



**Transforming** the Built Environment *into* the High-Performance Environment.

Restoring Airtightness and Weather-Resistance to Window and Curtain Wall Systems

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## Agenda

- Introduction
- Review 2 Case Studies
  - Cap Bead Repair
  - Gasket Overlay
- Present Test Protocol
- Report Results
- Conclusion















## Investigation and Support

Photographing glazing components















Not removing the gasket from the application may spread contaminates application the gasket to the glass and from the gasket to the glass and metal surfaces,
















































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Test Report For

Tremco

Tested in Accordance with

ASTM E283 ASTM E331 ASTM E547

Connectivity Project - Glazing Restoration Testing

Kawneer AA900 and Trifab 450 Window Units Baseline Test Cant Bead Overlay Gasket

Project Nos.: T0812-011 and 012, T0912-001-005, T1012-001-009, T1101-015 and 016

> Test Technician: Tim Mattox Test Engineer: Tim Mattox

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



#### AA 900 Series Window



#### **TRIFAB 451 Storefront**

#### **Overview**

- Testing program was designed to test window units as received from the factory
- Introduce leakage to test a baseline to compare the restorative results against, and then test each restoration practice for air and water leakage.
- Testing for air leakage was performed in accordance with ASTM E283 and testing for water leakage was performed in accordance with ASTM E331 or ASTM E547.

#### **Test Protocol**

 Provide quantitative analysis for glazing restoration methods, and understand the impact of each restoration style on air leakage and water leakage



### **Test Protocol**

- Baseline testing from factory units
- Introduce leakage
- Test restoration practice for air leakage
  - ASTM E 283
- Test restoration practice for water leakage
  - ASTM E 331, ASTM E 547

## **Air Tests**

- 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.
- ASTM E783 Standard Test Method for Field Measurement of Air Leakage Through Installed Exterior Windows and Doors.
- ASTM E2357 Standard Test Method for Determining Air Leakage of Air Barrier Assemblies.

### Air Tests - E283

- Laboratory Test. Tremco Lab
- Not referenced in IBC. Mentioned in IECC and ASHRAE 90.1-2010
- Pressurize chamber to 75 Pa (1.57 psf) or other prescribed pressure differential as directed by test sponsor.
- Measure and report air leakage.
- No pass/fail criteria in standard.
- ABAA / ASHRAE 90.1-2010 publishes air leakage for air barrier assemblies must be 0.04 cfm/sq. ft or less.

### Water Tests

- ASTM E331 Standard Test Methods for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by <u>Uniform</u> Static Air Pressure Difference.
- **ASTM E547** <u>Cyclic</u> Static Air Pressure Difference.
- ASTM E2268 <u>Rapid Pulsed</u> Air Pressure Difference.
- ASTM E1105 <u>Field Determination</u> by <u>Uniform or Cyclic Static</u> Air Pressure Difference.
- AAMA 501.2 Quality Assurance and Diagnostic Water Leakage Field Check if Installed Storefronts, Curtain Walls and Sloped Glazing Systems.

### Water Tests - E331

- Laboratory Test. Tremco Lab
- **IBC Section 1403.2, Exception 2** Exterior walls tested to ASTM E331 at 6.24psf for 2 hours meet the exterior weather protection performance requirements.
- Requires a test chamber where a static pressure differential can be maintained.
- Uniform water spray that delivers 5 gallons/sq. ft / hr. (Corresponds to an 8 in. per hour rainfall.)
- Size of test specimen shall be sufficient to determine performance of all typical parts of the system.
- Skylights tested at angle.
- Pressure and duration are determined by test sponsor. Min. requirements are 137 Pa (2.86 psf) for 15 minutes.
- Failure is determined when water penetrates a plane parallel to the glazing or the innermost edges of the penetrating unit frame.

### Water Tests - E547

- Laboratory Test. Tremco Lab
- Not specified in code.
- Identical to E331 in all ways except pressure is cycled.
- No less than 2 cycles Otherwise this is an E331 test.
- All cycles are minimum 5 min. duration.
- Total time of pressure application shall be no less than 15 minutes.
- Zero pressure rest between pressure application is no less than 1 minute.



