
**EVALUATION OF THE AIR PERMEANCE PROPERTIES OF
“BOREAL NATURE ELITE”
POLYURETHANE SPRAY FOAM MATERIAL
IN ACCORDANCE WITH ASTM E2178 STANDARD**

Report to: Genyk
1701 3e Avenue
Grand-Mere, QC
G9T 2W6

Attention: Mike Richmond

Telephone: +1 (226) 339-3089

Email: mikerichmond@genyk.com

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5 Pages, 2 Appendices

Proposal No.: 20-006-95292

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1.0 INTRODUCTION

At the request of Genyk, Element Materials Technology was retained to evaluate the air permeance properties of polyurethane spray foam material identified as "Boreal Nature Elite" in accordance with ASTM E2178 as outlined in Element Proposal No.: 20-006-95292.

The material used for testing was sample selected by an Element technical representative and prepared at the Element Toronto facility by Genyk personnel. Upon receipt, the samples were assigned the following Element Sample Numbers:

Client Sample Description:

Boreal Nature Elite

Element Specimen No.:

20-06-B0040-AP1 to AP5

2.0 PROCEDURE

The sample was evaluated for the following test:

Test Description	Test Method
Standard Test Method for Air Permeance of Building Materials	ASTM E2178-13

Note: SI units are the primary units of measure.

Air Permeance Specimen Preparation:

Material, five (5) 1.1 m x 1.1 m (43.34" x 43.34") test samples were sprayed on 16 mm HDPE boards and conditioned for a minimum of seven days at $21 \pm 1^\circ\text{C}$ ($70 \pm 2^\circ\text{F}$) and $40 \pm 5\%$ RH prior to testing.

Each specimen was installed within the air sealed test chamber as prescribed by ASTM E2178-13 standard (*Figure 1*).

The initial air leakage rate was measured by exhausting the air within the test chamber at a rate required to maintain the following incremental test pressure differentials of 25, 50, 75, 100, 150, and 300 Pa (0.52, 1.04, 1.57, 2.09, 3.13, and 6.27 psf), followed by decremental pressure differentials of 100, 75 and 50 Pa (2.09, 1.57, and 1.04 psf). Simultaneously, the test specimen was monitored for any physical changes.

