

## EPS Roofing Solutions

For more than 35 years, expanded polystyrene (EPS) roof insulation has been an exceptional building solution for a new or remodeling construction project. EPS is a closed cell, lightweight foam plastic insulation that is compatible with all commercial roofing systems. EPS insulation can be used in built up roofing, modified bitumen systems and single-ply membrane systems that are ballasted, mechanically fastened or fully adhered. As with any product, the successful use of EPS insulation depends upon correct installation in accordance with good building practices.

### Testing Codes & Standards

EPS insulation is recognized by all major code approval agencies and testing organizations in North America. EPS insulation manufacturers in the United States and Canada maintain numerous listings at Factory Mutual (FM), Underwriters Laboratory (UL), Underwriters Laboratory of Canada (ULC) and the International Code Council Evaluation Service (ICC-ES).



### EPS Insulation Properties

EPS insulation meets the requirements of ASTM C578, *Specifications for Rigid, Cellular Polystyrene Thermal Insulation* and CAN/ULC-S701, *Standard for Thermal Insulation, Polystyrene Boards and Pipe*, the material standards that cover the types, physical properties and dimensions of cellular polystyrene intended for use as thermal insulation in the United States and Canada. provides properties for seven EPS “types” and CAN|ULC-701 provides properties for three EPS “types.” This allows EPS insulation ASTM manufacturers the capability to provide a range of product types offering compressive resistance to meet the specification of virtually any roofing project. Compressive stress/strain characteristics of EPS insulation are determined using ASTM D1621, *Standard Test Method for Compressive Properties of Rigid Cellular Plastics*, or ASTM C165, *Standard Test Method for Measuring Compressive Properties of Thermal Insulations*. The most important mechanical property of

EPS insulation and building products is its resistance to

compressive stresses, which increase as the density becomes higher. EPS has a compressive resistance between 10 - 60 psi for most construction applications. Within that range EPS can be produced to meet specific strength requirements.

### Benefits of EPS Roofing

#### CONSISTENT R-VALUE

- Consistent over life of roof
- Measurable energy savings
- Lower cost per R-value than many other insulation products

#### DESIGN ATTRIBUTES

- Design flexibility and versatility in meeting project specific applications
- Compatible with fully adhered, ballasted or mechanically fastened systems
- Compatible with common roof assembly components

#### SUPERIOR PERFORMANCE

- Dimensional stability
- Moisture resistance
- Compressive strength

#### ENVIRONMENTAL BENEFITS

- Recycled EPS incorporated in many insulation products
- Never manufacturer with ozone-depleting gases, such as CFCs or HCFCs
- Lightweight, less material required to meet R-value standards

# Technical bulletin

## International Building Code & National Building Code of Canada

EPS insulation meets the requirements of the International Building Code (IBC). According to IBC Section 2603 Foam Plastic Insulation, for roofing applications foam plastic insulation must be separated from the interior of the building by a thermal barrier consisting of 0.5" (12.7 mm) gypsum board or wood structural panel sheathing not less than 0.47" (11/9 mm) thick. The National Building Code of Canada (NBC) requirements are somewhat different. Article 3.1.14.2.1 of the NBC addresses the use of EPS insulation in metal roof deck assemblies that form part of buildings required to be of non-combustible construction. This Article indicates that EPS manufacturers must demonstrate that the insulation component in a metal roof assembly has been tested as a component in a roof assembly complying with the conditions of acceptance in CAN/ULC-S126-M. However, the requirement to demonstrate compliance with CAN/ULCS126-M is waived if any of the following requirements included in NBC Sentence 3.1.14.2.(2) are met for the roof assembly:

- (a) A 12.7-mm (1/2-in.) gypsum board or other thermal barrier meeting the requirements of CAN/ULC-S124-M is located on the underside of the foam plastic insulation.
- (b) The building is sprinklered throughout.
- (c) The roof assembly has a fire-resistance rating of not less than 45 minutes.

