



4 Elements
Integrated Design Ltd.



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Air Tightness Report

Waterford Shrimp Farm
Wheatland County, AB

Green Building Experts

*Issued by: Tyler Hermanson
CEM, CBCP, EA-MURB
Issued: November 24, 2020*

General:

Modern building is a complicated system with many components and building systems coming together. Often overlooked or missed in early planning, the air barrier system is critical to the energy performance and durability of buildings today. As an engineered, fabric tensioned structure, this building is a unique case for air tightness testing.



Building Information:

The Waterford Shrimp Farm building is an engineered, fabric tensioned structure, designed to meet specific and controlled climate requirements.

- Address: Wheatland County, Alberta
- Elevation: 973 meters
- Constructed: 2018
- Floor area* (conditioned): 9239.6 SF
- Volume* (conditioned): 241,213.9 Cu Ft
- Exposed surface area* (conditioned): 19,055 SF

**Volume, floor area and exposed surface area calculations are as per calculations provided by client.*

Test Conditions:

Date: November 3, 2020
Weather: Mixed sun and clouds. Winds moderate throughout testing SSW 13-15km/h
RH: 24%
Temperature: Exterior 13-16deg Celsius; Interior 18deg Celsius
Technician: Cooper Le, Tyler Hermanson

Interconnection of test zone:

- Test zone was interconnected by standard door size openings.

Condition of openings:

- All doors closed and latched
- Mechanical system
 - Testing was completed with the ventilation system in a range of states, as noted in each test.
 - Test 1 – Equipment Off – depressurized
 - Doors and Windows Closed
 - Ventilation equipment off
 - Heating equipment off
 - Test 2 – MUA Sealed – depressurized
 - As above
 - Ventilation Openings sealed
 - Test 3 – Mechanical Sealed – depressurized
 - As Above
 - Heating System supply/exhaust sealed
 - Test 4 – Mechanical Sealed – pressurized
 - As Above

Test Procedure:

Test Equipment:

- Flow Device: Minneapolis Model 3 / Minneapolis Model 3
- Pressure Gauge: DG1000 / DG 1000
- Serial #: 746 / 2908
- Calibration Date:
 - #746 – Factory 2017-08-24 / Field 2020-10-13*
(*Procedure for Field Calibration Check of Digital Pressure Gauge published by The Energy Conservatory)
 - #2908 – Factory 2019-01-07



Test Set-Up – 2020-11-03

Test Location:

- Main building door – south side
- 4E1 – Serial #746
 - Envelope Reference – Exterior, South side of building at ground level - split to 4E2
 - Envelope Input – open at gauge
- 4E2 – Serial #2908
 - Envelope Reference – Exterior, South side of building at ground level - split to 4E1
 - Envelope Input – open at gauge

Testing Standard:

- ASTM E779 -19 Standard Test Method for Determining Air Leakage Rate by Fan Pressurization (or depressurization)

Test Method:

- Mechanical depressurization and measurements of resulting air flow rate at given indoor-outdoor static pressure differences. From the relationship between the air flow rates and pressure differences, the air leakage characteristics of the building envelope are taken.
 - *From ATMS E779-19 Standard Test Method for Determining Air Leakage Rate by Fan Pressurization (or depressurization)*
- Fan synchronization and digital logging through TecLog 4 to meet ASTM E779 minimum sample rates.
- Baseline Period of Record - 120 seconds
- Fan On Period of Record - 10 seconds
- *DG1000-746* *A* *Envelope Pressure* *P1(Pa)*
- *DG1000-746* *B* *Model 3 Fan Flow* *P2(Pa)*
- *DG1000-2908* *A* *Envelope Pressure* *P1(Pa)*
- *DG1000-2908* *B* *Model 3 Fan Flow* *P2(Pa)*

Software:

- Data was collected using TecLog4 (auto method). Data has been extracted to Tectite Express 5.0 for summary reporting purposes.

Deviations:

- “An interval between building pressures exceeds 10 Pa.” Due the effects of wind on the testing conditions some readings were excluded from the calculations to maintain correlation.

Air Tightness Test Results @ 50 Pascals

Test 1 – Equipment Off

This test presented an initial “as found” condition with intermittent ventilation equipment off but not sealed. This worse-case condition is the best representation of normal air leakage conditions.

