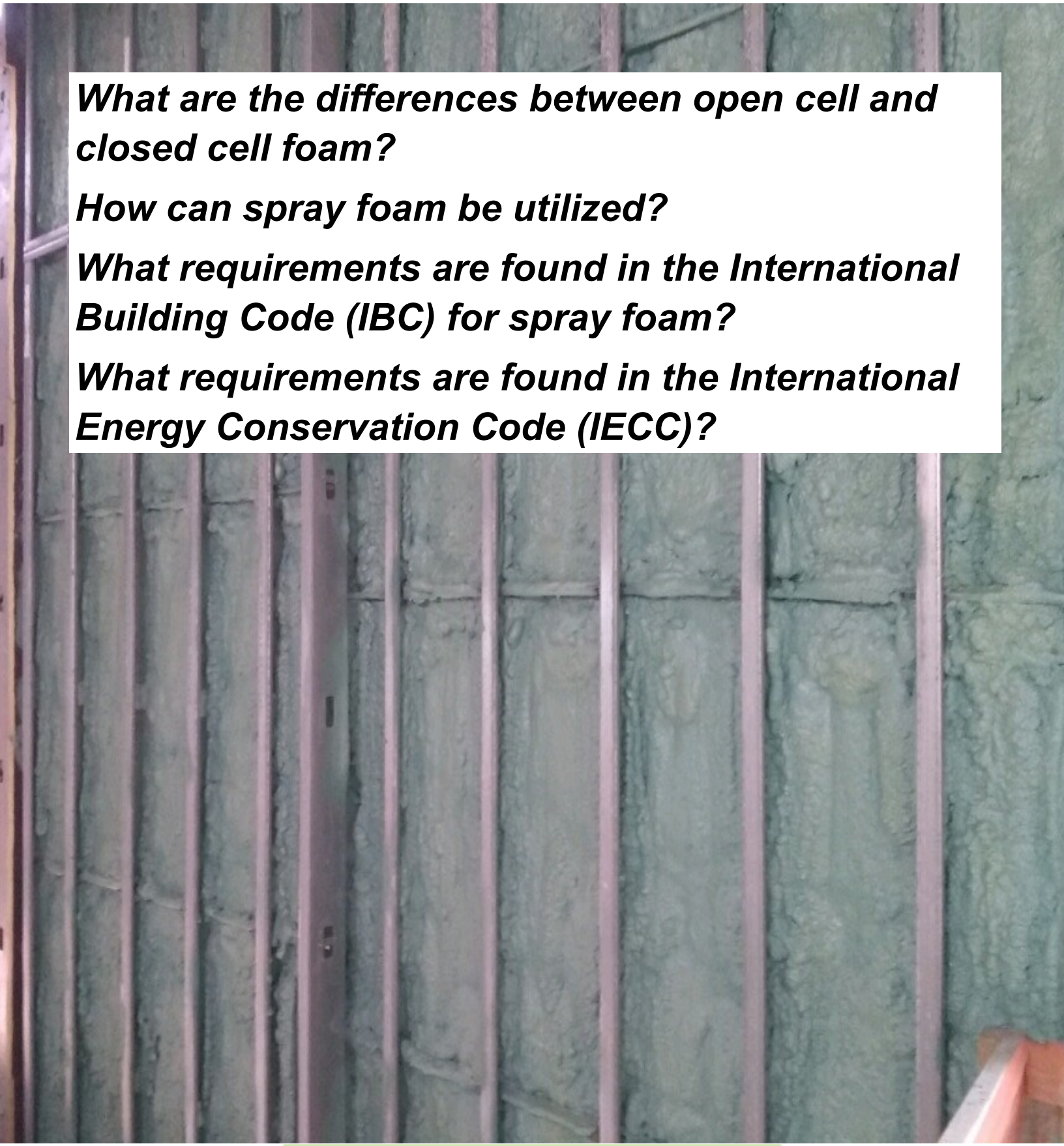
Xcel Energy®

Spray Foam Insulation
Energy Code Support Program



What are the differences between open cell and closed cell foam?

How can spray foam be utilized?

What requirements are found in the International Building Code (IBC) for spray foam?

What requirements are found in the International Energy Conservation Code (IECC)?

SHUMS CODA ASSOCIATES Group 14 ENGINEERING BUILDTank Inc.

Xcel Energy® Spray Foam Insulation

Open Cell Spray Foam

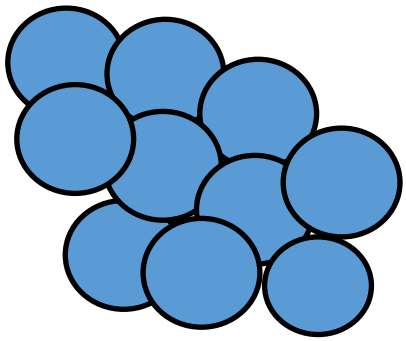
Open cell spray foam is when more than half of its cells are open.

