



Test Report  
For

Tremco

Tested in Accordance with

ASTM E2357  
ASTM E331

Products Tested:

Spectrem 1, TremFlex 834, Dymonic 100, OC 810, Eco, LEF, Duo  
Membrane

Report No.: T1112-038 - 043  
Test Start Time: 11/30/2012 10:06 AM  
Test Completion Time: 11/30/2012 5:26 PM

Test Technician: Tim Mattox  
Test Engineer: Tim Mattox

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**Tremco Commercial Sealants & Waterproofing**  
23150 Commerce Park Drive, Beachwood, OH 44122



## I. Test Assembly Description

### Basic Dimensions

Test Assembly Height (in.): 111.000

Test Assembly Width (in.): 96.000

Test Area (m<sup>2</sup>): 6.875

This report describes a testing program in accordance with ASTM E2357 and ASTM E331 for a Connectivity Project. The connections that will be discussed in this report are a balcony to wall connection and a wall to patio door connection using a T3 solution. All tests were performed in accordance with the test methods noted. The ASTM E2357 test method provides a choice for wind load exposure for geographical areas that have pressure design values having a Q<sub>10</sub> value less than or greater than 20 kPa. In addition, and the deflection test in accordance with ASTM E2357 provides a choice between geographical areas that have pressure design values having a Q<sub>10</sub> value less than or greater than 40 kPa. In both cases, the more severe case was chosen and the applicable exposures were applied. For the ASTM E331 test, the minimum requirement for pressure differential during the water leakage test is 137 Pa and the minimum time exposure is 15 minutes. Test project T1112-041 documents the test in strict accordance with the minimum pressure and time requirements of the test method. Test project T1112-042 documents the test with exposures of various pressure differentials and times and are discussed within the report. The details of the wall construction are as described below:

The wall frame was built with 2X6 lumber spaced 16 in. O.C. The base of the frame consisted of two series of solid concrete block that simulated a concrete balcony deck. The block was secured to the test buck frame with adhesive. Each block was also secured to adjacent block with adhesive. A block frame was constructed to surround a patio door frame, with an approximate 3/8 in. to 1/2 in. opening around the entire frame. The surface of the wall frame was covered with 1/2 in. USG Durock fiber reinforced concrete paneling.

The joints between the balcony and the curb, the curb and the wall, and the inside corners of the patio door opening were sealed with Dymonic 100 which was allowed to cure. Once cured the simulated balcony was covered with OC810 one-coat coating. The application thickness was 35 to 40 mils and covered the entire balcony top, the curb, and extended 4 in. onto the wall. The balcony coating was allowed to cure. Prior to the wall coating application, all seams and joints in the Durock concrete panel wall surface were sealed with Tremflex 834 which was allowed to cure. The Durock was then coated with 2 coats of wall coating primer and then one coat of a high build wall



coating. The wall coating extended onto the OC810 one-coat coating approximately 3 in, creating a lapped covering.

The perimeter of the patio door frame was sealed with an Illmod T3 system consisting of Eco, LEF Foam, and Duo membrane. The Duo membrane was secured to the perimeter block with Spectrem 1 sealant. The cavity space between the exterior face of the frame and the Duo membrane was filled with LEF foam. Eco was applied so that it was flush with the exterior face of the patio door frame. Clear Spectrem 2 was used to finish the corner intersections of the Eco tape in accordance with installation instructions. A mock patio door was placed into the frame and was sealed against the frame with Spectrem 1 silicone sealant.

The testing that was performed is described below:

**T1112-038** – This test was the preliminary air leakage test in accordance with ASTM E283 for the prescribed pressures in ASTM E2357.

**T1112-039** – This documents the wind conditioning in accordance with ASTM E2357. The test was performed for geographical areas where the pressure design value  $Q_{10}$  is greater than 0.20 kPa.

**T1112-040** – This test was the secondary air leakage test in accordance with ASTM E283 for the prescribed pressures in ASTM E2357.

**T1112-041** – This test was the deflection test in accordance with ASTM E2357. The test was performed for geographical areas where the pressure design value  $Q_{10}$  is greater than 0.40 kPa.

**T1112-042** – This test was performed in accordance with ASTM E331 with a pressure differential of 137 Pa for a 15 minute duration.

