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Air and Water Tightness Impacts of Insulation Fasteners through Exterior Insulated Wall Assemblies with Liquid Applied and Self-Adhered Bituminous Membranes

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Preface

As requested by ITW Construction Products (Ramset), RDH Building Engineering Ltd. (RDH) performed research and laboratory testing into the potential leakage impacts of Ramset® T3 InsulFast™ fasteners and generic screws on the air and water resistive barrier materials of commercial wall assemblies. This report documents the research and product laboratory testing work performed by RDH towards the development of a separate technical bulletin on the topic.

This report has been prepared for the exclusive use of ITW and is not to be relied upon by others. The conclusions demonstrate the potential impacts of selected fastener types through selected membranes used widely within the market, though may not be representative of all applications. The air and water testing was performed under a laboratory setting and the results cannot be directly applied to specific projects. The design of wall assemblies and selection of air barrier and water resistive barrier membranes and associated fasteners and penetrations must be carefully performed by a design professional. The selection of such materials and design strategies will depend on building type, height, and exposure to the environment and other specific project considerations.

1 Introduction

1.1 Background

A variety of types of exterior insulation fasteners and cladding attachment methods exist on the market today. These fasteners are attached to the structure and penetrate liquid and sheet applied membranes applied to the wall for the specific purpose of air and water resistance. As a result of this construction practice, there have been concerns raised by some parties about the impact that these fasteners have on air and water tightness, though little anecdotal evidence is available to suggest an issue. Regardless, there remain concerns and a need for further study and confirmatory testing of new products to the market.

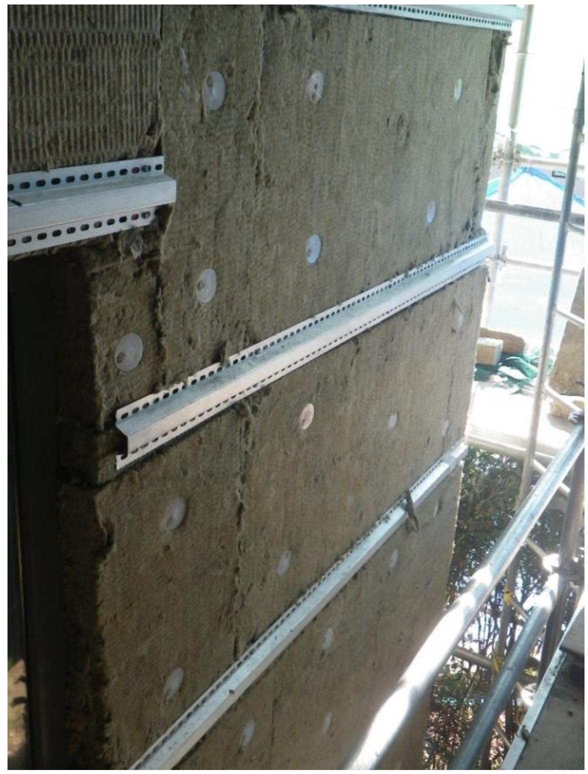


Figure 1.1 Exterior insulated wall assembly with InsulFast™ and screw fasteners penetrating the liquid applied membrane behind the insulation

Within the industry there is very little published information on the air and water tightness impacts of various fasteners through various air barrier/water resistive barrier (WRB) membranes. No standard ASTM test procedure or requirement needs to be met for either the fastener or membrane in this configuration, though there are several ASTM air and water penetration resistance standards which could be applied to the scenario.

Subsequently, there is very little information or target performance thresholds available to manufacturers of insulation or cladding attachment fasteners for purposes of comparison. While there is no requirement to meet a certain test threshold, it could be argued that any fasteners through the membrane should not cause significant air leakage, or water leaks or cause the penetrated material to no longer be considered an air barrier material or WRB by existing ASTM standards.

This study examines the impacts of Ramset® T3 InsulFast™ fasteners and common screws (with insulation washers) on two different industry standard air and water resistive barrier membranes applied to conventionally built concrete block (CMU) and steel stud backup walls. While the primary focus of this study is on the impact of the proprietary InsulFast™ fasteners, there currently is no laboratory testing data for standard screws or other fasteners in this assembly, so in each test the InsulFast™ and screws were tested side by side for reference.

The threshold for an air barrier material according to the Air Barrier Association of America (ABAA) is 0.004 cfm/ft^2 (0.02 L/s·m^2) at a pressure difference of 0.3" WC (75 Pa). It is therefore reasonable to expect that any type of fastener should not increase the air leakage through an air barrier membrane above this limit.

2 Methodology

The methodology for wall testing was based on two test standards: ASTM E2178 for air leakage testing and ASTM E331 for water penetration testing. The test specimens and apparatus were designed to ensure robust and repeatable results.

2.1 Wall Types – Membranes and Back-up Construction

The materials for testing includes different wall assembly configurations and a variety of vapour permeable membranes. Five common wall types (W1-W5) were selected for this study and laboratory testing procedure:

- → W1 - 6" Concrete block (CMU) wall with a 60 mil bituminous self-adhered membrane sheet
- → W2 - 6" Concrete block (CMU) wall with a 17 mil silicone-based liquid applied membrane
- → W3 - Steel stud wall with 5/8" exterior grade fiberglass faced gypsum sheathing and a 60 mil bituminous self-adhered membrane
- → W4 - Steel stud wall with 5/8" exterior grade fiberglass faced gypsum and a 17 mil silicone liquid applied membrane
- → W5 - Steel stud wall with 5/8" exterior grade fiberglass faced gypsum with fifteen different vapour permeable liquid and thin sheet applied membranes

In all five scenarios the primary air barrier (AB) and water resistive barrier (WRB) of each wall assembly is the applied membrane. The tests were setup so that the full air barrier test pressure occurred across the liquid or self-adhered membrane applied to the substrate and not another component of the wall test panels.

