Evaluation Report CCMC 12935-R
FOAMULAR® CodeBord® Air Barrier System (CABS)

MasterFormat:	07 27 09.01
Evaluation issued:	2000-01-24
Re-evaluated:	2018-07-06

1. Opinion

It is the opinion of the Canadian Construction Materials Centre (CCMC) that "FOAMULAR® CodeBord® Air Barrier System (CABS)," when used as an air barrier system for exterior walls of buildings in accordance with the conditions and limitations stated in Section 3 of this Report, complies with the National Building Code (NBC) of Canada 2015:

- Clause 1.2.1.1(1)(a) of Division A, as an acceptable solution from Division B:
  - Article 5.1.4.1., Structural and Environmental Loads
  - Article 5.1.4.2., Resistance to Deterioration
  - Subsection 5.2.2., Structural Loads and Design Procedures
  - Subsection 5.4.1., Air Barrier Systems
  - Article 9.25.3.1., Required Barrier to Air Leakage (exterior walls only)
  - Sentence 9.25.3.2.(1), Air Barrier System Properties (effective barrier to air infiltration and exfiltration)
  - Article 9.25.3.3., Continuity of the Air Barrier System (exterior walls only)
  - Clause 9.27.4.2.(2)(b), Materials (ASTM C 920-14, "Elastomeric Joint Sealants")
- Clause 1.2.1.1.(1)(b) of Division A, as an alternative solution that achieves at least the minimum level of performance required by Division B in the areas defined by the objectives and functional statements attributed to the following applicable acceptable solutions:
  - Sentence 9.25.3.2.(2), Air Barrier System Properties (alternative to 6-mil polyethylene air barrier)

Ruling No. 09-39-237 (12935-R) authorizing the use of this product in Ontario, subject to the terms and conditions contained in the Ruling, was made by the Minister of Municipal Affairs and Housing on 2009-12-30 (revised on 2017-03-31) pursuant to s.29 of the *Building Code Act*, 1992 (see Ruling for terms and conditions). This Ruling is subject to periodic revisions and updates.

2. Description

This report addresses the performance of the product as an air barrier system as specified by Owens Corning. The product consists of the following components and accessories (see Figure 1) providing the following functions:

- Plane of airtightness:

  "FOAMULAR® CodeBord®" extruded polystyrene (XPS), Type 3 (see CCMC 13431-L) as the principal material in the plane of airtightness. **Please note that this evaluated air barrier system is achieved without a sealed polyethylene vapour barrier on the interior side of wall assembly.**

- Continuity:

  Accessories for continuity include two approaches:

  For Original "CABS":

  - "FoamSealR™," a foamed polyethylene sealing gasket installed behind all (i.e., vertical and horizontal) "FOAMULAR® CodeBord®" XPS panel joints, and also at XPS panel termination points around penetrations such as around windows and doors;

  For Hybrid "CABS":

  - "FoamSealR™," a foamed polyethylene sealing gasket installed behind "FOAMULAR® CodeBord®" XPS horizontal joints at the perimeter of the uppermost top plate (i.e., top floor) and the bottom of the lowermost floor perimeter (i.e., along header) only, and around windows and doors;
  - CCMC-evaluated "Owens Corning (OC) JointSealR® Foam Joint Tape" (CCMC 14003-R) to seal horizontal and vertical joints of the XPS panels; and
  - CCMC-evaluated "OC FlashSealR® Foam Flashing Tape" (CCMC 14003-R) to seal around window and door openings, in lieu of "FoamSealR™," foam gaskets. A combination of specified gasket and tape can also be used as per the manufacturer's details.

  For both Original and Hybrid "CABS":

