

# Installing High Performance Insulation Part 1:

## A Guide to Installing Medium Density Spray Foam In Canada



Interest in high performance insulation materials is increasing due to consumer demand for more energy efficiency, resilient, and comfortable homes. Spray Polyurethane Foam (SPF) products are an ideal choice for consumers looking to ensure their homes are built to last. SPF products are unique because they are the only insulation products on the market that also control unwanted air leakage without the use of additional materials. Insulating and air sealing a home with SPF will help ensure the thermal envelope is as energy efficient as possible. The benefits don't stop with energy efficiency. SPF products help to minimize condensation, mold and other related problems, all while making the home stronger and more resilient. SPF for the residential market comes in two basic types: medium and light density products.

**Medium Density SPF (MD SPF) insulation, also called two-pound foam or closed-cell foam, is appropriate for both interior and exterior building envelope applications. MD SPF is air impermeable and provides industry-leading R-value (a measure of a product's thermal resistance), functions as an air barrier, and controls vapour and liquid moisture transfer. MD SPF can be installed in wall cavities, basements, crawlspaces, attics, and on exterior walls. When applied to the exterior of walls (i.e., behind cladding), MD SPF can provide "continuous insulation" over structural elements and act as a water-resistive barrier. MD SPF can fit easily into new and existing building designs including ones containing large irregular shaped, difficult-to-access cavities.**

**By Code, MD SPF in Canada must be applied under the oversight of third party quality assurance programs to ensure SPF products are installed safely. The quality assurance programs include certifying SPF products and product installers to ensure the products is installed per the manufacturer's recommendations. The industry also maintains a product stewardship website and SPF chemical health and safety training available at [www.spraypolyurethane.org](http://www.spraypolyurethane.org).**

**This guide provides a general overview of the physical properties and Canadian code requirements for the use of MD SPF.**

## Medium Density Spray Polyurethane Foam Performance Characteristics

The National Building Code (NBC) requires that MD SPF products conform to CAN/ULC S705.1 “Standard for Thermal Insulation – Spray Applied Rigid Polyurethane Foam, Medium Density – Material Specification.” Provincial building codes should be checked for amendments to the referenced standard. To conform to the standard, MD SPF must meet the key performance requirements in Table 1.1. MD SPF are optimized for different applications. Therefore, products vary slightly from one manufacturer to the next and from product to product. It is important for designers to obtain specific information on each product from the product manufacturer.

Products adhering to Standard CAN/ULC-S705.1 have met performance thresholds for R-values, long-term thermal resistance, air permeance, core density, dimensional stability, water vapour permeance, surface burning, compressive strength, and volatile organic emissions. In combination with the SPF quality assurance programs, CAN/ULC-S705.1 helps ensure that the building community can expect a high level of performance when using MD SPF.

MD SPF conforms easily to the shape of the substrate; when cured, it becomes rigid. Typically, installers slightly under-fill wall cavities to avoid trimming. At certain thicknesses (around 50 mm thick), MD SPF functions as a vapour barrier, therefore, secondary vapour barrier products are not required. In addition to wall cavities, MD SPF can be applied to areas such as interior basement walls avoiding the need for a moisture barrier while also providing a continuous insulation layer with no joints or seams to seal and with minimal thermal bridging.

**Reoccupancy Time:** the time when all building occupants can permanently return to the building without need for personal protection equipment. A toxicological assessment is necessary for compliance.

**Reentry Time:** the time when unprotected healthy workers can return to the building unprotected for an 8-hour work shift. This is typically regulated under provincial labour laws (e.g. WHMIS).

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**Table 1.1 Characteristics of Medium Density Spray Foam**