2.0 PROCEDURE (CONTINUED)

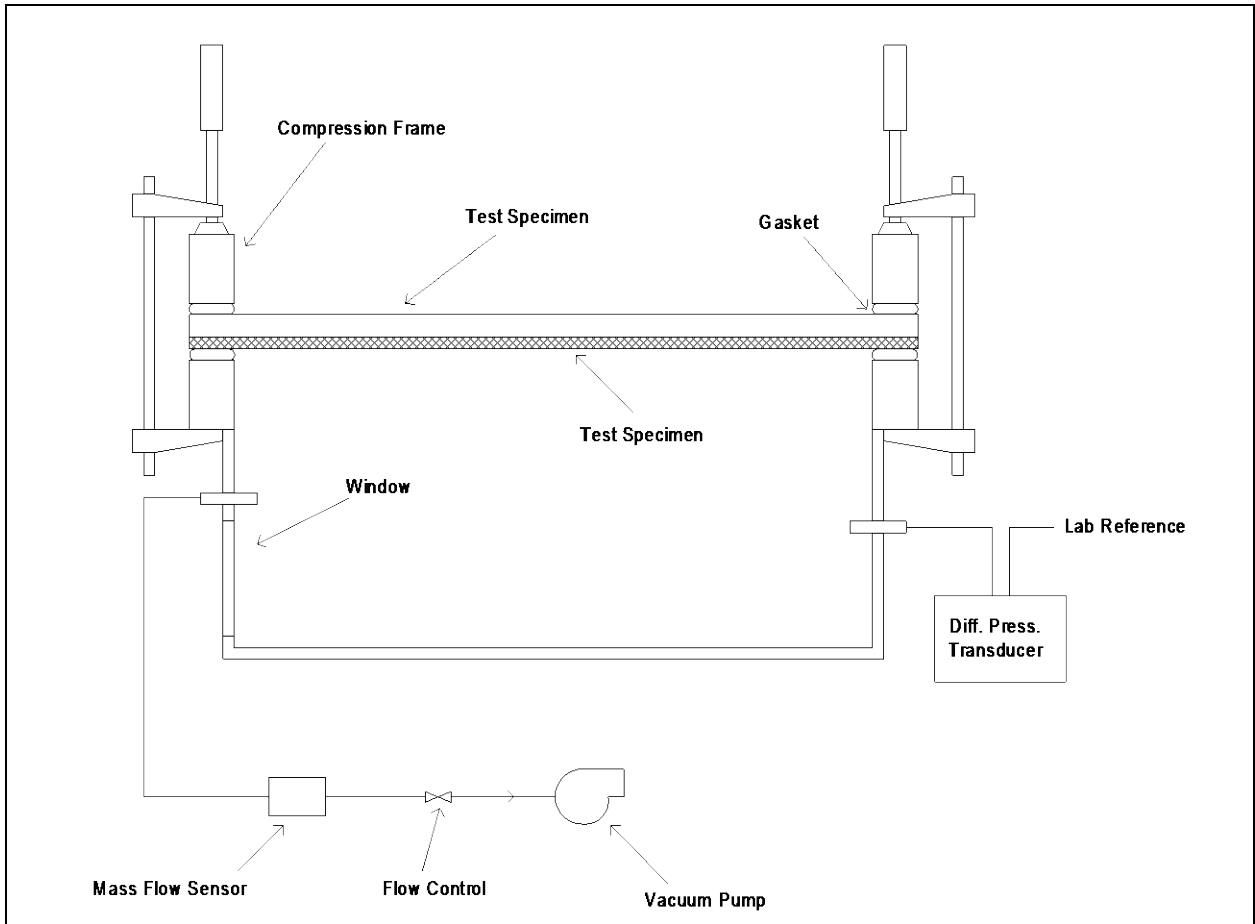


Figure 1 – Test Setup (ASTM E2178-13)

Equipment Used for Air Flow Measurements:

Manometer:	MII B12064
Mass Flow Meter:	MII A09200
Multimeter:	MII B11550
Condition Room	MII-B09680
Calipers	MII B10963
ASTM E2178-13 Chamber:	07973 (for reference)

Testing for each specimen was conducted on the following dates:

<u>Element Specimen No.:</u>	<u>Date:</u>
20-06-B0040-AP1	April 16, 2020
20-06-B0040-AP2	April 17, 2020
20-06-B0040-AP3	April 17, 2020
20-06-B0040-AP4	April 20, 2020
20-06-B0040-AP5	April 21, 2020

3.0 RESULTS

Table 1 – Air Permeance Averages in Accordance with ASTM E2178-13 Element Sample Number: 20-06-B0040-AP1 to AP5			
Differential Pressure		Calculated Air Flow	
Pa	(lbs./ft. ²)	(L/s·m ²)	(cfm/ft. ²)
25	0.52	0.0010	0.0002
50	1.05	0.0019	0.0004
75	1.57	0.0027	0.0005
100	2.09	0.0035	0.0007
150	3.14	0.0051	0.0010
300	6.27	0.0097	0.0020
100	2.09	0.0036	0.0007
75	1.57	0.0028	0.0006
50	1.05	0.0019	0.0004

Average Specimen Thickness: 47.89 mm (1.89")

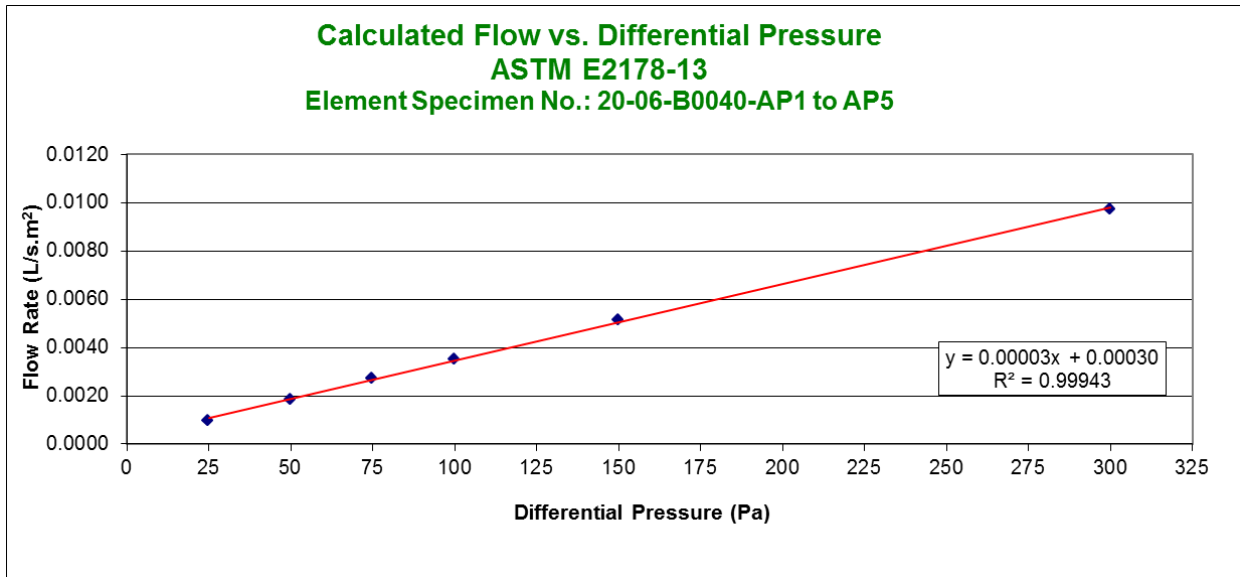


Figure 2 - Average Calculated Flow vs. Differential Pressure

4.0 CONCLUSION

Element Sample No. 20-06-B0040-AP1 to AP5 identified as "Boreal Nature Elite" achieved the air permeance requirements with an average air leakage result of $0.0027 \text{ L/(s}\cdot\text{m}^2)$ (0.0005 cfm/ft^2) at 75 Pa (1.57 PSF) at an average thickness of 47.89 mm (1.89"). This is below the maximum allowable air leakage resistance requirement of $0.02 \text{ L/(s}\cdot\text{m}^2)$ (0.0039 cfm/ft^2) referenced in the following building codes:

National Building Code of Canada 2015, Division B, Section 5.4.1.2 States:

(1) Except as provided in Sentence (2), materials intended to provide the principal resistance to air leakage shall:

(a) Have an air leakage characteristic not greater than $0.02 \text{ L/(s}\cdot\text{m}^2)$ (0.0039 cfm/ft^2) measured at an air pressure difference of 75 Pa (1.57 psf).