AA900 Window positioned on test wall for air and water testing

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Cut sections of the exterior gasket to simulate leak points

#### **Review - Defined Wall Performance Standards**

#### ASHRAE 90.1-2010

0.2 L/s.m<sup>2</sup> at 75 Pa (0.04 cfm/ft<sup>2</sup> at 1.57 psf) as the maximum allowable assembly air leakage as tested in accordance to ASTM E 2357 Standard Test Method for Determining Air Leakage of Air Barrier Assemblies.



AA900 Window repair option with cap bead

# AA 900 Window



#### AA 900 Base Line Testing - Air

AA 900 Base Line Testing Infiltration											
					Leakage					Leakage	
Pressure		Extraneous		Leakage	Rate Test	Total	Extraneous	Air	Leakage	Rate Test	
Differential	Total Airflow	Leakage	Air Leakage	Rate	Area	Airflow	Leakage	Leakage	Rate	Area	
Р	Qt	Qe	Qs	ql	qa	Qt	Qe	Qs	ql	qa	
(Pa)	(L/s)	(L/s)	(L/s)	(L/s*m)	(L/s*m^2)	(cfm)	(cfm)	(cfm)	(cfm/ft)	(cfm/ft^2)	
25	0.078	0.000	0.078	No Data	0.016	0.166	0.000	0.166	No Data	0.003	
50	0.116	0.000	0.116	No Data	0.023	0.246	0.000	0.246	No Data	0.005	ASHRA 90.1
75	0.139	0.000	0.139	No Data	0.028	0.295	0.000	0.295	No Data	0.005	0.04 cfm/ft <sup>2</sup>
100	0.165	0.000	0.165	No Data	0.033	0.349	0.000	0.349	No Data	0.006	
150	0.209	0.000	0.209	No Data	0.042	0.442	0.000	0.442	No Data	0.008	
250	0.273	0.000	0.273	No Data	0.055	0.578	0.000	0.578	No Data	0.011	
300	0.305	0.000	0.305	No Data	0.061	0.647	0.000	0.647	No Data	0.012	
			AA	900 Base Line	e Testing Exfilt	tration					
					Leakage					Leakage	
Pressure		Extraneous		Leakage	Rate Test	Total	Extraneous	Air	Leakage	Rate Test	
Differential	Total Airflow	Leakage	Air Leakage	Rate	Area	Airflow	Leakage	Leakage	Rate	Area	
Р	Qt	Qe	Qs	ql	qa	Qt	Qe	Qs	ql	qa	
(Pa)	(L/s)	(L/s)	(L/s)	(L/s*m)	(L/s*m^2)	(cfm)	(cfm)	(cfm)	(cfm/ft)	(cfm/ft^2)	
25	0.078	0.000	0.078	No Data	0.016	0.164	0.000	0.164	No Data	0.003	
50	0.108	0.000	0.108	No Data	0.022	0.228	0.000	0.228	No Data	0.004	<b>ASHRA 90.1</b>
75	0.142	0.000	0.142	No Data	0.028	0.301	0.000	0.301	No Data	0.006	0.04 cfm/ft <sup>2</sup>
100	0.153	0.000	0.153	No Data	0.031	0.324	0.000	0.324	No Data	0.006	
150	0.181	0.000	0.181	No Data	0.036	0.384	0.000	0.384	No Data	0.007	
250	0.281	0.000	0.281	No Data	0.056	0.595	0.000	0.595	No Data	0.011	
300	0.321	0.000	0.321	No Data	0.064	0.679	0.000	0.679	No Data	0.013	

#### AA 900 Base Line Test Water

#### T0812-012

Kawneer AA900 preliminary water leakage test in accordance with ASTM E331

Test Start Time: 8/24/2012 10:18 AM Test Completion Time: 8/24/2012 10:43 AM

Test Temperature at Start(°F): 73.378 Test Temperature at End (°F): 70.280 Average Temperature (°F): 73.193 Avg. Barometric Pressure (in. Hg): 30.172

Test Observations:

10:19:07 Pressure reached. Turning on water.

