Crawl Space Installations: For use of the ECO-Block ICF forms as walls of crawl spaces without a covering applied to the crawl space side of the foam plastic, all the following conditions must be met:

1. Entry to the crawl space is only to service utilities, and no heat-producing appliances are permitted.
2. There are no interconnected basement areas.
3. Air in the crawl space is not circulated to other parts of the building.
4. Underfloor ventilation is provided that complies with IBC Section 1203.3, IRC Section R408, UBC Section 2306.7, BNBC Section 1210.2 or SBC Section 1804.6.3.1.

4.4 Exterior Finish:

4.4.1 Above Grade: The ECO-Block ICF forms 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 plastic webs with the fasteners described in Table 2 of this report. The fasteners must be corrosion-resistant and have sufficient length to penetrate through the web flange at least 1/4 inch (6.4 mm). Fasteners have allowable withdrawal and lateral capacities as shown in Table 2 of this report. The maximum fastener spacing must be designed to support the gravity loads of the wall covering and resist the 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.

4.4.2 Below Grade: Materials used to damp-proof basement walls must be specified by ECO-Block, LLC, and must comply with the applicable code or a current evaluation report, and must be compatible with the foam plastic forms. Applicable damp-proofing and waterproofing requirements are in IBC Section 1807, IRC Section R406, UBC Appendix Chapter 18, BNBC Section 1813.0 and SBC Section 1814. Compliance is required with drainage requirements in IBC Section 1807.4, IRC Section R405.1, UBC Section 1804.7, BNBC Section 1813.5 or SBC Section 1814. 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.

4.5 Foundation Walls:

The ECO-Block ICF forms are permitted to be used as a foundation stem wall when supporting wood-framed or concrete construction and when the structure is supported on concrete footings complying with the applicable code. Design and installation of the ECO-Block ICF System as foundation stem walls must comply with IBC Section 1805.5, IRC Section R404.4, BNBC Section 1812.0 or SBC Section 1804.6.2, as applicable. In jurisdictions adopting the UBC, compliance with UBC Table 18-I-C is required.

4.6 Retaining Walls:

For use of the ECO-Block ICF forms as a retaining wall with reinforcement, design must be in accordance with accepted engineering principles and Section 4.1 of this report.

4.7 Protection Against Termites:

In jurisdictions that have adopted the IBC, IRC or SBC, 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, IRC Section R320.5 or SBC Sections 1916.7.5 and 2603.3, as applicable. Areas of very heavy termite infestation must be determined in accordance with IBC Figure 2603.8, IRC Figure R301.2(6) or SBC Figure 2304.1.4, as applicable.

4.8 Fire-resistance-rated Construction:

ECO-Block Standard Forms can be used to construct fire-resistance-rated wall assemblies as follows:

CONCRETE THICKNESS (inches)	FIRE-RESISTANCE RATING (hours)
4	2
6	4
8	4

For SI: 1 inch = 25.4 mm.

The normal-weight concrete must have carbonate aggregate and a minimum 28-day compressive strength of 3,500 psi (24.1 MPa). The minimum reinforcement must be No. 5 reinforcing bars. The bars placed vertically must be in the center of the wall, and spaced 12 inches (305 mm) on center. The bars placed horizontally must be spaced 16 inches (406 mm) on center, and must be staggered on either side of the vertical bars, from row to row. The maximum axial compression load must be 7 percent of the load determined in accordance with Chapter 19 of the IBC, UBC, BNBC or SBC, as applicable.

4.9 Types I, II, III and IV Construction (IBC), and Noncombustible Construction (UBC, BNBC and SBC):

4.9.1 General: The assemblies described in Section 4.9.2 of this report comply with IBC Section 1406.2.1.1.

4.9.2 Installation in Buildings Required to Be of Types I, II, III and IV Construction (IBC) and Noncombustible Construction (UBC, BNBC and SBC): Exterior walls constructed with ECO-Block ICFs are permitted to be used in buildings required to be Types I, II, III and IV construction (IBC) and noncombustible construction (UBC, BNBC and SBC), provided the applicable conditions cited below are met:

4.9.2.1 Interior Finish: The EPS foam plastic insulation must be separated from the building interior with an approved 15-minute thermal barrier, such as minimum 1/2-inch-thick (12.7 mm) regular gypsum wallboard installed as specified in Section 4.3 of this report. Other thermal barriers are acceptable, provided they are recognized as equivalent to minimum 1/2-inch-thick (12.7 mm) regular gypsum wallboard, and applied in accordance with a current evaluation report.