Cfm50 Airflow	2635 (+/-6.5%)
ACH50	0.66
Cfm/ft2 (Floor area)	0.2871
Cfm/ft2 (surface area)	0.1392

Test Standard:	E779-10 Correlation Coefficient = 0.99234
Test Mode:	Depressurization

Test 2 – MUA Sealed

This test followed the “as-operated” condition outlined in CGSB-149. This condition is typically used for building air tightness compliance assessments.

Cfm50 Airflow	1336 (+/-3.8%)
ACH50	0.33
Cfm/ft2 (Floor area)	0.1446
Cfm/ft2 (surface area)	0.0701

Test Standard:	E779-10 Correlation Coefficient = 0.99310
Test Mode:	Depressurization

Test 3 – Mech Sealed – Depressurized

*An envelope only test that excludes all air leakage from intentional and mechanical openings. This assessment looks at the building envelope interface only and measures the air leakage of the construction assembly alone. When assessing envelope air tightness this metric is often reported in l/s*m2 at 75pa.*

Cfm50 Airflow	1293 (+/-5.3%)
ACH50	0.32
Cfm/ft2 (Floor area)	0.1400
Cfm/ft2 (surface area)	0.0679
L/S*m2 @ 75	0.4561 (+/-7.9%)
Test Standard:	E779-10 Correlation Coefficient = 0.99550
Test Mode:	Depressurization

Test 4 – Mech Sealed – Pressurized

As above.

Cfm50 Airflow	1225 (+/-2.2%)
ACH50	0.30
Cfm/ft2 (Floor area)	0.1326
Cfm/ft2 (surface area)	0.0643
L/S*m2 @ 75	0.3591 (+/- 5.2%)
Test Standard:	E779-10 Correlation Coefficient = 0.95765
Test Mode:	Pressurization

**See Appendix A for full test results.*

Overall, the testing and visual observations show a well-sealed building with strong air tightness results. Although several leakage areas were identified, for the size of structure and volume of air it encloses, this testing showed very good performance.

Congratulations on excellent air tightness results on this innovative structure.



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Disclaimer

This review and report do not replace the need or role of an Engineer and should be not be used to assess the overall safety or quality of the building. The observations and recommendations included herein do not replace the need for mechanical, structural and similar engineering and design, as well as clients' personal choice. Contractors and subcontractors are responsible for their own calculations and system design; if a contradiction occurs, follow manufacturers or engineers' specifications.

4 Elements Integrated Design Ltd. can take no responsibility for the specification or installation and maintenance of the systems recommended herein or for building practices followed onsite during construction, renovations or operation. If problems do arise, consult an experienced engineer for specific solutions and advice

Appendix A
Waterford Shrimp Farm
Full Building Air Tighness Test
Summary Reports
(TecTite Express 5.0)

BUILDING LEAKAGE TEST

Date of Test: 11/3/2020 Test File: Sprung - Test 1 - Equipment Off

Technician: CL

Project Number:

Customer: SAIT Applied Research and Innovation Services
GBT Lab, LA100
1301-16 Ave NW
Calgary, AB T2M 0L4
Phone:
Fax:

Building Address: Waterford Shrimp Farm
Wheatland County, AB T0J 0M0

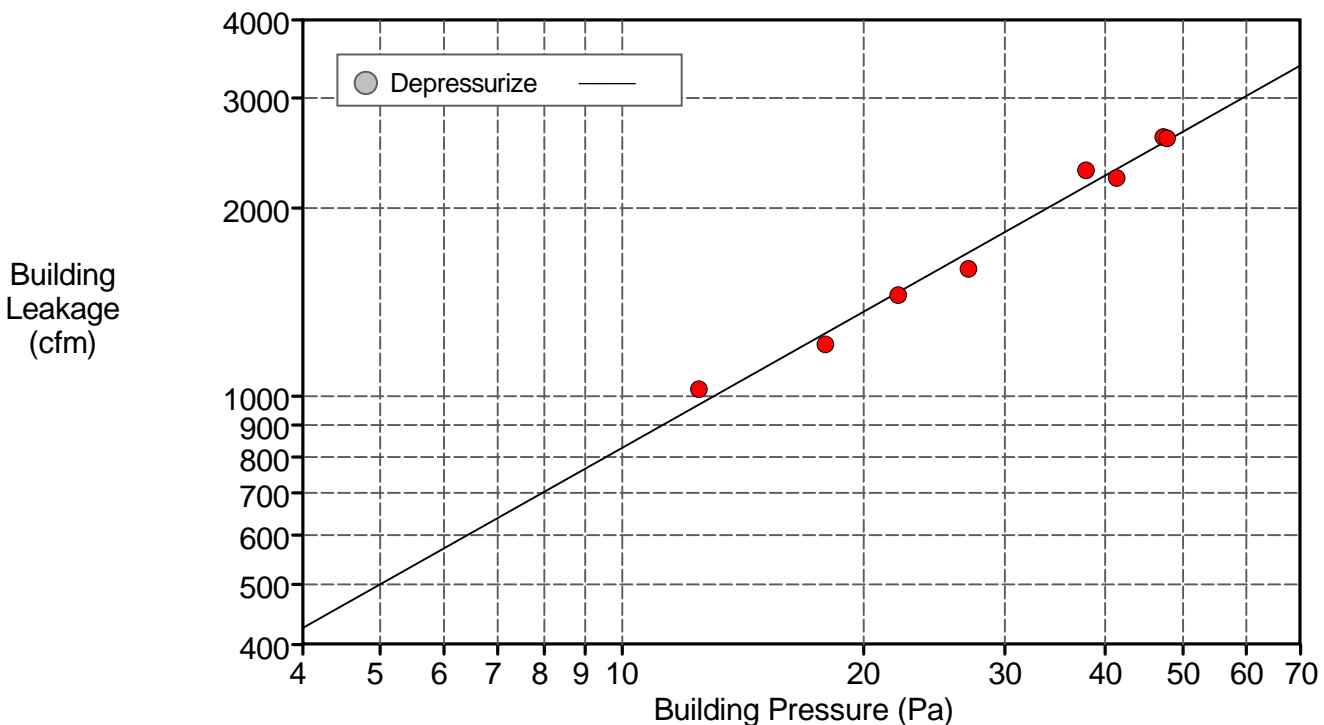
Test Results at 50 Pascals:

cfm50 Airflow	2653 (+/- 6.5 %)
ACH50	0.66
cfm/ft ² (Floor Area)	0.2871
cfm/ft ² (Surface Area)	0.1392

Leakage Areas: 243.1 in² (+/- 10.4 %) Canadian EqLA @ 10 Pa or 0.0128 in²/ft² Surface Area
121.0 in² (+/- 18.2 %) LBL ELA @ 4 Pa or 0.0063 in²/ft² Surface Area

Building Leakage Curve: Flow Coefficient (C) = 156.3 (+/- 30.5 %)
Exponent (n) = 0.724 (+/- 0.090)
Correlation Coefficient = 0.99234

Test Standard: E779-10
Test Mode: Depressurization



BUILDING LEAKAGE TEST Page 2 of 4

Date of Test: 11/3/2020 Test File: Sprung - Test 1 - Equipment Off

Building Information

Volume (ft³)	241213.9
Surface Area: (ft²)	19055
Floor Area: (ft²)	9239.6
Height (ft)	34
Year of Construction	2018

Equipment Information

Type	Manufacturer	Model	Serial Number	Custom Calibration Date
Fan	Energy Conservatory	Model 3 (110V)	Multiple	-

BUILDING LEAKAGE TEST Page 3 of 4

Date of Test: 11/3/2020 Test File: Sprung - Test 1 - Equipment Off

Depressurization Test:

Environmental Data

	Indoor Temperature (°C)	Outdoor Temperature (°C)	Altitude (ft)
Pre-Test	18.0	13.0	
Post-Test	18.0	13.0	
Average	18.0	13.0	0.0

Data Points - Collected using TECLOG - Automated Test

Nominal Building Pressure (Pa)	Baseline adjusted Building Pressure (Pa)	Fan Pressure (Pa)	Nominal Flow (cfm)	Adjusted Flow (cfm)	% Error	Fan Configuration
-1.4						
-49.8	-47.3	-	2663	2603	2.2	
-50.3	-47.8	-	2649	2590	0.9	
-43.8	-41.3	-	2286	2235	-3.3	
-40.4	-37.9	-	2355	2303	6.2	
-29.5	-27.0	-	1636	1599	-5.9	
-24.6	-22.1	-	1484	1451	-1.2	
-20.4	-17.9	-	1239	1212	-4.0	
-15.0	-12.5	-	1050	1027	5.7	
-3.6						