- 10:20:39 Test started.
- 10:31:19 No leakage noted at 10 min. At 15 minutes, moving to 720 Pa.
- 10:35:36 137 Pa test completed for 15 minutes. Moving to 720 Pa.
- 10:36:53 720 Pa test started.

10:39:14 Window is leaking on underside of frame on the bottom right corner looking from the inside out. Test is terminated.

#### AA 900 Leakage Induced - Air

AA 900 Leakage Induced -Infiltration											
					Leakage					Leakage	
Pressure		Extraneous		Leakage	Rate Test	Total	Extraneous	Air	Leakage	Rate Test	
Differential	Total Airflow	Leakage	Air Leakage	Rate	Area	Airflow	Leakage	Leakage	Rate	Area	
P	Qt	Qe	Qs	ql	qa	Qt	Qe	Qs	ql	qa	
(Pa)	(L/s)	(L/s)	(L/s)	(L/s*m)	(L/s*m^2)	(cfm)	(cfm)	(cfm)	(cfm/ft)	(cfm/ft^2)	о.
25	0.710	0.000	0.710	No Data	0.142	1.504	0.000	1.504	No Data	0.028	
50	1.054	0.000	1.054	No Data	0.211	2.233	0.000	2.233	No Data	0.042	
75	1.317	0.000	1.317	No Data	0.264	2.791	0.000	2.791	No Data	0.052	
100	1.549	0.000	1.549	No Data	0.311	3.283	0.000	3.283	No Data	0.061	$0.04  \text{cfm/ft}^2$
150	1.942	0.000	1.942	No Data	0.389	4.115	0.000	4.115	No Data	0.077	
250	2.565	0.000	2.565	No Data	0.514	5.434	0.000	5.434	No Data	0.101	
300	2.822	0.000	2.822	No Data	0.566	5.980	0.000	5.980	No Data	0.111	
			AA	900 Leakage	Induced Exfilt	ration					
					Leakage					Leakage	
Pressure		Extraneous		Leakage	Rate Test	Total	Extraneous	Air	Leakage	Rate Test	
Differential	Total Airflow	Leakage	Air Leakage	Rate	Area	Airflow	Leakage	Leakage	Rate	Area	
P	Qt	Qe	Qs	ql	qa	Qt	Qe	Qs	ql	qa	
(Pa)	(L/s)	(L/s)	(L/s)	(L/s*m)	(L/s*m^2)	(cfm)	(cfm)	(cfm)	(cfm/ft)	(cfm/ft^2)	
25	0.680	0.000	0.680	No Data	0.136	1.440	0.000	1.440	No Data	0.027	
50	1.019	0.000	1.019	No Data	0.204	2.159	0.000	2.159	No Data	0.040	
75	1.286	0.000	1.286	No Data	0.258	2.724	0.000	2.724	No Data	0.051	
100	1.516	0.000	1.516	No Data	0.304	3.212	0.000	3.212	No Data	0.060	
150	1.912	0.000	1.912	No Data	0.383	4.051	0.000	4.051	No Data	0.075	ASHRA 90.1
250	2.557	0.000	2.557	No Data	0.512	5.417	0.000	5.417	No Data	0.101	0.04 cfm/ft <sup>2</sup>
300	2.836	0.000	2.836	No Data	0.568	6.008	0.000	6.008	No Data	0.112	

#### AA 900 Leakage Induced - Water

#### T0912-003

Kawneer AA900 water leakage test in accordance with ASTM E331. Test was performed on assembly with compromised seals in order to establish a baseline.

Test Start Time: 9/20/2012 10:28 AM Test Completion Time: 9/20/2012 10:33 AM

Test Temperature at Start(°F): 67.434 Test Temperature at End (°F): 68.029 Average Temperature (°F): 67.778 Avg. Barometric Pressure (in. Hg): 30.004

Test Observations:

- 10:31:33 300 Pa. test started.
- 10:31:58 Water leakage noted at the bottom right pan.
- 10:32:19 Water now leaking from both weep holes in the window.
- 10:32:46 Test complete.



