Air Barrier Assemblies:

From the test mock-up results to the field performance, why is trade training so important?

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UL-CLEB

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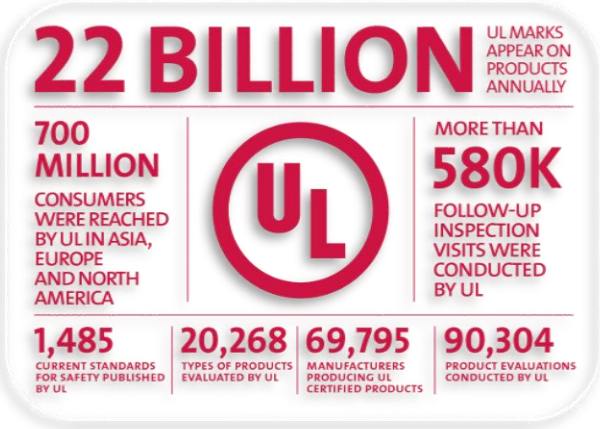
Introduction

Who is UL - CLEB?

- Global independent safety science company
- May - 2017, UL & CLEB combined Building Envelope experience and expertise
- Over 120 years in developing product standards and conducting evaluations of a wide range of building components, materials and systems

Our Mission…"Working for a Safer World"



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Acknowledgment

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Learning Objectives

Upon completion of this course, participants should:

- Have knowledge of the basic principles of air barrier design
- Understand the requirements of the testing standards
- Be able to identify the important information to be transfer to the trade
- To be able to compare the performance results

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Context

The growing demand for Air Barrier System Assembly testing has shown that it is feasible to develop Air Barrier Assemblies that will meet the required performance in terms of air tightness. The standard tests methods, like ASTM E2357 ‘’Standard Test Method for Determining Air Leakage of Air Barrier Assemblies’’ and ULC S742 ‘’Standard for Air Barrier Assemblies’’, clearly define the mock-ups needed to demonstrate conformance.

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Context

Those standards require several penetration details to be included in the testing mock-up, in order to evaluate the ability of the assembly to achieve continuity of the air barrier.

The performance of the air barrier system will be establish by the results obtained on mock-ups usually prepared by the proponent or approved trade personnel, in a laboratory environment.

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Context

The experience has shown that the knowledge acquired during the development and testing phases of the mock-up is not always transfer to the on-site installer or trade. A lack of information and/or training provided to these trades may lead to performance issue with respect to the as installed air tightness of the air barrier assembly.

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Agenda

- Air Barrier System Concept
- Review of ULC and ASTM Standards
- Preferred System Performance Evaluation Procedure
- Process to Improve the as Installed Performance
- Question & Answer

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Agenda

- **Air Barrier System Concept**
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- **Question & Answer**

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Air Barrier System Concept

- Use materials that have a low air permeability;
- Provide continuity of the air tightness throughout the system;
- Provide adequate system rigidity and structural resistance;
- Be durable.

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Review of ULC and ASTM Standards

- CAN/ULC-S741 «Air Barrier Materials»;
- CAN/ULC-S742 «Standard for Air Barrier Assemblies»;
- ASTM E2178 «Standard Test Method for Air Permeance of Building Materials»;
- ASTM E2357 «Standard Test Method for Determining Air Leakage of Air Barrier Assemblies».