  - sealant foam that is a one-component, spray-in-place polyurethane evaluated by CCMC (see CCMC 13074-L) or meeting CAN/ULC-S710.1-05, "Standard for Thermal Insulation – Bead-Applied One Component Polyurethane Air Sealant Foam, Part 1: Material Specification," and CAN/ULC-S710.2-05, "Standard for Thermal Insulation – Bead-Applied One Component Polyurethane Air Sealant Foam, Part 2: Installation." The sealant must have qualified for sealing the two relevant contact surfaces around penetrations to be sealed, covering vinyl and wood as a minimum (i.e., for sealing wood rough opening and vinyl windows), but preferably also XPS and galvanized metal;
  - 4-mil polyethylene as the designated 'vapour barrier' only (i.e., unsealed joints), compliant with Subsection 9.25.4., Vapour Barriers, of Division B of the NBC 2015;
  - 6-mil polyethylene air/vapour barrier conforming to CAN/CGSB-51.34-M86, "Vapour Barrier, Polyethylene Sheet for Use in Building Construction," installed at ceiling locations and on the interior where specified in the "CABS" for the continuity of the plane of airtightness; and
  - specified caulking sealants conforming to CAN/CGSB-19.0-M77, "Methods of Testing Putty, Caulking and Sealing Compounds."

- Strength:

  Specified XPS thickness, stud spacing, cap nails and nailing schedule to provide the strength to resist wind loads in low-rise buildings achieved by fastening the "CABS" to the supporting structure.

- Installation:

  To be installed by Owens Corning-trained installers following detailed air barrier system fabrication site details.

