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Code Compliance Research Report CCRR-1010

Re-Issue Date: 01-01-2016

Renewal Date: 01-01-2017

DIVISION: 03 00 00—CONCRETE
Section: 03 11 19—Insulating Concrete Forming

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REPORT SUBJECT:
Fox Block Insulating Concrete Forms (ICFs)

1.0 SCOPE OF EVALUATION

This Research Report addresses compliance with the following Codes:

- 2015, 2012, 2009 and 2006 *International Building Code® (IBC)*
- 2015, 2012, 2009 and 2006 *International Residential Code® (IRC)*

NOTE: This report references 2015 Code sections with [2012, 2009 and 2006] Code sections shown in square brackets where they differ.

The Fox Block ICF system has been evaluated for the following properties:

- Physical properties
- Surface-burning characteristics
- Attic and crawl space fire evaluation
- Fire-resistance-rated construction
- Exterior walls in Types I, II, III and IV construction

See Table 1 for applicable Code sections related to these properties.

2.0 USES

Fox Block insulation concrete forms (ICFs) are used as stay-in-place formwork for structural concrete load-bearing and non-load-bearing exterior and interior walls, concrete beams, lintels, foundation walls, and retaining walls. The forms may be installed in attics and crawl spaces without a covering on the interior side when installed in accordance with Section 4.3.2. The forms may be used in fire-resistance-rated construction, provided installation is in accordance with Section 4.8. The forms may be used in Types I, II, III or IV (noncombustible) construction provided installation is in accordance with Section 4.9.

3.0 DESCRIPTION

3.1 General: The Fox Block ICFs consist of two 2.625 inch thick (67 mm) expanded polystyrene (EPS) foam plastic panels, separated by injection-molded polypropylene plastic

cross-ties that are partially embedded into the EPS panels. The cross-ties maintain the EPS panel facings at a clear distance of 4 inches (102 mm), 6 inches (152 mm), 8 inches (203 mm), 10 inches (254 mm), or 12 inches (305 mm). The Fox Block ICF system complies with ASTM E2634 and is a flat ICF system as defined in IRC Section R611.3. In addition to straight forms, 45-degree angle, 90-degree corner, corbel ledge, taper top, T-block, and 6 inch radius forms are also available. See Figure 1 for an illustration of the forms.

3.2 Foam Plastic Panels:

The EPS foam plastic panels have a nominal density of 1.5 pcf (23.2 kg/m³), a flame-spread index of 25 or less and a smoke-developed index of 450 or less when tested in accordance with ASTM E84. The foam plastic complies with Type II requirements when tested in accordance with ASTM C578.

3.3 Cross-ties:

The polypropylene cross-ties are spaced 8 inches (203 mm) on center and connect the EPS panels at a fixed clear distance. The cross-ties consist of a flange that is embedded in the foam plastic panel during the molding process, and a web that connects the two flanges. The cross-ties have openings to permit concrete placement, and have slots to support horizontal steel reinforcing bars. The plastic flange, which is recessed 0.625 inches (15.9 mm) below the outer EPS surface, is used to attach exterior and interior finish materials. The flange is 1.5 inches (38.1 mm) wide by 16 inches (406 mm) high by 0.23 inch (5.8 mm) thick.

3.4 Concrete:

Concrete must be normal-weight concrete complying with the IBC, with a maximum 3/4 inch (19 mm) aggregate size. Concrete must have a minimum compressive strength of 3000 psi (21 MPa) at 28 days. Under the IRC, concrete must comply with IRC Sections R404.1 [2006 – R404.4.5] (foundation walls and retaining walls) and R608.5.1 [2012, 2009 - R611.5.1] [2006 – R611.6.1] (walls), as applicable.

3.5 Reinforcement:

Deformed steel reinforcement bars must have a minimum yield stress of either 40 ksi (276 MPa) or 60 ksi (413 MPa), depending on the structural design. Under the IBC, the deformed steel bars must comply with Section 3.5.3.1 of ACI 318 and IBC Section 1903. If construction is based on the IRC, reinforcement must comply with IRC Sections F404.1.3.3.7 [2012, 2009 - R404.1.2.3.7] [2006 – R404.4.6] (foundation walls and retaining walls) and R608.5.2 [2012, 2009 - R611.5.2] [2006 – R611.6.2] (walls).