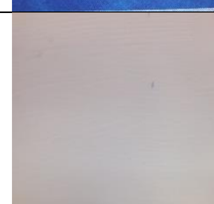
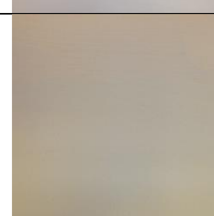
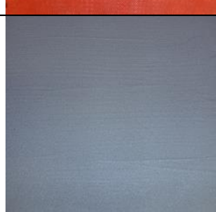
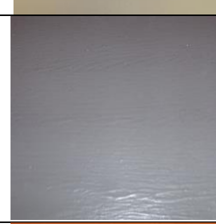
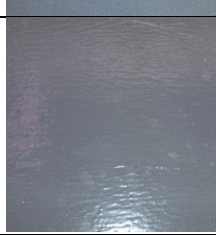
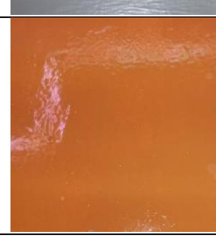
The two primary membranes selected for testing for Walls 1-4 are Bakor Blueskin WP200 (self-adhered bituminous membrane) and GE Silshield SEC 2600 (liquid applied silicone membrane). These two membranes represent a range of products and inherent self-sealing abilities ranging from thinly applied liquid to a thicker applied sheet. The self-sealing ability between both membranes is hypothesized to be different for the various tested fasteners.

TABLE 2.1 AIR AND WATER RESISTIVE BARRIER MEMBRANES	
Bakor Blueskin WP200[1] 	*Description:* Bakor Blueskin WP200 is a self-adhesive membrane (SAM) which consists of an SBS rubberized asphalt compound laminated to a blue, high density cross-laminated polyethylene film. *Thickness:* 60 mils (1.5mm)

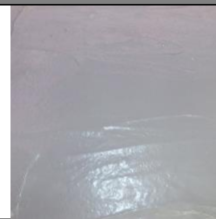
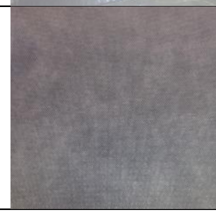
[1] Similar materials to Henry Blueskin WP 200: Soprema Sopraseal Stick 1100, Tremco Exo-Air 110, Protectowrap PW100/40, Grace Perm-a-barrier etc.

TABLE 2.1 AIR AND WATER RESISTIVE BARRIER MEMBRANES	
GE Silshield SEC 2500[2] 	*Description:* SEC2600 is a fluid-applied 100% silicone vapour permeable material. *Thickness:* 17 mils (0.43mm)

The fifth wall type (W5) was constructed to qualitatively evaluate differences in the self-sealing ability of various thin sheet and liquid applied membranes on gypsum sheathing with steel stud backup. The membranes were applied in 12" square sections to the manufacturer's recommended thickness. The membranes used for W5 are listed in Table 2.2.

TABLE 2.2 MEMBRANE TYPES FOR QUALITATIVE SELF-SEALING TEST			
	Grace Construction Products Perm-A-Barrier VPS Sheet 21 mils		Henry Company Blueskin VP 160 Sheet 23 mils
	Henry Company Air-Bloc 33MR Liquid 55 dry mils		Dow Corning DefendAir 200 Liquid 15 dry mils
	Vaproshield Wrapshield SA Sheet 26 mils		Sto Corp EmeraldCoat Liquid 10-30 wet mils
	BASF Enershield HP Cementitious Liquid 10 wet mils – gypsum 2x10 wet mils – osb/concrete		GE Momentive SEC 2500 Liquid 17 dry mils
	GE Momentive SEC 2600 Liquid 17 dry mils		Prosoco R-Guard Cat5 Liquid 12 dry mils

[2] Similar materials to GE Momentive Silshield SEC 2500/2600: Bakor Air-Bloc 33MR, Dow Corning DefendAir 200, Prosoco R-Guard Cat5, Carlisle Barritech VP, Pecora XL-Perm Air VP, Tremco ExoAir 230, Dupont Tyvek Fluid Applied WB etc.

TABLE 2.2 MEMBRANE TYPES FOR QUALITATIVE SELF-SEALING TEST			
	Carlisle CCW Barritech VP Liquid 40 dry mils		Tremco ExoAir 230 Liquid 35 dry mils
	Pecora Corporation XL-Perm Air VP Liquid 15 dry mils		Soprema SopraSeal Stick VP Sheet 24 mils
	Dupont Tyvek Liquid Applied WP 25 wet mils		

2.2 Fastener types

Two main types of fastener were selected for the study: Ramset® T3 InsulFast™ fasteners and generic concrete and metal screws (with insulation washers). The details and specifications for each fastener are listed in Table 2.3.

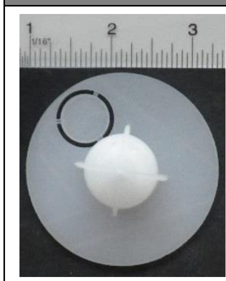
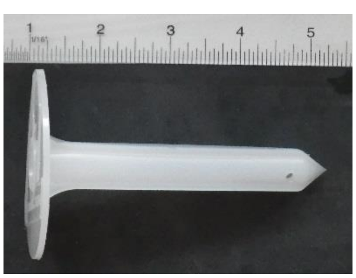
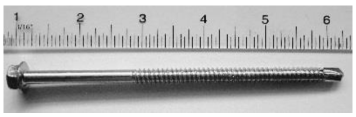
TABLE 2.3 INSULFAST™ AND GENERIC SCREW FASTENER INFORMATION	
 Ramset® T3 InsulFast™ for concrete block	***Description*** *Manufacturer:* Ramset® *Sleeve:* high-density polyethylene, 2-3/8” holding diameter; *Pin:* heat treated carbon steel pin, zinc plated (7 µm); 1 ¼” pin depth *Fastener tool:* T3 fuel cell, impact energy 100(J), compression force 7.7lbs (3.5kg)
 Ramset® T3 InsulFast™ for steel stud	***Description:*** *Manufacturer:* Ramset® *Sleeve:* high-density polyethylene, 2-3/8” holding diameter; *Pin:* heat treated carbon steel pin, zinc plated (7 µm); 2” pin depth *Fastener tool:* T3 fuel cell, impact energy 100(J), compression force 7.7lbs (3.5kg)

TABLE 2.3 INSULFAST™ AND GENERIC SCREW FASTENER INFORMATION	
 Generic concrete screw (with insulation washer)	***Description:*** *Manufacturer:* Buildex *Model:* Tapcon *Length:* 5” *Diameter:* ¼” *Type:* hex head
 Generic metal screw (with insulation washer)	***Description:*** *Manufacturer:* Leland Industries *Model:* Master Driller *Length:* 5.5” *Diameter:* ¼” *Type:* hex head, self-drilling
 Insulation washer	***Description:*** Generic insulation washer *Material:* Galvanized steel *Holding diameter:* 3 ¾”

2.3 Test Chamber

A test chamber was specially designed and constructed for the purposes of this study to accurately measure the air and water tightness impacts of very small fasteners through full size wall assembly mock-ups.