Ontario Building Code 2012, Division B, Section 5.4.1.2 States:

(1) Except as provided in Sentence (2), materials intended to provide the principal resistance to air leakage shall:

(a) Have an air leakage characteristic not greater than $0.02 \text{ L/(s}\cdot\text{m}^2)$ (0.0039 cfm/ft^2) measured at an air pressure difference of 75 Pa (1.57 psf).

5.0 REPORT REVISION SUMMARY

<u>Revision No:</u>	<u>Date:</u>	<u>Description of Revisions:</u>
N/A	November 2, 2020	Original Document

Reported by:

Reviewed by:



Fadi G. Basmaji, M.A.Sc., B.Eng., Ext. 11227
Building Science Specialist
Building Science Division



Allan Lawrence, Ext. 11212
Supervisor, Building Science
Building Science Division

Direct readings presented by the test method are the values being reported and form the basis for acceptance or rejection (pass/fail) and to not take into account or incorporate uncertainty. This report and service are covered under Element Materials Technology Inc.'s Standard Terms and Conditions of Contract which may be found on our company's website www.element.com, or by calling 1-888-786-7555

APPENDIX A

Individual Test Specimen Details

(3 Pages)

Table A1 – Air Permeance Results in Accordance with ASTM E2178-13 Element Sample Number: 20-06-B0040-AP1			
Differential Pressure		Calculated Air Flow	
Pa	(lbs./ft. ²)	(L/s·m ²)	(cfm/ft. ²)
25	0.52	0.0009	0.0002
50	1.05	0.0017	0.0003
75	1.57	0.0026	0.0005
100	2.09	0.0034	0.0007
150	3.14	0.0051	0.0010
300	6.27	0.0100	0.0020
100	2.09	0.0037	0.0007
75	1.57	0.0026	0.0005
50	1.05	0.0016	0.0003

Average Specimen Thickness: 39.69 mm (1.563")

Table A2 – Air Permeance Results in Accordance with ASTM E2178-13 Element Sample Number: 20-06-B0040-AP2			
Differential Pressure		Calculated Air Flow	
Pa	(lbs./ft. ²)	(L/s·m ²)	(cfm/ft. ²)
25	0.52	0.0009	0.0002
50	1.05	0.0018	0.0004
75	1.57	0.0026	0.0005
100	2.09	0.0034	0.0007
150	3.14	0.0049	0.0010
300	6.27	0.0093	0.0019
100	2.09	0.0032	0.0006
75	1.57	0.0025	0.0005
50	1.05	0.0018	0.0004

Average Specimen Thickness: 49.71 mm (1.957")

Table A3 – Air Permeance Results in Accordance with ASTM E2178-13 Element Sample Number: 20-06-B0040-AP3			
Differential Pressure		Calculated Air Flow	
Pa	(lbs./ft.²)	(L/s·m²)	(cfm/ft.²)
25	0.52	0.0010	0.0002
50	1.05	0.0019	0.0004
75	1.57	0.0027	0.0005
100	2.09	0.0035	0.0007
150	3.14	0.0050	0.0010
300	6.27	0.0093	0.0019
100	2.09	0.0035	0.0007
75	1.57	0.0027	0.0005
50	1.05	0.0019	0.0004

Average Specimen Thickness: 48.98 mm (1.929")

Table A4 – Air Permeance Results in Accordance with ASTM E2178-13 Element Sample Number: 20-06-B0040-AP4			
Differential Pressure		Calculated Air Flow	
Pa	(lbs./ft.²)	(L/s·m²)	(cfm/ft.²)
25	0.52	0.0009	0.0002
50	1.05	0.0018	0.0004
75	1.57	0.0026	0.0005
100	2.09	0.0035	0.0007
150	3.14	0.0051	0.0010
300	6.27	0.0099	0.0020
100	2.09	0.0037	0.0007
75	1.57	0.0027	0.0005
50	1.05	0.0018	0.0004

Average Specimen Thickness: 46.55 mm (1.833")



Table A5 – Air Permeance Results in Accordance with ASTM E2178-13 Element Sample Number: 20-06-B0040-AP5			
Differential Pressure		Calculated Air Flow	
Pa	(lbs./ft.²)	(L/s·m²)	(cfm/ft.²)
25	0.52	0.0012	0.0002
50	1.05	0.0022	0.0004
75	1.57	0.0031	0.0006
100	2.09	0.0040	0.0008
150	3.14	0.0056	0.0011
300	6.27	0.0102	0.0021
100	2.09	0.0038	0.0008
75	1.57	0.0032	0.0006
50	1.05	0.0024	0.0005