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3.6 Additional Standards:

The Fox Block ICFs conform to the standard requirements of CAN/ULC S717.1-12 "Standard for Flat Wall Insulating Concrete Forming (ICF) Units" and ASTM E2634-11 "Standard Specification for Flat Wall Insulating Concrete Form (ICF) Systems". See Intertek listing "[Fox Block Insulating Concrete Forms \(Fox Block ICFs\)](#)".

4.0 INSTALLATION

4.1 General:

Design and installation of the Fox Block ICFs must comply with this report, the applicable Code, and the manufacturer's published installation instructions, which must be available on the jobsite during installation.

4.2 Design:

4.2.1 IBC Method: Solid concrete walls must be designed and constructed in accordance with IBC Chapter 16 and 19, as applicable. Footings and foundations must be designed in accordance with IBC Chapter 18.

4.2.2 Alternative IBC Wind Design Method: Solid concrete walls may be designed and constructed in accordance with the provisions of Section 209 of ICC 600, subject to the limitations found in IBC Section 1609.1.1.1 in accordance with Exception 1 to Section 1609.1.1.1. Design and construction under the provisions of ICC 600 are limited to resisting wind forces.

4.2.3 IRC Method: Solid concrete walls, footings and foundations must be designed in accordance with IRC Sections R608 [2012, 2009 and 200 - R611] and R404.1.3 [2012, 2009 - R404.1.2] [2006 - R404.4], as applicable for flat wall systems.

4.2.4 Alternative IRC Methods: When used to construct buildings that do not conform to the applicability limits of IRC Sections R404.1.3 [2012, 2009 - R404.1.2] [2006 - R404.4.1] and R608 [2012, 2009 and 2006 - R611.2], construction must be in accordance with the prescriptive provisions of the 2007 Prescriptive Design of Exterior Concrete Walls (PCA 100), or the structural analysis and design of the concrete must be in accordance with ACI 318, ACI 332 and IBC Chapters 16, 18 and 19. For jurisdictions adopting the 2006 IBC the structural analysis and design of the concrete must be in accordance with ACI 318 and IBC Chapter 19 as applicable.

4.3 Interior Finish:

4.3.1 General: ICF units exposed to the building interior must be finished with an approved 15-minute thermal barrier, such as minimum 1/2 inch thick (12.7 mm) regular gypsum wallboard complying with ASTM C1396, installed horizontally or vertically, and attached to the cross-tie flanges with minimum 1-1/2 inch long (38.1 mm), No. 6, Type S, fine-thread gypsum board screws spaced a maximum of 12 inches (305 mm) on center vertically and 16 inches (406

mm) on center horizontally. The screws must penetrate a minimum of 1/4 inch (6.4 mm) through the flange. Gypsum board joints and screw heads must be taped and finished with joint compound in accordance with ASTM C840 or GA216. See Section 4.3.2 for installation details for crawl space applications without an ignition barrier on the interior face.

4.3.2 Attic and Crawl Space Installations: When the ICFs are used for walls of attic or crawl spaces, an ignition barrier complying with IBC Section 2603.4.1.6, or IRC Sections R316.5.3 or R316.5.4, is required, except when all of the following conditions are met:

- Entry to the attic or crawl space is only to service utilities, and no storage is permitted.
- There are no interconnected attic or basement areas.
- Air in the attic or crawl space is not circulated to other parts of the building.
- Under-floor (crawl space) ventilation is provided that complies with IBC Section 1203.4 [2012, 2009 and 2006 - 1203.3] or IRC Section R408.1, as applicable.
- Attic ventilation is provided when required by IBC Section 1203 or IRC Section R806, as applicable.
- Combustion air is provided in accordance with IMC (*International Mechanical Code*) Section 701 [2006 - 701 and 703].
- The ICFs must have at least one label as described in Section 7.0 visible in every 160 square feet (15 m²) of wall area.

4.4 Exterior Finish:

4.4.1 Above Grade: The exterior surface of the ICF must be covered with an approved wall covering in accordance with the applicable Code or a current evaluation report. When the wall covering is mechanically attached to structural members, the wall covering must be attached to the flanges of the embedded cross-ties with fasteners, described in Table 2, having sufficient length to penetrate through the flange a minimum of 1/4 inch (6.4 mm). The fasteners have an allowable fastener withdrawal and lateral shear strength as noted in Table 2.

The fastener spacing must be designed to support the gravity loads of the wall covering and to 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 and must not exceed the maximum withdrawal capacity of the fasteners listed in Table 2.