Figure 2.1 shows an exterior view of the chamber and how the sample walls are clamped into place through the test opening with a man access door on the opposite side. The chamber is pressurized/depressurized using a shop vacuum connected to a variac transformer to adjust the flow rate. An ASTM E1105 calibrated rain rack is mounted within the chamber at the appropriate distance from the wall sample. Dyed water is self-contained within the chamber for the rain rack testing. Figures 2.1 through 2.6 show general photos of the chamber and test components.

The design of the test chamber and test procedure allows for the installation of insulation and different fastener configurations from within the chamber (exterior of wall sample), without have to unclamp and reclamp the test specimen for each test as would need to be done using standard test walls, resulting in greater test accuracy.

Calibrated air flow gauges are installed inline with the vacuum to measure flow rates to an accuracy of 3.3scfh (0.055cfm) for the total enclosure area (including the test chamber). The accuracy per square foot is determined by dividing the total enclosure accuracy by the total enclosure area, which equals 0.00072 cfm/ft^2. The accuracy per square foot is 5.5x less than the air barrier requirement of 0.004 cfm/ft^2 at 75 Pa, which provides a fine enough resolution to determine whether or not the air barrier material meets the industry requirement.

Temperature sensors are installed on either side of the inline flow gauges to ensure normalized flow rates.

Figure 2.1 Exterior Views of Test chamber with CMU wall clamped for testing

Figure 2.2 Exterior and Partial Interior View of Test chamber with CMU wall clamped for testing

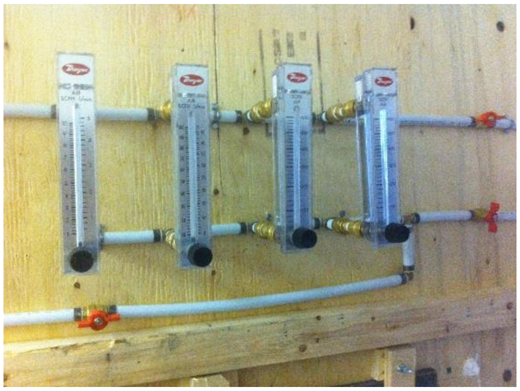


Figure 2.3 Calibrated inline flow gauges

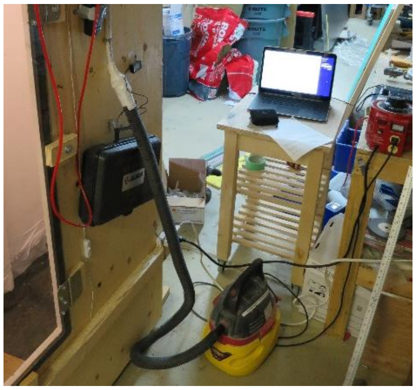


Figure 2.4 Vacuum system to control (de)pressurization of test chamber.

Figure 2.5 Test chamber clamping face and interior.

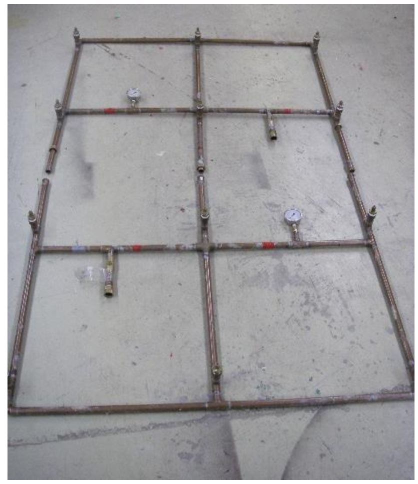


Figure 2.6 Calibrated (ASTM E1105) spray rack used for testing.

2.4 Laboratory Test Procedure

The testing is divided into two distinct phases; air and water. Each wall (W1-W4) was subjected to the same steps for each phase (outlined in Tables 2.3 and 2.4). The qualitative testing of W5 followed a different procedure outlined in Section 2.4.5. The steps are included below along with the layout for fastener installation at each step. The raw data acquired through the testing phases for W1-W4 is analyzed per the description below.

2.4.1 Air Leakage Testing

Air leakage testing was conducted over a range of differential pressures and fastener combinations and was done in accordance with the ASTM E2178. The following steps outline the test procedure (Table 2.4)

TABLE 2.4 AIR LEAKAGE TEST PROCEDURE	
Step	Description
Step A1	The wall specimen is clamped to the test chamber and theatrical fog is inserted into the chamber to test air tightness of the gaskets between the wall and test chamber and around the test chamber door. The test chamber is pressurized to 75Pa during this step. If leakage is noted, adjustments are made to eliminate it and the step is repeated.
Step A2	The wall is pressurized through a differential pressure range of 10Pa to 100Pa at intervals of 10Pa. The wall is tested at 75Pa as well, though it does not lie within the 10Pa intervals. Leakage values are noted at each pressure interval and recorded.
Step A3	The wall is depressurized through a differential pressure range of -10Pa to -100Pa at intervals of 10Pa. The wall is tested at -75Pa as well, though it does not lie within the 10Pa intervals. Leakage values are noted at each pressure interval and recorded.
Step A4	Ramset® T3 InsulFast™ fasteners are properly installed and steps A2 and A3 are repeated. (refer to Table 2.6 for layout)
Step A4a	*-for steel stud walls only-* Ramset® T3 InsulFast™ fasteners are intentionally installed to miss the steel studs and steps A2 and A3 are repeated. (refer to Table 2.6 for layout)
Step A5	Conventional screws and insulation plates are properly installed and steps A2 and A3 are repeated. (refer to Table 2.6 FASTENER LAYOUT and Test phases for layout)

TABLE 2.4 AIR LEAKAGE TEST PROCEDURE	
Step A5a	*-for steel stud walls only-* Screws are intentionally installed to miss the steel studs and steps A2 and A3 are repeated. (refer to Table 2.6 for layout)
Step A6	Step A1 is repeated to note any visible leakage paths through fastener penetrations.