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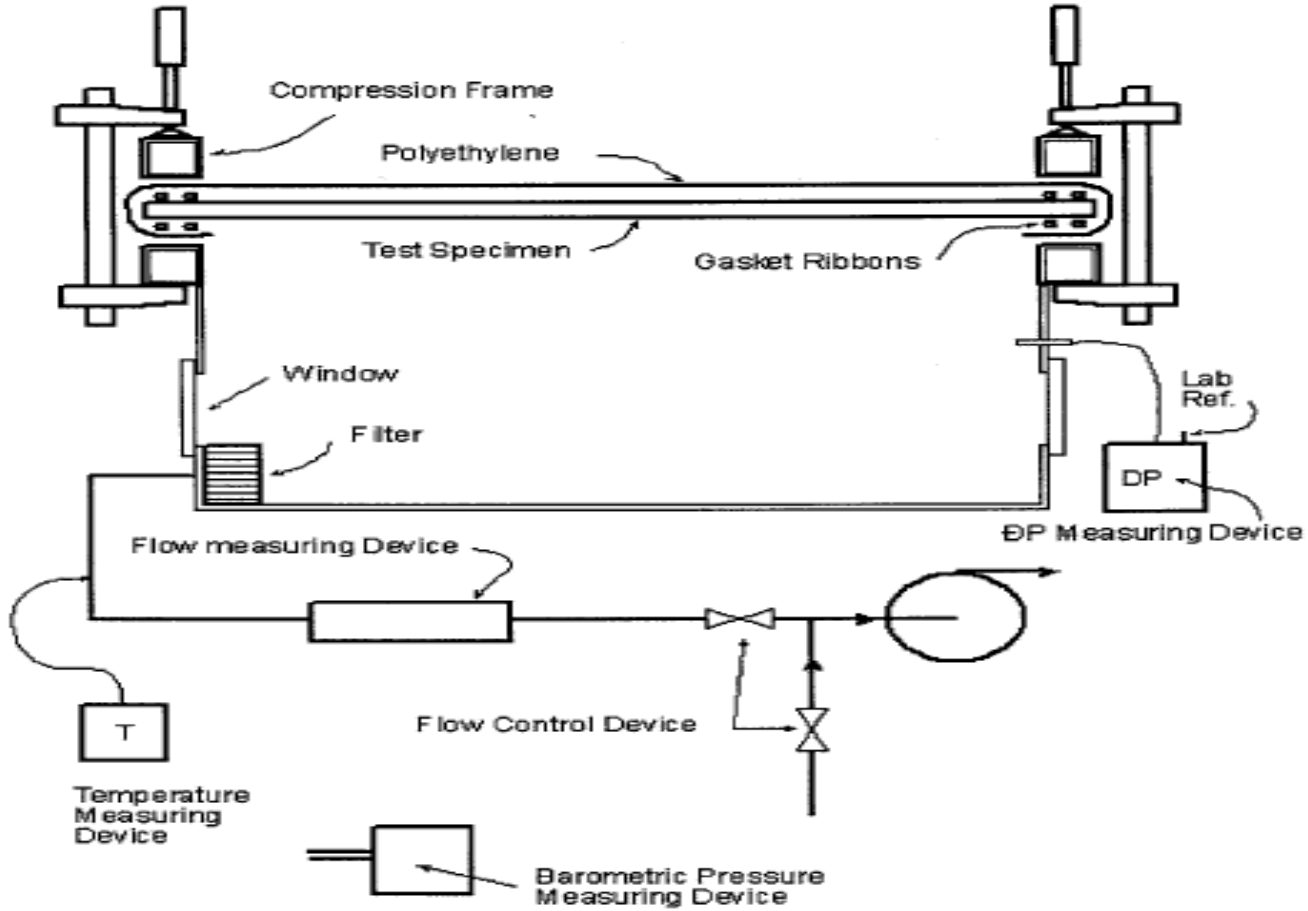
CAN/ULC-S741 and ASTM E2178 (Material)

- **Test Apparatus schematic:**



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CAN/ULC-S741 and ASTM E2178 (Material)

- **Specimen Preparation:**
  - Conditioning for 7 days at 21 ± 1°C and 40 ± 5% RH;
  - Flexible material to be supported by wire grid;
  - Wrapping of sample in 6 mils poly;
  - Clamping of the specimen to the test chamber.

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CAN/ULC-S741 and ASTM E2178 (Material)

- **Test Sequence:**
  - Measure the extraneous air leakage of the test apparatus/specimen at various static pressure differentials (DP) as follows: 25,50, 75, 100, 150 and 300 Pa;
  - Cut the top section of the polyethylene film;
  - Measure the total air leakage at the same various static pressure differentials;