4.9.2.2 Exterior Finish—EIFS: The following EIFS lamina may be installed over the exterior of the forms when applied using the reinforcing fabric or lath, base coat and finish coat materials described in their respective evaluation reports:

- Dryvit Systems, Inc., Outsulation EIFS as described in ESR-1232.
- Senergy, LLC, Senerflex EIFS as described in ESR-1794.
- STO Corp., STO Classic EIFS as described in ESR-1748
- Parex, Inc., Water Master Commercial DB EIFS as described in ER-5555.

4.9.2.3 Exterior Finish—Exterior Plaster: Metal lath and exterior plaster must comply with the applicable code, and the exterior plaster must be a minimum of 7/8 inch (22.2 mm) thick. The lath must be attached to the flanges of the plastic ties with fasteners as described in Section 4.4.1 of this report.

4.9.2.4 Exterior Finish—Brick Veneer: Anchored brick veneer must be attached to the flanges of the plastic ties with fasteners as described in Section 4.4.1 of this report. Installation of the 4-inch-thick (102 mm) brick veneer must comply with the applicable code, and the veneer must be installed with a minimum 1-inch (25.4 mm) air gap between the face of the exterior EPS formwork and the brick. The brick must be installed with a steel shelf angle attached to the concrete, and at each floor line and at the top of each window and door opening.

4.9.2.5 Fireblocking: For applications on buildings of any height, floor-to-wall intersections must be fireblocked in accordance with the applicable code to prevent the passage of flame, smoke and hot gases from one story to another. The foam plastic insulation on the interior side of the exterior walls and on both sides of interior walls must not be continuous from one story to another. See Figure 2 of this report for typical details.

4.10 Special Inspection:

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

Special inspections in accordance with IBC Sections 1704.1 and 1704.12 are required when the EIFS wall covering system is applied. Duties of the special inspector include verifying field preparation of materials, expiration dates, installation of components, curing of components, installation of joints and sealants.

4.10.2 IRC: For walls constructed in accordance with Section 4.1.3 of this report, special inspection is not required. For walls designed in accordance with the IBC, as permitted by IRC Sections R104.11 and R301.1.1, special inspection in accordance with Section 4.10.1 of this report is required.

4.10.3 UBC: Special inspection is required as noted in UBC Section 1701 for placement of reinforcing steel and concrete, and for concrete cylinder testing. When approved by the code official, special inspection may be waived when all of the following conditions are met:

1. Walls are a maximum of 8 feet (2.4 m) high, and are limited to use in single-story construction of Group R, Division 3, or Group U, Division 1, Occupancies.
2. Maximum height of a concrete deposit is 48 inches (1219 mm). Succeeding deposits must be placed in accordance with UBC Section 1905.10.5.
3. Installation is by installers approved by ECO-Block, LLC.
4. Half the allowable stresses or loads permitted by the UBC are used for the design of the walls.

5. Installation instructions indicate methods used to verify proper placement of concrete.

4.10.4 BNBC: Special inspection is required as noted in BNBC Section 1705.4, and is to include, but not be limited to: concrete, reinforcing steel and formwork materials, installation of reinforcing steel, formwork installation, bracing, and concreting operations.

4.10.5 SBC: Special inspection is required as noted in SBC Section 1707.1, and is to include, but not be limited to: concrete, reinforcing steel and formwork materials, installation of reinforcing steel, formwork installation, bracing, and concreting operations.

5.0 CONDITIONS OF USE

The ECO-Block Insulated Concrete Forms (ICFs) 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 ECO-Block's published installation instructions. If there is a conflict between the manufacturer's published installation instructions and this report, this report governs.
- 5.2 Forms are separated from the building interior as described in Section 4.3.1 of this report, except for crawl space construction as described in Section 4.3.2 of this report.
- 5.3 When use is as part of a fire-resistance-rated assembly, Section 4.8 of this report applies.
- 5.4 Except as described in Section 4.9 of this report, concrete walls formed by the forms are limited to combustible construction as defined in Chapter 6 of the IBC, BNBC, SBC or UBC, as applicable, and to construction in accordance with the IRC.
- 5.5 When use is in buildings required to be of noncombustible construction, as described in Section 4.9 of this report, the forms must have at least one label as described in Section 7.0 of this report visible in every 160 square feet (14.7 m²) of wall area.
- 5.6 When required by the code official, calculations showing compliance with the general design requirements of Chapter 16 of the IBC, BNBC or UBC must be submitted to the code official for approval, except calculations are not required when the building design is based on Section 4.1.2 or Section 4.1.3 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.
- 5.7 Concrete quality, mixing and placement must comply with IBC Section 1905, IRC Section R611.6.1, UBC

Section 1905, Chapter 5 of ACI 318-95 (BNBC) or SBC Section 1916.6.1, as applicable.