### AA 900 Cap Bead - Air

AA 900 Cap Bead Infiltration											
					Leakage					Leakage	
Pressure		Extraneous		Leakage	Rate Test	Total	Extraneous	Air	Leakage	Rate Test	
Differential	Total Airflow	Leakage	Air Leakage	Rate	Area	Airflow	Leakage	Leakage	Rate	Area	
P	Qt	Qe	Qs	ql	qa	Qt	Qe	Qs	ql	qa	
(Pa)	(L/s)	(L/s)	(L/s)	(L/s*m)	(L/s*m^2)	(cfm)	(cfm)	(cfm)	(cfm/ft)	(cfm/ft^2)	
25	0.026	0.000	0.026	No Data	0.005	0.054	0.000	0.054	No Data	0.0010	
50	0.047	0.000	0.047	No Data	0.009	0.099	0.000	0.099	No Data	0.0018	
75	0.061	0.000	0.061	No Data	0.012	0.130	0.000	0.130	No Data	0.0024	
100	0.075	0.000	0.075	No Data	0.015	0.159	0.000	0.159	No Data	0.0030	ASHKA 90.1
150	0.101	0.000	0.101	No Data	0.020	0.213	0.000	0.213	No Data	0.0040	$0.04 \text{ cfm/ft}^2$
250	0.143	0.000	0.143	No Data	0.029	0.303	0.000	0.303	No Data	0.0056	
300	0.146	0.000	0.146	No Data	0.029	0.309	0.000	0.309	No Data	0.0057	
				AA 900 Cap I	Bead Exfiltration	on			_		
					Leakage					Leakage	
Pressure		Extraneous		Leakage	Rate Test	Total	Extraneous	Air	Leakage	Rate Test	
Differential	Total Airflow	Leakage	Air Leakage	Rate	Area	Airflow	Leakage	Leakage	Rate	Area	
Р	Qt	Qe	Qs	ql	qa	Qt	Qe	Qs	ql	qa	
(Pa)	(L/s)	(L/s)	(L/s)	(L/s*m)	(L/s*m^2)	(cfm)	(cfm)	(cfm)	(cfm/ft)	(cfm/ft^2)	
25	0.024	0.000	0.024	No Data	0.005	0.052	0.000	0.052	No Data		
50	0.048	0.000	0.048	No Data	0.010	0.101	0.000	0.101	No Data	0.0019	
75	0.057	0.000	0.057	No Data	0.011	0.120	0.000	0.120	No Data	0.0022	
100	0.067	0.000	0.067	No Data	0.014	0.143	0.000	0.143	No Data	0.0027	
150	0.093	0.000	0.093	No Data	0.019	0.197	0.000	0.197	No Data	0.0037	ASHRA 90.1
250	0.131	0.000	0.131	No Data	0.026	0.278	0.000	0.278	No Data	0.0052	$0.04 \text{ cfm/ft}^2$
300	0.157	0.000	0.157	No Data	0.032	0.333	0.000	0.333	No Data	0.0062	

#### AA 900 Cap Bead - Water

#### T1012-006

Kawneer AA900 with cant bead restoration. Water leakage test in accordance with ASTM E547. Testing is different from T1012-002 in that the maximum test pressure was 2100 Pa.

Test Start Time: 10/8/2012 9:35 AM Test Completion Time: 10/8/2012 10:23 AM

Test Temperature at Start(°F): 56.150 Test Temperature at End (°F): 56.040 Average Temperature (°F): 56.002 Avg. Barometric Pressure (in. Hg): 30.211

#### AA 900 Cap Bead - Water

Test Observations:

09:39:22 Test started.

09:44:21 End of first cycle. 300 Pa.

09:45:36 600 Pa cycle started.

09:50:35 End of 600 Pa. cycle. No leakage around window perimeter or in window.

09:51:55 Start of 900 pa. test.

09:56:59 900 Pa. test cycle complete. No leakage noted around glass/frame interface or anywhere on the wall.

09:58:18 1200 Pa. test cycle started.

10:03:18 End of 1200 Pa. cycle. No leakage noted.

10:04:40 1500 Pa. test started.

10:09:42 1500 Pa. cycle ended. No leakage noted from the window

perimeter or glass/frame interface.

10:11:01 1800 Pa. cycle started.

10:16:00 End of 1800 Pa. cycle. No leakage noted.