2.4.2 Water Penetration Testing

Water penetration testing was conducted by spraying the test specimen with fluorescent dye water at a calibrated rate for 15 minutes through a range of differential pressures per the ASTM E1105 test standard. A pressure differential of 200 Pa was selected to represent a low-rise exposure and 700 Pa for a high-rise exposure

Figure 2.7 Samples being tested for water penetration

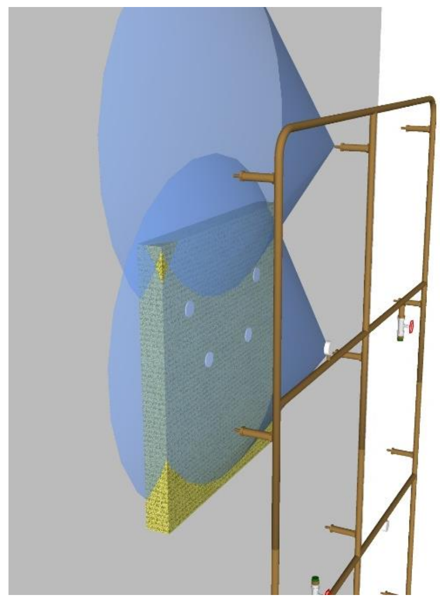


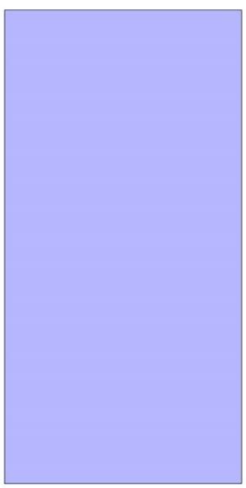
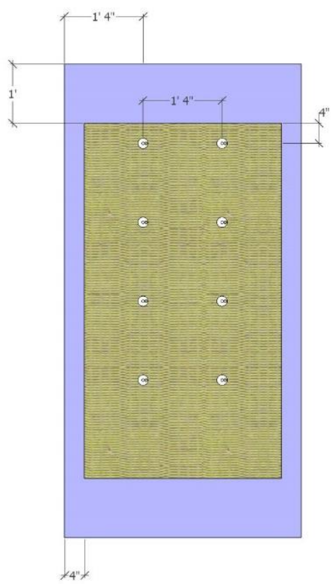
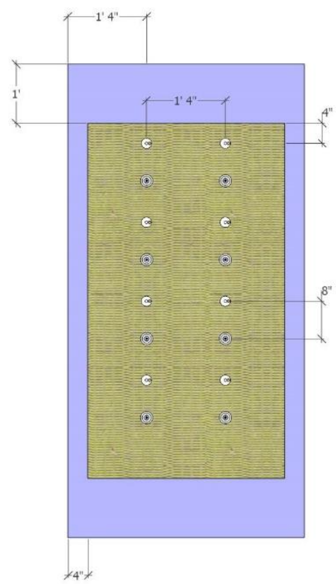
Figure 2.8 Representation of how calibrated spray was used on test specimens.

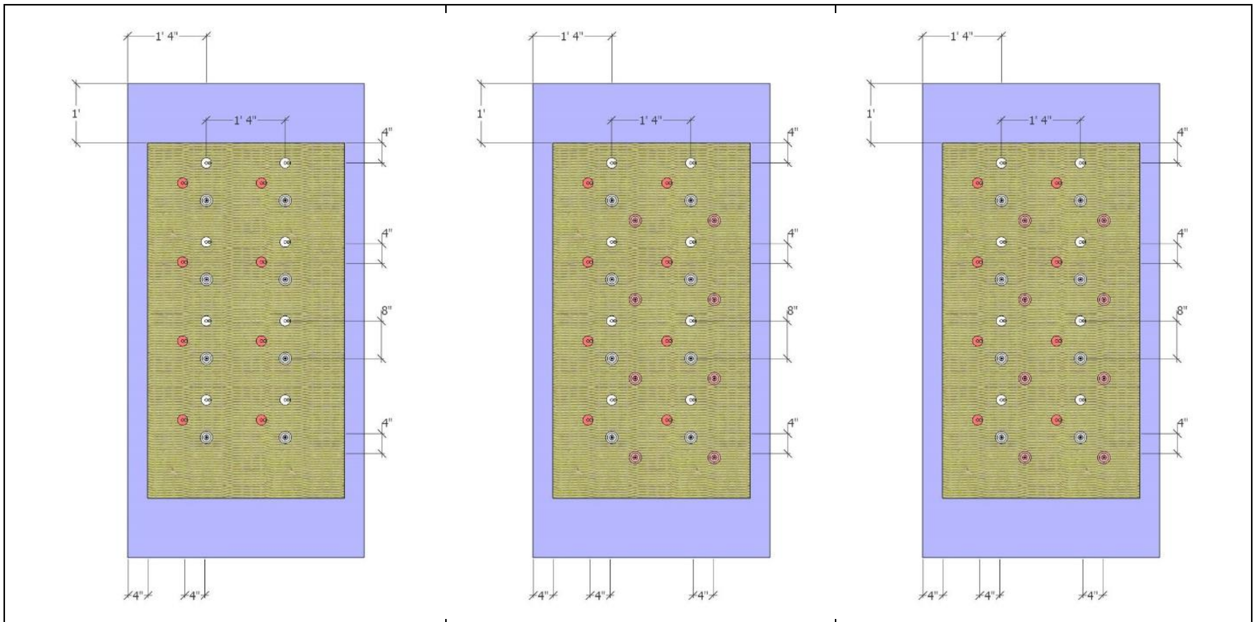
While this unclad and exposed insulation test setup may not be a real world wetting scenario, mainly as the volume of water reaching this interface in the lab is several orders of magnitude greater than what would reach this location in the field, it does provide a relative comparison and potential susceptibility to water if large amounts of water were draining behind the insulation layer. Table 2.5 outlines the procedure followed during testing.

TABLE 2.5 WATER PENETRATION TESTING PROCEDURE	
Step P1	The wall was sprayed at a calibrated rate for 15 minutes with fluorescent dye at 0 Pa (0" WC)
Step P2	The wall was sprayed at a calibrated rate for 15 minutes with fluorescent dye at 200 Pa (0.8" WC)
Step P3	The wall was sprayed at a calibrated rate for 15 minutes with fluorescent dye at 700 Pa (2.8" WC)
Step P4	If no leakage was noted, the insulation was removed and the fasteners retained and the wall was sprayed at a calibrated rate for 15 minutes with fluorescent dye at 700 Pa (2.8" WC)

2.4.3 Fastener Layouts

The test procedure for wall types W1-W4 followed a specific fastening procedure as outlined in Table 2.3. This was performed so that the incremental impact of different fasteners (and misfires into steel stud walls) could be individually measured on the same wall panel. The test procedure for each test wall consists of quantitative air tightness testing, followed by qualitative air tightness testing (theatrical fog) and qualitative water testing. The steps for testing are listed above and can be cross-referenced with the table below to better understand the fastener layout for each phase of testing.