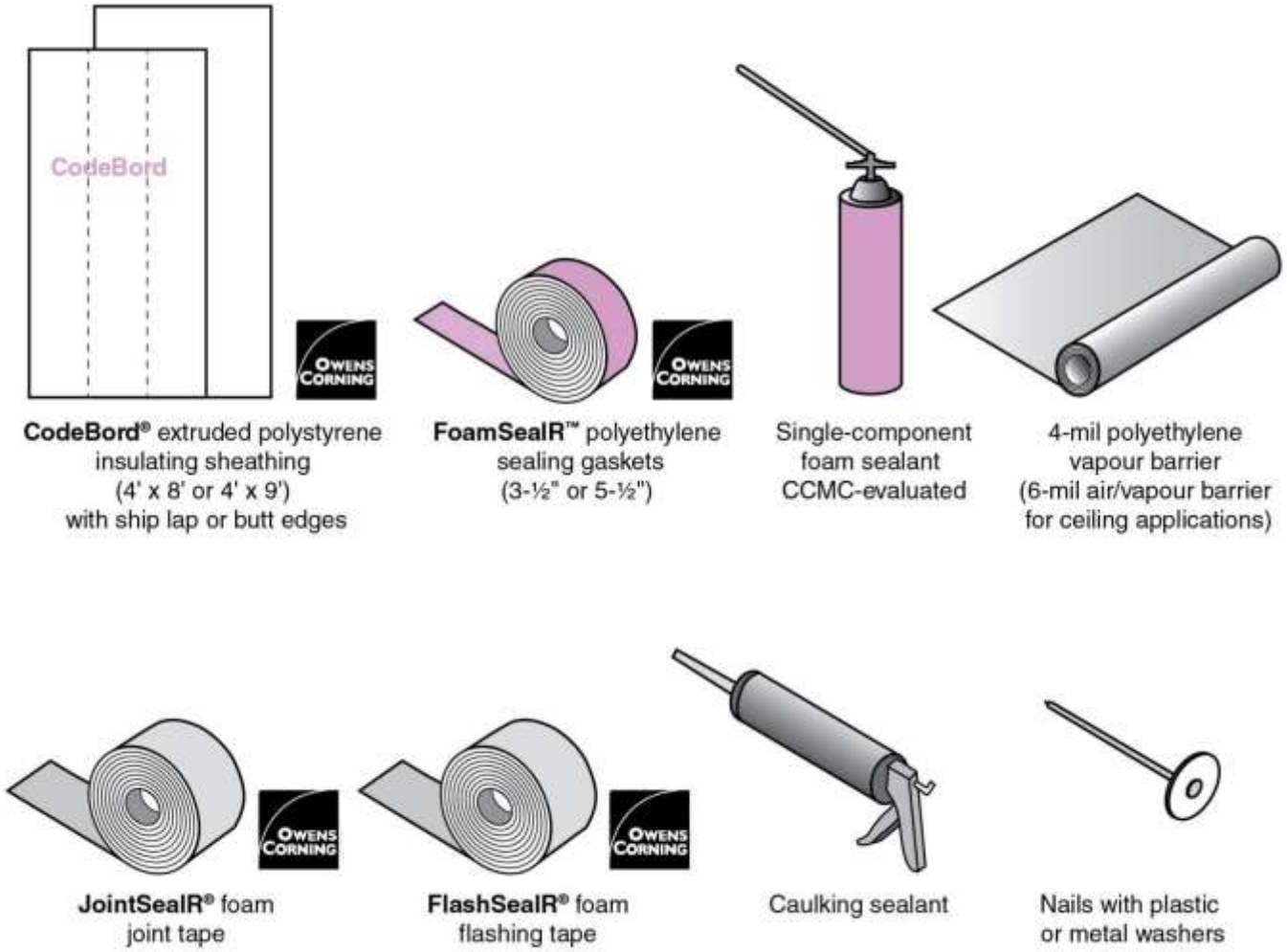

Figure 1. Components and accessories used for the in-field installation of the product

3. Conditions and Limitations

CCMC's compliance opinion in Section 1 is bound by the "FOAMULAR® CodeBord® Air Barrier System (CABS)" being used in accordance with the conditions and limitations set out below.

- The two (2) "CABS" systems have demonstrated sufficiently low air permeance in accordance with NBC 2015 for buildings with an indoor environment of 20°C and winter design relative humidity (RH) of 35% or less (see Table 4.1.1).
- The **Hybrid "CABS"** has demonstrated sufficient strength to resist wind loads and to be used in low-rise buildings in geographical locations:
  - where the wind pressure $Q_{50} \leq 0.75$ kPa (1-in-50 year wind pressure return period found in Appendix C of the NBC 2015), for the 20-mm-thick XPS on studs at 400 mm (16 in.) o.c., for maximum building height of 20 m, and
  - where the wind pressure $Q_{50} \leq 0.55$ kPa, for the 25-mm-thick XPS on studs at 600 mm (24 in.) o.c., for a maximum building height of 12 m.
- The **Original "CABS"** has demonstrated sufficient strength to be used in low-rise buildings in geographical locations:
  - where the wind pressure $Q_{50} \leq 0.60$ kPa, for the 25-mm-thick XPS on studs at 400 mm (16 in.) o.c., for maximum building height of 12 m.
- In order to confirm air leakage control and strength in the field, the "CABS" must be installed:
  - with the minimum specified thickness for the respective stud spacing over wood-frame walls; and
  - installed in the field by Owens Corning-trained installers/contractors according to the Owens Corning "FOAMULAR® CodeBord® Air Barrier System (CABS)" installation manual, publication no.300494, dated 2011, which contains detailed construction drawings which must be followed for the original CABS and alternative details (Section 6-1), and also "FOAMULAR® CodeBord® Air Barrier System Installation Manual," pub. No. 300494A, dated 2016 for installation of the hybrid system (see Appendix A for examples).