Average Specimen Thickness: 54.51 mm (2.146")

APPENDIX B

Air Flow Versus Pressure Differential (log/log) Graphs
(5 Pages)

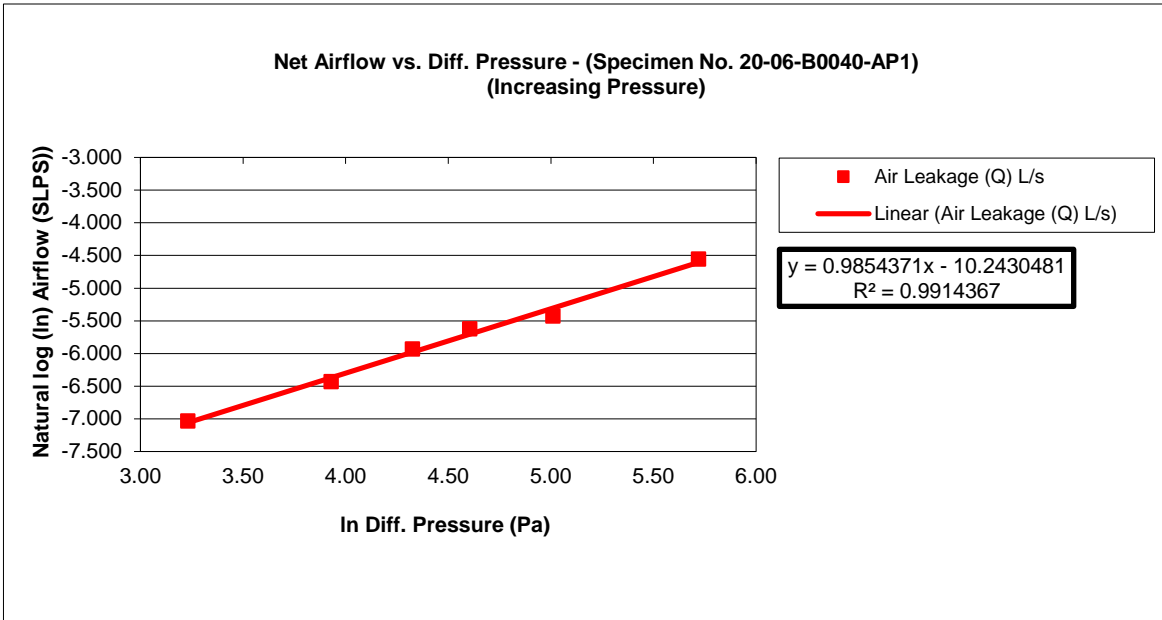


Figure B-1 – Element Specimen No.: 20-06-B0040-AP1 Increasing Air Flow vs. Pressure
Direction of Air Flow: Infiltration

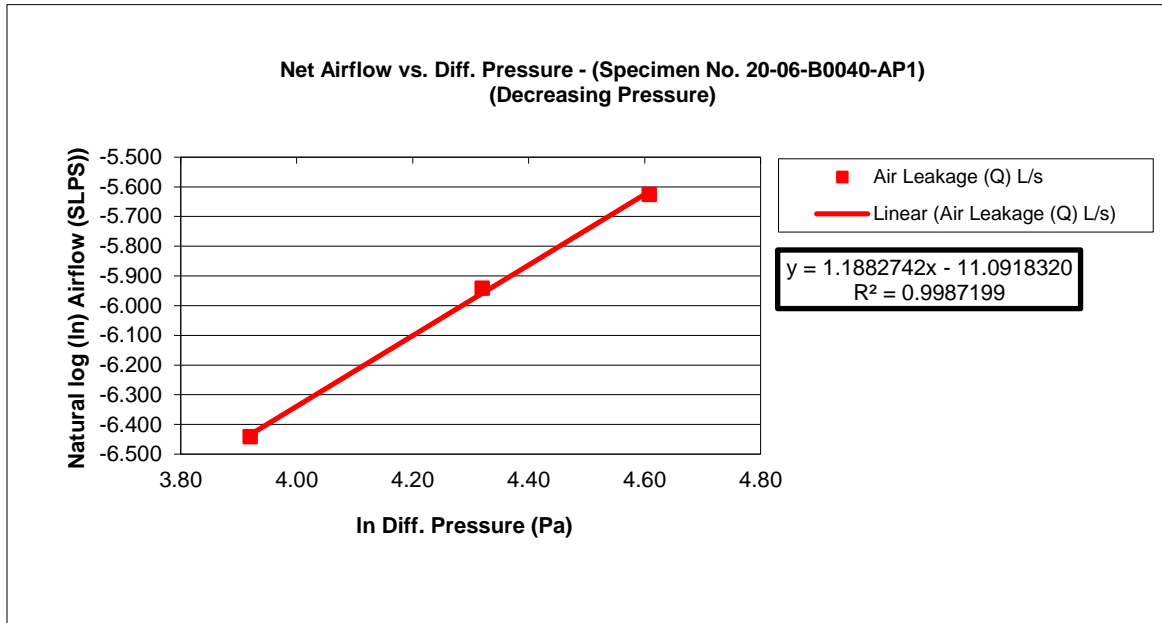


Figure B-2 – Element Specimen No.: 20-06-B0040-AP1 Decreasing Air Flow vs. Pressure
Direction of Air Flow: Infiltration.