<b>R-Value</b>	"Has high insulation value. A minimum Long Term Thermal Resistance (LTTR) at 50 mm thickness of RSI 1.8 (R 10.2). Typically product performance can exceed RSI 2.0 (R 11.4) at 50 mm. [1]"
<b>Air Permeance</b>	Has low air permeance. A maximum air permeance of 0.02 L/s @ 75 Pa. Most products comply with this requirement with a minimum 25 mm thickness. Reduced air leakage results in minimized airborne moisture transfer and airborne noise control.
<b>Density</b>	Has hard, rigid, stable foam structure, with a minimum density of 28.0 kg/m <sup>3</sup> (1.75 lb/ft <sup>3</sup> ). Typical density 29.6 to 38.4 kg/m <sup>3</sup> (1.85 to 2.40 lb/ft <sup>3</sup> ). Improves structural rigidity of framed assemblies.
<b>Water Resistance</b>	Can act as water resistant barrier. When applied to the exterior of walls it acts as a drainage plane that sheds bulk water.
<b>Water Absorption</b>	Has low water absorption. Such performance assures water is not trapped within the product. A preferred insulation solution for building areas prone to flooding.
<b>Vapour Permeance</b>	Has low water vapour permeance. Maximum 60 ng/Pa·s·m <sup>2</sup> at 50 mm. Most products typically qualify as a code compliant vapour barrier at a 38 mm thickness or greater.
<b>Tensile Strength</b>	Delivers high tensile strength – 200 kPa or greater – gives the product tenacious adhesion to walls and on the underside or floor and roof decks.
<b>Applications</b>	Suitable for interior, exterior, and below grade applications including under a concrete slab.

1) Earlier versions of the standard provided an LTTR testing methodology that yielded slightly higher results. For comparison purposes, designers are advised to compare tests done to the same version of the standard. LTTR test value results per the 2003 version of CAN/ULC S770 (CAN/ULC S770-03) tend to be higher than testing done per later versions of the standard.

MD SPF can be applied in relatively cold conditions, as cold as -20°C depending on formulation. Most common construction materials are suitable as substrate for MD SPF application. MD SPF can be applied to wood, concrete, concrete block, metal, and gypsum board products. SPF manufacturers have conducted field evaluations and product compatibility testing to demonstrate MD SPF products are chemically compatible and adhesively compatible with most common adjacent materials including transition materials, membranes (self-adhered or liquid), electrical wiring, and various piping materials.

As of January 2021, MD SPF in Canada only contains low global warming potential (GWP) blowing agents. Generally, the low GWP MD SPF formulations have reduced the GWP by about 1,400 times.

#### Code Compliance: Installing Medium Density Spray Polyurethane Foam

In the 2015 NBC, Article 9.25.2.2 Insulation Materials, notes that MD SPF conform to CAN/ULC-S705.1 and CAN/ULC S705.2 – the standard providing guidance on product installation as referenced in NBC Article 9.25.2.5, Installation of Spray-Applied Polyurethane.

All MD SPF products are required to undergo testing to assess Volatile Organic Compound (VOC) emissions, according to CAN/ULC-S774, to determine the reoccupancy time. Time to re-occupancy may not be less than 24 hours. Reentry time is determined in accordance with provincial labour and Workplace Hazardous Materials Information System (WHMIS) regulations. Consult the manufacturer's safety data sheet for guidance.

#### Code Compliance: Fire Safety and Medium Density Spray Polyurethane Foam

MD SPF is a thermoset plastic. Generally, MD SPF is more thermally stable at increased temperatures than other foam plastics. Regardless, all foam insulation products are combustible and are not permitted to be left exposed. All foam plastics installed in Canada are required to have a protective thermal barrier to separate the foam plastic from the occupied space.

#### Part 9 – Housing and Small Buildings

As required by NBC Article 9.10.17.10. – Protection of Foamed Plastics, foamed plastics are to be protected from adjacent space in the building by an interior finish, such as plaster, gypsum board, plywood, or oriented strand board (OSB) or an approved thermal barrier. Foam insulation adjacent to a concealed space, such as within attic or roof spaces, is not subject to this requirement.

Foamed plastic is subject to flame spread limits in NBC Sentence 9.10.17. CAN/ULC S705.2 includes the same requirements.

It is generally accepted that MD SPF can be applied on most types of plumbing and wiring. Good practice in cold climates indicates that plumbing should be oriented towards the interior of insulated assemblies to protect pipes from freezing. MD SPF can also be applied to metal ductwork in accordance with NBC Subsection 9.33.6.4.6,

provided it is not less than 3 meters away from the furnace bonnet.

NBC Sentence 9.10.16 specifies requirements for fire blocks within concealed spaces and wall assemblies. In some cases, fire blocks are omitted when the concealed wall space is filled with insulation. The use of foamed plastic to fill the annular space around penetrations in fire block materials is subject to the approval by the authority having jurisdiction. NBC Article 9.10.16.4 states that the effectiveness around penetrations of fire blocks shall be maintained, but there is no defined rating for combustible materials in unrated assemblies.