- A copy of the installation instructions must be available on the job site at all times during the installation for review by building officials. All installers must present their identification card upon request by the building official.

4. Technical Evidence

The Report Holder has submitted technical documentation for CCMC's evaluation. Testing was conducted at laboratories recognized by CCMC. The corresponding technical evidence for this product is summarized below.

The product has demonstrated performance that meets the criteria of the CCMC Technical Guide. To qualify, a conforming air barrier system must:

i. have an acceptable low air leakage rate;
ii. be continuous;
iii. be durable;
iv. have sufficient strength to resist the anticipated air pressure load; and
v. be buildable in the field.

Table 4.1.1 Results of Testing of Air Leakage Rate of the Product After Wind Loading

Wood-Frame Walls		Requirement	Result
Original "CABS" (25-mm "FOAMULAR® CodeBord®" XPS with foam gaskets beneath XPS panel joints)	**Specimen no. 1 – opaque wall**	Air leakage rate[(1)] at 75 Pa ΔP ≤ 0.05 L/(s·m^2)	0.048 L/(s·m^2)[(3)]
	Specimen no. 2 – continuity at penetrations		
	Specimen no. 3 – continuity at foundation and brick straps		
Hybrid "CABS" (20-mm "FOAMULAR® CodeBord®" XPS(R4) with exterior taped seams)	**Specimen no. 1 – opaque wall**	Air leakage rate[(2)] at 75 Pa ΔP ≤ 0.05 L/(s·m^2)	0.042 L/(s·m^2)[(3)]
	Specimen no. 2 – continuity at penetrations, foundation, brick straps		
Hybrid "CABS" (25-mm "FOAMULAR® CodeBord®" XPS(R5) with exterior taped seams)	**Specimen no. 1 – opaque wall**	Air leakage rate[(1)] at 75 Pa ΔP ≤ 0.05 L/(s·m^2)	0.040 L/(s·m^2)[(3)]
	Specimen no. 2 – continuity at penetrations, foundation, brick straps		

