Evaluation Report CCMC 13612-R
StoGuard® (w/ Sto Gold Coat® and Sto Gold Fill®) – sheathing membrane

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1. Opinion

It is the opinion of the Canadian Construction Materials Centre (CCMC) that "StoGuard® (w/ Sto Gold Coat® and Sto Gold Fill®) – sheathing membrane", when used as a sheathing membrane in accordance with the conditions and limitations stated in Section 3 of this Report, complies with the National Building Code 2010:

- Clause 1.2.1.1.(1)(a), Division A, using the following acceptable solutions from Division B:
  - Sentence 9.27.2.1.(2), Minimizing and Preventing Ingress and Damage (deterioration resistance)
  - Article 9.27.3.1., Elements of the Second Plane of Protection (inner boundary of drainage plane)

- Clause 1.2.1.1.(1)(b), Division A, as an alternative solution that achieves at least the minimum level of performance required by Division B in the areas defined by the objectives and functional statements attributed to the following applicable acceptable solutions:
  - Article 9.27.3.2., Sheathing Membrane Material Standard (asphalt-impregnated paper)

This opinion is based on CCMC's evaluation of the technical evidence in Section 4 provided by the Report Holder.

Ruling No. 12-11-281 (13612-R) authorizing the use of this product in Ontario, subject to the terms and conditions contained in the Ruling, was made by the Minister of Municipal Affairs and Housing on 2012-07-05 pursuant to s.29 of the Building Code Act, 1992 (see Ruling for terms and conditions). This Ruling is subject to periodic revisions and updates.

2. Description

StoGuard® is identified by Sto Corp. as an assembly of proprietary component materials for sealing installed exterior wall sheathing. The "StoGuard® (w/ Sto Gold Coat® and Sto Gold Fill®)" is one specific assembly with: (i) an exterior sheathing joint treatment comprised of Sto Gold Fill® with StoGuard® Mesh and (ii) Sto Gold Coat® water resistant coating over the entire sheathing surface and filled joints.

Liquid-Applied Weather Penetration Barrier (LA-WPB) - Pre-qualification

The proposed assembly has already been qualified for use as a liquid-applied weather penetration barrier (LA-WPB) behind Sto's proprietary EIFS cladding system (see CCMC 12416-R). It is defined as a liquid-applied WPB since the Sto Gold Coat® is a liquid-applied coating that is sprayed or rolled onto the exterior sheathing rather than being trowel-applied.

Sheathing Membrane Function- Scope of this Evaluation

As per CCMC 12416-R, the product has been qualified as the inner boundary[1] of the required second plane of protection from precipitation. However, as the Sto EIFS cladding system is an 'adhered system' with no penetrating cladding fasteners, the effect of fastener penetrations on the water resistance of the coating system needs to be assessed for Part 9 claddings of Division B of the NBC 2010 (see Appendix A). To demonstrate equivalent water resistance performance as the code-specified sheathing membrane (i.e. acceptable solution), this evaluation combines the following: (i) the evaluation of the coating system under CCMC 12416-R as a suitable 'inner boundary' of the second plane of

protection, (ii) evaluation of the water penetration resistance at cladding fastener (stud) locations and (iii) additional resistance to deterioration performance.

StoGuard®

The proposed assembly consists of the following components:

- Sto Gold Fill® , a water-based, flexible, spray- or trowel-applied joint compound that bridges sheathing joints and protects rough openings.
- StoGuard® Mesh, a specifically designed coated glass fiber fabric for embedding into the Sto Gold Fill® at sheathing joint locations.
- Sto Gold Coat® , a ready-mixed, water-based flexible waterproof coating for direct application to vertical above- grade wall sheathing.

Step 1: Sto Gold Fill® shall be sprayed or trowelled into the panel joints and embedded with StoGuard® Mesh at joints between panels. Spot-fill fasteners, knots, or other voids in the sheathing surface with Sto Gold Fill® and then spray or roll the Sto Gold Coat® over the joint/fastener head filler. (See Product Bulletin 266, Sto Gold Fill® and StoGuard® Mesh for detailed application.)

Step 2: Two-coats [2] of Sto Gold Coat® shall be applied over the entire surface by spray, brush or roller. The spraying or rolled application of the Sto Gold Coat® must deliver a wet thickness of 0.25 mm. (See Sto Product Bulletin 265 for detailed application instructions on specific substrates).

Substrates

As per CCMC 12416-R, the product has been evaluated for use over specific exterior sheathing substrates. For sheathings intended to be installed behind Part 9 claddings, specifically: OSB, plywood or GP DensGlass® Gold exterior gypsum sheathing shall be used.