10:17:48 2100 Pa. testing started.

10:22:42 End of test. No leakage.

### AA 900 with Overlay Gasket



#### AA 900 Overlay Gasket - Air

AA 900 Ovrlay Gasket Infiltration											
					Leakage					Leakage	
Pressure		Extraneous		Leakage	Rate Test	Total	Extraneous	Air	Leakage	Rate Test	
Differential	Total Airflow	Leakage	Air Leakage	Rate	Area	Airflow	Leakage	Leakage	Rate	Area	
Р	Qt	Qe	Qs	ql	qa	Qt	Qe	Qs	ql	qa	
(Pa)	(L/s)	(L/s)	(L/s)	(L/s*m)	(L/s*m^2)	(cfm)	(cfm)	(cfm)	(cfm/ft)	(cfm/ft^2)	
25	0.041	0.000	0.041	No Data	0.008	0.086	0.000	0.086	No Data	0.0016	
50	0.071	0.000	0.071	No Data	0.014	0.150	0.000	0.150	No Data	0.0028	
75	0.091	0.000	0.091	No Data	0.018	0.192	0.000	0.192	No Data	0.0036	
100	0.114	0.000	0.114	No Data	0.023	0.242	0.000	0.242	No Data	0.0045	ASHKA 90.1
150	0.139	0.000	0.139	No Data	0.028	0.295	0.000	0.295	No Data	0.0055	$0.04 \text{ cfm/ft}^2$
250	0.194	0.000	0.194	No Data	0.039	0.412	0.000	0.412	No Data	0.0077	
300	0.217	0.000	0.217	No Data	0.043	0.459	0.000	0.459	No Data	0.0085	
			A	A 900 Ovrlay (	Gasket Exfiltra	ation					
					Leakage					Leakage	
Pressure		Extraneous		Leakage	Rate Test	Total	Extraneous	Air	Leakage	Rate Test	
Differential	Total Airflow	Leakage	Air Leakage	Rate	Area	Airflow	Leakage	Leakage	Rate	Area	
P	Qt	Qe	Qs	ql	qa	Qt	Qe	Qs	ql	qa	
(Pa)	(L/s)	(L/s)	(L/s)	(L/s*m)	(L/s*m^2)	(cfm)	(cfm)	(cfm)	(cfm/ft)	(cfm/ft^2)	
25	0.031	0.000	0.031	No Data	0.006	0.066	0.000	0.066	No Data	0.0012	
50	0.061	0.000	0.061	No Data	0.012	0.128	0.000	0.128	No Data	0.0024	
75	0.081	0.000	0.081	No Data	0.016	0.172	0.000	0.172	No Data	0.0032	
100	0.093	0.000	0.093	No Data	0.019	0.197	0.000	0.197	No Data	0.0037	
150	0.137	0.000	0.137	No Data	0.027	0.290	0.000	0.290	No Data	0.0054	ASHRA 90 1
250	0.199	0.000	0.199	No Data	0.040	0.421	0.000	0.421	No Data	0.0078	$0.04 \text{ ofm/ft}^2$
300	0.227	0.000	0.227	No Data	0.045	0.480	0.000	0.480	No Data	0.0089	0.04 0111/10

#### AA 900 Over Lay Gasket - Water

#### T1112-016

Kawneer AA900 with overlay gasket restoration. Water leakage test in accordance with ASTM E547.

Test Start Time: 11/12/2012 3:24 PM Test Completion Time: 11/12/2012 3:58 PM

Test Temperature at Start(°F): 63.486 Test Temperature at End (°F): 59.671 Average Temperature (°F): 61.602 Avg. Barometric Pressure (in. Hg): 30.048

Test Observations:

15:25:09 300 Pa test started.
15:30:14 300 Pa test over. No leakage.
15:31:30 600 Pa test started.
15:32:44 450 Pa test started
15:37:59 450 Pa test over.
15:39:17 600 Pa test started.
15:44:16 600 Pa test complete. No leakage.
15:45:40 900 Pa test started.
15:50:40 900 Pa test completed. No leakage.
15:52:08 1200 Pa test started.
15:57:07 Test completed. No leakage.