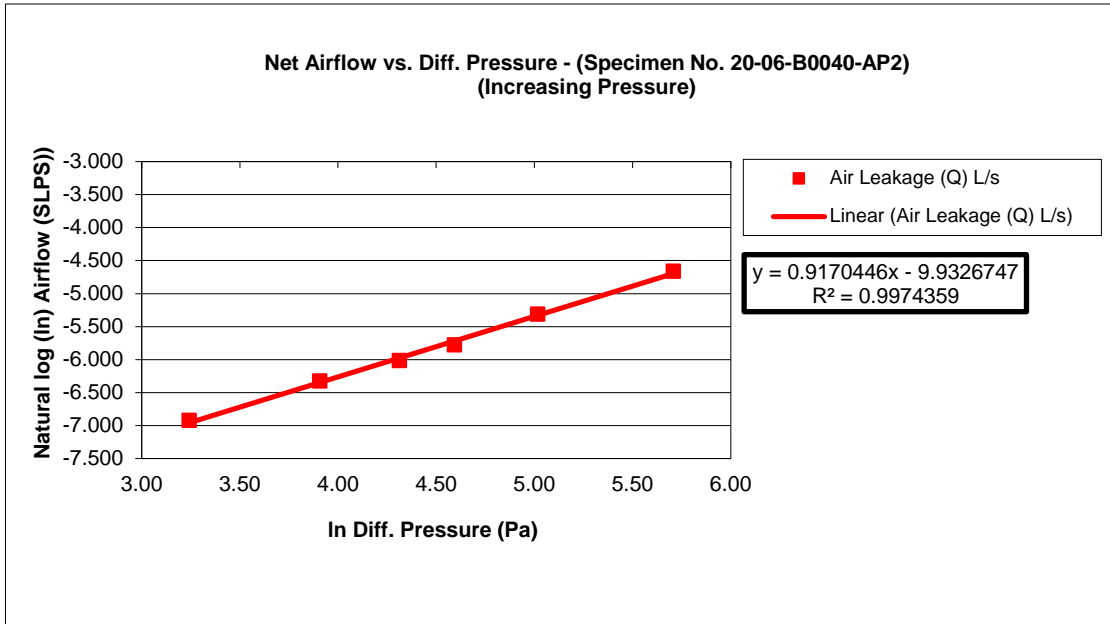


Figure B-3 – Element Specimen No.: 20-06-B0040-AP2 Increasing Air Flow vs. Pressure
 Direction of Air Flow: Infiltration

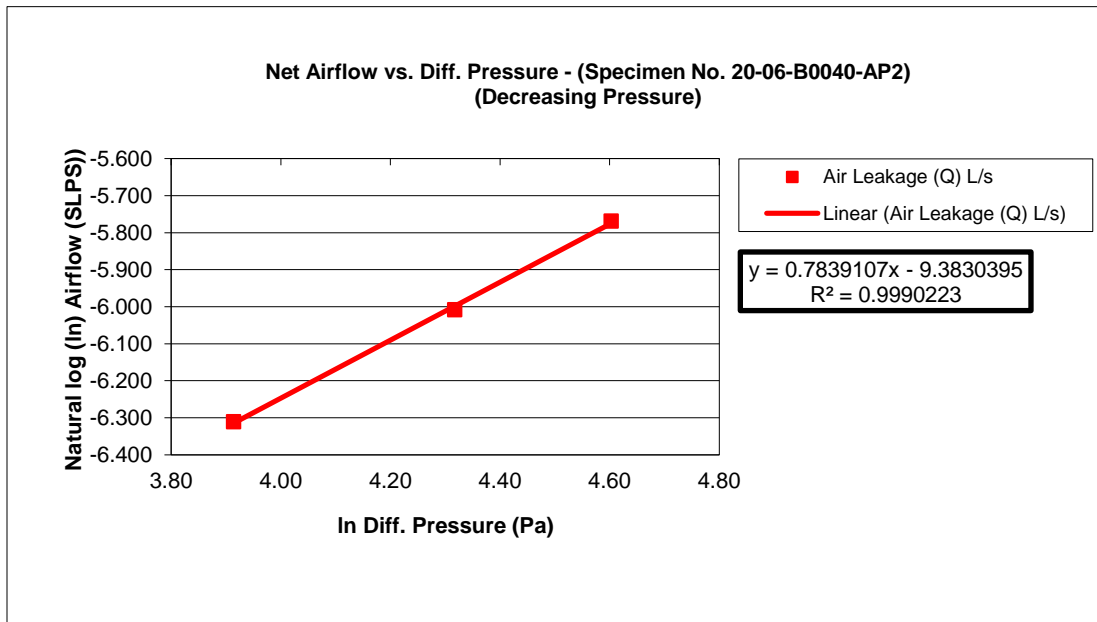


Figure B-4 – Element Specimen No.: 20-06-B0040-AP2 Decreasing Air Flow vs. Pressure
 Direction of Air Flow: Infiltration.