5.8 Special inspection must be provided in accordance with Section 4.10 of this report.

5.9 Form units are manufactured by the manufacturers noted in Table 1 of this report, under a quality control program with inspections by Intertek Testing Services NA, Ltd. (AA-688).

6.0 EVIDENCE SUBMITTED

6.1 Data in accordance with the ICC-ES Acceptance Criteria for Foam Plastic Insulation (AC12), dated February 2007, including data in accordance with Section 3.3.2.2; reports of tests in accordance with ASTM C 578; reports of comparative crawl space fire tests; and a report of a room corner fire test in accordance with UBC Standard 26-3.

6.2 Data in accordance with the ICC-ES Acceptance Criteria for Concrete Floor, Roof and Wall Systems and Concrete Masonry Wall Systems (AC15), dated June 2007.

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

6.4 Reports of fastener withdrawal and lateral load tests.

7.0 IDENTIFICATION

Both faces of the ICF forms are labeled such that a label will be visible every 160 square feet (14.9 m²) of wall area. The labels include the product name (ECO-Block Standard or ECO-Block 24-inch); the ECO-Block, LLC, name, address and telephone number; the evaluation report number (ESR-1182); the manufacturing date; the shift number; the molder's location identifier; and the name of the inspection agency (Intertek Testing Services NA, Ltd.). See Table 1 of this report for molder's location identifier and recognized product name(s).

Plastic web connectors and splice connectors are provided in boxes that are marked with the connector manufacturing date and lot number. Also, web connectors and splice connectors are molded with the word "eco", as follows:



TABLE 1—ICF PRODUCT AND MANUFACTURER INFORMATION

ICF PRODUCT NAME	MOLDER	MOLDER'S ADDRESS	MOLDER'S LOCATION IDENTIFIER
Standard 24-inch	ACH Foam Technologies	4001 Kaw Street Kansas City, Kansas 66102	D
Standard 24-inch			
Standard 24-inch	Foam Molders, Inc.	9456 N. McGuire Road Post Falls, Idaho 83854	G
Standard 24-inch			
Standard 24-inch	Lifoam Industries	17 Douglas Street Rome, Georgia 30161	E
Standard 24-inch			
Standard 24-inch	Marko Foam Products	2990 W. Directors Row Salt Lake City, Utah 84104	C
Standard 24-inch			
Standard 24-inch	Polyfoam Corporation	2355 Providence Road Northbridge, Massachusetts 01534	H
Standard 24-inch			
Standard 24-inch	Polymos, Inc.	150, 5e Boulevard Terrasse-Vaudreuil Quebec, Canada J7V 5M3	B
Standard 24-inch			
Standard	Tegrant Corporation	1830 Rockdale Industrial Boulevard Conyers, Georgia 30012	F