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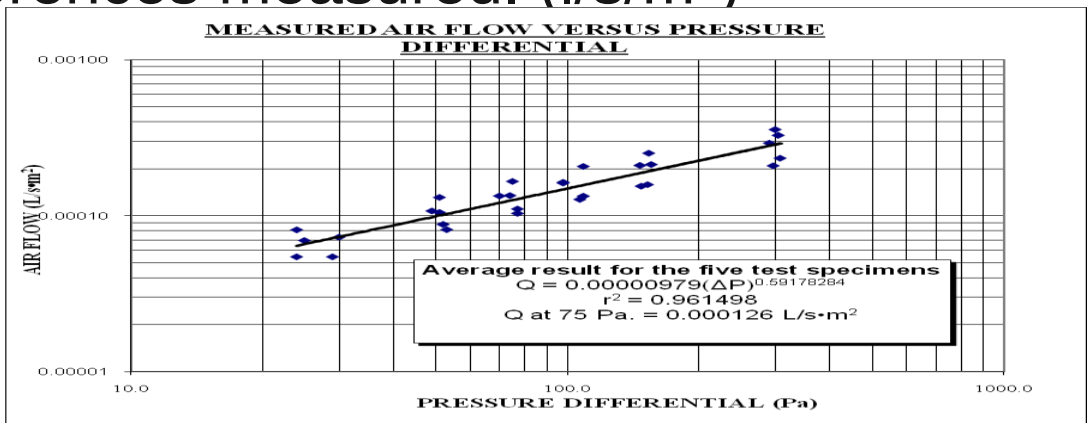
CAN/ULC-S741 and ASTM E2178 (Material)

- **Calculation of Air Permeance:**
  - At each pressure station, the flow rate through the specimen shall be determined by subtracting the extraneous air flow rate from the total air leakage;
  - The flow rate equation of the form
  - $Q = C \cdot A \cdot (DP)^n$ shall be established by fitting the data (30 points) on a Log/Log graph;
  - Calculate the material permeance at the pressure differences measured. (l/s/m^2)



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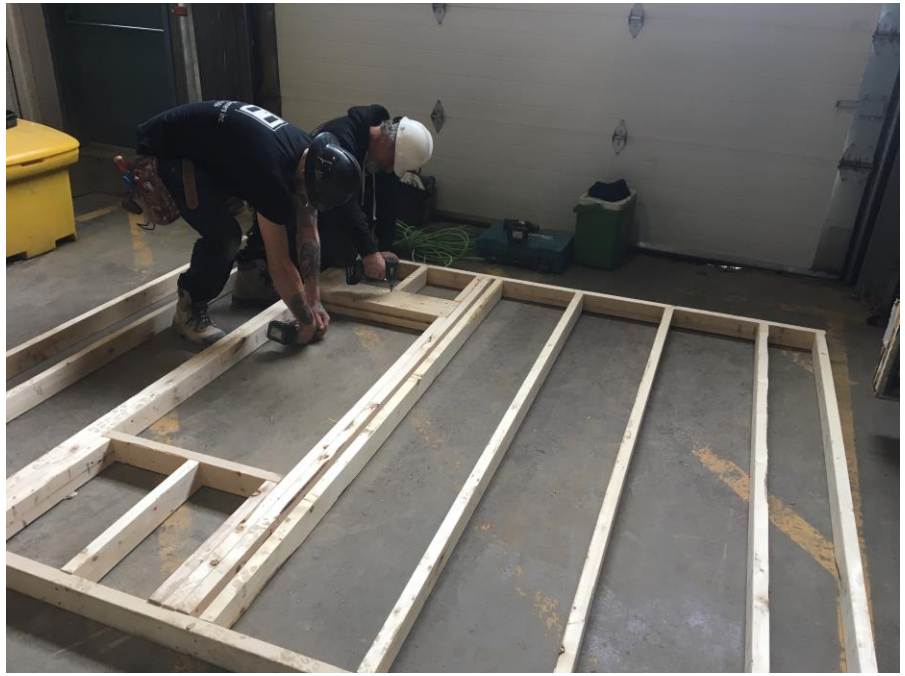
CAN/ULC-S742 and ASTM E2357 (Assembly)

- **Specimen Preparation:**

As the air barrier assembly is site-assembled, the specimens tested shall be representative of the site assembly. Therefore the test specimens shall be fabricated as prescribed by the proponent in providing for the specimen construction required herein.