Notes to Table 4.1.1:

(1) The air leakage rate of the specimens is determined after structural aging of the air barrier system. Aging of the air barrier system was conducted to qualify it for a design structural wind load of Q_{50} = 0.60 kPa (**Original "CABS"**) and Q_{50} = 0.55 kPa (**Hybrid "CABS"**), the Q_{50} being 1-in-50 year wind pressure return period from NBC climatic data in Appendix C. The air barrier system was subjected to a loading schedule involving one-hour sustained positive and negative pressure at the Q_{50} value (kPa), 2 000 cycles of positive and negative pressure set at 0.80 kPa, and a wind gust of positive and negative pressure set at 1.2 kPa. The air leakage rate was determined in accordance with ASTM E 1424-91(2008), "Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure and Temperature Differences Across the Specimen," at an air temperature of −20°C to verify any deformation causing leakage at low temperatures.

(2) The air leakage rate of the specimens is determined after structural aging of the air barrier system. Aging of the air barrier system was conducted to qualify it for a design structural wind load of Q_{50} = 0.75 kPa (NBC climatic data in Appendix C) for a 1-in-50 year return period. The air barrier system was subjected to a loading schedule involving one-hour sustained positive and negative pressure set at 0.75 kPa, 2 000 cycles of positive and negative pressure set at 1.210 kPa, and a wind gust of positive and negative pressure set at 1.810 kPa. The air leakage rate was determined in accordance with ASTM E 1424-91(2008) at an air temperature of −20°C to verify any deformation causing leakage at low temperatures.

(3) The air leakage performance results in a Classification A1 as per CAN/ULC-S742-11, "Standard for Air Barrier Assemblies – Specification." The air leakage rate criteria is based on the permissible air leakage rates shown in Table 4.1.2, which are considered to be in accordance with the NBC in regards to air barrier system performance and drying potential of the wall assembly

Table 4.1.2 Permissible Air Leakage Rates

Drying Potential Based on Water Vapour Permeance (WVP) of Outermost Layer of Wall Assembly (ng/Pa·s·m^2)	Maximum Permissible Air Leakage Rates (L/s·m^2) @ 75 Pa
15 < WVP[(1)] ≤ 60	0.05[(1)]
60 < WVP ≤ 170	0.10
170 < WVP ≤ 800	0.15
> 800	0.20

Note to Table 4.1.2:

(1) As the "FOAMULAR® CodeBord®" extruded polystyrene is less than 60 ng/(Pa·s·m^2) (for a 20-mm thickness, WVP = 50 ng/(Pa·s·m^2)), this air leakage requirement must be met. However, due to the reduction in the risk of condensation from the insulation value, the air leakage rate could be increased by 0.05 L/s·m^2 if the thermal resistance "FOAMULAR® CodeBord®" meets the requirements of Table 9.25.5.2., Ratio of Outboard to Inboard Thermal Resistance, of Division B of the NBC 2015.

Table 4.1.3 Results of Testing of Durability of Components of the Product

Component		Requirement	Result
Original "CABS"	**"FOAMULAR® CodeBord®"**	Air permeance before and after aging (ASTM D 726-84) < 10% increase	Passed[(1)]
		Thermal resistance after heat aging and weathering 90% retention	Passed
	"FoamSealR™" polyethylene sealing gasket	Oxidative induction time (OIT) ≥ 30 minutes	Passed
	proprietary spray-in-place foam sealant	Air leakage after aging ≤ 0.5 L/s at 75 Pa ΔP	Passed
	caulking sealant for protection from weather	Meets ASTM C 920-14	Not evaluated for durability of air leakage performance
Hybrid "CABS"	**"FOAMULAR® CodeBord®"**	Air permeance before and after aging as per ULC S741 aging (i.e., 28 cycles of UV exposure + heat aging 772 h at 50°C) < 10% increase	Passed
	"JointSealR® Foam Joint Tape"	See CCMC 14003-R	Passed
	"FlashSealR® Foam Flashing Tape"	See CCMC 14003-R	Passed

Note to Table 4.1.3:

(1) The results of the testing were deemed a pass when reviewing the performance of the control specimen and considering the error and bias of the test procedure.