TABLE 2.6 FASTENER LAYOUT AND TEST PHASES FOR WALL TYPES W1-W4		
		
Step A1 to 3	*Step A4*	*Step A4a*



Step A5	Step A5a	*Step A6 and P1-4*

The fastener layout for wall type W5 is similar to the layout in step A5a for wall types W1-W4. However, unlike W1-W4, the fasteners for W5 were installed all at the same time and the insulation was removed after installation. Two fasteners of each type (Ramset® T3 InsulFast™ and generic screws) were installed into each of the 15 membrane sections. One of each type of fastener was installed properly to bed into the steel stud backing and one of each type of fastener was installed intentionally to miss the steel stud (representing a misfire).

2.4.4 Data Analysis

The raw data from the testing phases is used to determine the air leakage rate curve for the test specimen. The advantage in converting measured pressure values to idealized pressure values is that it provides a better overall understanding of how pressure and flow are related to the test specimen reducing anomalous differences between testing phases.

Once idealized values have been determined, the values for each test phase (except the baseline) are isolated by negating the values from the previous test phase. The result is the air leakage rate associated with the fasteners installed in that test phase.

For example:

To determine the air leakage rate associated with the installation of Ramset® T3 InsulFast™ fasteners, one simply takes the values for the pressure intervals of the Ramset® T3 InsulFast™ test phase and negates the values for the same pressure intervals from the baseline test phase. The remainder is the leakage associated with installation of the fasteners as shown in Table 2.3.

TABLE 2.7 CMU WALL WITH LIQUID APPLIED AIR BARRIER			
Pressure differential	Ramset® T3 InsulFast™ (cfm)	Baseline (cfm)	Ramset® T3 InsulFast™ Isolated results (cfm)
10.0	0.1304	-0.1278	= 0.0027
20.0	0.2227	-0.2194	= 0.0033
30.0	0.3044	-0.3009	= 0.0035
40.0	0.3800	-0.3766	= 0.0034
50.0	0.4514	-0.4482	= 0.0032

2.4.5 Qualitative Membrane Testing

Wall type W5 was qualitatively tested for the self-sealing ability of a variety of sheet and liquid applied membranes around generic screws and Ramset® T3 InsulFast™ fasteners.

Air Leakage Testing

Theatrical fog was injected into the test chamber and pressurized to 75 Pa, similar to step A1. Any visible air leakage through fastener penetrations was noted. If no leakage was observed the pressure difference was lowered to 10Pa and the penetrations again examined for visible leakage.

Water Penetration Testing

Wall type W5 was tested for water penetration according to the steps P1 – P3 outlined in Table 2.5. Any observed leakage was noted along with the time (into the test) of observation.

3 Results and Analysis

The results from the testing are presented in two sections. The first section describes the results of air leakage and water penetration testing for wall types W1-W4. The second section describes the qualitative results of air leakage and water penetration testing for wall type W5.

3.1 Results & Observations - Wall Types W1-W4

3.1.1 CMU wall with sheet applied membrane

TABLE 3.1 W1 - CMU WALL WITH SHEET APPLIED MEMBRANE OBSERVATIONS	
Air leakage testing	No measureable difference from fastener installation
Water penetration testing	No observed water penetration Elevated moisture level behind sheet applied membrane at one screw location
Observations	Concrete screws spalled concrete block at all locations Ramset® T3 InsulFast™ spalled concrete block at three of four locations

There was no measureable impact on the airtightness of the CMU wall with sheet applied membrane from the installation of Ramset® T3 InsulFast™ fasteners or conventional screws. Similarly, no water penetration was observed through any of the fastener locations. The removal of the sheet membrane showed elevated moisture levels at one of the screw locations. The elevated moisture levels were confined to the immediate area (~1.5" diameter) around the screw location and did not penetrate farther into the assembly.

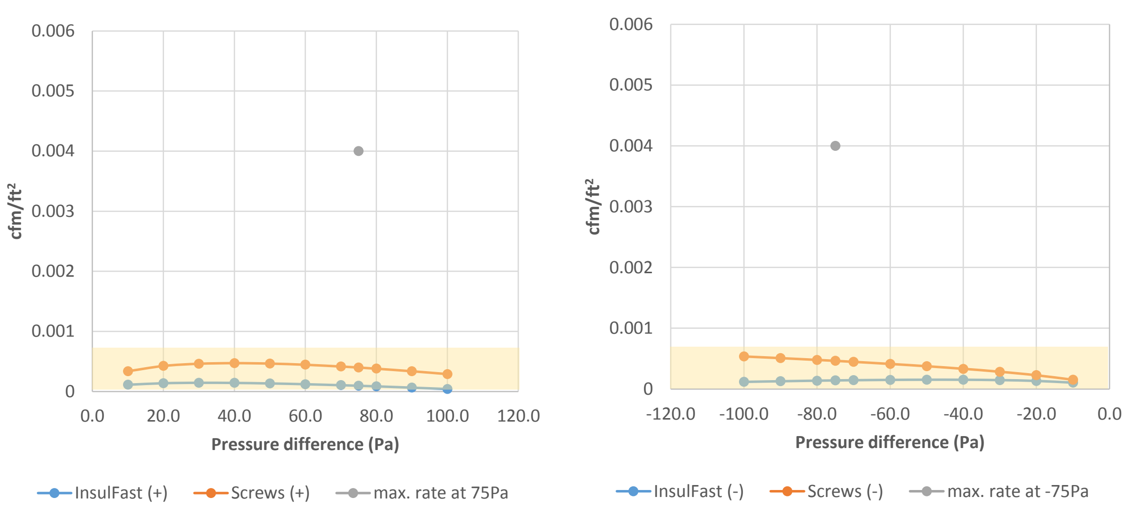


Figure 3.1 Air leakage rate of CMU with sheet applied membrane during pressurization and depressurization (yellow shading indicates error margin).