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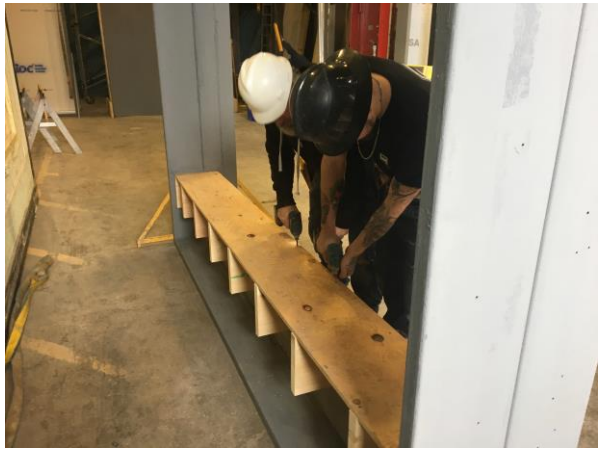
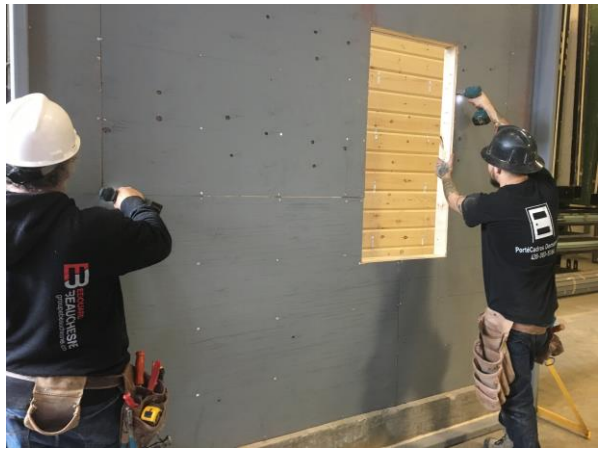
CAN/ULC-S742 and ASTM E2357 (Assembly)





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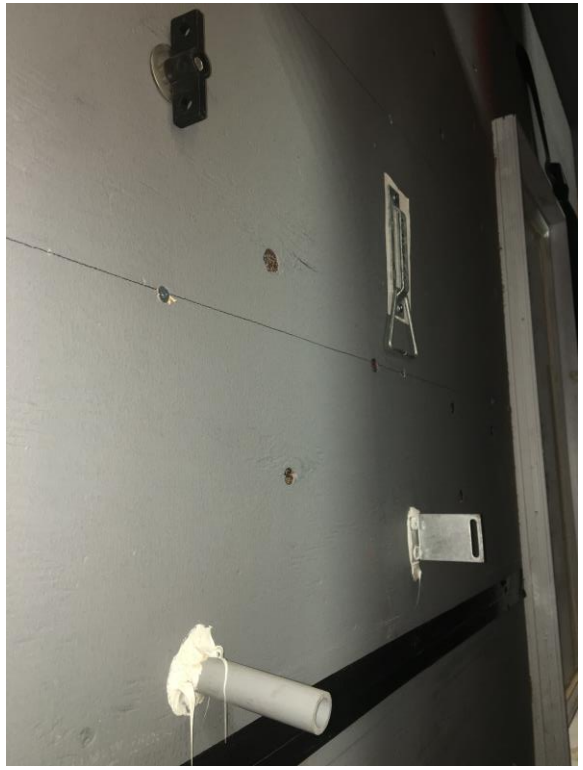
CAN/ULC-S742 and ASTM E2357 (Assembly)



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CAN/ULC-S742 and ASTM E2357 (Assembly)

- **Test Sequence:**
  - Measure the extraneous air leakage of the test apparatus/specimen at various static pressure differentials (DP) as follows: 25,50, 75, 100, 150, 250 and 300 Pa (Both under positive and negative pressure differentials);
  - Measure the total air leakage at the same various static pressure differentials;
  - After the initial leakage testing, the specimen shall be exposed to a pressure loading. The loading schedule for application of positive and negative pressure shall be as outlined by the graph presented here after at the predetermined maximum values for sustained loads, cyclic loads and gust loads.