In other words, the Canadian code allows EPS direct to deck application when a sprinkler system is installed under the metal deck. Since this is a common practice in commercial construction, EPS insulation can be used without a thermal barrier in many projects. Separate to the above thermal barrier requirements, both the IBC and NBC require that roof covering on roof assemblies that incorporate EPS insulation must be classified as part of a Class A, B or C roof assembly. Fire-resistance classifications A, B and C relate to exterior fire exposure and are intended to represent different levels of fire resistance performance. They are defined by ANSI/UL 790, ASTM E108 and CAN/ULCS107 as follows:

- Class A roof coverings are not readily flammable, are effective against severe fire exposures, and do not carry or communicate (i.e., spread) fire.
- Class B roof coverings are not readily flammable, are effective against moderate fire exposures, and do not readily carry or communicate fire.
- Class C roof coverings are not readily flammable, are effective against light fire exposures, and do not readily carry or communicate fire.

## Factory Mutual

Factory Mutual testing protocol, FM 4450, *Approval Standard for Class 1 Insulated Steel Deck Roofs*, assesses the flame spread of an interior fire on the underside of the roof deck

## Regulatory & Test Organizations

|                                                                                                       |                                                                                                                                                                                                                                                                                        |
|-------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| ASTM International<br>Canadian General Standards Board (CGSB)<br>Canadian Standards Association (CSA) | ASTM, CGSB, and CSA develop voluntary standards that provide minimum performance standards, test methods and evaluation criteria for building products including components used in roofing assemblies.                                                                                |
| Underwriters Laboratories (UL)<br>Underwriters Laboratories Canada (ULC)                              | UL identifies standards and performs tests necessary to establish ratings for roof assemblies, i.e. ability to meet building code requirement in both countries.                                                                                                                       |
| Factory Mutual Global (FM Global)                                                                     | Similar to UL, FM Global is a commercial and industrial property insurance and risk management organization specializing in property protection. FM Research is its testing and evaluation resource for roofing materials.                                                             |
| International Code Council (ICC)                                                                      | ICC, a membership association dedicated to building safety and fire prevention, develops codes used to construct residential and commercial buildings, including homes and school. ICC provides a single forum for the highest quality national and international codes and standards. |

# Technical bulletin

assembly.

Recognized by U.S. and Canadian code organizations, FM 4450 covers fire, wind uplift, live load resistances, corrosion of metal parts and fatigue of plastic parts. The standard applies to the assembling and performance of all components of an insulated steel deck roof. Assemblies that pass FM 4450 are given a FM Class 1 rating. Those that don't are rated Class 2. It is important to make a distinction between what FM defines as an "acceptance" and an "approval". An "acceptance" refers to installation in a specific project and means the product must be evaluated on a case by case basis while an "approval" of a product applies to multiple products.

## Underwriters Laboratory (UL)

Underwriters Lab's test protocol UL 1256, *Fire Test of Roof Deck Constructions*, examines the behavior of roof deck assemblies. EPS insulation has been tested in accordance with UL

1256 and is listed as part of UL fire classified roof deck Construction #458. A separate standard, UL 580, *Test for Uplift Resistance of Roof Assemblies*, is used to evaluate the comparative resistance of roof assemblies to positive and negative pressures associated with wind uplift. When a product obtains UL certification, it is appropriately labeled as UL-listed or UL-classified.

## Versatile EPS Insulation Works in Many Roofing Systems

### Tapered Roofing

EPS insulation is a versatile, cost effective choice in low-slope or tapered roofing systems where proper drainage is the key to maximum performance and longevity. EPS provides the required



positive slope while retaining the structural and economic advantages of a flat roof deck. EPS can be customized and cut to obtain the desired pitch, from 1/8 inch per foot up. Installers can cut the EPS insulation on site which gives a precise fit and allows application in a single layer creating a continual form. This design versatility translates into considerable savings in labor and framing costs. Usually the ridges and valleys necessary to provide correct drainage are supplied at 45 degree increments to the horizontal, but custom

angles can be easily accommodated. EPS manufacturers are available to provide complete specification and design assistance. Field assistance becomes even more valuable when unanticipated modifications become necessary. Delays are avoided with EPS since the material can be cut to specification on site, achieving a precise fit and decreased labor costs.