4.4.2 Below Grade: Materials used to dampproof or waterproof basement walls must be specified by Airlite Plastics Co., and must comply with the applicable Code or a current evaluation report. The material must be compatible with the ICF foam plastic units, and free of solvents that will adversely affect the EPS foam plastic panels. Dampproofing, waterproofing, and drainage requirements must comply with the applicable Code. No backfill may 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 ICF system may be used as a foundation stem wall when supporting wood-framed construction, provided the structure is supported on concrete footings complying with the applicable Code. For jurisdictions adopting the IRC, compliance with Section R404 [2006 – R404.4] is required. For jurisdictions adopting the 2006 IBC, compliance with Section 1805.5 is required.

4.6 Retaining Walls:

The ICF system may be used to construct retaining walls, with reinforcement designed in accordance with accepted engineering principles, Section 4.2 of this report and the applicable Code.

4.7 Protection Against Termites:

Where the probability of termite infestation is defined by the Code official as "very heavy", the foam plastic must be installed in accordance with IBC Section 2603.8 [2012 - 2603.9] or IRC Section R318.4, [2006 – R 320.5] as applicable. Areas of very heavy termite infestation must be determined in accordance with IBC Figure 2603.8 [2012 - 2603.9] or IRC Figure R301.2(6).

4.8 Fire-resistance-rated Construction:

The ICFs may be used to construct fire-resistance-rated wall assemblies as described in Intertek Design Listing FXB/ICF 240-01. See [Intertek listing](#) for current details.

4.9 Use in Buildings Required to be of Types I, II, III and IV Construction:

4.9.1 General: Exterior walls constructed with the ICFs for use in buildings required to be of Type I, II, III or IV construction must comply with the applicable conditions cited in Sections 4.9.2 through 4.9.4.

4.9.2 Interior Finish:

4.9.2.1 Buildings of Any Height: The ICFs must be finished on the interior with an approved 15-minute thermal barrier, such as 1/2 inch thick (12.7 mm) gypsum board, as required by the IBC. The gypsum board must be installed and attached as described in Section 4.3.1.

4.9.2.2 Alternate Interior Finish for One-story Buildings:

For one-story buildings, the interior finish may be in accordance with IBC Section 2603.4.1.4, provided all the conditions in that section are met.

4.9.3 Exterior Finish:

4.9.3.1 Buildings of Any Height: The ICFs must be finished on the exterior with materials described in Sections 4.9.3.1.1, 4.9.3.1.2 and 4.9.3.1.3. The ICFs must have at

least one label as described in Section 7.0 visible in every 160 square feet (15 m²) of wall area prior to applying the wall covering.

4.9.3.1.1 Exterior Finish – EIFS and One-coat Stucco:

EIFS and one-coat stucco wall coverings may be applied over the ICF, provided the wall covering system is recognized in a current evaluation report and is recognized for use in Types I, II, III and IV construction. The wall covering system must be installed in accordance with the respective evaluation report and the maximum mass per wall surface area [lbs/ft² (kg/m²)] qualified in the wall covering evaluation report must be greater than 0.361 lbs/ft² (1.76 kg/m²) (which is the max-tolerance mass of the EPS panel on the exterior side of the concrete wall). Acceptable EIFS wall coverings include the following:

- BASF Corporation Acrocrete Acrowall-ES EIFS as described in ESR-2164;
- BASF Corporation Finestone Pebbletex EIFS as described in ESR-2165;
- Sto Corp. StoTherm Essence as described in ESR-1720.

4.9.3.1.2 Exterior Plaster: 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 cross-ties with fasteners described in Section 4.4.1.

4.9.3.1.3 Exterior Finish – Brick Veneer: Anchored brick veneer must be attached to the flanges of the cross-ties with fasteners as described in Section 4.4.1. The 4 inch thick (102 mm) brick veneer must comply with the IBC and must be installed with a minimum 1 inch (25.4 mm) air gap between the face of the exterior EPS panel and the brick. The brick must be installed with a steel shelf angle attached to the concrete and installed at each floor line and at the top of each window and door opening.

4.9.4 Fireblocking: Foam plastic on the interior side of exterior walls and on both sides of interior walls must be discontinuous at floor lines. The intersections must be constructed to prevent the passage of flame, smoke and hot gases from one floor to another.

4.10 Special Inspection:

4.10.1 IBC: Special inspection is required as noted in IBC Section 1705 [1704] for placement of reinforcing steel and concrete, and for concrete cylinder testing. When an EIFS wall covering is applied, special inspection in accordance with IBC Sections 1704.1 [2012 - 1704] and 1705.16 [2012 – 1705.15] [2009 and 2006 – 1704.14, 1704.12] is required.