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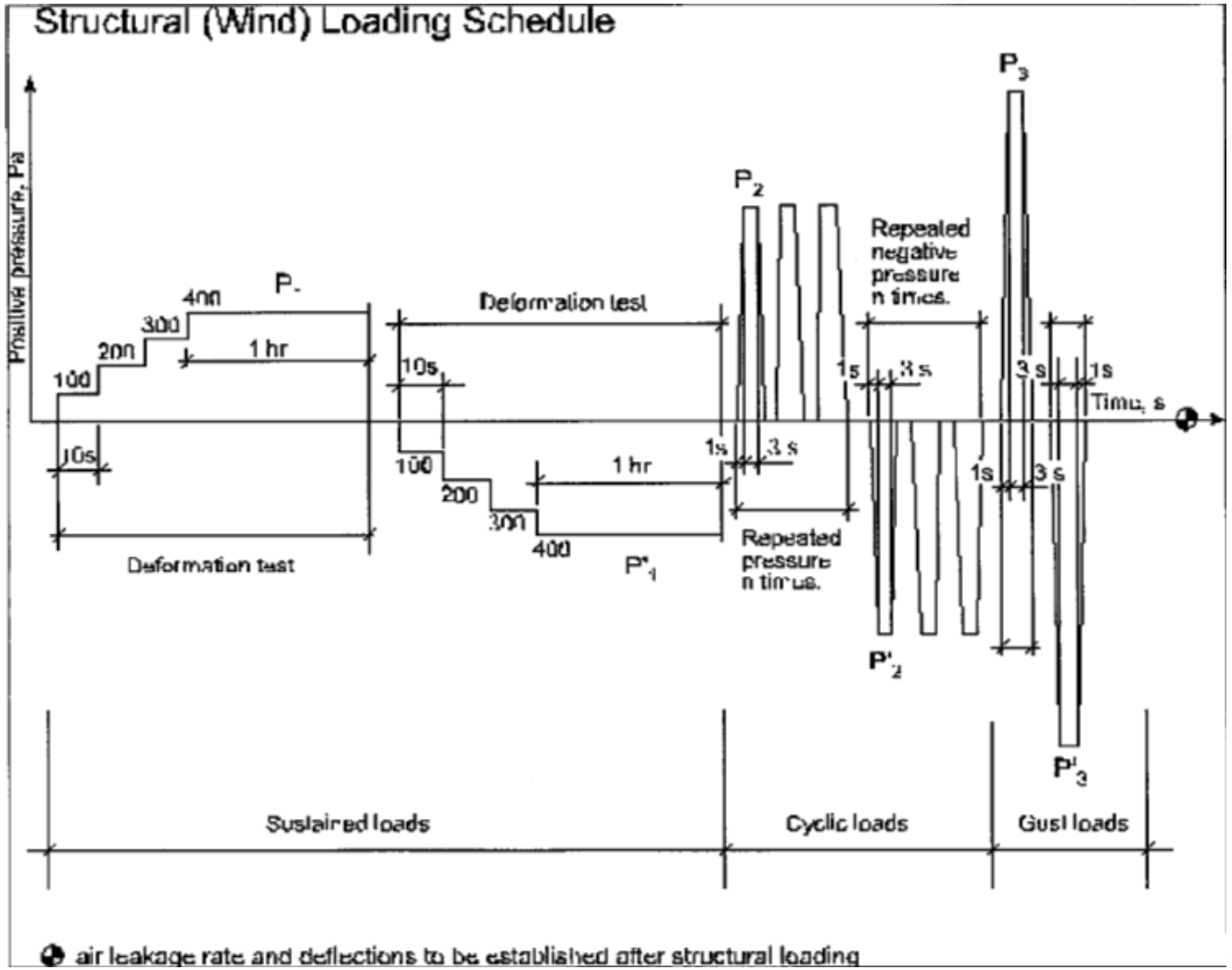
CAN/ULC-S742 and ASTM E2357 (Assembly)



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Preferred System Performance Evaluation Procedure

- System requirement analysis;
- Defining the testing program;
- Third party sampling of the materials to be tested;
- Testing of the system and reporting;
- Establish plant quality control system;
- Implementation of a site inspection program;
- Development of an installation manual.

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Preferred System Performance Evaluation Procedure

- **System requirement analysis:**

  ✓Construction details vs air barrier system continuity;
  ✓Defining test samples configuration;
  ✓Defining the air leakage rate;
  ✓Structural requirements;
  ✓Durability requirements;
  ✓Other requirements.

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Process to Improve as Installed Performance

- **Involve the trade and:**
  - Do training on the basics of air barrier design and performance;
  - Review with them the methods of performance evaluation;
  - Perform on hand installation of the air barrier assembly on a mock-up representing different situation like wall and small building to include all the important details of construction;
  - Perform air tightness testing of the mock-ups similar to the test performed as per ASTM or ULC standards.

