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Tech Hotline

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Performance Criteria and Building Code Compliance of Fluid Applied Air Barriers

Introduction

This technical paper discusses codes, standards, and relevant performance criteria – air leakage resistance, durability, and water resistance – for fluid applied air barriers. StoGuard® thin-film waterproof air barrier applied over sheathing and concrete masonry units (CMU) has been proven to perform in a series of tests that is unmatched by any other air barrier product. Testing has shown StoGuard to be highly effective on sheathing at 5-7 dry mil thickness. When sprayed more liberally on CMU it has been shown to provide continuous coverage over high and low spots of the CMU and to function both as an air barrier and water-resistive barrier.

Air barriers are made of different materials which have different properties. They should be evaluated based on performance criteria.

Thickness of an air barrier coating is not by itself a performance property. Final film thickness depends on the composition of the coating, the manner in which it is applied, and the demands of the substrate to which it is applied. Codes and standards refer to air leakage, durability, and water resistance, for which performance criteria have been established. Air barrier materials must be independently tested to demonstrate compliance with building code performance criteria.

Key performance criteria for air barriers are listed in:

1. The *CCMC*[1] *Technical Guide for Air Barrier Materials*

   and, when the air barrier is also intended to perform as a water-resistive barrier (WRB),

2. ICC-ES[2] AC 212, *Acceptance Criteria for Water-Resistive Coatings Used As Water-Resistive Barriers over Exterior Sheathing*

StoGuard meets both of these criteria. In fact, **StoGuard is the only fluid applied waterproof air barrier material that has been evaluated by ICC-ES and CCMC and received national recognition in the US as a water-resistive barrier and in Canada as an air barrier material.**

These evaluations are based on independent testing that proves 5-7 dry mils of StoGuard waterproof coating over sheathing in tandem with StoGuard joint treatment meets both the stringent air leakage resistance requirements of the National Building Code of Canada (NBCC), and the waterproofing and structural requirements of ICC-ES for compliance with the International Building Code (IBC) and the International Residential Code (IRC), in effect in most parts of the United States.

Substrate properties affect air barrier choice and application. Wood and gypsum-based sheathings by themselves are air barriers. For this reason, the important aspect of achieving a continuous air barrier over sheathing is to address the joints between sheathing panels with a durable joint treatment.

The application of StoGuard over sheathing recognizes this and uses materials efficiently with a reinforced joint treatment and a thin-film waterproof topcoat that protects the sheathing. Thin film waterproofing works over sheathing because sheathings have relatively smooth surfaces and do not need thick, heavy films for panels to be successfully waterproofed.

StoGuard has been tested and shown to be highly effective on sheathing as well as CMU substrates. Sto's thin-film waterproof air barrier can be applied in thicker sections by spray application over CMU substrates *(See photomicrography on the next page).*

Photomicrography: StoGuard Applied to CMU

Micrograph images confirm StoGuard's effectiveness in providing continuous coverage of CMU substrates. The images show a continuous film on CMU, which is sufficient to bridge voids in CMU surfaces and to accommodate surface irregularities. These photographs were taken microscopically by an independent testing laboratory.