4.10.2 IRC: For walls designed in accordance with Section 4.2.3 or PCA 100 (Section 4.2.4), special inspection is not required. When walls are designed in accordance with the IBC, as described in Section 4.2.4, special inspection is required as described in Section 4.8.1.

5.0 CONDITIONS OF USE

The Fox Block Insulating Concrete Forms described in this

Research Report comply with, or are a suitable alternative to, what is specified in those Codes listed in Sections 1.0 and 2.0 of this report, subject to the following conditions:

5.1 The ICFs must be manufactured, identified, and installed in accordance with this Research Report, the manufacturer's published installation instructions and the applicable Code. The provisions in this report take precedence over the provisions in the manufacturer's instructions.

5.2 When required by the Code official, calculations showing compliance with the general design requirements of the applicable Code must be submitted to the building official for approval, except where calculations are not required under IRC Section R608.1 [2012, 2009, 2006 - R611.1]. 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.

5.3 When required by the Code official, calculations and details showing compliance with IRC Section R08.5.3 [2012, 2009, 2006 - R611.5.3] and R404.1.3.3.6 [2012, 2009, 2006 - R404.1.2.3.6] must be submitted, establishing that the ICFs provide sufficient strength to contain concrete during placement and the cross-ties are capable of resisting the forces created by fluid pressure of fresh concrete. The calculations and details must be prepared by registered design professional where required by the statutes of the jurisdiction in which the project is to be constructed.

5.4 The ICFs must be separated from the building interior with an approved 15-minute thermal barrier, except for attic and crawl space construction as described in Section 4.3.2.

5.5 The plastic cross-ties must be stored indoors away from direct sunlight.

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

5.7 The forms are manufactured by Airlite Plastics Co. in Omaha, NE; Post Falls, ID; Jerome ID; Colorado Springs, CO; McFarland, CA; Phoenix, AZ; Orlando, FL; Cherryville, NC; Anchorage, AK; Northbridge MA; Starbuck, MB; Becker, MN; Cap-Pelé, NB; Vaudreuil-Dorion, QC; Keller, TX; Nazareth, PA; Nixa, MO; Elkhart, IN; and Decatur, AL, and are produced under a quality control program with inspections conducted by Intertek Testing Services NA Inc. (AA-647).

6.0 SUPPORTING EVIDENCE

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 2012.

6.2 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), editorially revised October 2013.

6.3 Data in accordance with ASTM E2634-11.

6.4 Intertek Listing Report "[Fox Block Insulating Concrete Forms \(Fox Block ICFs\)](#)".

7.0 IDENTIFICATION

The Fox Block forms are identified by a marking bearing the report holder's name (Airlite Plastics Co.), the product name, the manufacturing location, the serial number, the Intertek Mark, and the Code Compliance Research Report number CCRR-1010 (formerly IRR-1010).

When use in an attic or crawl space without an ignition barrier, as described in Section 4.2.2.2, one label bearing the evaluation report number and the phrase "Acceptable for use in attics and crawl spaces" must be visible in every 160 square feet (15 m²) of exposed exterior wall area.

When use is in buildings required to be of Type I, II, III or IV construction, one label must be visible in every 160 square feet (15 m²) of wall area.

8.0 OTHER CODES

This section is not applicable.

9.0 CODE COMPLIANCE RESEARCH REPORT USE

9.1 Approval of building products and/or materials can only be granted by a building official having legal authority in the specific jurisdiction where approval is sought.

9.2 Code Compliance Research Reports shall not be used in any manner that implies an endorsement of the product by Intertek.

9.3 Reference to the [Intertek Directory of Listed Products](#) is recommended to ascertain the current version and status of this report.

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TABLE 1 – PROPERTIES EVALUATED

PROPERTY	IBC SECTION	IRC SECTION
Physical properties	NA	R404.1.2.3.6.1 [NA] and R611.4.4 [2015 – R608.4.4] [2009 and 2006 - R611.3]
Surface Burning Characteristics	2603.4 [2012, 2009, 2006 - 2603.3]	R316.3 [R316.1]
Attic and crawl space applications	2603.4.1.6 and 2603.9 [2012, 2009 and 206 - – 2603.9]	R316.5.3, R316.5.4 [316.1] and R316.6
Fire Resistance	703.2	R302.1
Exterior walls in Types I – IV construction	2603.5	NA