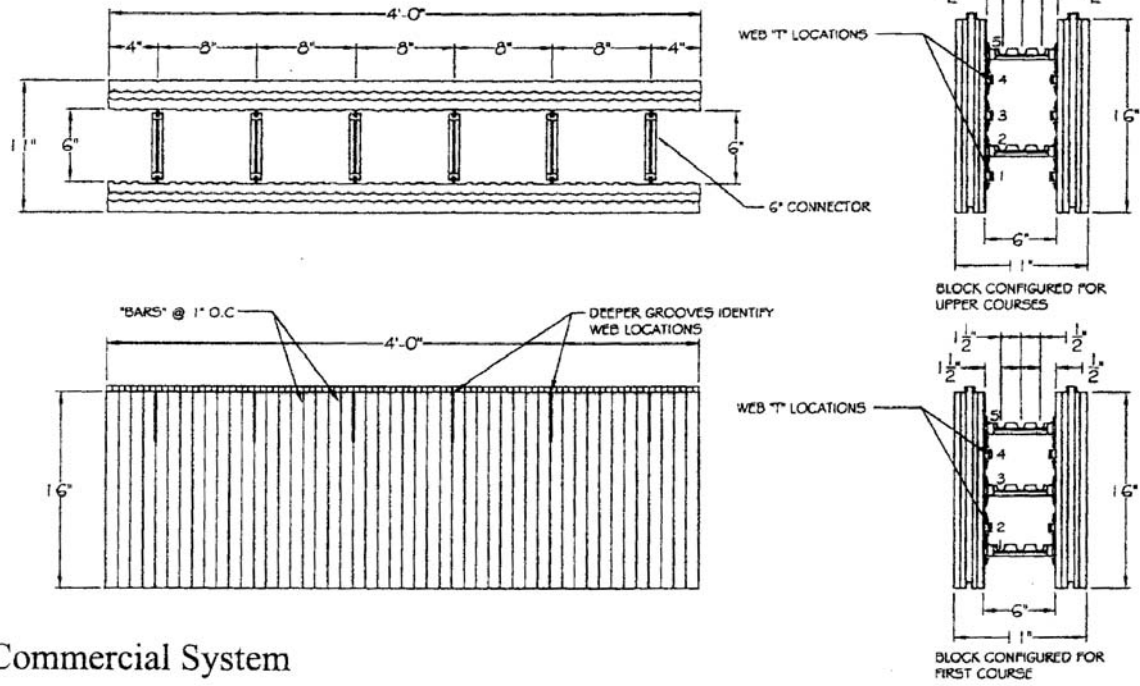
TABLE 2—ALLOWABLE WITHDRAWAL AND LATERAL CAPACITIES OF FASTENERS IN PLASTIC WEB FLANGES¹

FASTENER	ALLOWABLE CAPACITY (pounds)	
	Lateral	Withdrawal
No. 6, coarse-thread (single thread) gypsum wallboard screw	50	30
No. 8, fine-thread gypsum wallboard screw	95	35
No. 10 wood screw	110	40
No. 16 gage staple (1/2-inch crown width)	25	5
No. 10, Type S dual-thread Rock-on Hi-Lo screw	80	55

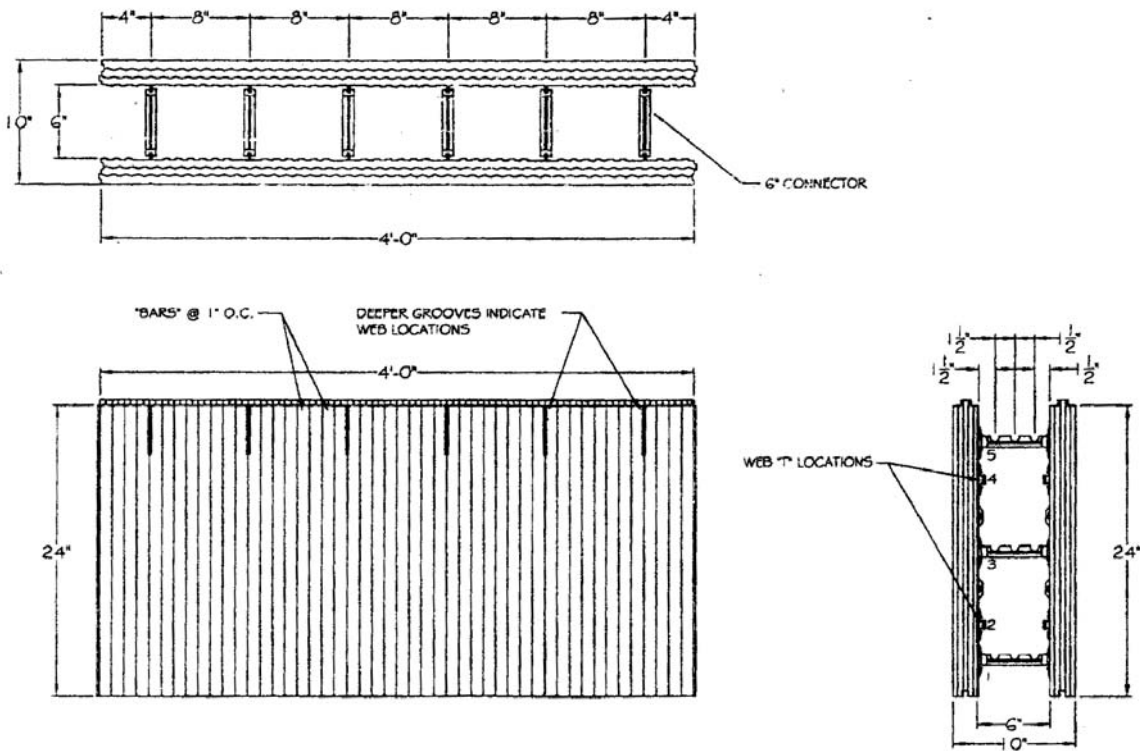
For SI: 1 pound = 4.45 N; 1 inch = 25.4 mm.