**T1112-043** - This test was performed in accordance with ASTM E331 with a pressure differential ranging from 300 Pa to 2100 Pa with variable time exposures ranging from 5 minutes to 15 minutes.



II. Test Conditions

**T1112-038**

Test Temperature at Start(°F): 65.341  
Test Temperature at End (°F): 65.872  
Average Temperature (°F): 65.752  
Avg. Barometric Pressure (in. Hg): 30.227

**T1112-039**

Test Temperature at Start(°F): 65.727  
Test Temperature at End (°F): 66.089  
Average Temperature (°F): 65.923  
Avg. Barometric Pressure (in. Hg): 30.222

Geographical Area:  $Q_{10}$  is greater than 0.20 kPa.

Wind Cycling: Sample was cycled with 2 alternating 1000 cycle series

**T1112-040**

Test Temperature at Start(°F): 66.162  
Test Temperature at End (°F): 69.091  
Average Temperature (°F): 67.652  
Avg. Barometric Pressure (in. Hg): 30.178

**T1112-041**

Test Temperature at Start(°F): 69.311  
Test Temperature at End (°F): 69.146  
Average Temperature (°F): 69.013  
Avg. Barometric Pressure (in. Hg): 30.145

Geographical Area:  $Q_{10}$  is greater than 0.40 kPa.

**T1112-042**

Test Temperature at Start(°F): 69.252  
Test Temperature at End (°F): 69.407  
Average Temperature (°F): 69.128  
Avg. Barometric Pressure (in. Hg): 30.146



**T1112-043**

Test Temperature at Start(°F): 69.327  
Test Temperature at End (°F): 65.051  
Average Temperature (°F): 66.363  
Avg. Barometric Pressure (in. Hg): 30.149



### III. Test Results

#### **T1112-038**

##### Infiltration

Assembly Air Leakage Values @ 75Pa

Air Leakage – 0.914 L/s (1.937 cfm)

Area Leakage Rate – 0.133 L/s·m<sup>2</sup> (0.026 cfm/ft<sup>2</sup>)

##### Exfiltration

Assembly Air Leakage Values @ 75Pa

Air Leakage – 0.932 L/s (1.975 cfm)

Area Leakage Rate – 0.136 L/s·m<sup>2</sup> (0.027 cfm/ft<sup>2</sup>)

#### **T1112-039**

No damage was noted during the wind conditioning.

#### **T1112-040**

##### Infiltration

Assembly Air Leakage Values @ 75Pa

Air Leakage – 0.739 L/s (1.565 cfm)

Area Leakage Rate – 0.107 L/s·m<sup>2</sup> (0.021 cfm/ft<sup>2</sup>)

##### Exfiltration

Assembly Air Leakage Values @ 75Pa

Air Leakage – 0.745 L/s (1.578 cfm)

Area Leakage Rate – 0.108 L/s·m<sup>2</sup> (0.021 cfm/ft<sup>2</sup>)



**T1112-041**

Deflection Report				
	Deflection Point 1	Deflection Point 2	Deflection Point 3	Deflection Point 4
	(in)	(in)	(in)	(in)
Nominal	7.33	5.60	4.89	7.03
Infiltration	7.51	5.77	5.05	7.21
Exfiltration	7.09	5.42	4.69	6.85
Movement Inf	0.18	0.17	0.17	0.19
Movement Exf	-0.24	-0.19	-0.19	-0.17
Max Movement Inf	0.19			
Max Movement Exf	-0.24			

Deflection Point #1 - 49 in. above base of test assembly, 23 in. to left of centerline. Mounted to concrete wall between studs.
Deflection Point #2 - 51 in. above base of test assembly, 2 in. left of centerline. Mounted to concrete block surrounding patio door.
Deflection Point #3 - 49 in. above base of test assembly, 2 in. right of centerline. Mounted to patio door frame.
Deflection Point #4 - 49 in. above base of test assembly, 23 in. right of centerline. Mounted to concrete wall between studs.

**T1112-042**

Time elapsed	Note
0:00:00	137 Pa. test started.
0:12:46	Water entering through the seal between the mock door and the patio door frame. This is not a failure of the system.
0:15:00	Test complete. No leakage noted that was within the scope of the test assembly. Test is a pass at 137 Pa.