TABLE 2 – ALLOWABLE WITHDRAWAL AND LATERAL CAPACITIES OF FASTENERS IN CROSS-TIE FLANGES

FASTENER ¹	ALLOWABLE LOAD CAPACITY (lbf)	
	Lateral	Withdrawal
2 ¹ / ₂ -inch-long, No.10 wood screw	68	38
1 ⁵ / ₈ -inch-long, No. 6 coarse-thread drywall screw	45	29
1 ⁵ / ₈ -inch-long, No. 6 fine-thread drywall screw	37	32
2-inch-long, 0.098-inch-diameter ring shank drywall nail	19	16
2-inch-long, No. 8 saw tooth-thread exterior deck screw	71	36

For SI: 1 lb = 4.45 N, 1 inch = 25.4 mm

¹Fasteners must be of sufficient length to penetrate through the flange a minimum of ¼ inch

TABLE 3 – LIMITED LOADBEARING FIRE-RESISTANCE-RATED WALL ASSEMBLIES

CONCRETE THICKNESS (inches)	FIRE-RESISTANCE-RATING (hours)
4	2
6	3
8	4

For SI: 1 inch = 25.4 mm

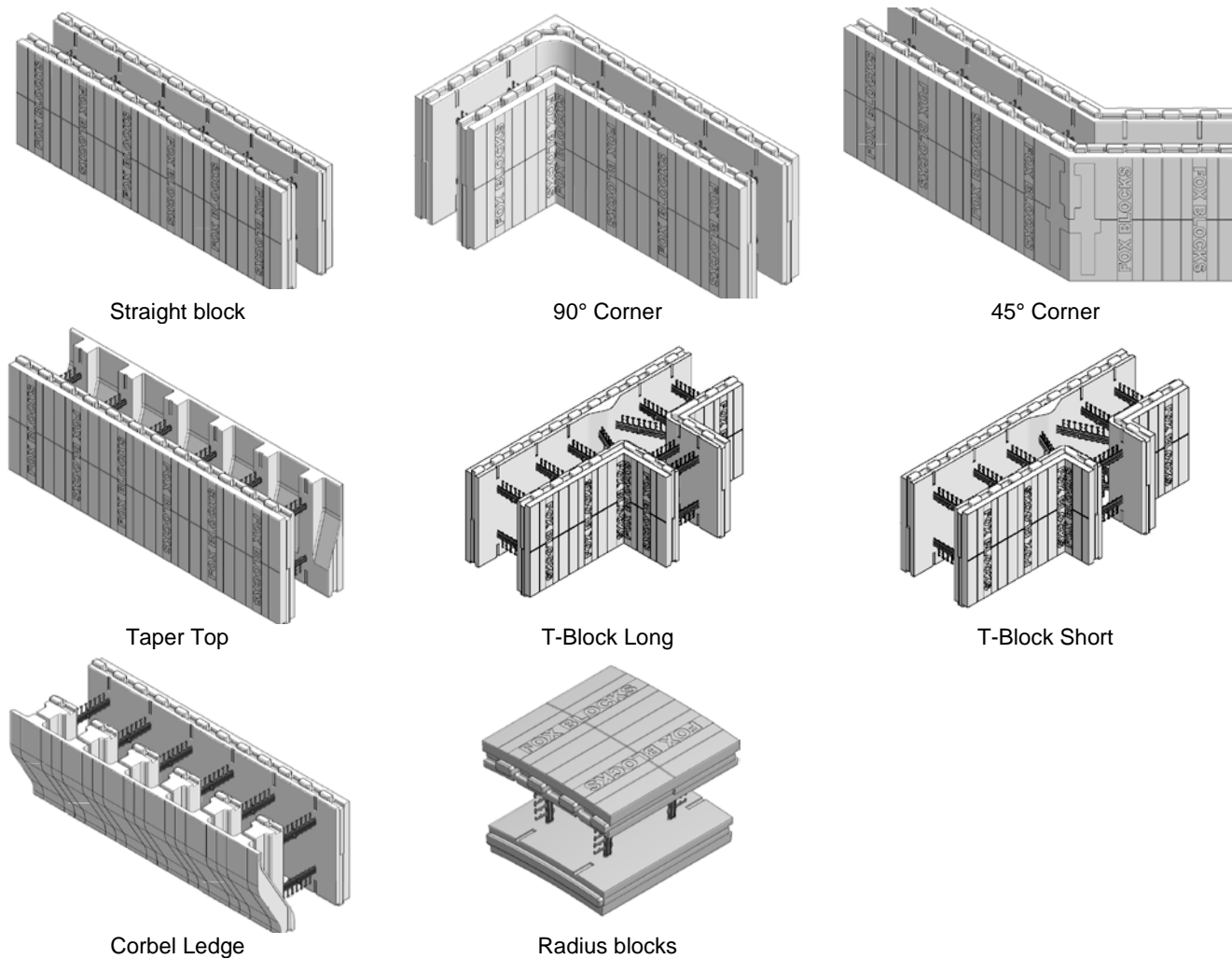


Figure 1 – FOX BLOCK ICF SYSTEM TYPE ILLUSTRATIONS

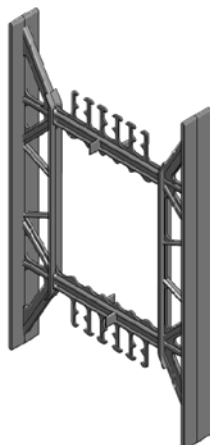


Figure 2 – Fox Block ICF System Web Connector

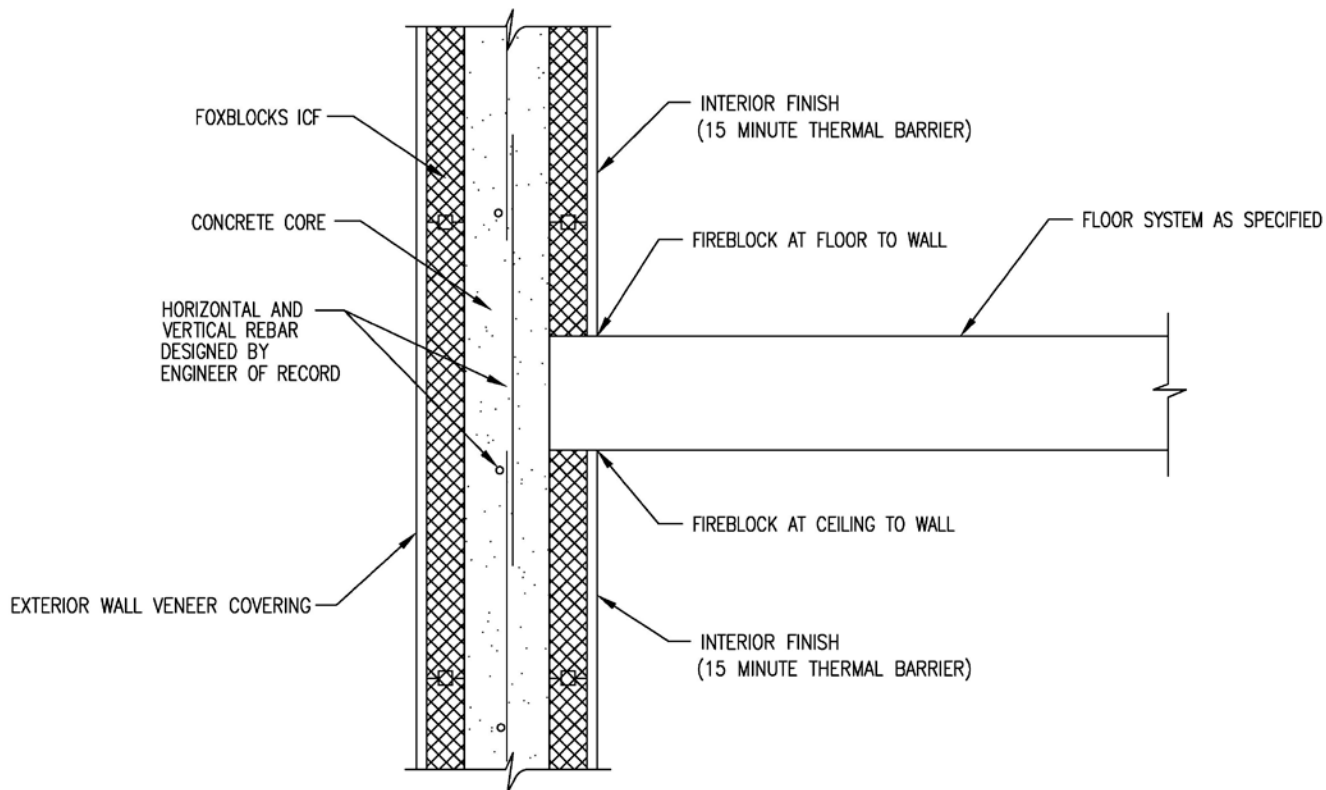


Figure 3 – Typical Wall-to-Floor Intersection for Types I, II, III and IV Construction