TriFab 451 Storefront System positioned on test wall for testing for air & water

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### Tri Fab 450 Leakage Induced - Air

Tri Fab 450 Leakage Induced Infiltration											
						Tri Fab					
						450					
					Leakage	Leakage				Leakage	
Pressure		Extraneous		Leakage	Rate Test	Induced	Extraneous	Air	Leakage	Rate Test	
Differential	Total Airflow	Leakage	Air Leakage	Rate	Area	Air	Leakage	Leakage	Rate	Area	
Р	Qt	Qe	Qs	ql	qa	Qt	Qe	Qs	ql	qa	
(Pa)	(L/s)	(L/s)	(L/s)	(L/s*m)	(L/s*m^2)	(cfm)	(cfm)	(cfm)	(cfm/ft)	(cfm/ft^2)	
25	0.726	0.000	0.726	No Data	0.145	1.538	0.000	1.538	No Data	0.029	
50	1.048	0.000	1.048	No Data	0.210	2.220	0.000	2.220	No Data	0.041	
75	1.298	0.000	1.298	No Data	0.260	2.751	0.000	2.751	No Data	0.051	ASHRA 90
100	1.509	0.000	1.509	No Data	0.302	3.197	0.000	3.197	No Data	0.060	0.04 cfm/ft <sup>2</sup>
150	1.866	0.000	1.866	No Data	0.374	3.954	0.000	3.954	No Data	0.074	
250	2.449	0.000	2.449	No Data	0.491	5.189	0.000	5.189	No Data	0.097	
300	2.695	0.000	2.695	No Data	0.540	5.711	0.000	5.711	No Data	0.106	
			Tri Fa	ab 450 Leakag	je Induced Ext	filtration					
					Leakage					Leakage	
Pressure		Extraneous		Leakage	Rate Test	Total	Extraneous	Air	Leakage	Rate Test	
Differential	Total Airflow	Leakage	Air Leakage	Rate	Area	Airflow	Leakage	Leakage	Rate	Area	
Р	Qt	Qe	Qs	ql	qa	Qt	Qe	Qs	ql	qa	
(Pa)	(L/s)	(L/s)	(L/s)	(L/s*m)	(L/s*m^2)	(cfm)	(cfm)	(cfm)	(cfm/ft)	(cfm/ft^2)	
25	0.672	0.000	0.672	No Data	0.135	1.423	0.000	1.423	No Data	0.027	
50	0.986	0.000	0.986	No Data	0.198	2.089	0.000	2.089	No Data	0.039	ASHRA 90
75	1.241	0.000	1.241	No Data	0.249	2.629	0.000	2.629	No Data	0.049	0.04 of m /642
100	1.474	0.000	1.474	No Data	0.295	3.123	0.000	3.123	No Data	0.058	0.04 CIM/II-
150	1.852	0.000	1.852	No Data	0.371	3.925	0.000	3.925	No Data	0.073	
250	2.467	0.000	2.467	No Data	0.495	5.228	0.000	5.228	No Data	0.097	
300	2.740	0.000	2.740	No Data	0.549	5.806	0.000	5.806	No Data	0.108	

### Tri Fab 450 Leakage Induced - Water

#### T0912-005

Trifab 450 water leakage test in accordance with ASTM E331. Test was performed on assembly with compromised seals in order to establish a baseline.

Test Start Time: 9/20/2012 1:59 PM Test Completion Time: 9/20/2012 2:12 PM

Test Temperature at Start(°F): 68.340 Test Temperature at End (°F): 68.691 Average Temperature (°F): 68.478 Avg. Barometric Pressure (in. Hg): 29.948

Test Observations:

14:02:06 300 Pa test started. Water starting to enter the test chamber before full water spray in effect. Test completed.