Table 4.1.4 Wind Load Resistance for the Product

XPS Panel	Attachment Schedule	Wind Load Limit (Q_{50})	Deflection Beyond Framing (Max.)
20-mm "FOAMULAR® CodeBord®"	Nails with 25-mm (1-in.) diameter cap washers, at 150 mm (6 in.) o.c., into wood studs at 400 mm (16 in.) o.c.	$Q_{50} \leq 0.75$ kPa	22 mm
25-mm "FOAMULAR® CodeBord®"	Nails with 25-mm (1-in.) diameter cap washers, at 150 mm (6 in.) o.c., into wood studs 600 mm (24 in.) o.c.	$Q_{50} \leq 0.55$ kPa	11 mm

Report Holder

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Date modified:
2018-07-13

Appendix A – Additional Information

Figures 1 to 5 outline the specimens tested representing typical construction details to be reproduced in the field by OC-trained installers as part of the installation quality control of the "FOAMULAR® CodeBord® Air Barrier System (CABS)." See Owens Corning's installation manuals entitled "FOAMULAR® CodeBord® Air Barrier System" publication no. 300494, dated 2011 and "FOAMULAR® CodeBord® Air Barrier System Installation Manual" publication No. 300494A, dated 2016, for more complete details.

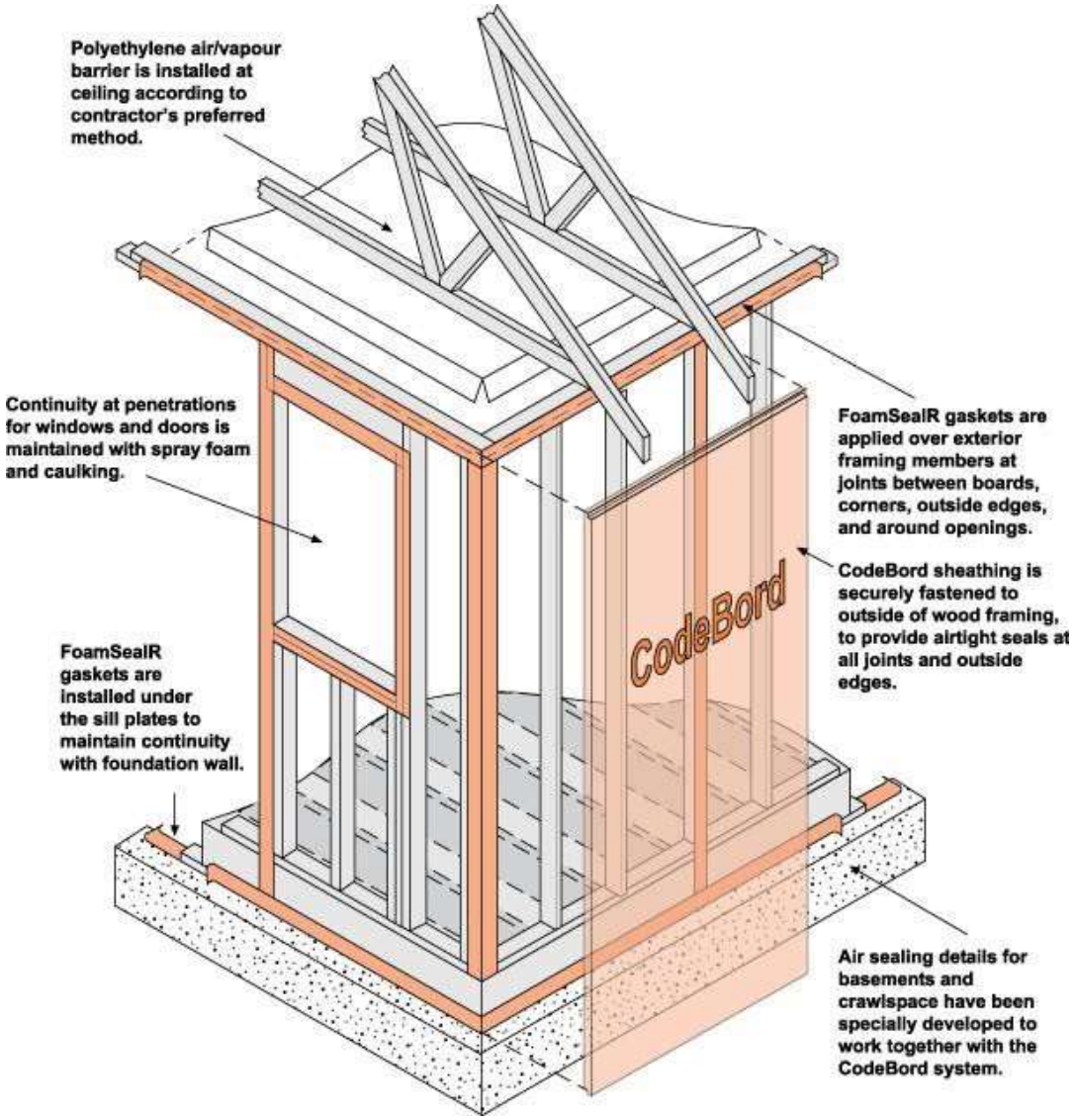


Figure 1. "FOAMULAR® CodeBord® Air Barrier System (CABS)" – Original "CABS"

Figure 2. "FOAMULAR® CodeBord® Air Barrier System (CABS)" – Hybrid "CABS" with exterior seam and flashing tape