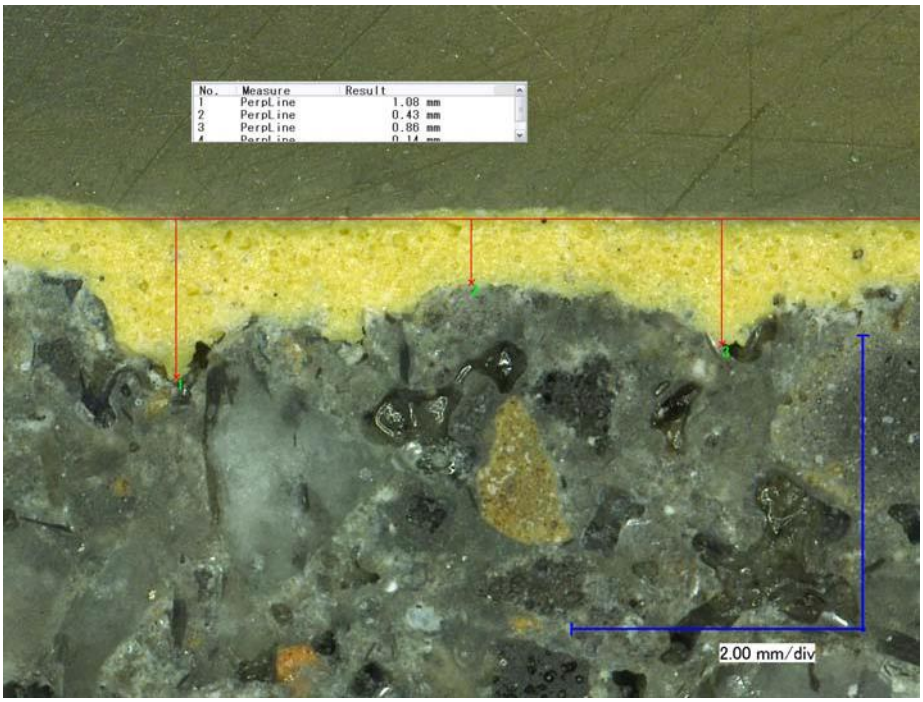

Photo 1: StoGuard is able to penetrate the low spots of a typical CMU wall surface at 1.08 mm thickness (approximately 43 dry mils) while providing a complete and continuous "air tight" film across the surface

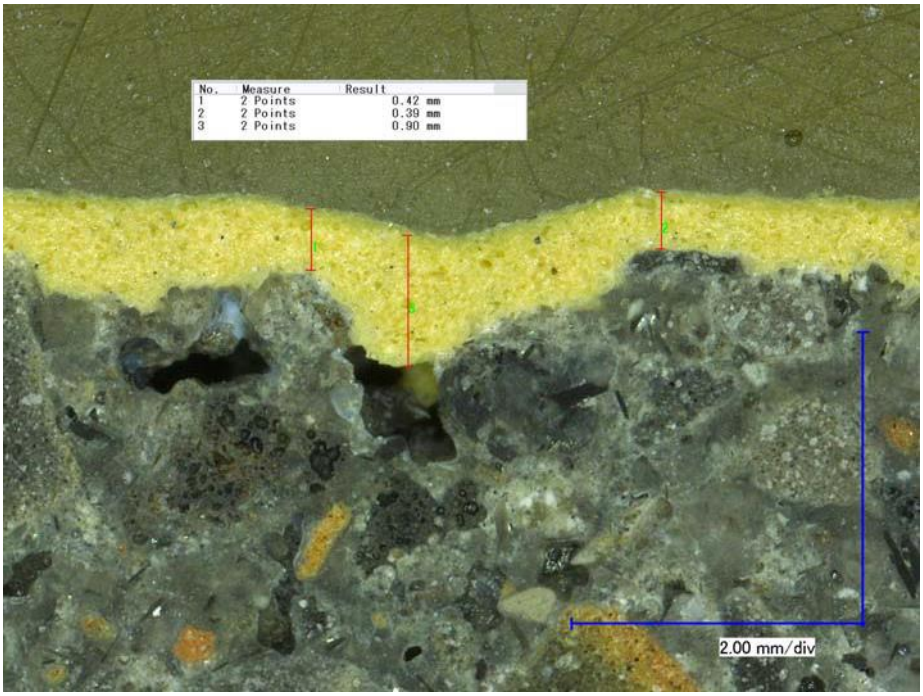

Photo 2: StoGuard accommodates the irregularity and porosity of the CMU surface at a thickness of 0.90 mm (approximately 35 dry mils) in the low spot (3) and 0.39 mm (approximately 15 dry mils) at the high spot (2). Note that StoGuard bridges the surface void in the CMU substrate at the point of maximum thickness.

Because of the porosity and inherent variability in CMU wall surfaces — joint profile, unit weight, and planarity — **specifying a minimum mil thickness is not appropriate** for establishing air barrier performance. What is important is to obtain a durable continuous film that fills and bridges voids. StoGuard has been proven through testing to perform as both an effective air barrier and water barrier on CMU substrates. Keys to successful application are: 1. joints should be struck flush with the masonry wall surface, and 2. application should be in one coat by airless spray, or a minimum of 2 coats with back rolling if applied by roller. Job site mock-ups are recommended to verify application and performance prior to full installations.