Required Insulation

This Report is focused on the evaluation of "StoGuard® (w/ Sto Gold Coat® and Sto Gold Fill®)", in combination with the exterior sheathing, serving the function as the designated sheathing membrane behind Part 9 claddings. Since the combination of the StoGuard® and the exterior sheathing has a low air and water vapour permeance, the amount of insulation required shall be determined based on the geographical location (i.e. Heating Degree Day) and the amount of cavity insulation, in accordance with Table 9.25.5.2. of Division B of the NBC 2010. Figures 1 and 2 show typical installations with insulation. Insulation is not shown in Figure 3 to better illustrate the details.

Note: The product is also qualified for other applications and functions covered under separate evaluations. For example, the product has been qualified as an air barrier material for air leakage control under CCMC 13120-R.

When the product is to be installed as the designated sheathing membrane, the StoGuard® components must be clearly identified with the following information: name of manufacturer or logo, and the phrase "CCMC 13612-R."

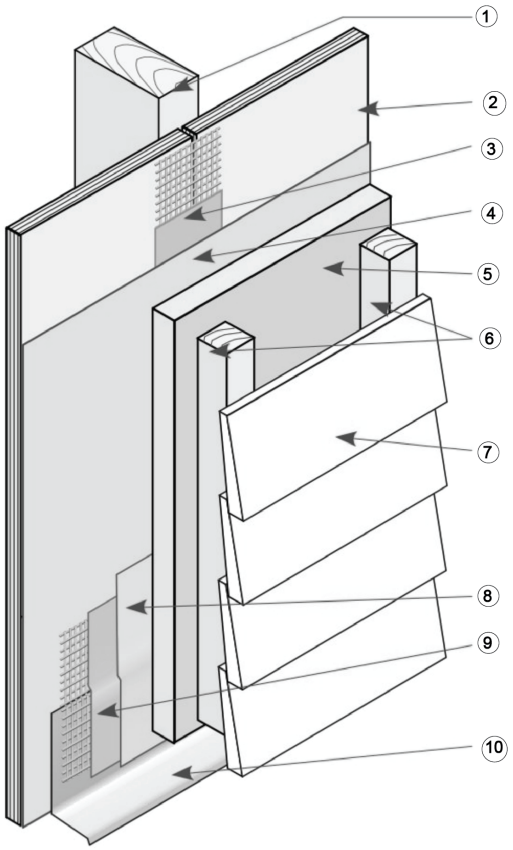

Figure 1. Typical installation of the product behind insulation and Part 9 cladding:

1. **supporting structure**
2. **substrate**
3. **Sto Gold Fill® with StoGuard® Mesh**
4. **Sto Gold Coat®**
5. **insulation**
6. **strapping**
7. **horizontal siding**
8. **Sto Gold Coat®**
9. **Sto Gold Fill® with StoGuard® Mesh**
10. **flashing**

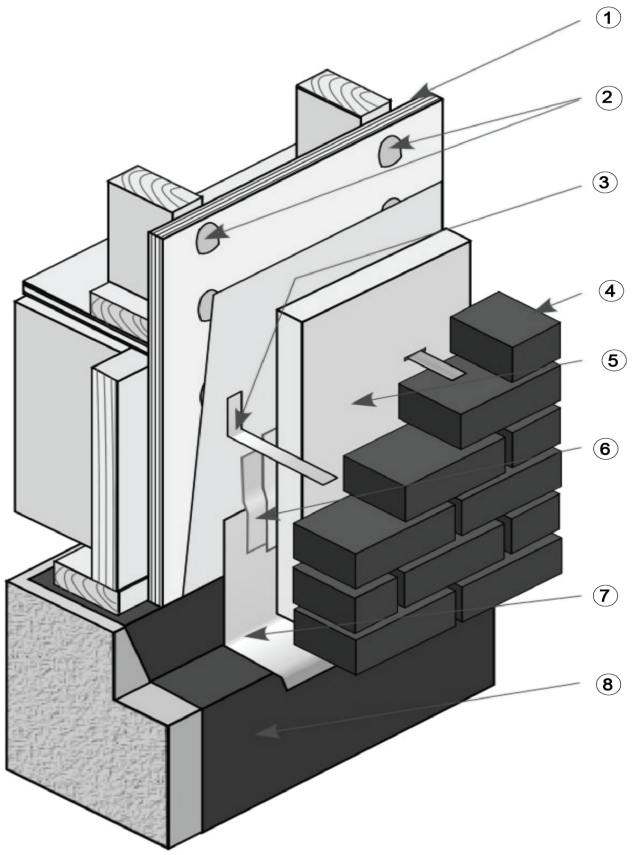

Figure 2. Product continuity at foundation walls and typical insulation with brick veneer cladding:

1. **substrate**
2. **fasteners spotted with Sto Gold Fill®**
3. **masonry anchors fastened through StoGuard®**
4. **brick**
5. **insulation**
6. **Sto Gold Fill® with StoGuard® Mesh and Sto Gold Coat® lapped over flashing**
7. **through-wall flashing**
8. **foundation waterproofing**

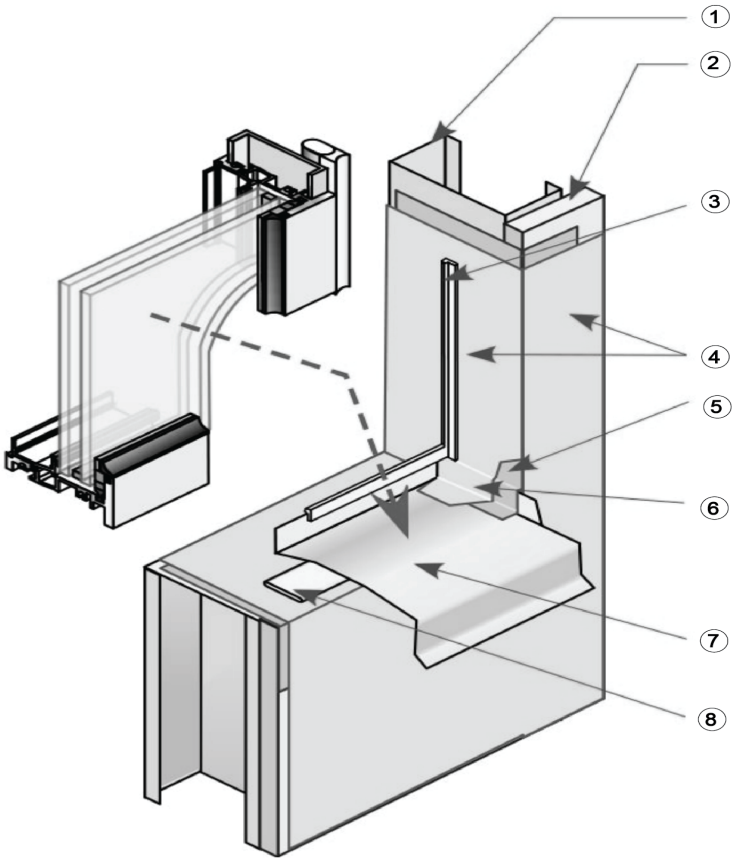

Figure 3. Exterior wall section – continuity at windows (NB: required insulation not shown):

1. **supporting structure**
2. **substrate**
3. **air seal continuous around interior perimeter of window**
4. **Sto Gold Fill®**
5. **Sto Gold Fill® with StoGuard® Mesh**
6. **Sto Gold Fill® lapped over end dam of flashing to direct water to the exterior**
7. **pan flashing**
8. **sealant or other gasket material to maintain air seal between sill and flashing**

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1 The NBC 2010 requires a second plane of protection behind cladding and a sheathing membrane is specified 'to function as' the inner boundary of said second plane of protection. The terms, sheathing membrane or inner boundary can be used interchangeably when addressing the expected performance of protection from (incidental) precipitation of the element intended to function in the role of inner boundary.

2 From CCMC 12416-R, two coats of Sto Gold Coat® are required due to the likelihood of pinholes being present with only one coat. Two coats are mandated to ensure complete coverage and protection in the field application.

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3. Conditions and Limitations

CCMC's compliance opinion in Section 1 is bound by the "StoGuard® (w/ Sto Gold Coat® and Sto Gold Fill®) – sheathing membrane" being used in accordance with the conditions and limitations set out below.

- The relevant limitations related to the proper installation of StoGuard® with Sto Gold Fill® and Sto Gold Coat® , as the inner boundary outlined in CCMC 12416-R, apply to the installation behind Part 9 claddings;
- The product can be used as a sheathing membrane forming the inner boundary of the NBC-specified second plane of protection if installed according to the manufacturer's detailed field application instructions and by knowledgeable and qualified installers. Details are contained in the StoGuard® : Waterproofing/Air Barrier Handbook published by Sto Corp. and available at www.stocorp.com.
- The cladding fasteners must conform to the fastener penetration requirements of the NBC 2010 for claddings outlined in Appendix A of this Report.
- Insulation must be installed outboard of the product. The level of insulation must comply with Table 9.25.5.2. of Division B of NBC 2010. The product must be protected by the cladding from exposure to ultraviolet (UV) radiation from the sun within 60 days.
- Shall be installed with a minimum 10-mm air space between the coated sheathing and the Part 9 cladding, unless the cladding system has been deemed to not require an air space.
- It should be noted that a concealed air space exceeding 25 mm in width must contain proper fire stopping in accordance with Subsection 9.10.16., Fire Blocks, of Division B of the NBC 2010.
- The components must be clearly identified with the phrase "CCMC 13612-R."