- Lower R-value per inch than closed cell
  - *R- 3.5 - 4.2*
- Becomes an air barrier when installed at 4.5 inches.
- Can shrink over time
- Open cell is porous can allow water vapor to be absorbed
- Requires an ignition or thermal barrier per the IBC or IRC
- Must comply with IBC 2603 for foam plastic requirements
- Can be used as part of the assembly requirements for vapor retarders found in Section 1404.3 of the IBC

Closed Cell Spray Foam

Closed cell spray foam is when its cells are completely enclosed by walls.

- Higher R-value per inch than open cell
  - *R– 6.0 - 7.0*
- Becomes an air barriers when installed at 1.5 inches.
- More rigid than open cell
- Requires an ignition or thermal barrier per the IBC or IRC
- Must comply with IBC 2603 for foam plastic requirements
- Can be used as part of the assembly requirements for vapor retarders found in Section 1404.3 of the IBC



Spray Foam Insulation

2018 International Building Code

2603.2 and 2603.3

2603.2

- Packages and containers of foam plastic (including spray foam) that is delivers to jobsite must contain a label from an approved agency with the following information:
  - Manufacturer's name
  - Product listing
  - Product identification
  - Information to demonstrate the product will comply with the requirements

2603.3

- Flame spread 75 or less
- Smoke index 450 or less
- Exceptions are as follows:
  - Interior trim smoke index to comply with Section 2604.2
  - Cold storage buildings, ice plants, food plants, food processing rooms, and other similar areas when equipped with sprinkler systems can have up to 10" insulation
  - Unlimited smoke index for foam plastic insulation part of a Class A, B, or C roof assembly when tested
  - 4" or more can have flame spread of 75 and smoke 450 if end use is approved by Section2603.9
  - Foam plastic interior signs in covered malls comply with 402.6.4

Spray Foam Insulation International Building Code 2603.1.1, 2603.4

2603.4 Thermal barrier

Thermal barriers are required to separate foam plastic from the interior of the building be one of the following

- 1/2” gypsum board
- Heavy timber in accordance with Section 602.4 of the IBC
- Materials tested and meets the criteria of NFPA 275
- Combustible concealed spaces must comply with Section 718 of the IBC

Thermal barrier not required (2603.4.1)

Thermal barriers are not required for specific applications if it complies with Sections 2603.4.1.1 through 2603.4.1.14 of the IBC

Masonry or concrete (2603.4.1.1)

- Not required in masonry or concrete walls, floor, or roof if separated from the interior by a minimum of 1” of concrete or masonry

Cooler and freezer walls (2603.4.1.2)

- Foam plastic in cooler or freezer walls must comply with the following:
    - Flame spread of 25 or less
    - Smoke index of 450 or less
    - Flash ignition of 600°F or more
    - Self ignition of 800°F or more
    - Covered by a minimum of 0.032” aluminum or corrosion resistant steel having a metal base of 0.016” or more base metal thickness
    - Protected by sprinkler system in accordance with Section 903.3.1.1 of IBC.
        - When cooler or freezer is located in a building both building and cooler and/or freezer is sprinklered

Spray Foam Insulation International Building Code 2603.4

Walk-in coolers (2603.4.1.3)

When the building does not contain a sprinkler system foam plastic can be used if complies with the following:

- Foam plastic thickness is 4” or less
- Flame spread is 75 or less
- Aggregate floor area is 400 sq ft or less
- Foam plastic covered by a minimum of 0.032” aluminum or corrosion resistant steel having a metal base of 0.016” or more base metal thickness
- Foam plastic can have a thickness of 10” if a thermal barrier is installed

Exterior walls, one-story buildings (2603.4.1.4)

Thermal barriers is not required when complying with the following:

- Foam plastic thickness is 4” or less
- Flame spread of 25 or less
- Smoke index of 450 or less
- Covered by a minimum of 0.032” aluminum or corrosion resistant steel having a metal base of 0.016” of thickness
- Protected by sprinkler system in accordance with Section 903.3.1.1 of IBC.