The outcome is to evaluate the as-build condition and performance in order to identify defects and propose corrective measures.

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Training on the basics of air barrier design, review of the methods of performance evaluation and specific details of the system

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On hand installation of the air barrier assembly on a mock-up

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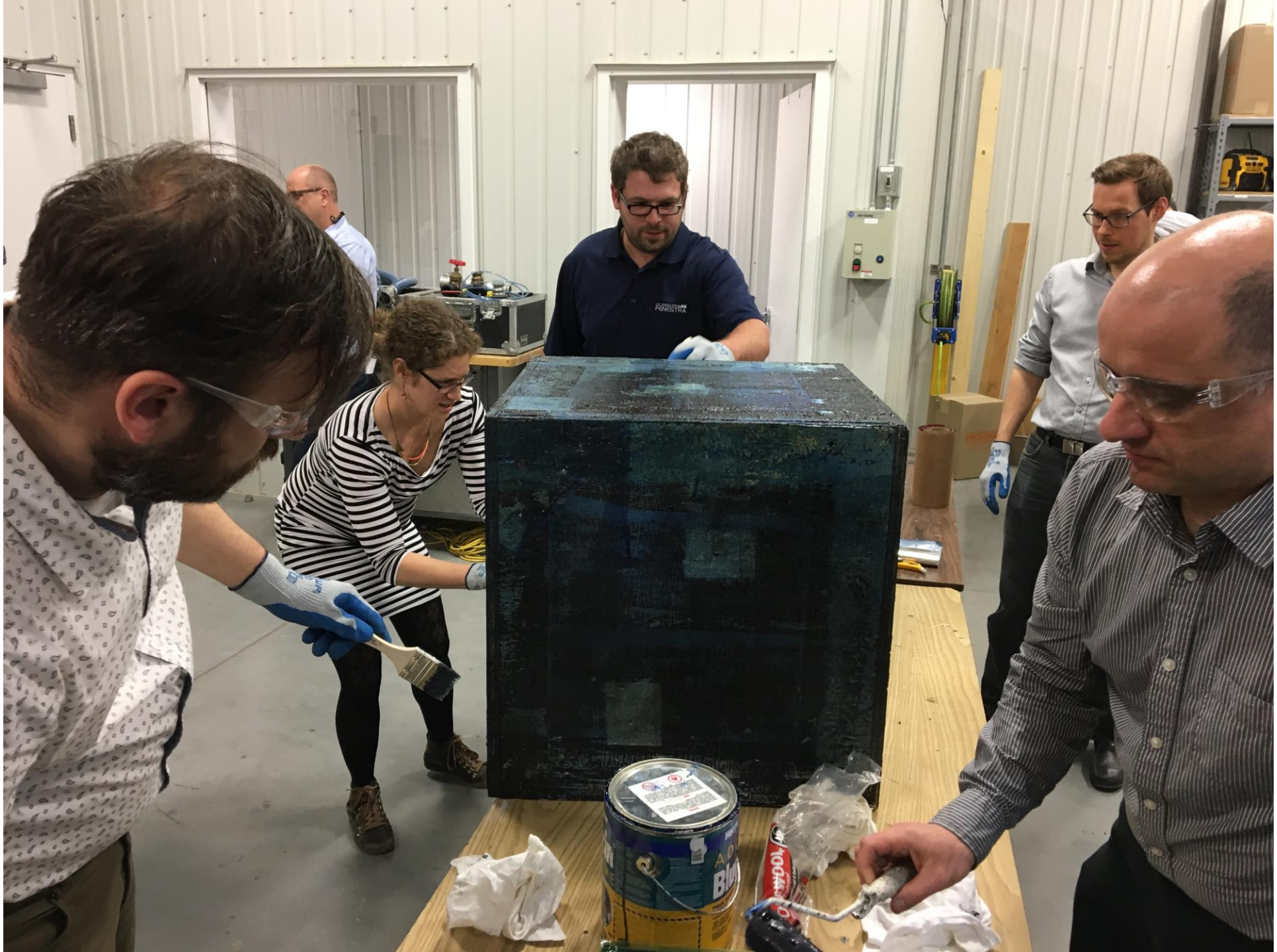