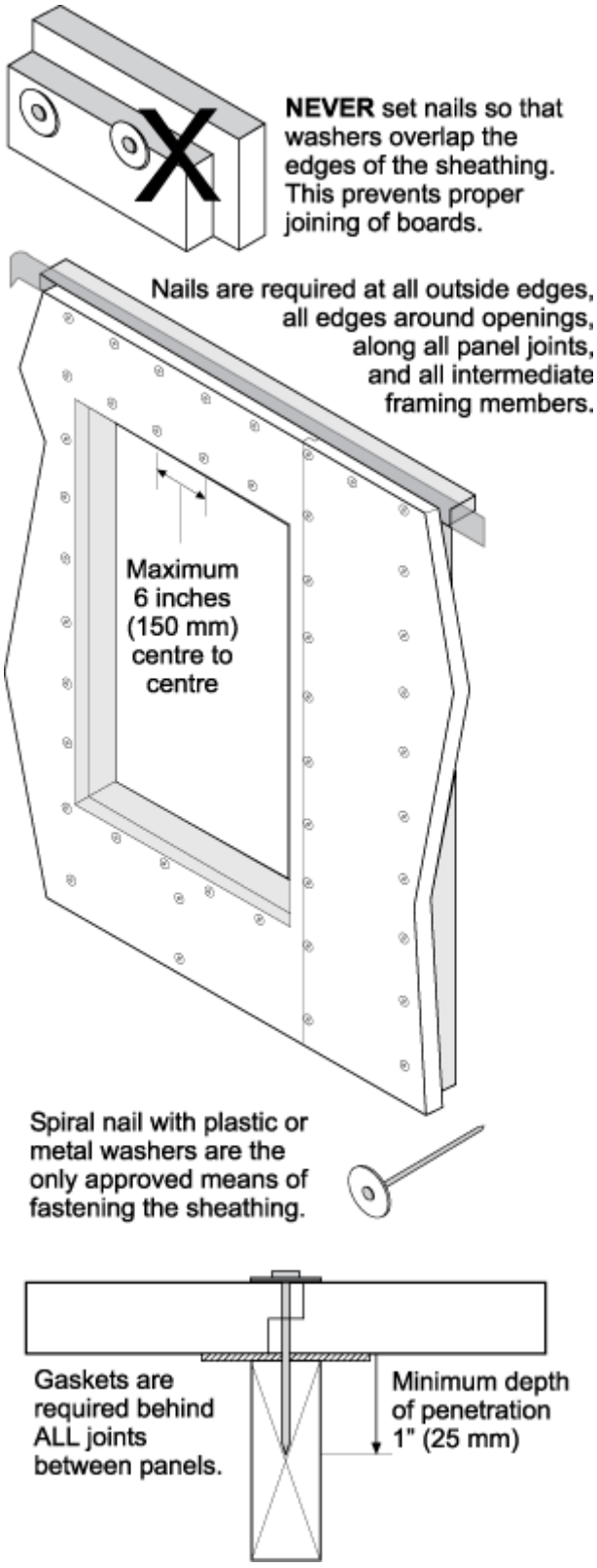
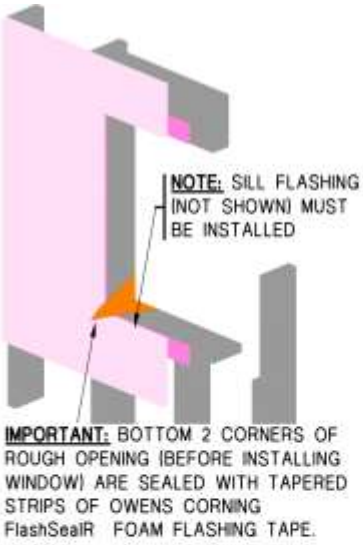
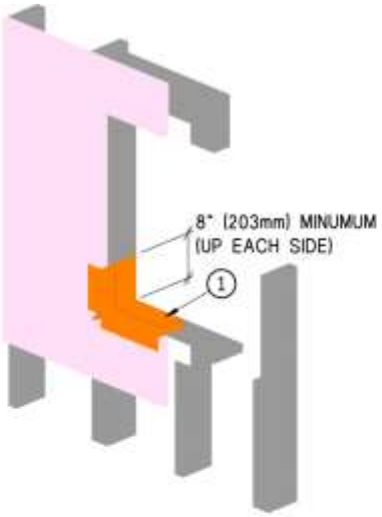
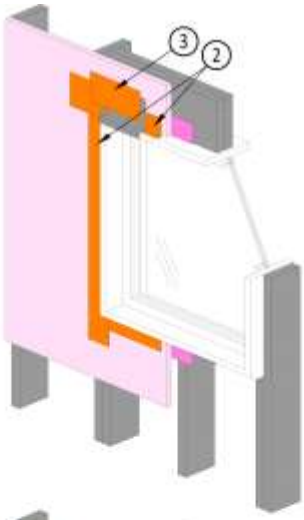
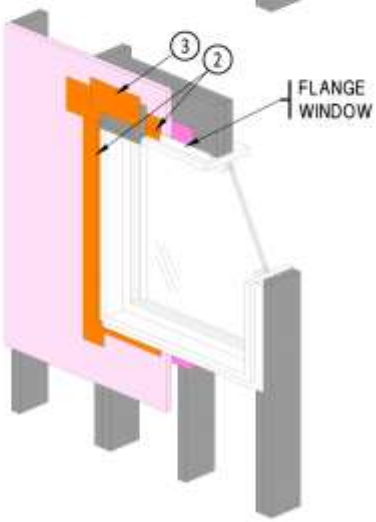


Figure 3. "FOAMULAR® CodeBord® Air Barrier System (CABS)" sealing with gasket at joints (Original "CABS") and fastening details (or Hybrid "CABS," the gasket is replaced by a proprietary sheathing tape over the panel joint)