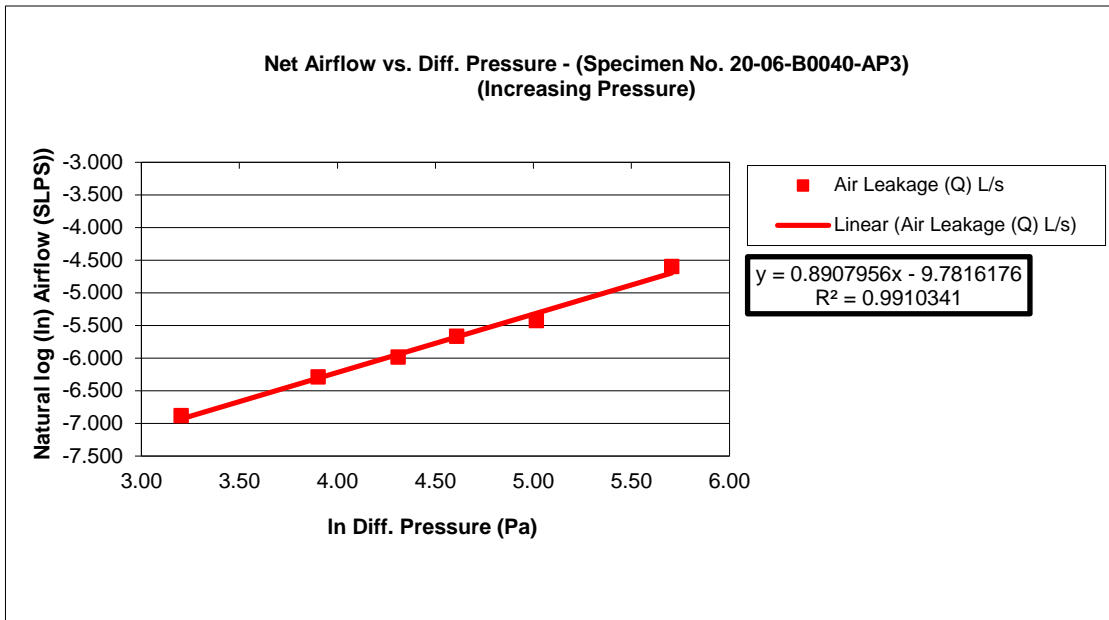


Figure B-5 – Element Specimen No.: 20-06-B0040-AP3 Increasing Air Flow vs. Pressure
Direction of Air Flow: Infiltration

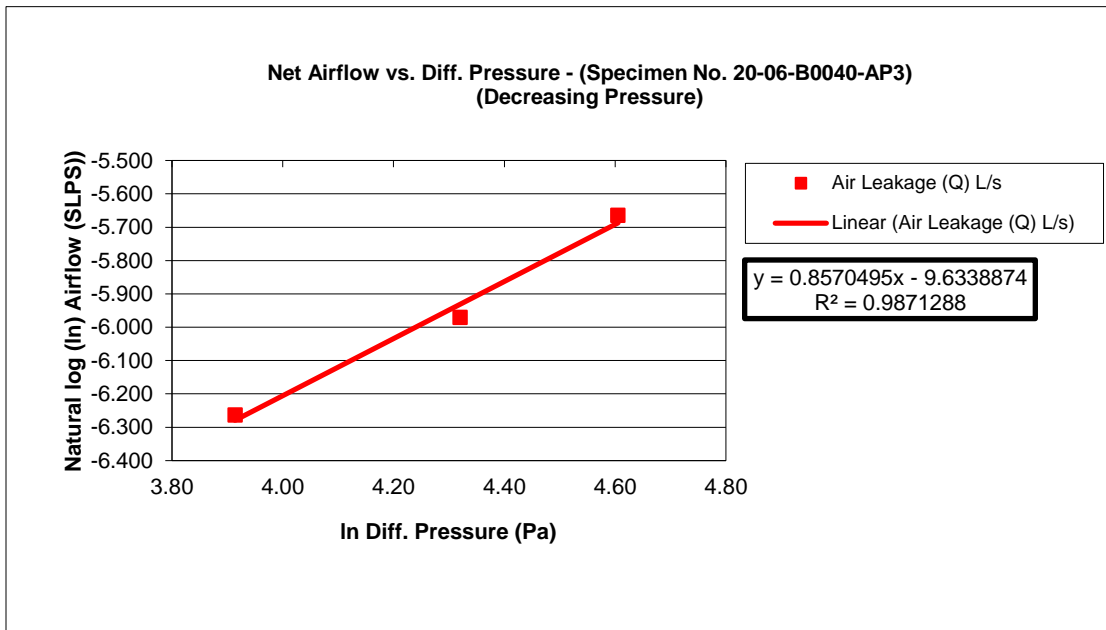


Figure B-6 – Element Specimen No.: 20-06-B0040-AP3 Decreasing Air Flow vs. Pressure
Direction of Air Flow: Infiltration.