Deviations from Standard ASTM E779-10 - Test Parameters

- An interval between building pressures exceeds 10 Pa.
 - Pressurization test not included.
-

BUILDING LEAKAGE TEST Page 4 of 4

Date of Test: 11/3/2020 Test File: Sprung - Test 1 - Equipment Off

Comments

Pressure Measurement Devices

- 1.) DG1000-746. Calibration Date: 2017 Aug 24; Field Calibration October 13, 2020
- 2.) DG1000-2908. Calibration Date: 2019 Jan 07

Flow Devices

- 1.) Model 3 Fan-. Calibration Date: N/A
 - 2.) Model 3 Fan-. Calibration Date: N/A
-

BUILDING LEAKAGE TEST

Date of Test: 11/3/2020 Test File: Sprung - Test 2 - MUA Sealed

Technician: CL

Project Number:

Customer: SAIT Building Address: Waterford Shrimp Farm
Applied Research and Innovation Services Wheatland County, AB
GBT Lab, LA 100
1301-16 Ave NW
Calgary, AB T2M 0L4
Phone:
Fax:

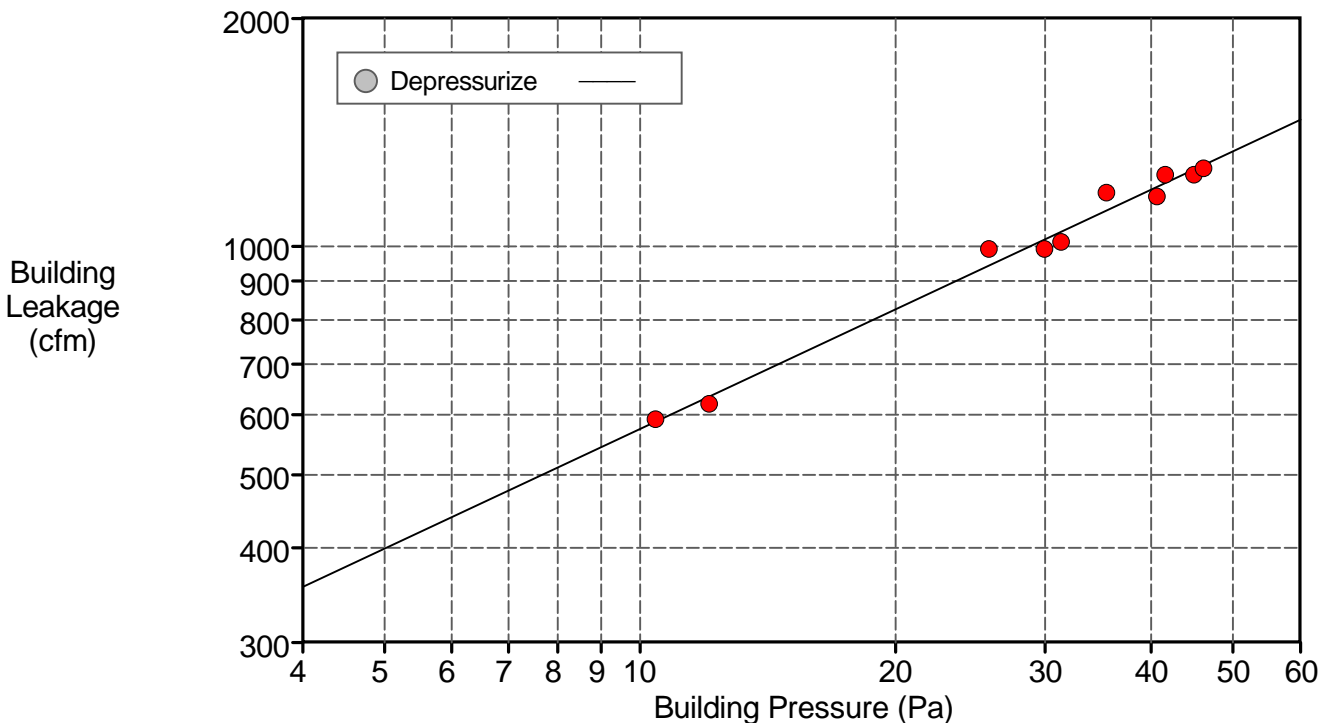
Test Results at 50 Pascals:

cfm50 Airflow 1336 (+/- 3.8 %)
ACH50 0.33
cfm/ft² (Floor Area) 0.1446
cfm/ft² (Surface Area) 0.0701