**T1112-043**

<b>Time elapsed</b>	<b>Note</b>
0:00:00	300 Pa test started.
<b>0:05:15</b>	450 Pa test started. There was no leakage during the 300 Pa test.
0:07:21	No leakage noted.
0:08:24	Water entering the assembly at the buck perimeter on the top side. Outside the scope of the test. This is not a failure.
0:10:14	5 minute mark in 450 Pa test. Only leaks are those noted in T1112-042 between the mock door and the frame which is outside the scope. Moving to 600 Pa.
<b>0:10:54</b>	600 Pa test started.
0:15:47	Water entering the patio door enclosure at the weep holes. <b>Patio door perimeter has failed.</b> Testing will continue to evaluate the balcony to wall connection.
0:24:27	No leakage noted at the balcony to wall interface. Will move to 900 Pa for 5 minutes then to 1200 Pa for 15 minutes unless leaks are noted.
0:25:52	15 minute mark complete. No leakage of the balcony to wall system noted. Moving to 900 Pa for 5 minutes.
<b>0:26:54</b>	900 Pa test started.
0:27:31	Water is pouring in through the patio door weep holes. No leakage noted at the balcony to wall interface.
0:31:52	5 minute mark at 900 Pa. No leakage noted at the balcony to wall interface. No leakage occurring on the balcony to wall connection. Moving to 1200 Pa.
<b>0:32:54</b>	1200 Pa test started.
0:47:52	1200 Pa test complete. No leakage at the balcony to wall interface. Moving to 2100 Pa in 300 Pa steps lasting 5 minutes each.
<b>0:49:10</b>	1500 Pa test started.
0:54:08	5 minute mark at 1500 Pa complete. No leakage noted at the balcony to wall interface. Moving to 1800 Pa.
<b>0:55:05</b>	1800 Pa test started.
1:00:04	5 minute mark at 1800 Pa. No leakage noted at the balcony to wall interface.. Moving to 2100 Pa. for 5 minutes.
<b>1:00:55</b>	2100 Pa test started. 43.9 psf, 8.4 in. H <sub>2</sub> O, 133 mph static wind load.
1:05:59	5 minute mark. No leakage noted at the balcony to wall interface.
1:07:42	Test complete after 7 minutes. No leakage noted at the balcony to wall interface.





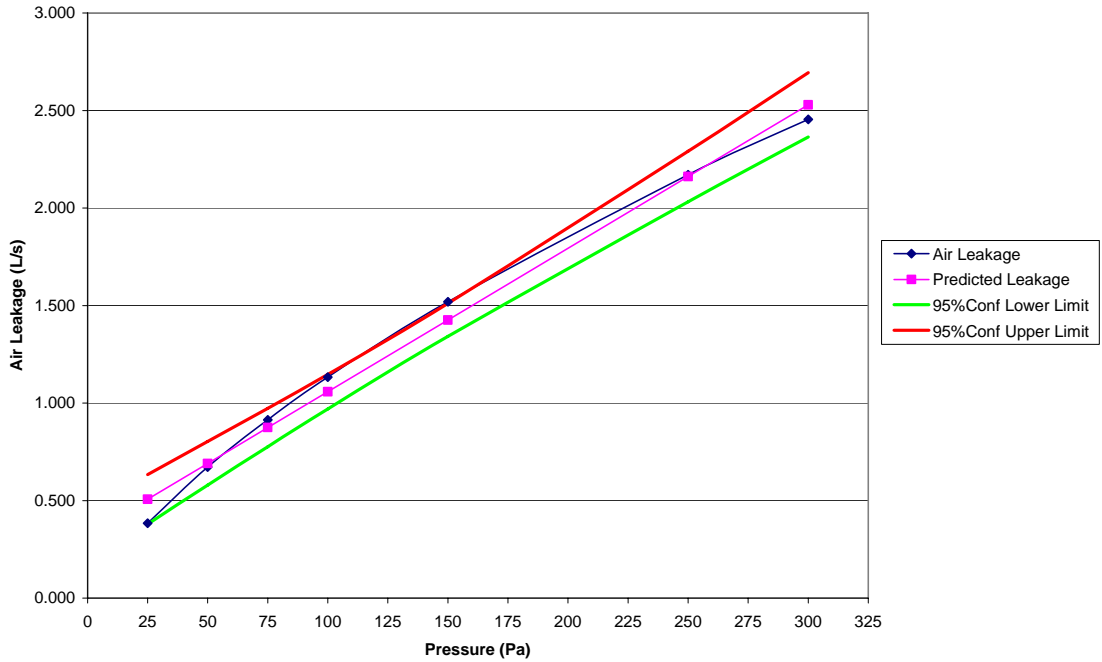
Comments:

Air leakage values were measured to be within the acceptable levels as directed by ASHRAE 90.1 for air barrier assemblies. No damage to the wall occurred during the wind conditioning. The air leakage of the assembly, as determined in accordance with ASTM E2357 criteria, is 0.021 cfm/ ft<sup>2</sup> at 75 Pa. The patio door frame tested successfully to ASTM E331, ultimately failing to resist the passage of water at 15 minutes 47 seconds after the water exposure began, with pressure differential ranging from 300 Pa to 600 Pa. Because failure occurred at 600 Pa, the patio door system passed the test with a pressure differential of 450 Pa. The balcony-to-wall interface tested successfully with a water exposure duration of 1 hour 7 minutes 42 seconds and pressure differential ranging from 300 Pa to 2100 Pa. The 2100 Pa pressure differential is equivalent to 43.9 psf, 8.4 in. H<sub>2</sub>O, and is representative of a load equivalent to that of a 133 mph wind. The 2100 Pa pressure differential was applied for 6 minutes 47 seconds before the test was stopped due to time constraints. The balcony-to-wall connection never leaked water.

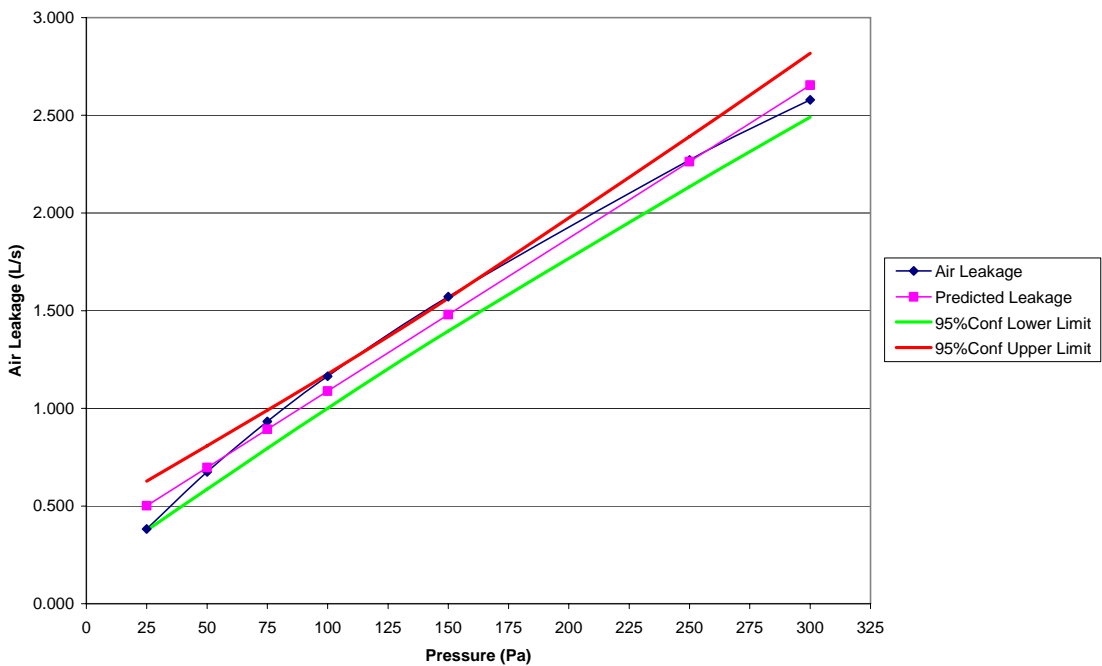