Roofing (2603.4.1.5)

Thermal barriers is not required for foam plastic insulation that is part of Class A, B, or C roof cover assembly when it complies with the following:

- Installed in accordance with the code and manufacturer’s installation instructions and complies with one of the following:
    - Roof assembly is separated and complies with the following
        - Wood structural panel sheathing 0.47” or more thickness
        - Bonded with exterior glue
        - Edge support by blocking, tongue and groove joint, or other approved edge support, or an equivalent material
    - Assembly with foam plastic passes NFPA 276 or UL 1256

Spray Foam Insulation International Building Code 2603.4

Attic & Crawl spaces (2603.4.1.6)

Thermal barrier not required when complying with all of the following:

- Attic and crawl space entries for service of utilities
- 1 1/2” mineral fiber insulation
- 1/4” wood structural panels, particleboard, or hardboard
- 3/8” gypsum board
- Corrosion resistant steel with thickness of 0.016”
- 1 1/2 self supported spray applied cellulose insulation (Attics only)

The protective covering shall be consistent with the type of construction requirements

Doors not required to have a fire protection rating (2603.4.1.7)

Side-hinged or pivoting doors are permitted to use foam plastic insulation as a core when it complies with the following:

- Flame spread of 75 or less
- Smoke index of 450 or less
- Door facing is aluminum and has a minimum of 0.032” or more thickness
- Door facing is steel having a metal base of 0.016” or more thickness

Exterior doors in buildings of Group R-2 or R-3 (2603.4.1.8)

Exterior entrance doors to individual dwelling units not required to have a fire resistance raing can have foam filled doors with door facing of one of the following:

- Aluminum
- Steel
- Fiberglass
- Wood
- Or other approved materials

Spray Foam Insulation International Building Code 2603.4

Garage doors (2603.4.1.9)

Garage doors not required to have a fire-resistance rating that has a foam plastic as the core shall have a door covering of one of the following:

- Aluminum that has a minimum of 0.032” or more thickness
- Steel having a metal base of 0.010” or more thickness
- Wood having a base of 0.125” or more thickness
- Other materials tested and meet criteria of DASMA 107

Exception for garage doors of detached or attached garages for one and two family dwellings do not need a thermal barrier

Siding backer board (2603.4.1.10)

Foam plastic insulation must not exceed 2,000 Btu per sq ft is permitted to be used as siding backer board if meeting the following requirements:

- Siding backer board of 1/2” of thickness or less
- Separated from the interior of building by 2” of mineral fiber insulation or equivalent
- Applied as insulation with residing over existing wall construction

Interior trim (2603.4.1.11)

Thermal barrier not required for foam plastic as interior trim

Interior signs (2603.4.1.12)

- Foam plastic interior signs in covered malls comply with 402.6.4
- Foam plastic signs not affixed to interior surfaces will comply with Chapter 8 of IFC

Type V construction (2603.4.1.13)

Spray foam applied to sill plate, joist header, and rim joist must comply with the following:

- Have a thickness of 3 1/2” or less
- Have a density between 1.5 to 2.0 pcf
- Flame spread of 25 or less
- Smoke index of 450 or less

Spray Foam Insulation International Building Code 2603.4 & 2603.5 (Exterior Walls)

Floors (2603.4.1.14)

- Thermal barrier not required on the walking surface of floor system when covered by 1/2” wood structural panel or equivalent
- Required on the underside of floor system when the floor is located in the interior of the building

Exception for foam plastic as part of an interior floor finish

Exterior walls of buildings of any height (2603.5) - This section is the requirements of exterior walls of a building using foam plastic.

- Exterior walls of Type I, II, III, or IV shall comply with Sections 2603.5.1 - 2603.5.7
- Exterior walls of cold storage made of noncombustible materials in building more than 1 story in height shall comply with Sections 2603.5.1– 2603.5.7
- Exterior walls of Type V construction shall comply with Sections 2603.2, 2603.3 and 2603.4
- Fireblocking shall be in accordance of Section 718.2 of the IBC

Exterior walls

Fire-resistance rated walls (2603.5.1)

When a wall is required to have a fire-resistance rating the assembly must be able to demonstrate the foam plastic insulation will maintain the fire-resistance rating in accordance with tests ASTM E119 or UL 263.

Thermal barrier (2603.5.2)

Foam plastic insulation shall be separated from the interior of the building on of the following:

- Thermal barrier in accordance with Section 2603.4 (Thermal barrier)
- Complying with Section 2603.9 (Special approval)

One story buildings that comply with Section 2603.1.4 (Exterior wall, one-story buildings) are exempt from this provision.

Spray Foam Insulation International Building Code 2603.5 (Exterior Walls)

Potential heat (2603.5.3)

- Potential heat of foam plastic insulation can not exceed the potential heat of the wall or panel
    - Expressing in Btu per square feet of foam plastic in wall assembly in accordance with Section 2603.5.5
- The potential heat of the foam plastic shall be determined using NFPA 259
    - Expressing in Btu per square feet
- One-story building complying with Section 2603.4.14 (Exterior wall, one-story buildings) are exempt from this provision.