4. Technical Evidence

The Report Holder has submitted technical documentation for CCMC's evaluation. Testing was conducted at laboratories recognized by CCMC. The corresponding technical evidence for this product is summarized below.

4.1 Performance Requirements

Table 4.1.1 Results from testing the product to CCMC's Technical Guide for EIFS with no fasteners (CCMC 12416-R)

Qualification to CCMC Technical Guide MF 07 24 13.01 for weather penetration barrier behind EIFS cladding		
Substrates (sheathings on framing) to be qualified for fastener attached cladding	**Criteria**	**Results**
Tension Bond Tests to qualify WPB coating (Sto Gold Coat) on non-wood substrates		
WPB Bond test (MPa)		
Adhesion to substrate (Sto Gold Coat® to DensGlass® Gold):	**No detachment at bonding plane @**	Pass[1]
dry state	0.3	
2 h drying	0.1	
7 d drying	0.3	
Water Resistance Tests on WPB coating		
Coefficient of water absorption @ 96h kg/(m^2 ·s$^{1/2}$)	≤ 0.0040	Sto Gold Coat® : 0.0008 Sto Gold Fill® : 0.00192

Table 4.1.1 Results from testing the product to CCMC's Technical Guide for EIFS with no fasteners (CCMC 12416-R) (cont.)

Qualification to CCMC Technical Guide MF 07 24 13.01 for weather penetration barrier behind EIFS cladding		
Substrates (sheathings on framing) to be qualified for fastener attached cladding	**Criteria**	**Results**
WPB coating (Sto Gold Coat) on wood substrate qualification		
Adhesion to wood substrates under different moisture conditions - WPB coating adhesion test on wet OSB	**No detachment at bonding plane @**	Pass
	0.3	
	0.1	
	0.3	
Water transmission resistance, WPB coating, 25 mm head of water for 10 days	Max. 2 x 10^{-7} kg/m^2 ·s	Pass
Accelerated weathering resistance (250h) of WPB coating	No visible cracks	Pass
Nail popping resistance (Sto Gold Fill®)	1-mm push back of nail head, no cracking	Pass
Joint disruption resistance (Sto Gold Fill®)bending/tension test on WPB in horizontal OSB 2-3 mm gap	No visible cracks	Pass
Resistance to relaxation under environmental cycling (Sto Gold Fill®)	No visible cracks or conduct water transmission test to confirm	Pass

Notes to Table 4.1.1:

1 Substrate failure (i.e. DensGlass® Gold glass mat facer) occurred before the requirement of 0.3 MPa could be attained. The conformity of the respective coating (water penetration barrier) to the 0.3 MPa criterion was established by testing over a concrete substrate, on which it exceeded the minimum requirement.

Table 4.1.2 Results from testing the product for water resistance at fastener locations

Alternative Sheathing Membrane Solutions 6	Substrate	Criteria 1 (Grams of moisture 2 at pressure difference(ΔP) across joint assembly)		Result
Wood Based Sheathing				
StoGuard® with 2 coats of Sto Gold Coat® over Sto Gold Fill® in sheathing gaps	OSB	**ΔP**	**grams 3**	**grams**
		75 Pa	6.51	0.0
		150 Pa	7.22	0.71
		300 Pa	7.87	1.41
DensGlass® Gold Sheathing				
StoGuard® with 1 coat of Sto Gold Coat® over Sto Gold Fill® in sheathing gaps	DensGlass® Gold (DGG)	**ΔP**	**grams 4**	**grams**

Table 4.1.2 Results from testing the product for water resistance at fastener locations (cont.)

Alternative Sheathing Membrane Solutions [6]	Substrate	Criteria [1] (Grams of moisture [2] at pressure difference(ΔP) across joint assembly)		Result
		75 Pa	2.13	3.12 [5]
		150 Pa	4.37	3.29
		300 Pa	5.06	3.39

Notes to Table 4.1.2:

1 Tests were conducted before and after aging of specimens.

2 The test values are median values.

3 For wood based substrates, the water penetration criteria are based on benchmark testing of an acceptable solution (i.e. sheathing membrane) typically used in wood-frame construction.