3.1.2 CMU wall with liquid applied membrane

TABLE 3.2 W2 - CMU WALL WITH LIQUID APPLIED MEMBRANE OBSERVATIONS	
Air leakage testing	No measureable difference from fastener installation
Water penetration testing	No observed water penetration
Observations	Concrete screws spalled concrete block at all locations Ramset® T3 InsulFast™ spalled concrete block at one of four locations

There was no measureable impact on the airtightness of the CMU wall with liquid applied membrane from the installation of Ramset® T3 InsulFast™ fasteners or conventional screws. Similarly, no water penetration was observed through any of the fastener locations.

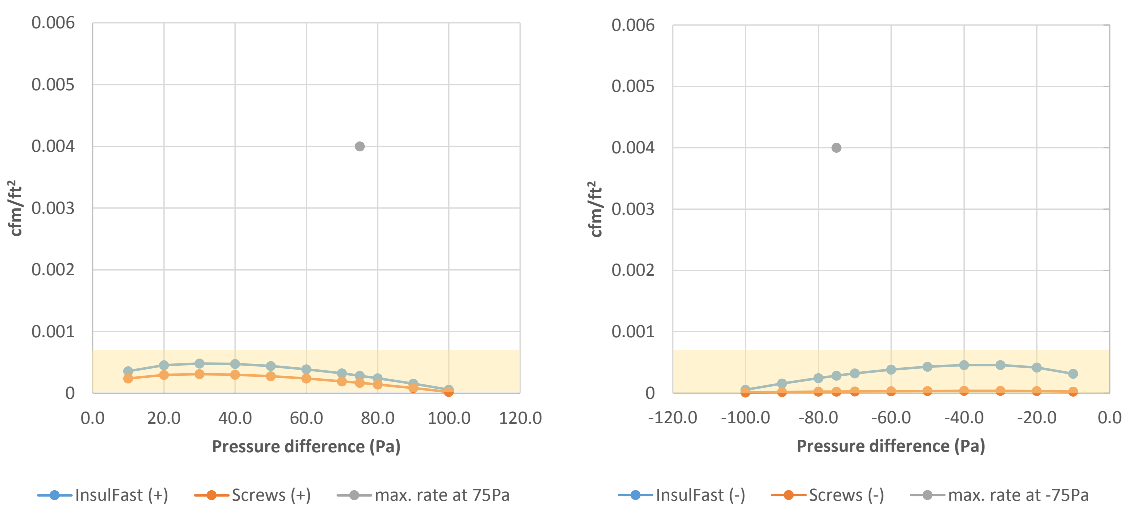


Figure 3.2 Air leakage rate of CMU with liquid applied membrane during pressurization and depressurization (yellow shading indicates error margin).

3.1.3 Steel stud wall with sheet applied membrane

TABLE 3.3 W2 - STEEL STUD WALL WITH SHEET APPLIED MEMBRANE OBSERVATIONS	
Air leakage testing	No measureable difference from fastener installation
Water penetration testing	Water penetration occurred at one screw penetration through a steel stud at all differential pressure levels.
Observations	The Ramset® T3 InsulFast™ fasteners had little holding power if not installed at a steel stud.

There was no measureable impact on the airtightness of the CMU wall with liquid applied membrane from the installation of Ramset® T3 InsulFast™ fasteners or conventional screws.

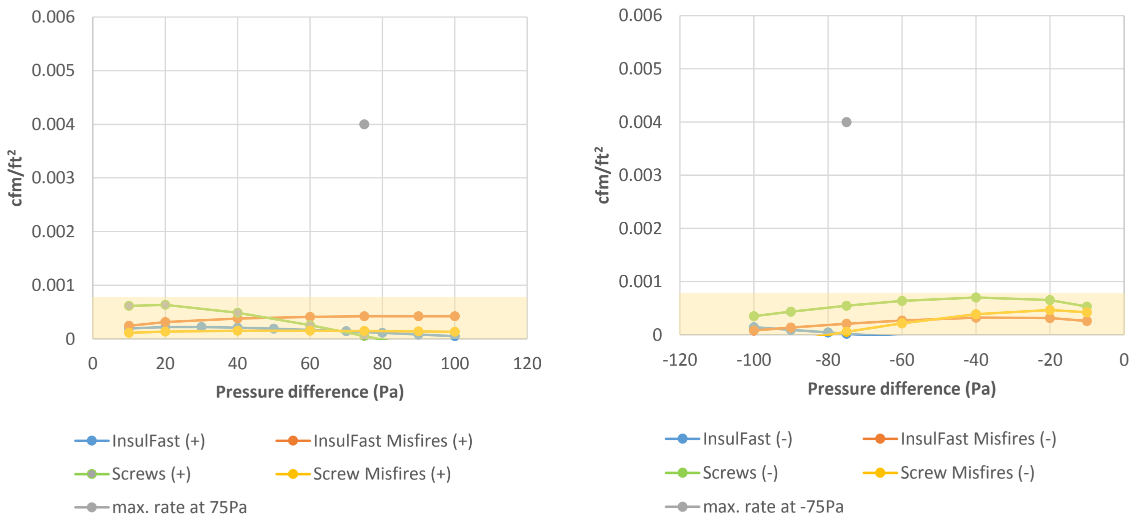


Figure 3.3 Air leakage rate of steel stud with sheet applied membrane during pressurization and depressurization.

Water penetrated at a screw to steel stud location. Examination of the location showed nothing anomalous with the installation but rather suggested poor self-sealing of the 17 mil liquid applied membrane around the screw penetration.

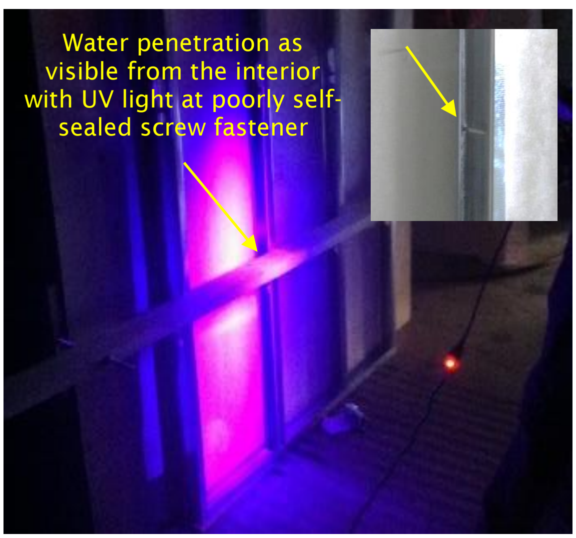


Figure 3.4 Location of fastener where water penetration was observed with UV light.