Flame spread and smoke-developed indices (2603.5.4)

Foam plastic insulation, exterior coatings, and facing shall be tested separately and comply with the following:

- Thickness of 4” or less
- Flame spread of 25 or less
- Smoke index of 450 or less
- Tested in accordance with ASTM E84 or UL 723

Vertical and lateral fire propagation (2603.5.5)

Exterior wall assemblies shall be tested to NFPA 285

Except for the following:

- One-story building complying with Section 2603.4.14 (Exterior wall, one-story buildings) are exempt from this provision.
- Wall assemblies foam plastic covered by 1” or more of masonry or contrete when complying with one of the following:
    - No air space between concrete and masonry
    - Insulation has the following:
        - Flame spread of 25 or less when tested to ASTM E84 or UL 723
        - Air space between insulation and masonry or concrete is 1” or less

Spray Foam Insulation International Building Code 2603.5 (Exterior Walls)

Label required (2603.5.6)

Label from an approved agency must be placed on the edge or face of each piece of foams plastic, package, or container and shall contain the following:

- Manufacturer's or distributors identification
- Model number
- Serial number or definitive information with product performance characteristics and approved agencies identification

Ignition (2603.5.7)

- Exterior walls shall not exhibit sustained flaming when testing in accordance with NFPA 268
- Material intended to exceed 1" in thickness shall having testing for minimum and maximum thickness
- Exceptions
    - Install a thermal barrier complying with Section 2603.4 (Thermal barrier)
    - Install 1" or more of concrete or masonry over foam plastic insulation
    - Install 3/8" or more of glass-fiber reinforced concrete panels over foam plastic insulation
    - Metal-faced panels having minimum 0.019" thick aluminum or 0.016" thick corrosions resistant steel outer facings
    - 7/8" or more thickness of stucco that complies with Section 2510 (Lathing and furring for cement plaster {Stucco})
    - 1/4" or more thickness of fiber cement lap, panel, or shingle siding complying with Section 1404.16 (Fiber-cement siding), 1404.16.1 (Panel siding), or 1604.16.2 (Lap siding)

Spray Foam Insulation International Building Code 2603.5, & 2603.6

Roofing (2603.6)

Foam plastic insulation that is part of a roof assembly must comply with the following:

- Meet the requirements of Sections 2603.2 (Labeling and identification), 2603.3 (Surface-burning characteristics), and 2603.4 (Thermal barrier)

Foam plastic in plenums as interior finish or interior trim (2603.7)

Foam plastic in plenums used as interior wall or ceiling finish or interior trim shall comply with the following:

- Flame spread of 25 or less in accordance of ASTM R84 or UL723
- Smoke index of 50 or less in accordance of ASTM R84 or UL723
- Tested with NFPA 286 and meets 803.1.1 of the IBC or 2603.9 of the IBC

Exceptions

- Flame spread of 75 or less and smoke index of 450 or less when separated from airflow by a thermal barrier
- Flame spread of 75 or less and smoke index of 450 or less when separated from airflow by corrosion resistant steel with thickness of 0.016”
- Flame spread of 75 or less and smoke index of 450 or less when separated from airflow by 1” or more thickness of masonry or concrete

Spray Foam Insulation International Building Code 2603.8—2603.13

Protection against termites (2603.8)

Heavy infestation category of figure 2603.8 must comply with the following:

- Installed on exterior face or under interior or exterior foundation walls or slab located below grade is not permitted
- 6” clearance between foam plastic and the grade ro exposed earth is required

Exceptions for structural members of noncombustible materials or preservative treated wood, or if using an approved method of protecting the foam plastic from termite damage, or located on the interior side of basement walls

Special approval (2603.9)

- Not required to comply with Sections 2603.4 or 2603.6 if approved large scale test of NFPA 286 meeting Section 803.1.1.1 criteria, FM4880, UL 1040, or UL 1715.
- Interior finishes comply with Chapter 8 of the IBC

Wind resistance (203.10)

Must comply with ANSI/FS 100 for wind pressure resistance

Cladding attachment over foam sheathing and various construction

Various construction material types must comply with the following sections as applicable:

- ***Cladding attachment over foam sheathing to masonry or concrete wall construction (2603.11)***
- ***Cladding attachment over foam sheathing to cold-formed steel framing (2603.12)***
- ***Cladding attachment over foam sheathing to wood framing (2603.13)***

Spray Foam Insulation
International Energy Conservation Code

Thermal Envelope Requirements

Spray foam can be utilized for various components of the thermal envelope.

- Insulation for thermal resistance of building's thermal envelope
    - Roof/ceiling - above roof deck, metal building, or attic
    - Above grade walls - mass, metal building, metal stud, or wood or other
    - Below grade walls
    - Floors - mass, or joist/framing
    - Slab on grade floors - unheated or heated
- Air barrier and air leakage requirements
    - Open cell and closed cell spray foam is an approved material for air barrier in accordance with Section C402.5.1.3
        - Open cell - thickness of 4.5" or more having a density of 0.4 and 1.5 pcf
        - Closed cell - thickness of 1.5" or more having minimum density of 1.5 pcf
    - Spray foam and other foams can be used to air seal the following:
        - Penetrations
        - Joints and seams