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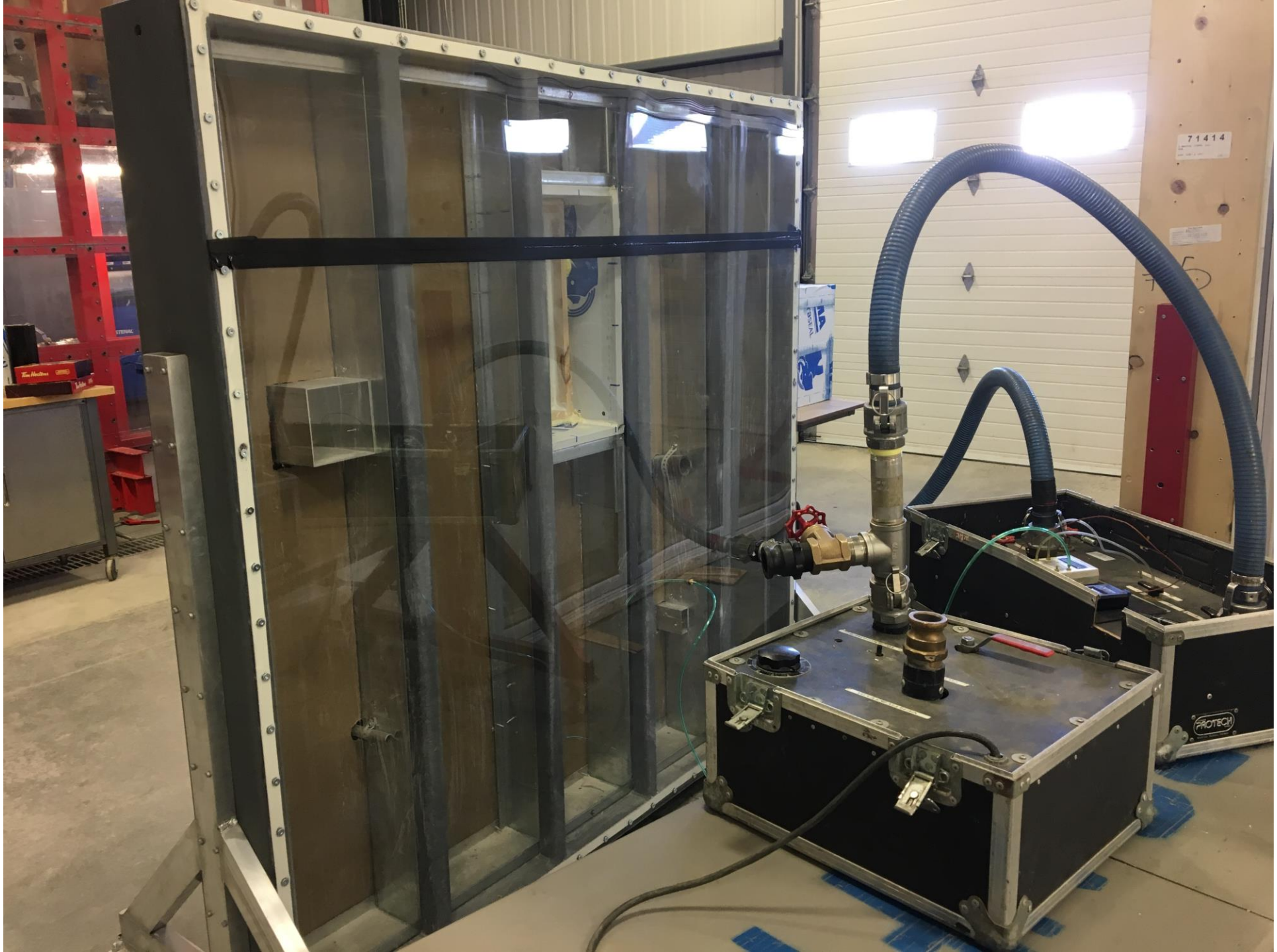