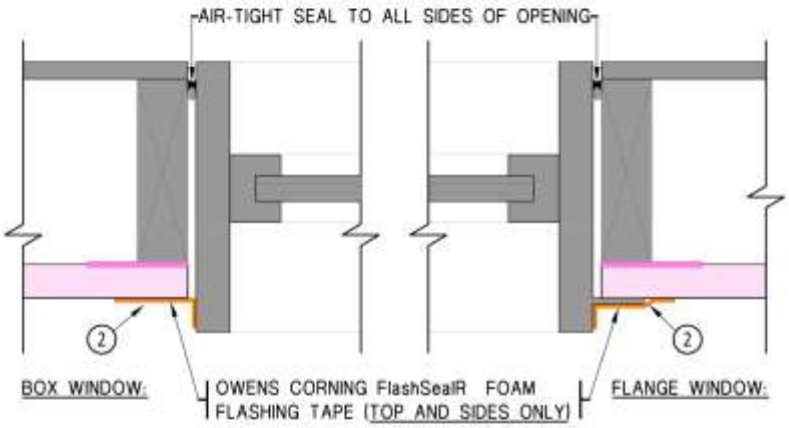




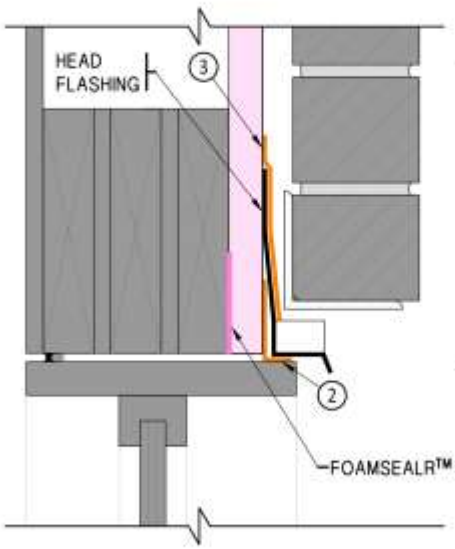




PLAN VIEW:



SECTION (BRICK VENEER):



OWENS CORNING FlashSealR FOAM FLASHING TAPE (SHOWN ORANGE) USED IN 3 WAYS:

1. SEALING ROUGH OPENING TO FOAMULAR® CODEBORD® PANEL
2. SEALING WINDOW FRAME TO FOAMULAR® CODEBORD® PANEL
3. SEALING HEAD FLASHING TO FOAMULAR® CODEBORD® PANEL

SECTION (VINYL SIDING):

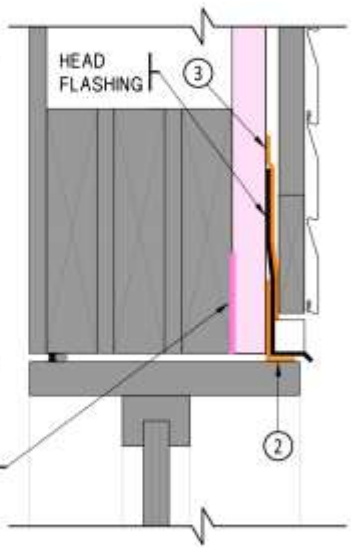
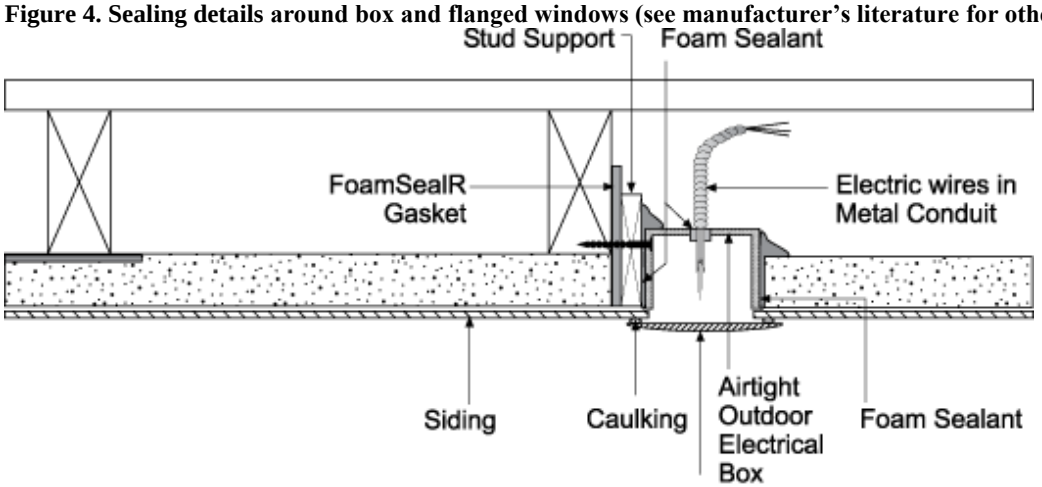


Figure 4. Sealing details around box and flanged windows (see manufacturer's literature for other sealing options)



Locate electrical box adjacent to stud framing member, and cut hole in the CodeBord. Apply FoamSealR gasket to stud and attach stud support for electrical box. Screw the airtight outdoor electrical box to stud support. Seal around the electrical box with PinkSeal foam sealant. Seal the opening for the electrical wires. Caulk the box cap to the siding.

Figure 5. Sealing of exterior electrical boxes to maintain plane of airtightness