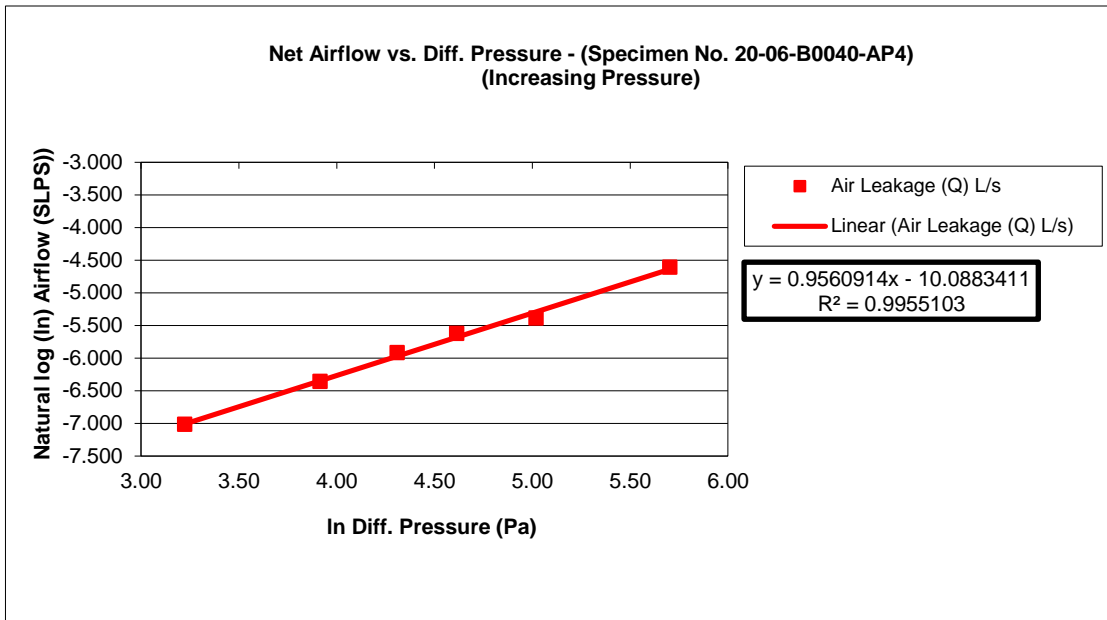


Figure B-7 – Element Specimen No.: 20-06-B0040-AP4 Increasing Air Flow vs. Pressure
Direction of Air Flow: Infiltration

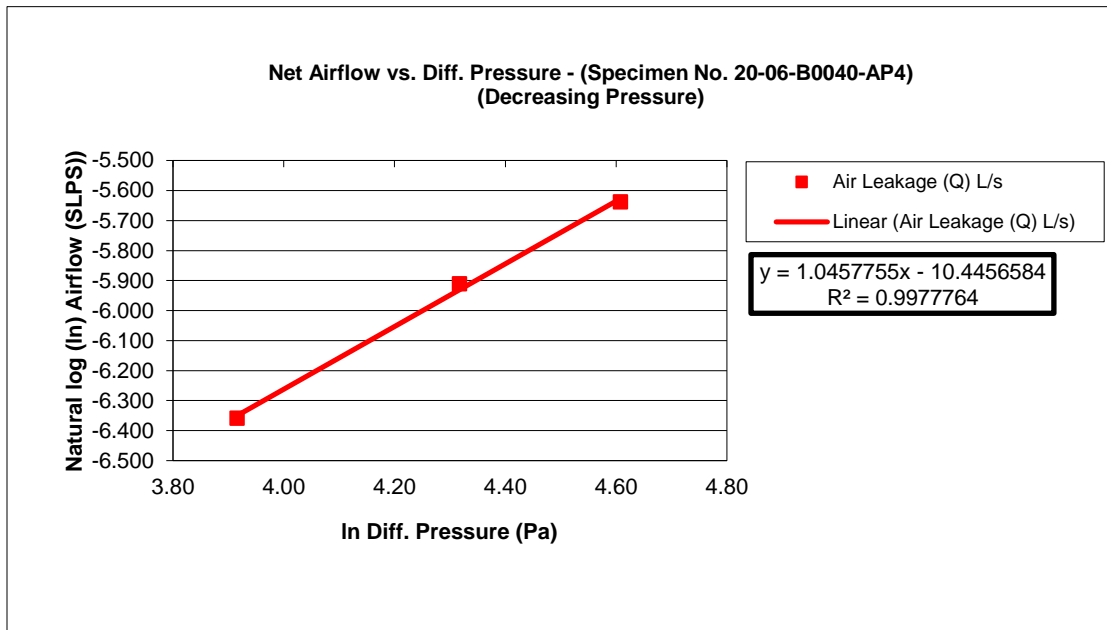


Figure B-8 – Element Specimen No.: 20-06-B0040-AP4 Decreasing Air Flow vs. Pressure
Direction of Air Flow: Infiltration.