Leakage Areas: 168.8 in² (+/- 5.9 %) Canadian EqLA @ 10 Pa or 0.0089 in²/ft² Surface Area
100.8 in² (+/- 10.3 %) LBL ELA @ 4 Pa or 0.0053 in²/ft² Surface Area

Building Leakage Curve: Flow Coefficient (C) = 171.8 (+/- 17.1 %)
Exponent (n) = 0.524 (+/- 0.050)
Correlation Coefficient = 0.99310

Test Standard: E779-10
Test Mode: Depressurization



BUILDING LEAKAGE TEST Page 2 of 4

Date of Test: 11/3/2020 Test File: Sprung - Test 2 - MUA Sealed

Building Information

Volume (ft³)	241213.9
Surface Area: (ft²)	19055
Floor Area: (ft²)	9239.6
Height (ft)	34
Year of Construction	2018

Equipment Information

Type	Manufacturer	Model	Serial Number	Custom Calibration Date
Fan	Energy Conservatory	Model 3 (110V)	Multiple	-

BUILDING LEAKAGE TEST Page 3 of 4

Date of Test: 11/3/2020 Test File: Sprung - Test 2 - MUA Sealed

Depressurization Test:

Environmental Data

	Indoor Temperature (°C)	Outdoor Temperature (°C)	Altitude (ft)
Pre-Test	18.0	13.0	
Post-Test	18.0	13.0	
Average	18.0	13.0	0.0

Data Points - Collected using TECLOG - Automated Test

Nominal Building Pressure (Pa)	Baseline adjusted Building Pressure (Pa)	Fan Pressure (Pa)	Nominal Flow (cfm)	Adjusted Flow (cfm)	% Error	Fan Configuration
-4.7						
-49.3	-45.0	-	1256	1244	-1.6	
-50.4	-46.1	-	1281	1268	-0.9	
-45.0	-40.7	-	1176	1164	-2.9	
-45.9	-41.6	-	1255	1243	2.4	
-39.8	-35.5	-	1189	1177	5.5	
-34.3	-30.0	-	1002	992	-2.9	
-35.6	-31.3	-	1025	1014	-3.0	
-30.0	-25.8	-	1004	993	5.3	
-16.4	-12.1	-	626	620	-2.2	
-14.7	-10.4	-	598	592	0.8	
-3.9						

Deviations from Standard ASTM E779-10 - Test Parameters

- An interval between building pressures exceeds 10 Pa.
 - Pressurization test not included.
-

BUILDING LEAKAGE TEST Page 4 of 4

Date of Test: 11/3/2020 Test File: Sprung - Test 2 - MUA Sealed

Comments

Pressure Measurement Devices

- 1.) DG1000-746. Calibration Date: 2017 Aug 24; Field Calibrated October 13, 2020
- 2.) DG1000-2908. Calibration Date: 2019 Jan 07

Flow Devices

- 1.) Model 3 Fan-. Calibration Date: N/A
 - 2.) Model 3 Fan-. Calibration Date: N/A
-

BUILDING LEAKAGE TEST

Date of Test: 11/3/2020 Test File: Sprung - Test 3 - Mech Sealed

Technician: CL

Project Number:

Customer: SAIT Building Address: Waterford Shrimp Farm
Applied Research and Innovation Services Wheatland County, AB
GBT Lab, LA100
1301 - 16 Ave NW
Calgary, AB T2M 0L4
Phone:
Fax:

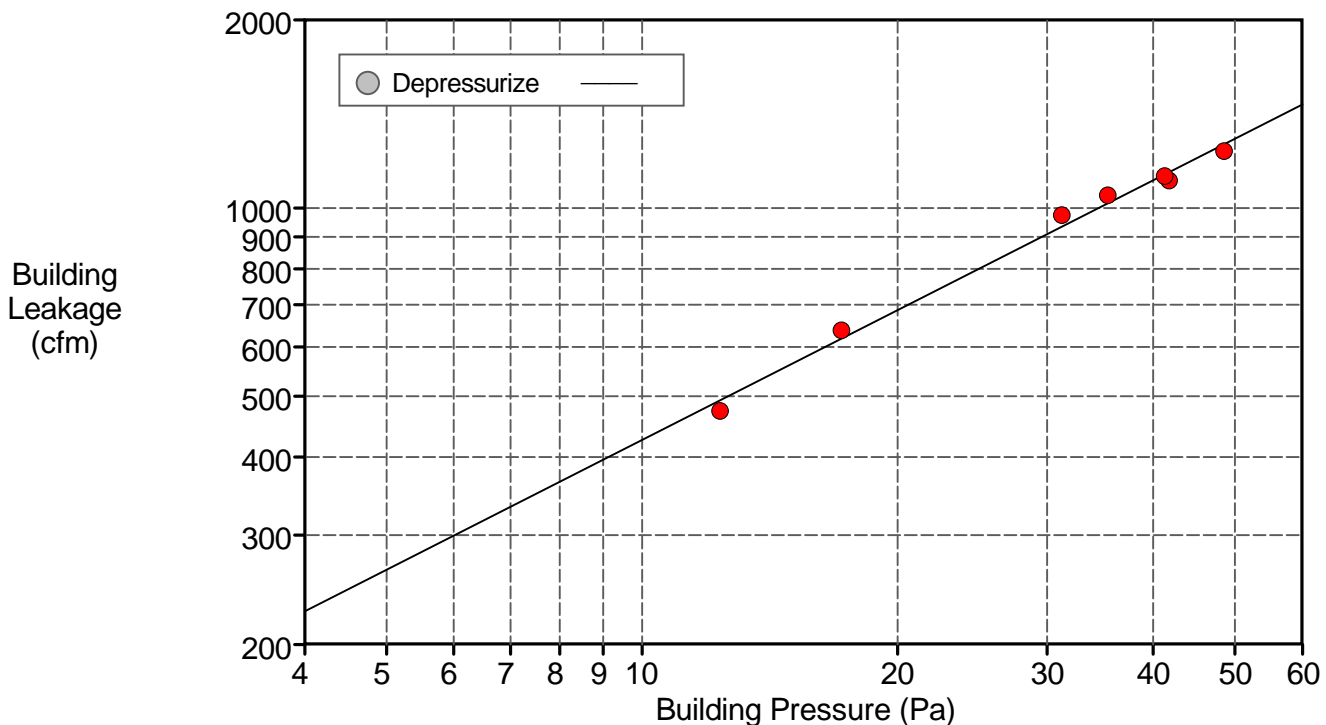
Test Results at 50 Pascals:

cfm50 Airflow	1293 (+/- 5.3 %)
ACH50	0.32
cfm/ft ² (Floor Area)	0.1400
cfm/ft ² (Surface Area)	0.0679

Leakage Areas: 125.1 in² (+/- 8.9 %) Canadian EqLA @ 10 Pa or 0.0066 in²/ft² Surface Area
64.2 in² (+/- 15.5 %) LBL ELA @ 4 Pa or 0.0034 in²/ft² Surface Area

Building Leakage Curve: Flow Coefficient (C) = 86.9 (+/- 25.8 %)
Exponent (n) = 0.690 (+/- 0.075)
Correlation Coefficient = 0.99550

Test Standard: E779-10
Test Mode: Depressurization



BUILDING LEAKAGE TEST Page 2 of 4Date of Test: 11/3/2020 Test File: Sprung - Test 3 - Mech Sealed

Building Information

Volume (ft³)	241213.9
Surface Area: (ft²)	19055
Floor Area: (ft²)	9239.6
Height (ft)	34
Year of Construction	2018

Equipment Information

Type	Manufacturer	Model	Serial Number	Custom Calibration Date
Fan	Energy Conservatory	Model 3 (110V)	Multiple	-