3.1.4 Steel stud wall with liquid applied membrane

TABLE 3.4 W4 - STEEL STUD WALL WITH LIQUID APPLIED MEMBRANE OBSERVATIONS	
Air leakage testing	No measureable difference from fastener installation
Water penetration testing	No observed water penetration
Observations	The Ramset® T3 InsulFast™ fasteners had little holding power if not installed at a steel stud.

There was no measureable impact on the airtightness of the CMU wall with liquid applied membrane from the installation of Ramset® T3 InsulFast™ fasteners or conventional screws. Similarly, no water penetration was observed through any of the fastener locations.

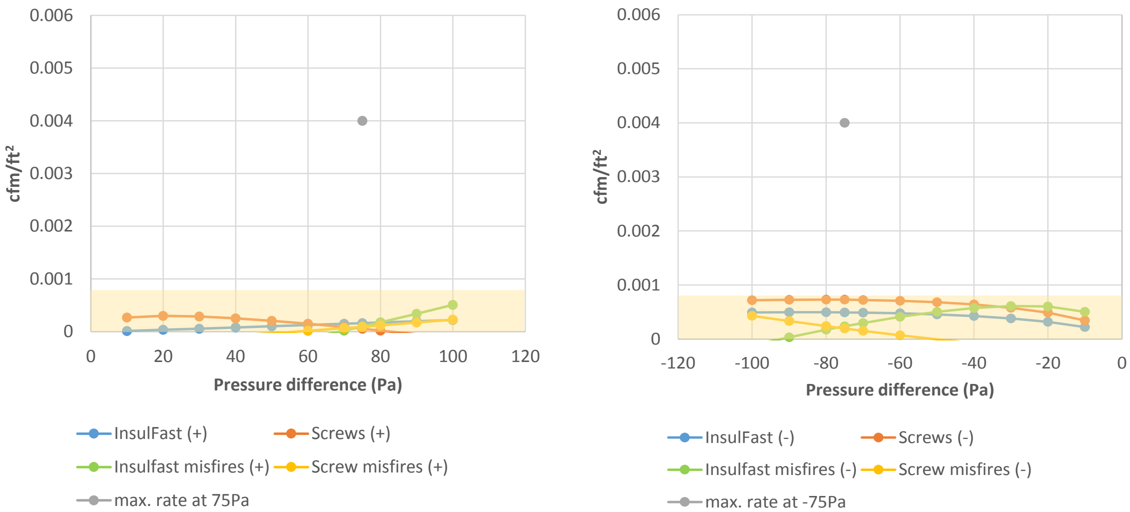


Figure 3.5 Air leakage rate of steel stud with liquid applied membrane during pressurization and depressurization (yellow shading indicates error margin).

3.2 Qualitative Membrane Testing – Wall Type W5

Air leakage was qualitatively noted at misfired screw locations at 6 of the 14 membranes tested plus one of the stud locations. There was no air leakage observed at any Ramset® T3 InsulFast™ fastener locations. Similarly, water penetration was observed at only screw locations, while no water penetration was observed at Ramset® T3 InsulFast™ fastener locations. Water penetration was observed at 5 of the misfired screws at 0 Pa and one properly installed screw into the steel stud. At 200 Pa the water penetration points had increased to 100% of misfired screws and approximately 20% of properly installed screws. At 700 Pa water penetration was observed at all screw locations regardless of installation type. It should be stressed that the test does not represent a real-world wetting scenario as it is unlikely that the volume of water used in the test would penetrate through the cladding and insulation and contact the membrane like this in the field. It does, however, allow a comparison between fastener types within the same test conditions and compare the different self-sealing abilities of various commercially available membranes

Figure 3.6 Fifteen different samples with screw and InsulFast™ fasteners prepared for testing

Figure 3.7 Water penetration testing of samples.

Figure 3.8 Water penetration point at screw misfire.

Figure 3.9 Water penetration point at properly installed screw through stud

3.3 Summary

There was no measureable impact on membrane airtightness from the installation of Ramset® T3 InsulFast™ fasteners or screws and plates. While some differences were observed between the fasteners and baseline unpenetrated walls, the measurements were extremely small and within the error of the measurement. An air barrier material according to the accepted industry standard, ABAA (Air Barrier Association of America) is any material through which air passes at a rate no greater than 0.004 cfm/ft^2 at 75 Pa (0.30" WC). It is clear from the results presented below that the air barrier materials, whether it is self-adhered or liquid applied, perform to the requirement regardless of the fastener type installed.

Figure 3.10 compares the air leakage rate of each air barrier material and wall type with Ramset® T3 InsulFast™ fasteners and screws installed. It is clearly visible that air leakage through the material is well below the industry accepted requirement for an air barrier material, and therefore of negligible impact.

