



870 Curé Boivin, Boisbriand (Québec) Canada, J7G 2A7

27-Sep-07

Re: Alternative Application: **POLARFOAM PF7300 SPRAYED-IN-PLACE-POLYURETHANE FOAM INSIDE A WOOD FRAME STRUCTURE**

There is nothing in the CCMC report describing the wood stud application and vapour barrier.

The reason for this is that CCMC does not have a Technical Guide on Vapour barrier properties for Sprayed Polyurethane Foam. The technical guides address the physical properties and how they relate to the NBC requirements. This is why CUFGA and Demilec had the Civil Engineering Department, University of Waterloo, do a Field Performance of Spray Polyurethane Foam: The Role of Vapour Diffusion Control in a wood structure. This work covers the actual vapour permeance results in a wood frame construction using Sprayed Polyurethane foam compared to traditional 6mil poly vapour barrier with fibrous insulation. Demilec Inc. product was used in this study and on page 3 product A is Polarfoam PF 7300, product B is HEATLOK SOYA and product C is SEALECTION 500

Demilec Inc.'s closed cell Sprayed-in-Place Polyurethane foam material goes under the names Airmetic 0223, Heatlok 0240, Polarfoam PF 7300 and Burnaby Air Barrier, has been evaluated by CCMC since 1992 in compliance with the intent of the National Building Code of Canada, Article 9.25.2.2. and 5.3.1.2. (2). These sections are in reference to the listed CAN/ULC-S705.1-98 Standard. The CCMC evaluation is based on the technical results we had to meet in the CAN/ULC-S705.1-98 Material Standard specified in the NBC. In all of the CCMC Evaluations Reports their comments are general in nature and relate to the performance of the product equivalent to that required in the NBC 1995 based on independent testing we did on our product. The CCMC evaluation is not designed to be specific to an application but general like the building code. Demilec's product can be used in all open walls, as an exterior insulating sheathing, ceilings and floors as described in Section 9.25.2.1. (1) of the NBC and in the CAN/ULC-S705.1, which is covered in the CCMC 12380-R Evaluation Report.

Before we could receive a CCMC evaluation we had to meet the CAN/ULC-S705.1 Material Standard that involved meeting 10 physical requirements. One of those was Vapour Permeance using the ASTM E96 Standard (dry cup method), which is mentioned in Section 5.5.1.2. (4) Vapour Barrier Properties and Installation. Polarfoam PF 7300 has met that requirement. CCMC has also mentioned in our CCMC 12839-R Evaluation that at 25.4 mm our WVP is less than the maximum  $60 \text{ ng/Pa}\cdot\text{s}\cdot\text{m}^2$  when sprayed on wood sheathing or concrete block. It also states if it is installed on a substrate as the sole wall insulation it may qualify as the designated vapour barrier if installed thickness meets Sentence 9.25.4.2. (1) or 5.5.1.2 (1). We have had three independent laboratories (Bodycote, NRC A3136 study, University of Waterloo) test our product for its vapour permeance in accordance to the ASTM E 96 (dry cup method) and all show that at a minimum of 38 mm (core only) of Polarfoam PF 7300 meets the vapour permeance of less than  $60 \text{ ng/Pa}\cdot\text{s}\cdot\text{m}^2$  as stated in Section 9.25.1.2. (1) of the NBC, meeting the requirement to be considered a vapour barrier material. When spraying on a concrete, gypsum and or plywood substrate the vapour permeance would be  $38 \text{ ng/Pa}\cdot\text{s}\cdot\text{m}^2$  and lower depending on the thickness applied.



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The CAN/ULC-S705.1 says the samples should be sprayed on a substrate panel 1m x 1m to a minimum thickness of 60mm. The specimens will then be cut to 50mm thickness. There will be core testing with no skin. In the CNRC A 3136 study, 2 different substrates were examined, a non-

hygroscopic material (such as concrete) and a hygroscopic material (such as plywood or gypsum board). These results show that to satisfy the requirement of water vapour permeance of  $60\text{ng}/(\text{Pa}\cdot\text{s}\cdot\text{m}^2)$ , as per NBC Section 9.25.2, a 38mm thick layer is needed if the medium density Spray Polyurethane is sprayed on gypsum board. Yet, a 20mm thick layer is sufficient when sprayed on concrete block. This is tested in accordance with the desiccant method of ASTM E96 as per section 5.5.1.2 Vapour Barrier Properties and Installation of NBC.