BUILDING LEAKAGE TEST Page 3 of 4

Date of Test: 11/3/2020 Test File: Sprung - Test 3 - Mech Sealed

Depressurization Test:

Environmental Data

	Indoor Temperature (°C)	Outdoor Temperature (°C)	Altitude (ft)
Pre-Test	18.0	13.0	
Post-Test	18.0	13.0	
Average	18.0	13.0	0.0

Data Points - Collected using TECLOG - Automated Test

Nominal Building Pressure (Pa)	Baseline adjusted Building Pressure (Pa)	Fan Pressure (Pa)	Nominal Flow (cfm)	Adjusted Flow (cfm)	% Error	Fan Configuration
-4.1						
-44.7	-41.8	-	1131	1108	-3.0	
-44.3	-41.3	-	1150	1127	-0.7	
-51.4	-48.5	-	1260	1234	-2.5	
-38.3	-35.4	-	1070	1049	3.0	
-34.1	-31.2	-	995	975	4.4	
-20.1	-17.2	-	651	638	3.0	
-15.3	-12.4	-	484	474	-3.8	
-1.8						

Deviations from Standard ASTM E779-10 - Test Parameters

- An interval between building pressures exceeds 10 Pa.
 - Pressurization test not included.
-

BUILDING LEAKAGE TEST Page 4 of 4

Date of Test: 11/3/2020 Test File: Sprung - Test 3 - Mech Sealed

Comments

Pressure Measurement Devices

- 1.) DG1000-746. Calibration Date: 2017 Aug 24; Field Calibrated October 13, 2020
- 2.) DG1000-2908. Calibration Date: 2019 Jan 07

Flow Devices

- 1.) Model 3 Fan-. Calibration Date: N/A
 - 2.) Model 3 Fan-. Calibration Date: N/A
-

BUILDING LEAKAGE TEST

Date of Test: 11/3/2020 Test File: Sprung - Test 4 - Mech Sealed Pressurized

Technician: CL

Project Number:

Customer: SAIT Building Address: Waterford Shrimp Farm
Applied Research and Innovation Services Wheatland County, AB
GBT Lab - LA100
1301 - 16 Ave NW
Calgary, AB T2M 0L4
Phone:
Fax:

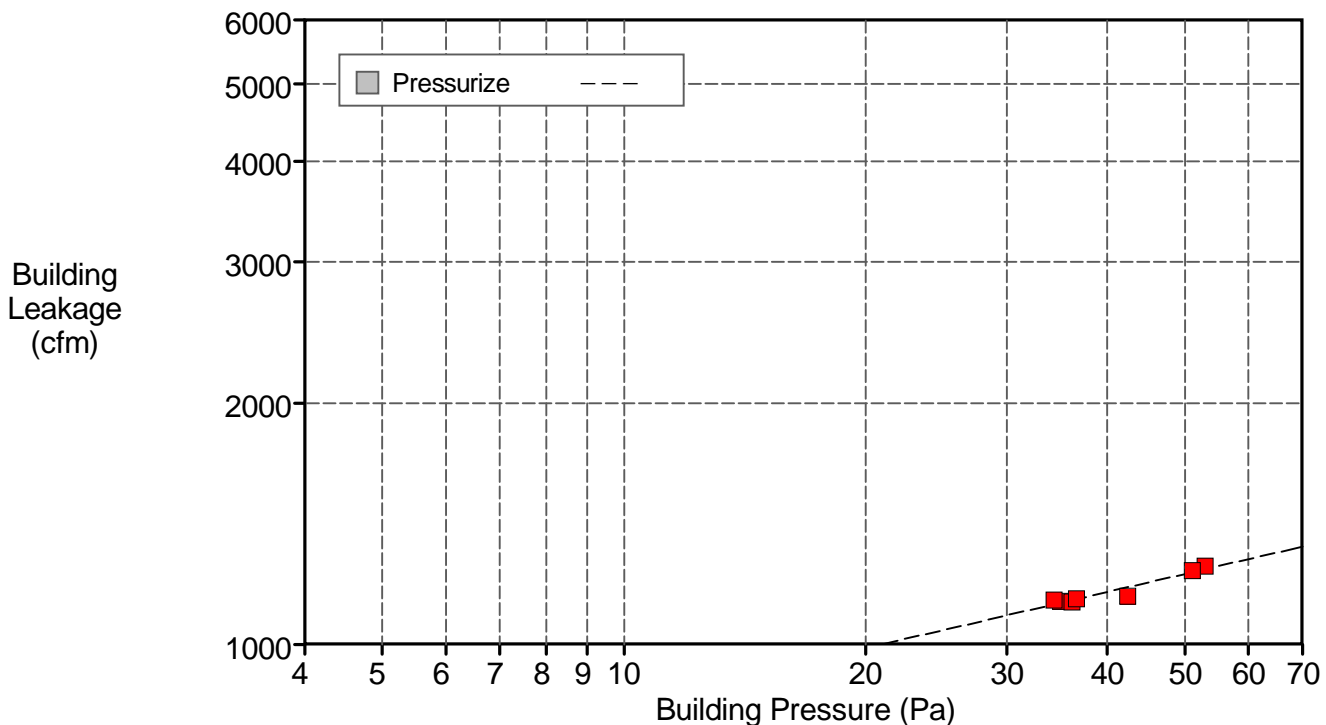
Test Results at 50 Pascals:

cfm50 Airflow 1225 (+/- 2.2 %)
ACH50 0.30
cfm/ft² (Floor Area) 0.1326
cfm/ft² (Surface Area) 0.0643

Leakage Areas: 246.7 in² (+/- 11.4 %) Canadian EqLA @ 10 Pa or 0.0129 in²/ft² Surface Area
192.3 in² (+/- 18.8 %) LBL ELA @ 4 Pa or 0.0101 in²/ft² Surface Area

Building Leakage Curve: Flow Coefficient (C) = 489.4 (+/- 30.1 %)
Exponent (n) = 0.234 (+/- 0.081)
Correlation Coefficient = 0.95765

Test Standard: E779-10
Test Mode: Pressurization



BUILDING LEAKAGE TEST Page 2 of 4

Date of Test: 11/3/2020 Test File: Sprung - Test 4 - Mech Sealed Pressurized

Building Information

Volume (ft³)	241213.9
Surface Area: (ft²)	19055
Floor Area: (ft²)	9239.6
Height (ft)	34
Year of Construction	2018

Equipment Information

Type	Manufacturer	Model	Serial Number	Custom Calibration Date
Fan	Energy Conservatory	Model 3 (110V)	Multiple	-

BUILDING LEAKAGE TEST Page 3 of 4

Date of Test: 11/3/2020 Test File: Sprung - Test 4 - Mech Sealed Pressurized

Pressurization Test:

Environmental Data

	Indoor Temperature (°C)	Outdoor Temperature (°C)	Altitude (ft)
Pre-Test	18.0	16.0	
Post-Test	18.0	16.0	
Average	18.0	16.0	0.0

Data Points - Collected using TECLOG - Automated Test

Nominal Building Pressure (Pa)	Baseline adjusted Building Pressure (Pa)	Fan Pressure (Pa)	Nominal Flow (cfm)	Adjusted Flow (cfm)	% Error	Fan Configuration
-0.9						
51.7	52.9	-	1243	1253	0.9	
49.8	51.0	-	1226	1236	0.4	
41.2	42.4	-	1139	1148	-2.6	
33.8	35.0	-	1123	1132	0.5	
35.0	36.2	-	1121	1130	-0.5	
33.2	34.4	-	1126	1135	1.2	
35.4	36.6	-	1130	1140	0.1	
-1.5						

Deviations from Standard ASTM E779-10 - Test Parameters

- n value (0.234) outside of acceptable limits ($0.5 \leq n \leq 1$).
 - Correlation coefficient (0.958) outside of acceptable limits.
 - Depressurization test not included.
-

BUILDING LEAKAGE TEST Page 4 of 4

Date of Test: 11/3/2020 Test File: Sprung - Test 4 - Mech Sealed Pressurized

Comments

Pressure Measurement Devices

- 1.) DG1000-746. Calibration Date: 2017 Aug 24; Field Calibrated October 13, 2020
- 2.) DG1000-2908. Calibration Date: 2019 Jan 07

Flow Devices

- 1.) Model 3 Fan-. Calibration Date: N/A
 - 2.) Model 3 Fan-. Calibration Date: N/A
-