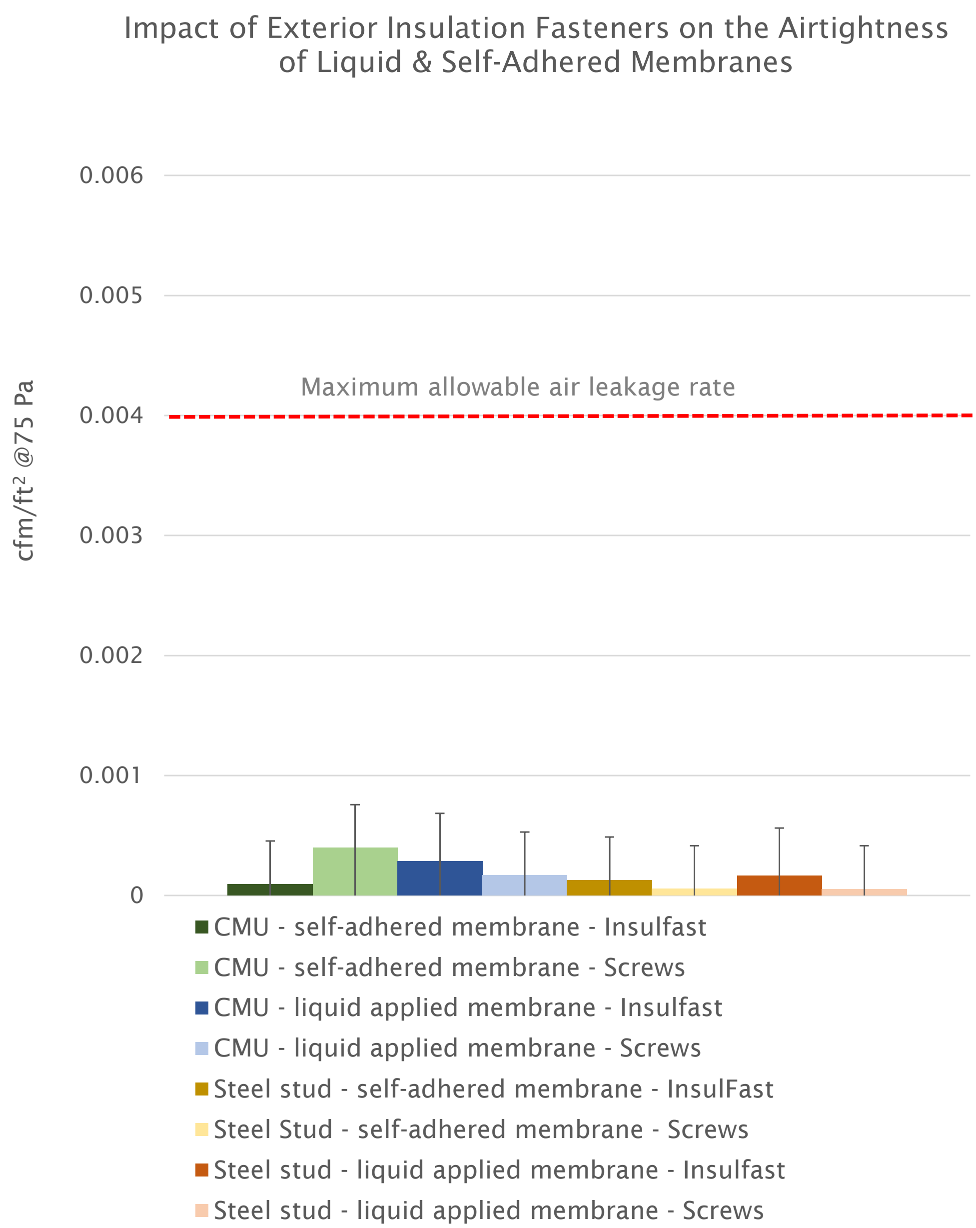


Figure 3.10 Air leakage per square foot comparison of InsulFast™ and screws by wall type

3.3.1 Other Qualitative Observations

Spalling (blowout of the substrate) of the 6” concrete block (1 1/4” thick face on concrete block) was observed within the unfilled core cavity in the case of both fastener types and does not appear to affect the ability of the wall assembly to manage air or water. The spalling was less prevalent in the Ramset® T3 InsulFast™ System. Spalling occurred in 8 of 8 of the conventional screw fasteners and the screw tip was visible in all circumstances. Spalling occurred in 5 of the 8 of the Ramset® T3 InsulFast™ fasteners and the tip of the pin was never visible.

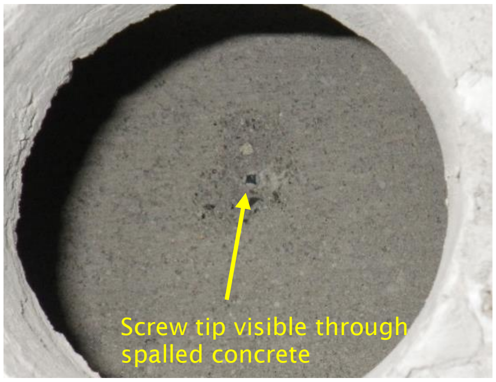


Figure 3.11 Concrete screw tip visilble through spalled concrete

Figure 3.12 InsulFast™ pin tip not visible through spalled concrete

Figure 3.13 InsulFast™ pin and screw tips through gypsum sheathing and steel studs

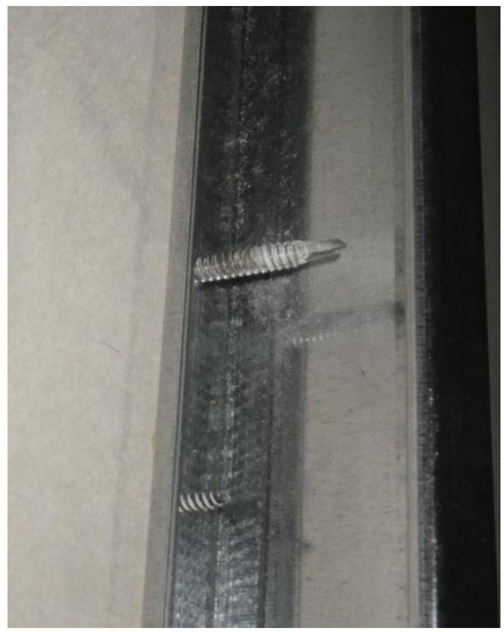


Figure 3.14 Close-up of screw tips through gypsum sheathing and steel studs

4 Conclusion & Recommendations

The study has demonstrated that the small penetration made by concrete and steel stud screws or Ramset® T3 InsulFast™ fasteners to secure exterior insulation has a negligible impact on the air and water tightness of commonly liquid applied and self-adhered bituminous sheet membranes under laboratory conditions. The self-sealing ability of these membranes and the nature of the fastener installation should instruct the industry that exterior insulation fasteners and typical concrete/steel stud screws for cladding attachment are not generally a concern from an air and water management perspective in these wall assemblies.

Spalling of the concrete block back-up wall was observed in the case of both fastener types and does not appear to affect the ability of the wall assembly to manage air or water; however spalling was less prevalent in the Ramset® T3 InsulFast™ System compared to concrete screws.

Qualitative observations suggest that under some circumstances water may penetrate the wall assembly through screw penetrations in membrane that do not self-seal; however the lack of available evidence suggests caution in making any widespread conclusions. In particular the amount of water flowing behind the exterior insulation within the laboratory test setup here is extreme and does not represent real world wetting conditions. That being said, the Ramset® T3 Insulfast™ performed better than the screws in this scenario. Further research is needed to quantify the amount of water running down WRB membranes within exterior insulated and clad wall assemblies in the field so that more refined laboratory tests can be developed.

5 Closure

This report serves to formally document the research and product testing work performed by RDH exclusively for ITW Construction Products (Ramset) in development of a technical bulletin and report on the potential impact of Ramset® T3 InsulFast™ fasteners and generic screws on the air and water resistive barrier of commercial wall assemblies.

If you require any further information or clarification of the findings presented here, please do not hesitate to contact us.

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