The use of foamed plastic materials within fire-resistance rated assemblies in NBC Part 9 buildings is subject to its inclusion within an approved listing, such as that found in the NBC Fire and Sound Resistance Tables or an approved agency.

#### Part 3 – Commercial Buildings

NBC Part 3 classifies buildings by two types of construction materials: combustible construction in Subsection 3.1.4 and noncombustible construction in Subsection 3.1.5. Flame spread ratings requirements are specified in NBC Subsection 3.1.12. Interestingly, there are hundreds of exceptions where combustible materials are permitted in noncombustible construction. The complexities of these exceptions are beyond the scope of this document, other than to say the use of combustible materials in noncombustible construction depends on the building height, area, use of sprinklers and adjacent materials to the foamed plastic in the assembly.

For combustible construction, protection of foamed plastic is specified in Article 3.1.4.2.

For noncombustible construction, minor combustible components such as foamed plastic sealants are permitted in NBC Article 3.1.5.2. For larger combustible components such as spray foam insulation, Article 3.1.5.15 provides instructions as to how foam plastic should be protected.

NBC Sentence 3.1.5.15.(2) – Foamed Plastic Insulation, clarifies that 12.7 mm thick gypsum board, among other materials, qualifies as a thermal barrier. The thermal barrier protection should be continuous and cover the foamed plastic, such that the foamed plastic



is not exposed to the interior of the building. The local Authority Having Jurisdiction (AHJ) should be contacted as to their thermal barrier approvals.

Other thermal barrier options include gypsum based or cementitious coatings that have been tested and found to meet the thermal barrier requirements of the NBC as shown in an evaluation report or appropriately tested in conformance with CAN/ULC-S124. Because MD SPF does not melt, other thermal barrier options such as intumescent paints may also be available in some applications and in some markets. Again, designers should consult the manufacturer for product evaluations or listings and ensure approval is obtained from the local AHJ allowing its use.

Combustible cladding that contains foamed plastic insulation is subject to the provisions in Article 3.1.5.5.

Fire blocks in concealed spaces are subject to the provisions in NBC Subsection 3.1.11. MD SPF or sealants should not be used as a fire stop to fill the annular space around penetrations in fire blocks unless they meet the rating requirements in accordance with CAN/ULC S-115.

MD SPF is permitted within fire resistance rated assemblies if the AHJ accepts results of fire tests performed according to applicable standards. Article 9.10.3.1., Fire-Resistance and Fire-Protection Ratings, Appendix D refers to CAN/ULC-S101 standard test results. As a general rule, always consult with a fire safety consultant for guidance when combustible materials, such as LD SPF, are used in fire resistance rated assemblies, or in applications where the integrity of fire separations may be affected.

### Spray Foam Compliance Documentation

To show conformance to CAN/ULC-S705.1, manufacturers obtain a Canadian Construction Materials Centre (CCMC) or ULC evaluation document (listing or report) for their MD SPF product. These documents also provide key information on use of the product in the field as required in CAN/ULC S705.2. This document also notes the physical properties of the product, its uniquely identifiable colour, and identity of the Certification Organization selected by the manufacturer to provide a site quality assurance program (SQAP). Manufacturers must specify one SQAP provider as part of the listing process—either Caliber Quality Solutions, the Canadian Urethane Foam Contractors Association (CUFCA), Building Professionals Canada (BPC) or Urethane Foam Consultants (UFC) – to license qualified installers and guide the process of third-party field auditing. The listing process requires manufacturers to use one consistent provider for this work.

### Quality Assurance and Specifications

The Canadian National Master Construction Specification (NMS) - Sprayed Insulation – Polyurethane Foam (Section 07 21 29) was updated in January 2019. The previous version of the NMS referenced only one of the four SQAP providers recognized by CCMC, creating quality assurance compliance confusion in the building industry. In response, newer specification references for spray foam were developed with all four organizations in Canada recognized by CCMC as third-party quality assurance bodies for MD SPF now noted.

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For additional information on MD SPF, see:

<https://www.spraypolyurethane.org/>

<https://nrc.canada.ca/en/certifications-evaluations-standards/canadian-construction-materials-centre>

<https://canada.ul.com/ulcstandards/>

<https://nrc.canada.ca/en/certifications-evaluations-standards/canadian-national-master-construction-specification>

<https://www.caliberqa.com/>

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