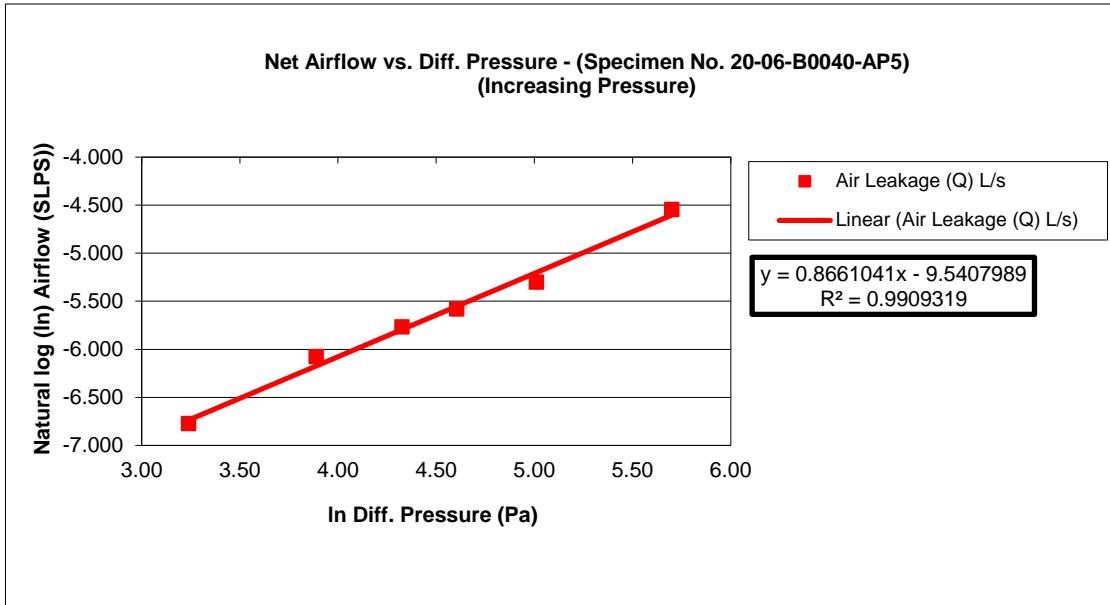


Figure B-9 – Element Specimen No.: 19-06-B0014-AP5 Increasing Air Flow vs. Pressure
Direction of Air Flow: Infiltration

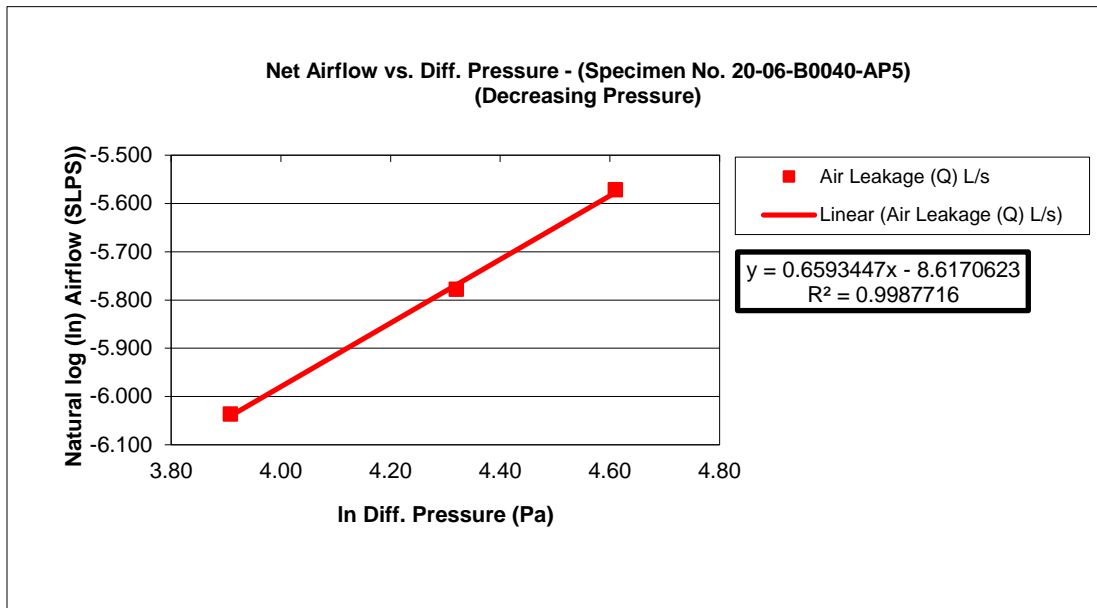


Figure B-10 – Element Specimen No.: 19-06-B0014-AP5 Decreasing Air Flow vs. Pressure
Direction of Air Flow: Infiltration.