¹Fasteners must be corrosion-resistant and have sufficient length to penetrate through the web flange at least 1/4 inch (6 mm).

Standard System

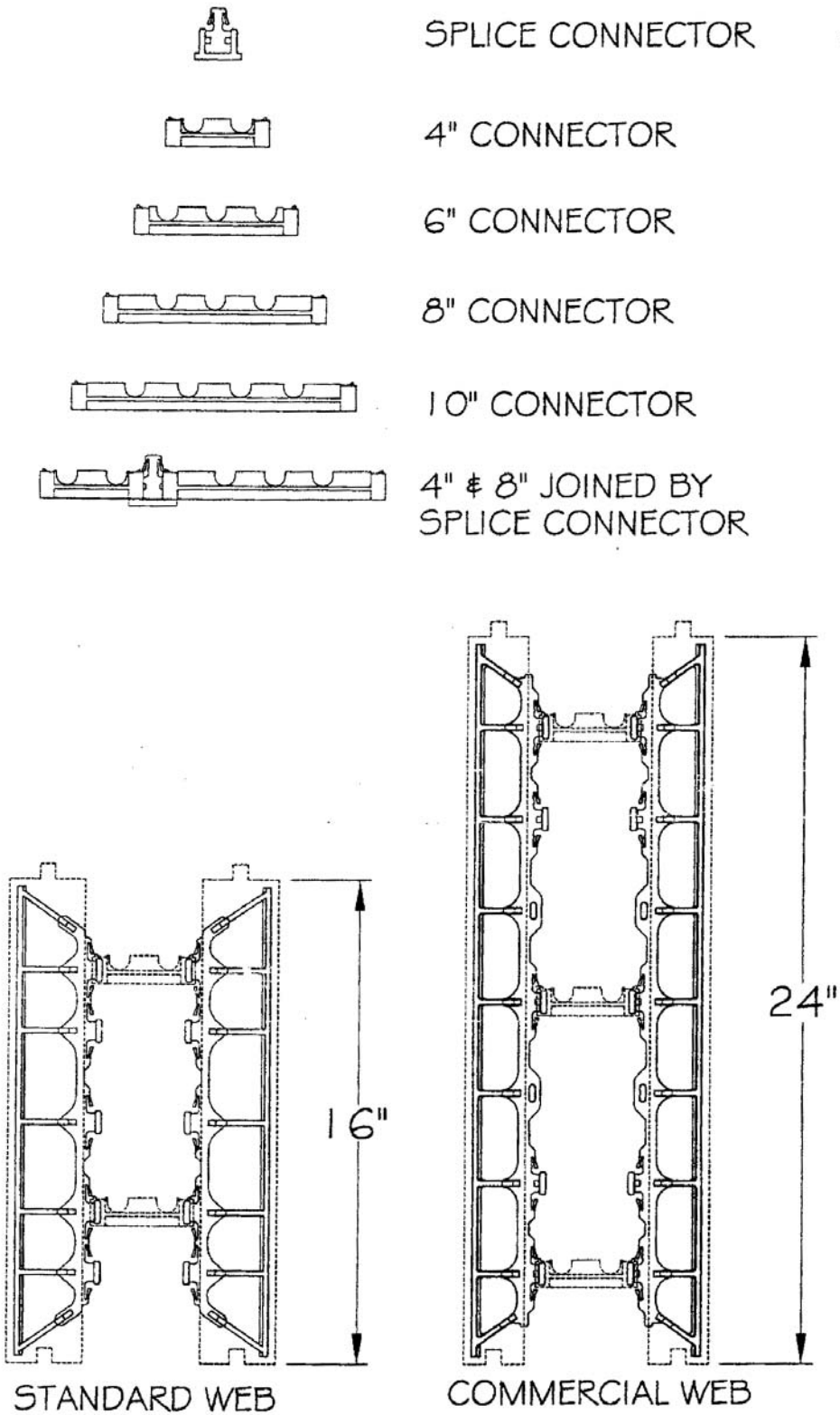


Commercial System



For SI: 1 inch = 25.4 mm.