Building Code Compliance of Air Barriers

Building code evaluation reports validate that air barrier materials comply with applicable codes and meet key performance standards. These reports require independent evaluation and testing of fluid-applied air barrier products under an extremely harsh series of tests intended to replicate real world conditions and to stress the material to its maximum in an attempt to induce failure. Only StoGuard waterproof air barrier has undergone this type of independent evaluation and performance validation. Evaluation criteria for air barriers and water-resistive barriers require performance testing for air leakage resistance, durability, and water resistance. One key evaluation criteria is the *CCMC Technical Guide for Air Barrier Materials*, which addresses air leakage. If the air barrier is also intended to perform as a water-resistive barrier, a second key set of evaluation criteria is ICC-ES AC 212, *Acceptance Criteria for Water-Resistive Coatings Used As Water-Resistive Barriers over Exterior Sheathing*. StoGuard meets both of these criteria. **In fact, StoGuard is the only fluid-applied air barrier material that has been evaluated by ICC-ES and CCMC and received national recognition in the US as a water-resistive barrier and in Canada as an air barrier material (refer to Table 1)**:

These criteria recognize that air barriers often will be buried within a wall assembly, and, because they are inaccessible for maintenance, must be durable and perform for the life of the structure. The criteria impose harsh conditions on the air barrier material to replicate the stress that the material may encounter in service. For example, the CCMC Technical Guide includes testing after accelerated aging, while the ICC-ES criteria include a different regime of testing with heat aging and UV exposure to verify performance after aging.

The CCMC Technical Guide attempts to induce failure in the air barrier though a modified water vapor transmission test that subjects the air barrier to the compound effect of a desiccant on one side of the material and liquid water on the other. The ICC- ES criteria takes a different tack in relation to the effects of water on the air barrier material by requiring no leakage of aged material that spans a ¼ inch (6 mm) wide sheathing joint with a 22 inch (55 cm) column of water (Figure 1).

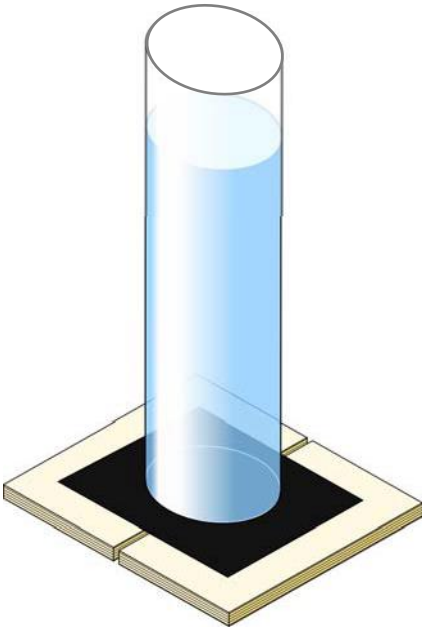

Figure 1: 55 cm (approximate 22 inch) water column testing in ICC-ES criteria requires aged air barrier to resist water penetration through the sheathing and a 6 mm (¼ inch) wide joint.

Recognizing the importance of the air barrier material's ability to withstand the effects of structural movement, the CCMC Technical Guide anticipates the reality of "nail pops" and requires the air barrier to stay intact after being subjected to a simulated "nail pop". The ICC-ES criteria subject the air barrier to a sequence of structural tests followed by environmental exposure. Cyclic transverse loading is followed by racking loads with emphasis on panel to panel joint integrity (Figure 2). After the full sequence of structural and environmental loading the panels are subjected to a simulated wind driven rain to verify waterproofing integrity. In summary, these and other tests in the CCMC and ICC-ES evaluation criteria are an extraordinary series of performance requirements for fluid applied air barriers that independently validate their performance. **Meeting these performance criteria is essential for code compliance in Canada and the US.**

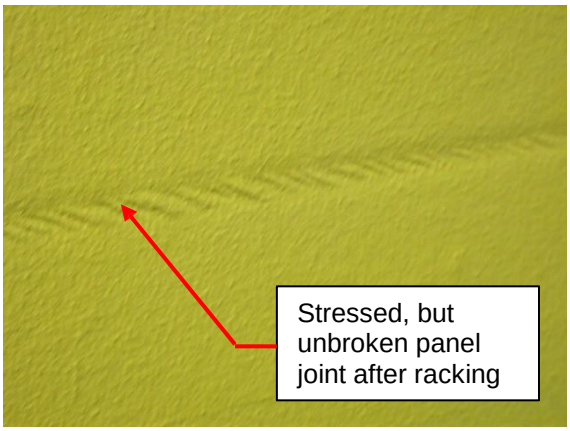

Figure 2: Panel joint waterproofing integrity of StoGuard is maintained after cyclic transverse loading, racking loads, and environmental cycling.