#### IV. Charts and Graphs

Infiltration T1112-038

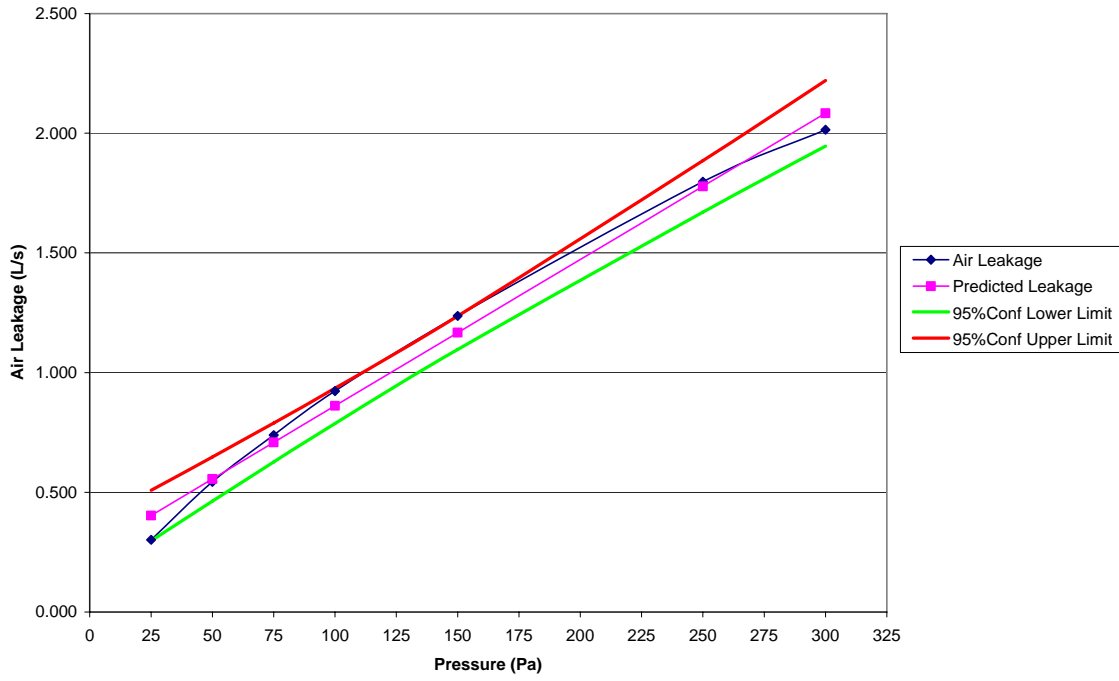


Exfiltration T1112-038

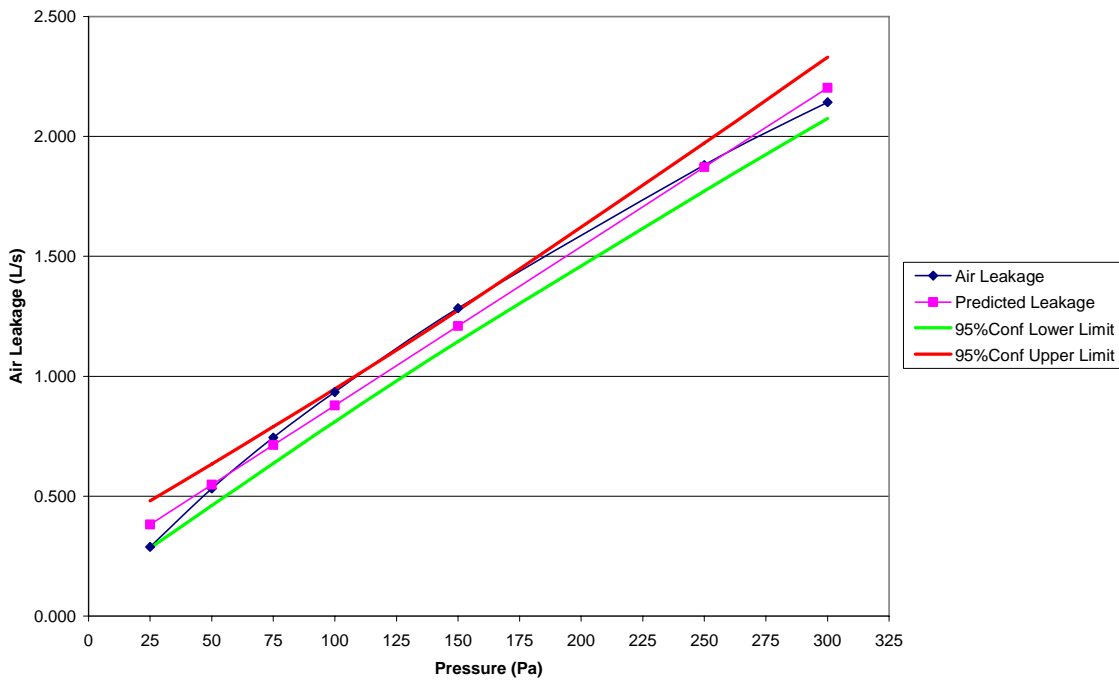




Infiltration T1112-040



Exfiltration T1112-040



Infiltration T1112-038													
Pressure Differential	Total Airflow	Extraneous Leakage	Air Leakage	Leakage Rate	Leakage Rate Test Area	Predicted Leakage	95%Conf Lower Limit	95%Conf Upper Limit	Total Airflow	Extraneous Leakage	Air Leakage	Leakage Rate	Leakage Rate Test Area
P	Qt	Qe	Qs	ql	qa	yf			Qt	Qe	Qs	ql	qa
(Pa)	(L/s)	(L/s)	(L/s)	(L/s*m)	(L/s*m^2)	(L/s)	(L/s)	(L/s)	(cfm)	(cfm)	(cfm)	(cfm/ft)	(cfm/ft^2)
25	0.384	0.000	0.384	No Data	0.056	0.506	0.379	0.634	0.814	0.000	0.814	No Data	0.011
50	0.672	0.000	0.672	No Data	0.098	0.690	0.579	0.802	1.423	0.000	1.423	No Data	0.019
<b>75</b>	<b>0.914</b>	<b>0.000</b>	<b>0.914</b>	<b>No Data</b>	<b>0.133</b>	<b>0.874</b>	<b>0.776</b>	<b>0.973</b>	<b>1.937</b>	<b>0.000</b>	<b>1.937</b>	<b>No Data</b>	<b>0.026</b>
100	1.133	0.000	1.133	No Data	0.165	1.058	0.969	1.147	2.401	0.000	2.401	No Data	0.032
150	1.519	0.000	1.519	No Data	0.221	1.426	1.342	1.510	3.218	0.000	3.218	No Data	0.043
250	2.170	0.000	2.170	No Data	0.316	2.161	2.032	2.291	4.598	0.000	4.598	No Data	0.062