FIGURE 1—ECO-BLOCK DESCRIPTIONS



For SI: 1 inch = 25.4 mm.

FIGURE 1—ECO-BLOCK DESCRIPTIONS (Continued)

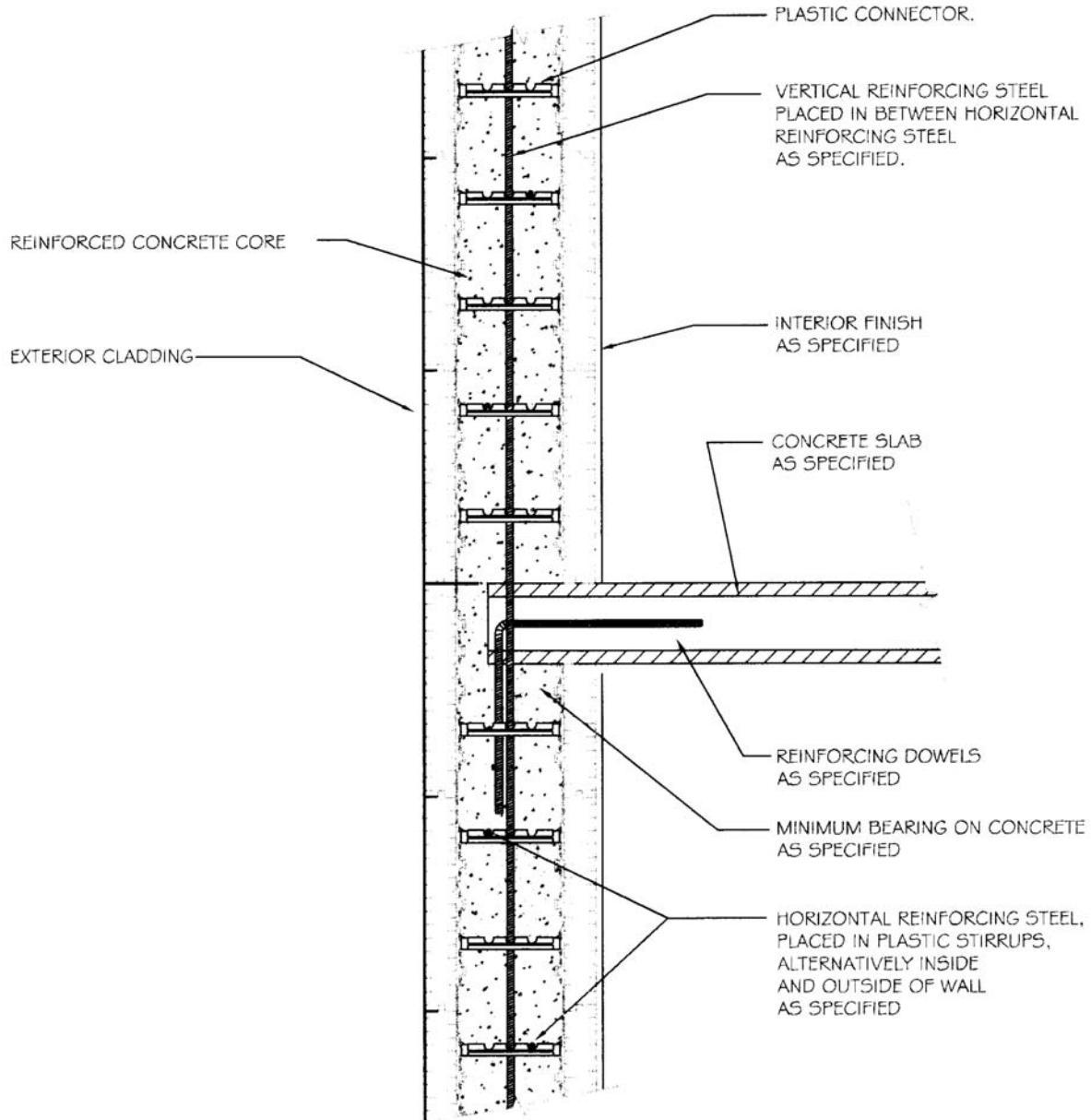


FIGURE 2—TYPICAL WALL-TO-FLOOR INTERSECTION FOR TYPES I, II, III AND IV CONSTRUCTION (IBC), AND NONCOMBUSTIBLE CONSTRUCTION (UBC, BNBC AND SBC)