# For testing we used the gasket in black silicone

### Tri Fab 450 Gasket & Sealant Bead - Air

Tri Fab 450 Sealant Bead & Gasket Infiltration											[
					Leakage					Leakage	
Pressure		Extraneous		Leakage	Rate Test	Total	Extraneous	Air	Leakage	Rate Test	
Differential	Total Airflow	Leakage	Air Leakage	Rate	Area	Airflow	Leakage	Leakage	Rate	Area	_
P	Qt	Qe	Qs	ql	qa	Qt	Qe	Qs	ql	qa	
(Pa)	(L/s)	(L/s)	(L/s)	(L/s*m)	(L/s*m^2)	(cfm)	(cfm)	(cfm)	(cfm/ft)	(cfm/ft^2)	_
25	0.018	0.000	0.018	No Data	0.004	0.037	0.000	0.037	No Data	0.0007	
50	0.032	0.000	0.032	No Data	0.007	0.069	0.000	0.069	No Data	0.0013	4 SHR4 90 1
75	0.049	0.000	0.049	No Data	0.010	0.103	0.000	0.103	No Data	0.0019	0.04 of m/ft2
100	0.060	0.000	0.060	No Data	0.012	0.128	0.000	0.128	No Data	0.0024	0.04 cim/it-
150	0.089	0.000	0.089	No Data	0.018	0.189	0.000	0.189	No Data	0.0035	
250	0.127	0.000	0.127	No Data	0.026	0.270	0.000	0.270	No Data	0.0050	
300	0.149	0.000	0.149	No Data	0.030	0.315	0.000	0.315	No Data	0.0059	
											-
Tri Fab 450 Sealant Bead & GasketExfiltration											
					Leakage					Leakage	
Pressure		Extraneous		Leakage	Rate Test	Total	Extraneous	Air	Leakage	Rate Test	
Differential	Total Airflow	Leakage	Air Leakage	Rate	Area	Airflow	Leakage	Leakage	Rate	Area	
P	Qt	Qe	Qs	ql	qa	Qt	Qe	Qs	ql	qa	_
(Pa)	(L/s)	(L/s)	(L/s)	(L/s*m)	(L/s*m^2)	(cfm)	(cfm)	(cfm)	(cfm/ft)	(cfm/ft^2)	
25	0.015	0.000	0.015	No Data	0.003	0.032	0.000	0.032	No Data	0.0006	
50	0.030	0.000	0.030	No Data	0.006	0.064	0.000	0.064	No Data	0.0012	
75	0.043	0.000	0.043	No Data	0.009	0.092	0.000	0.092	No Data	0.0017	ASHKA 90.1
100	0.057	0.000	0.057	No Data	0.011	0.120	0.000	0.120	No Data	0.0022	$0.04  \mathrm{cfm/ft^2}$
150	0.082	0.000	0.082	No Data	0.017	0.174	0.000	0.174	No Data	0.0032	
250	0.130	0.000	0.130	No Data	0.026	0.275	0.000	0.275	No Data	0.0051	
300	0.148	0.000	0.148	No Data	0.030	0.314	0.000	0.314	No Data	0.0058	

### Tri Fab 450 Gasket & Sealant Bead - Water

#### T1012-009

Trifab 450 water leakage test in accordance with ASTM E547. Test was performed on assembly that was restored with a bead of Spectrem 2 silicone sealant in the glazing pocket with a new gasket placed around the perimeter of the glass on the exterior side. This test was performed after a repair was made to the leakage path discovered in T1012-007

Test Start Time: 10/31/2012 10:23 AM Test Completion Time: 10/31/2012 10:38 AM

Test Temperature at Start(°F): 55.969 Test Temperature at End (°F): 56.459 Average Temperature (°F): 56.177 Avg. Barometric Pressure (in. Hg): 29.484

Test Observations:

10:25:50 300 Pa water test started.

10:30:50 300 Pa test completed. No leakage.

10:31:59 600 Pa test started.

10:35:11 Water leakage noted at the same bottom left location as before in

T1012-004

10:37:03 600 Pa test completed.

10:38:09 Test completed with failure recorded at 600 Pa.

### Conclusion

- Window/curtain wall restoration can result in substantial energy savings
- Retrofit measures can achieve performance results without the cost and disruption of window replacement.
- Kawneer AA900 punched window selected for testing as being representative of common systems with small face clearance.
- A restoration alternative capable of withstanding thermal and structural movement, the overlay system was tested in addition to the frequently used cap bead.
- Overlay cost of the is approximately half the cost per lineal foot of typical window removal and replacement



## Questions

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