Table 1: StoGuard and Compliance with Building Code Evaluation Criteria and Standards

Evaluation Criteria or Standard for Air Barriers	What the Standard Means	Meets or Exceeds Code Requirements	
		StoGuard®	Other Fluid-Applied Air Barrier Products
Evaluation Criteria: CCMC *Technical Guide for Air Barrier Materials* (NRCC)	Air barrier performance criteria unique for fluid applied air barriers. CCMC listing means the air barrier product has been independently evaluated and found to be in compliance with the National Building Code of Canada as an air barrier material	YES CCMC Report No. 13120-R	None
Evaluation Criteria: ICC-ES AC 212 - *Acceptance Criteria for Water-Resistive Coatings Used As Water-Resistive Barriers over Exterior Sheathing*	Fluid applied water-resistive barrier criteria test for water resistance and leakage using water spray and accelerated weathering, freeze-thaw cycling, and structural cycling. ICC-ES recognition means the product has been independently evaluated and found to be in compliance with the International Building Code and International Residential Code	YES, ICC ESR - 1233	One (see mfr literature)
Standard: ASTM E2178, *Standard Test Method for Air Permeance of Building Materials*	Measures air leakage through air barrier materials. Air leakage less than 0.02 L/sec m^2 (0.004 cfm/ft^2) qualifies as an air-barrier material. Testing can be done as a standalone thin film or on air porous (CMU) substrates	YES Tested over sheathing, CMU	Most (see mfr literature)
Standard: ASTM E2570, *Standard Test Methods for Evaluating Water-Resistive Barrier (WRB) Coatings used under Exterior Insulation and Finish Systems (EIFS) or EIFS with Drainage*	Defines durability testing of water-resistive barriers used under exterior insulation and finish systems. Fire tests are also incorporated to qualify systems for use with foam plastic insulation on noncombustible type construction and in fire-resistive assemblies	YES	Some (see mfr literature)
Standard: ASTM E283, *Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors under Specified Pressure Differences Across the Specimen*	Tests for air leakage through full panel specimens, including joints in sheathing at prescribed pressures.	YES	Some (see mfr literature)
Standard: ASTM E 2357, *Standard Test Method for Determining Air Leakage of Air Barrier Assemblies*	Tests air leakage of full wall assemblies, including joints, penetrations and an opening after cyclic pressure loading	YES	Some (see mfr literature)

Additional Benefits of StoGuard

- **Coating thickness and Cost** - thick film air barrier products tend to cost more than StoGuard thin-film waterproof air barrier, which requires 5-7 dry mils for sheathing substrates (in tandem with joint treatment). In general, CMU substrates require thicker sections of material because of the porosity and irregularity of the substrate. Dry mil thickness will vary from thick to thin, depending where the measurement is taken; hence a minimum mil thickness should NOT be the basis of a specification. Instead a continuous film that fills and covers voids in the surface should be the basis.
- **Energy Savings** – as an effective air barrier StoGuard can reduce energy consumption and costs
- **Efficient, Effective use of Materials** – by requiring less material for an effective air barrier, StoGuard can contribute to the sustainability of building projects

- **Improved Air Quality** – low VOC StoGuard meets US and Canadian air quality standards, including the strictest standard, SCAQMD[3]. In addition air barriers improve indoor air quality by limiting infiltration of outside air which can introduce allergens and pollutants into indoor air
- **Job Site Safety and User Friendliness** - unlike many asphaltic or bituminous products, StoGuard is a water-based product, is safe to use, nonflammable, and cleans with water
- **Quality Control** - StoGuard is manufactured by Sto Corp. under rigorous controls in Sto Corp. ISO 9001:2000[4] and ISO 14001:2004[5] compliant manufacturing facilities

Footnotes:

1. CCMC: Canadian Construction Materials Center. See CCMC 13120-R, *StoGuard® - Air Barrier Material*, http://www.nrc-cnrc.gc.ca/ccmc-ccmc/index.html
2. ICC – ES: International Code Council Evaluation Service. See ICC – ESR 1233, *StoGuard® with Gold Coat® and StoGuard® with EmeraldCoat® Water-Resistive Barriers*, http://www.icc-es.org
3. SCQAMD: South Coast Air Quality Management District, http://www.aqmd.gov
4. ISO 9001:2000 – International Organization for Standardization 9001:2000 Quality Management System, http://www.iso.org/iso/home.htm
5. ISO 14001:2004 – International Organization for Standardization 14001:2004 Environmental Management System, http://www.iso.org/iso/home.htm

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