Demilec's CCMC 12380-R Evaluation Report states for vapour barrier requirements:

- The application shall conform to subsection 9.25.4 as per NBC 1995,

**9.25.4.2. Vapour Barrier Materials**

*(1) Except as required in Sentence (2), vapour barriers shall have an initial permeance not greater than  $45\text{ ng}/(\text{Pa}\cdot\text{s}\cdot\text{m}^2)$  (0.78 PERM INS.).*

50mm of HEATLOK 0240 ( $43\text{ ng}/(\text{Pa}\cdot\text{s}\cdot\text{m}^2)$ ) applied between studs meets that requirement.

**9.25.4.2. Vapour Barrier Materials**

*(2) When used where a high resistance to vapour movement is required, such as in wall constructions that incorporate exterior cladding or sheathing having a low water vapour permeance, vapour barriers shall have a permeance not greater than  $15\text{ ng}/(\text{Pa}\cdot\text{s}\cdot\text{m}^2)$  (0.26 PERM INS.). (See Appendix A)*

**A-9.25.4.2.(2) Increased Vapour Diffusion Resistance.**

*Thermal Insulation*

*Where low permeance foamed plastic is the sole thermal insulation in the building assembly, the inner surface of this element will be close to the interior temperature. In this case, no additional vapour barrier is needed to control condensation within the assembly. Where low permeance thermal insulation is installed on the outside of an insulated frame wall, however, the inner surface of the plastic insulation may fall below the temperature at which saturation will occur. In this case, a separate element must be installed to provide the necessary vapour diffusion protection. (See A-9.25.1.2.)*

If Polarfoam PF 7300 is the only insulation in the wall there is no need for additional vapour barrier

- The foam installation meets Article 9.25.4.3. "Installation of Vapour Barrier".

Our product meets this requirement because it protects the entire surface it is sprayed to.

The Civil Engineering Department, University of Waterloo verifies this on page 9, first sentence: "the closed cell SPURF wall performs with similar trends to the poly wall.....".

Demilec Inc. also had communications with the Canadian and U.S. Wood Council in regards to spraying polyurethane foam in wood stud construction. According to Mr. Antoni Ten Wolde, Research Physicist, Building and Moisture & Durability Team, they feel with closed cell sprayed polyurethane foam in a wood cavity no additional vapour barrier is necessary because the foam is sealed along the perimeter of the stud that inhibits air movement. He states the only reason for a vapour barrier is to protect fibrous insulation in the stud cavity. Mr. Antoni Ten Wolde also stated that the perm value of the wood members is immaterial because the perm value for 2x4 wood members would be in the order of 0.2 to 0.3 and larger wood members would even be better.



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This is shown by the Building Officials accepting Log Construction without an additional vapour barrier. Dr. John Straube, University of Waterloo Engineering, quantifies the vapour permeance of lumber on page 9 of the Engineering report.

It is very clear in Demilec's CCMC 12380-R Evaluation Report that our product provides a level of performance equivalent to that required in NBC 1995, Article 9.25.2.2 and Sentence 5.3.1.2. (2) and CAN/ULC-S705.1. As we stated earlier CCMC is general in their comments to all CCMC Evaluation Reports and they have a "Usage and Limitations" section that gives some guidelines when applying inside versus as a sheathing material on the outside. If you are using Sprayed Polyurethane Foam on the outside greater than 25mm as wall sheathing, with a fibrous insulation between studs on the inside then a vapour barrier type 1 on the stud is required. The assembly shall conform to art: 9.25.1.2 caution ..".

In other words when spraying 75mm (3") between the studs, and you achieve a vapour permeance rating of less than 45ng for both the spray foam and the wood stud, it meets this requirement. We recommend that all double or multiple wood members and the plate be sealed with acoustic sealant to also ensure a continuous air barrier (seal).

Based on the Engineer Reports that we have on our Sprayed Polyurethane Foam product from NRC, Bodycote, Civil Engineering Department, University of Waterloo and CCMC 12380-R Evaluation Report we have met the intent of the NBC as a product which insulates and provides a barrier to water vapour diffusion from the interior into wall spaces, floor spaces and attic or roof spaces. The Polarfoam PF 7300 sprayed foam insulation resists the diffusion of water vapour so that the amount of water vapor is reduced as it moves through the thickness of the foam. By the time the water vapour reaches the back of the sheathing, there is not enough left to cause condensation. Polarfoam PF 7300 is air impermeable creating an air seal and eliminating air leakage. In cold weather it prevents warm, humid indoor air from reaching the back of the sheathing where it can condense.

For additional information, please do not hesitate to contact the undersigned.

Sincerely,

Clifford Strassburger  
Technical Representative

encl: CAN/ULC-S705.1 – Vapour Permeance (Partial)  
Bodycote Materials Testing Canada Inc.  
NRC Report A-3136.1 (Partial)  
U of W Field Performance Study

Additional Info: AIR-INS inc – Project A1-01531-A  
Wood Frame Envelope-CMHC Best Practice Guide-Page 6-14, 6-15