### Built Up Roofing

EPS insulation has been successfully used in built up roofing (BUR) applications for more than 35 years. BUR systems constructed with a concrete roof deck allow roof insulation to be applied directly to the deck since there is no thermal barrier requirement with the noncombustible concrete deck. The EPS foam may be affixed to the concrete deck with asphalt using a technique described as "mop and flop" by the roofing industry. Hot asphalt is applied to the concrete deck and allowed to cool slightly before the foam is permanently dropped into place.

A coverboard is then "mopped and flopped" onto the EPS with the joints overlapping and taped. The BUR is then applied on top of the coverboard which provides a uniform and consistent base for the weatherproofing system. The thermoplastic properties of EPS insulation make it necessary to place a coverboard above the foam in BUR systems. This provides protection from hot asphalt used to adhere and build up the waterproof protective roof covering materials. In a typical BUR system there will be three or four alternating

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Single-ply membrane systems account for over 40% of all new low-slope construction and about 32% of re-roofing. Unlike BUR membrane systems that are constructed on the roof, single-ply membranes are factory manufactured from bitumen and reinforcing fabric materials. They are generally categorized as either thermo-plastic or thermo-set and are often identified by their chemical acronyms, i.e. ethylene propylene diene monomer (EPDM) or polyvinyl chloride (PVC). The membranes may contain reinforcement layers of polyester fabrics, glass fiber or felt. The finished membrane thickness is referred to as mil thickness where 1 mil equals 0.001 inch. Typical membrane thickness range from 30 to 60 mils; however, greater thickness can be produced depending upon the manufacturer and product type. Single-ply thermo-plastic membranes will soften when heated and harden when cooled while thermo-set membranes are irreversibly set and will not soften when heated. Because of these fundamental differences single-ply membranes may be installed in the following ways: ballasted, mechanically attached or fully adhered. The top surface of the EPS insulation must be protected from melting in built up roofing applications, in torch on membrane applications and in single ply membrane applications when solvent and adhesive attack are possible. In these cases, a protection board of fibreboard or particleboard is generally used.

## Direct-to-Deck

The application of polystyrene foam roofing insulation applied directly to steel roof decks without a thermal barrier in single-ply membrane roofing systems is recognized by UL and ICC-ES. As long as it's covered by a current ICC-ES Evaluation Report, EPS insulation can be applied directly over steel roof decks as a component of a Class A, B or C roof covering without the use of a code specified thermal barrier. Direct-to-Deck EPS insulation is a cost-effective, durable and energy efficient solution for roof insulation. It is compatible with all major roofing materials and assemblies and available in flat, tapered and compound tapered panels in densities ranging from 1.0 to 2.0 pcf.

## Summary

EPS insulation offers many benefits in a wide variety of roof insulation applications. EPS manufacturers are often local, close to building sites, reducing shipping costs. They can design roof layouts to reduce installation labor time and costs. Also, the manufacturers maintain test and code approvals necessary to protect the consumer. The insulating value of EPS remains constant after manufacture and does not decrease over time, providing the same protection over the life of the roof. Since EPS insulation is available in a range of compressive properties and thicknesses, the builder can select the most economical product to meet design requirements. In addition, the energy-saving properties and the ability to incorporate recycled material into EPS insulation make it a natural choice for "green building" applications.



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*The EPS Molders Association publishes technical bulletins to help inform building professionals on the performance characteristics of expanded polystyrene (EPS) building products. The information contained herein is provided without any express or implied warranty as to its truthfulness or accuracy.*