300	2.454	0.000	2.454	No Data	0.357	2.529	2.364	2.694	5.200	0.000	5.200	No Data	0.070

Exfiltration T1112-038													
Pressure Differential	Total Airflow	Extraneous Leakage	Air Leakage	Leakage Rate	Leakage Rate Test Area	Predicted Leakage	95%Conf Lower Limit	95%Conf Upper Limit	Total Airflow	Extraneous Leakage	Air Leakage	Leakage Rate	Leakage Rate Test Area
P	Qt	Qe	Qs	ql	qa	yf			Qt	Qe	Qs	ql	qa
(Pa)	(L/s)	(L/s)	(L/s)	(L/s*m)	(L/s*m^2)	(L/s)	(L/s)	(L/s)	(cfm)	(cfm)	(cfm)	(cfm/ft)	(cfm/ft^2)
25	0.382	0.000	0.382	No Data	0.056	0.501	0.376	0.627	0.810	0.000	0.810	No Data	0.011
50	0.675	0.000	0.675	No Data	0.098	0.697	0.586	0.808	1.430	0.000	1.430	No Data	0.019
<b>75</b>	<b>0.932</b>	<b>0.000</b>	<b>0.932</b>	<b>No Data</b>	<b>0.136</b>	<b>0.893</b>	<b>0.795</b>	<b>0.990</b>	<b>1.975</b>	<b>0.000</b>	<b>1.975</b>	<b>No Data</b>	<b>0.027</b>
100	1.164	0.000	1.164	No Data	0.169	1.088	1.000	1.177	2.467	0.000	2.467	No Data	0.033
150	1.572	0.000	1.572	No Data	0.229	1.480	1.396	1.563	3.332	0.000	3.332	No Data	0.045
250	2.271	0.000	2.271	No Data	0.330	2.262	2.134	2.391	4.812	0.000	4.812	No Data	0.065
300	2.579	0.000	2.579	No Data	0.375	2.654	2.490	2.817	5.465	0.000	5.465	No Data	0.074