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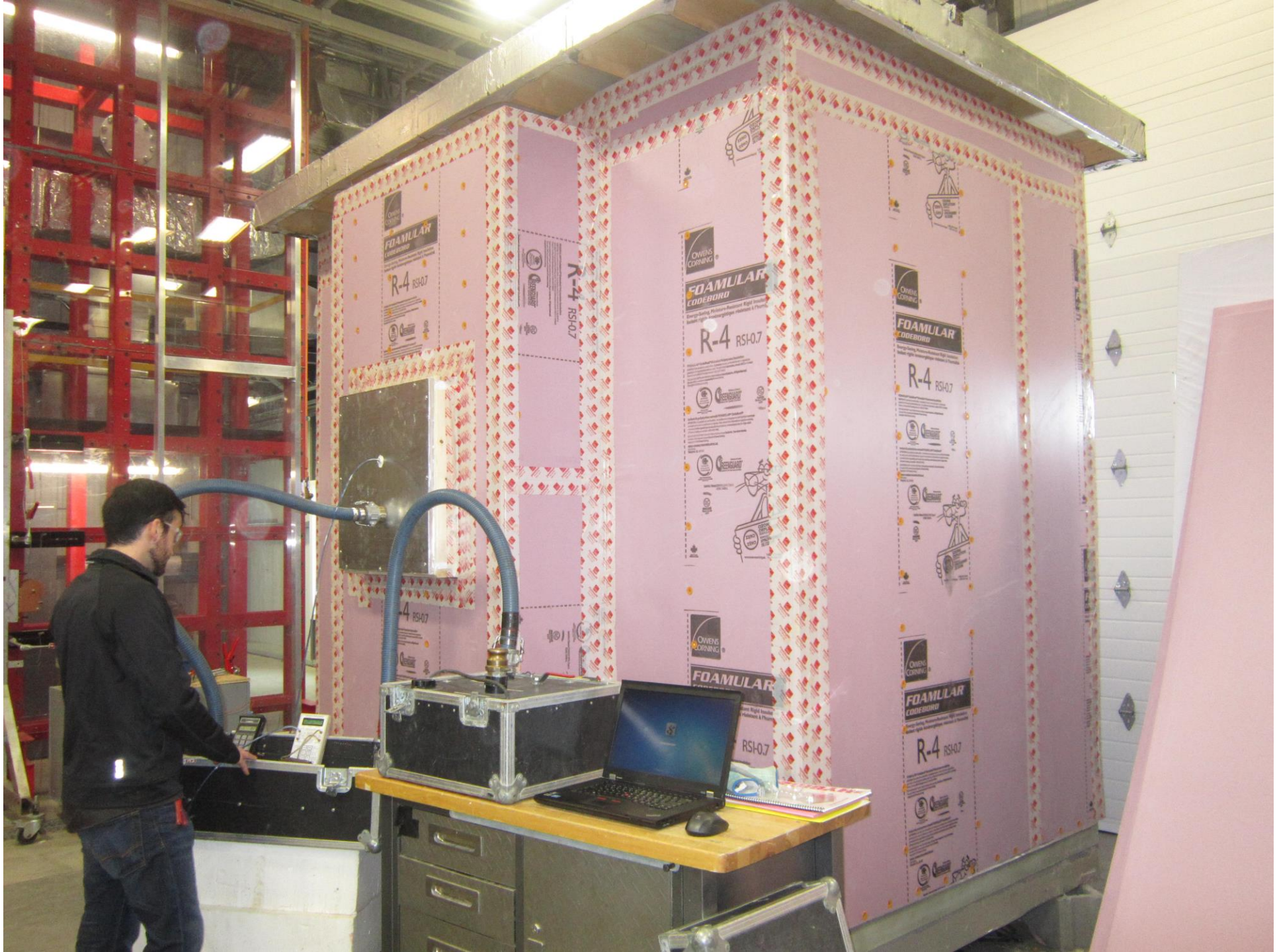

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Process to Improve as Installed Performance

Back in the class room…

- **Performance results analysis and comparison:**
  - Result for the material as per ASTM E283 or ULC S741;
  - Results for the assembly as per ASTM E2357 or ULC S742 ;
  - Results for the different mock-ups;

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Process to Improve as Installed Performance

The goal is:

- **For approved trade installers to grasp the importance of their work on the final performance of the system;**
- **Insure their understanding of each steps in the design, fabrication and installation of the air barrier system;**
- **Stress their attention on the importance of following the details and methods described in the installation manual.**

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Thanks you

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