4 For fiber glass coated exterior gypsum substrates, the water penetration criteria are based on benchmark testing of an acceptable solution (i.e. sheathing membrane) typically used in commercial construction (i.e. sheathing membrane over DGG on steel studs).

5 This result is the only case where the LA-WPB had a higher water penetration by 1g of moisture. This testing was conducted with only 1 coat of the LA-WPB applied over the DGG substrate, while the Conditions and Limitations in this Report and CCMC 12416-R require 2 coats. Therefore, based on the overall performance of the LA-WPB applied in 2 coats, it is deemed to pass the criterion as having an equal or better performance compared to the benchmark specimen (i.e. acceptable solution).

6 Water shall be sprayed onto fasteners through the listed alternative sheathing membrane solutions at stud location.

Table 4.1.3 Results from testing the product for resistance to deterioration (in addition to CCMC 12416-R requirements) [1]

Property	Criteria	Result
Water Resistance Performance after Aging (no fasteners)		
Section 3.3 - Freeze-Thaw Resistance	No cracking, checking, crazing, erosion or other adverse characteristics	Passed
Section 3.4 – Water Resistance Testing (14d at 100% humidity)	No cracking, checking, crazing, erosion or other adverse characteristics	Passed
Section 3.9 – Water Penetration after UV Aging and Accelerated Aging	No cracking, checking, crazing, or water penetration	Passed
Racking Resistance (high wind and seismic areas)		
Section 3.8 - Structural, racking, restrained and water penetration tests	No cracking of coating	Passed

Note to Table 4.1.3:

1 Taken from Acceptance Criteria AC212, "Acceptance Criteria for Water-resistive Coatings Used as Water-Resistive Barriers Over Exterior Sheathing".

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Appendix A Intended Part 9 Cladding Applications over StoGuard® with Sto Gold Coat®

The evaluation to this CCMC Report is limited in scope to the proprietary LA-WPB being installed behind the following claddings in buildings located in coastal or non-coastal areas as defined by the NBC 2010 based on the Heating Degree-Days (HDD) and the Moisture Index (MI) of building location.

Table B.1

Non-coastal areas			
Sheathing	**LA-WPB**	**Insulation Requirement** [3]	**Cladding** [1]
OSB	2 coats	Insulation Requirement based on WVP[2] & required insulation thickness based on geographical HDD	• Lumber siding • Wood shingles & shakes • Fiber cement shingles and sheets • Plywood • Hardboard • OSB and waferboard • Metal siding (horizontal or vertical) [1] • Vinyl siding (horizontal or vertical) [1] • Stucco (with paper-backed lath or mesh as slip sheet to not stick to WPB, unless deemed not necessary for specific WPB) • Brick with 25-mm air space ◦ brick straps ◦ ~~brick ties~~ (no method of sealing) [3]
Plywood	2 coats		
Glass-mat gypsum	2 coats		
Coastal areas			
Sheathing	**LA-WPB**	**Insulation Requirement** [3]	**Cladding** [1] **on 10-mm furred air space**
OSB	2 coats	Insulation Requirement based on WVP[2] & required insulation thickness based on geographical HDD	• Lumber siding • Wood shingles & shakes • Fiber cement shingles and sheets • Plywood • Hardboard • OSB and waferboard • Metal siding (horizontal or vertical) [1] • Vinyl siding (horizontal or vertical) [1] • Stucco (with sheathing membrane as slip sheet to not stick to WPB, unless deemed not necessary for specific WPB) • brick straps • ~~brick ties~~ (no method of sealing) [3]
Plywood	2 coats		
Glass-mat gypsum	2 coats		

Notes to Table B.1:

[1] If the sheathing membrane is to qualify as the air barrier, then fasteners for cladding attachment must be installed at stud locations only, through the sheathing and into stud at Code-specified fastener depth penetration. No fasteners between studs are permitted through the sheathing and into the wall cavity. In the case of vertically installed sidings or stucco mesh, the fasteners are permitted to be installed through the sheathing and into the wall cavity. If the evaluation with this vertically installed cladding or stucco mesh is sought, then air leakage with fasteners into the wall cavity shall be carried out.

2	The water vapour permeance (WVP) is the value of the composite LA-WPB coated sheathing. The default position is that the coated exterior sheathing has a low air and vapour permeance requiring insulation as per subsection 9.25.5.
3	Sealing methods of any holes created as 'through penetrations' have not been evaluated.