Infiltration T1112-040													
Pressure Differential	Total Airflow	Extraneous Leakage	Air Leakage	Leakage Rate	Leakage Rate Test Area	Predicted Leakage	95%Conf Lower Limit	95%Conf Upper Limit	Total Airflow	Extraneous Leakage	Air Leakage	Leakage Rate	Leakage Rate Test Area
P	Qt	Qe	Qs	ql	qa	yf			Qt	Qe	Qs	ql	qa
(Pa)	(L/s)	(L/s)	(L/s)	(L/s*m)	(L/s*m^2)	(L/s)	(L/s)	(L/s)	(cfm)	(cfm)	(cfm)	(cfm/ft)	(cfm/ft^2)
25	0.301	0.000	0.301	No Data	0.044	0.402	0.297	0.508	0.638	0.000	0.638	No Data	0.009
50	0.543	0.000	0.543	No Data	0.079	0.555	0.463	0.648	1.152	0.000	1.152	No Data	0.016
<b>75</b>	<b>0.739</b>	<b>0.000</b>	<b>0.739</b>	<b>No Data</b>	<b>0.107</b>	<b>0.708</b>	<b>0.626</b>	<b>0.790</b>	<b>1.565</b>	<b>0.000</b>	<b>1.565</b>	<b>No Data</b>	<b>0.021</b>
100	0.923	0.000	0.923	No Data	0.134	0.861	0.787	0.935	1.956	0.000	1.956	No Data	0.026
150	1.236	0.000	1.236	No Data	0.180	1.167	1.097	1.236	2.620	0.000	2.620	No Data	0.035
250	1.797	0.000	1.797	No Data	0.261	1.778	1.670	1.885	3.808	0.000	3.808	No Data	0.051
300	2.014	0.000	2.014	No Data	0.293	2.083	1.947	2.220	4.268	0.000	4.268	No Data	0.058

Exfiltration T1112-040													
Pressure Differential	Total Airflow	Extraneous Leakage	Air Leakage	Leakage Rate	Leakage Rate Test Area	Predicted Leakage	95%Conf Lower Limit	95%Conf Upper Limit	Total Airflow	Extraneous Leakage	Air Leakage	Leakage Rate	Leakage Rate Test Area
P	Qt	Qe	Qs	ql	qa	yf			Qt	Qe	Qs	ql	qa
(Pa)	(L/s)	(L/s)	(L/s)	(L/s*m)	(L/s*m^2)	(L/s)	(L/s)	(L/s)	(cfm)	(cfm)	(cfm)	(cfm/ft)	(cfm/ft^2)
25	0.288	0.000	0.288	No Data	0.042	0.382	0.283	0.481	0.611	0.000	0.611	No Data	0.008
50	0.532	0.000	0.532	No Data	0.077	0.548	0.461	0.634	1.127	0.000	1.127	No Data	0.015
<b>75</b>	<b>0.745</b>	<b>0.000</b>	<b>0.745</b>	<b>No Data</b>	<b>0.108</b>	<b>0.713</b>	<b>0.637</b>	<b>0.790</b>	<b>1.578</b>	<b>0.000</b>	<b>1.578</b>	<b>No Data</b>	<b>0.021</b>
100	0.934	0.000	0.934	No Data	0.136	0.879	0.810	0.948	1.979	0.000	1.979	No Data	0.027
150	1.284	0.000	1.284	No Data	0.187	1.210	1.144	1.275	2.720	0.000	2.720	No Data	0.037
250	1.880	0.000	1.880	No Data	0.273	1.872	1.771	1.972	3.984	0.000	3.984	No Data	0.054
300	2.143	0.000	2.143	No Data	0.312	2.203	2.075	2.331	4.541	0.000	4.541	No Data	0.061