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Addressing the Air Barriers when Renovating Commercial / Institutional Buildings

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Addressing the Air Barriers When Renovating Commercial/Institutional Buildings

Learning Objectives

1. Understand the two different approaches when renovating Commercial/Institutional buildings: qualitative or quantitative.
2. To learn the basic principles of the default plane of airtightness.
3. Understand the assessment process of the airtightness of the building enclosure.
4. Learn the testing methods and standards used during the renovations.

Addressing the Air Barriers When Renovating Commercial/Institutional Buildings

Prior to the 1990's, most buildings did not include an air barrier membrane as we understand it today. This presentation will address how to determine the upgrade of the air barrier/airtightness of a Commercial/Institutional building under renovation

Addressing the Air Barriers When Renovating Commercial /Institutional Buildings

Commercial/Institutional buildings increasing market for deep retrofits

The Drivers

- To Reduce Energy Costs and Associated Fuel Consumption / Green House Gas Emissions
- Repurposing, Change of Occupancy Use
- Change in Aesthetics
- Additions

Addressing the Air Barriers When Renovating Commercial/Institutional Buildings

Two Different Approaches for Retro-fits Utilizing both Invasive and Non-Invasive Investigation

Canadian Standard CSA Z5001 Existing building commissioning for energy using systems

- Quantified measurements of pre-retrofit conditions to help establish reasonable reductions in air leakage and increased thermal performance and post-construction testing for confirmation

- Qualitative In-situ performance test for thermal insulation continuity and identification of thermal bridges; and in-situ performance test for measuring the performance of airtightness of the building envelope systems and locating of discontinuities. Positive and negative pressurization tests might be needed to locate leakage paths.

Local Utilities, Government Agencies may have incentives for the reduction in air leakage requiring before and after renovations testing. Usually reported as Air Changes per Hour or reduction of leakage area.

Addressing the Air Barriers When Renovating Commercial/Institutional Buildings

Similarly for the IECC:

C501.4 Compliance.

Alterations, *repairs*, *additions* and changes of occupancy to, or relocation of, existing *buildings* and structures shall comply with the provisions for *alterations*, *repairs*, *additions* and changes of occupancy or relocation, respectively, in this code and in the *International Building Code*, *International Existing Building Code*, *International Fire Code*, *International Fuel Gas Code*, *International Mechanical Code*, *International Plumbing Code*, *International Property Maintenance Code*, *International Private Sewage Disposal Code* and NFPA 70.

C402.5.1.1 Air barrier construction. P

The *continuous air barrier* shall be constructed to comply with the following:

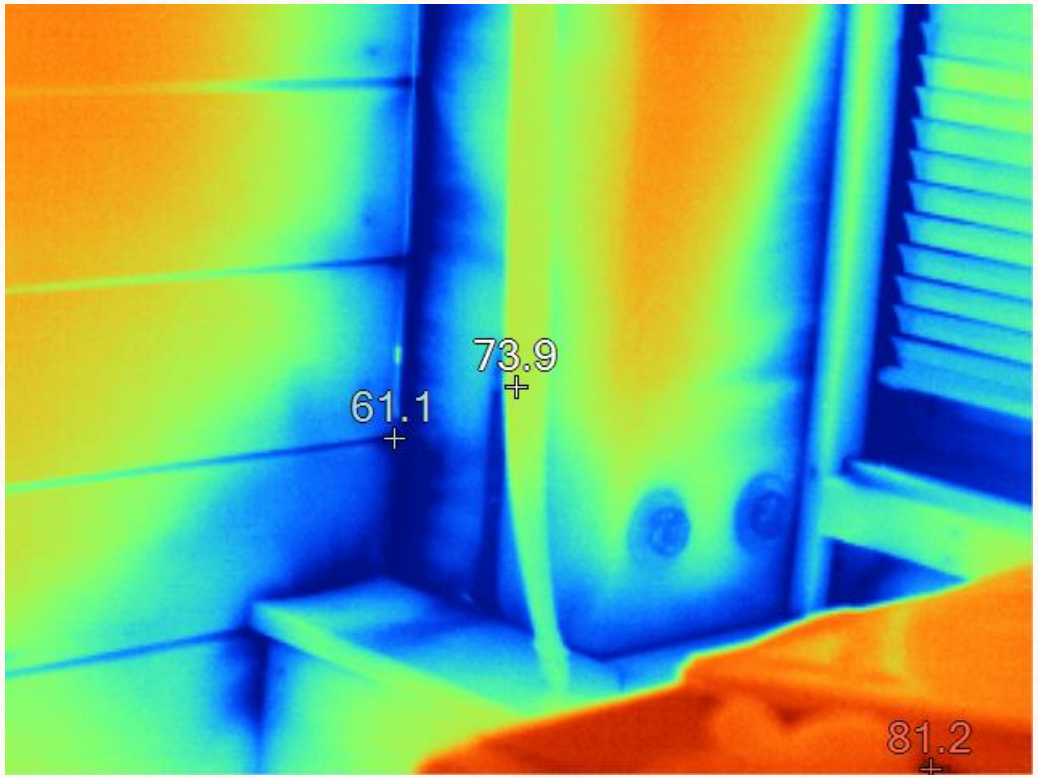
1. The air barrier shall be continuous for all assemblies that are the thermal envelope of the building and across the joints and assemblies.
2. Air barrier joints and seams shall be sealed, including sealing transitions in places and changes in materials. The joints and seals shall be securely installed in or on the joint for its entire length so as not to dislodge, loosen or otherwise impair its ability to resist positive and negative pressure from wind, stack effect and mechanical ventilation.
3. Penetrations of the air barrier shall be caulked, gasketed or otherwise sealed in a manner compatible with the construction materials and location. Sealing shall allow for expansion, contraction and mechanical vibration. Joints and seams associated with penetrations shall be sealed in the same manner or taped. Sealing materials shall be securely installed around the penetration so as not to dislodge, loosen or otherwise impair the penetrations' ability to resist positive and negative pressure from wind, stack effect and mechanical ventilation. Sealing of concealed fire sprinklers, where required, shall be in a manner that is recommended by the manufacturer. Caulking or other adhesive sealants shall not be used to fill voids between fire sprinkler cover plates and walls or ceilings.
4. Recessed lighting fixtures shall comply with Section C402.5.8. Where similar objects are installed that penetrate the air barrier, provisions shall be made to maintain the integrity of the air barrier.

C406.9 Reduced air infiltration. P

Air infiltration shall be verified by whole-building pressurization testing conducted in accordance with ASTM E779 or ASTM E1827 by an independent third party. The measured air-leakage rate of the building envelope shall not exceed 0.25 cfm/ft^2(2.0 L/s x m^2) under a pressure differential of 0.3 inches water column (75 Pa), with the calculated surface area being the sum of the above- and below-grade building envelope. A report that includes the tested surface area, floor area, air by volume, stories above grade, and leakage rates shall be submitted to the code official and the building owner.

Addressing the Air Barriers When Renovating Commercial/Institutional Buildings

Qualitative Non-Invasive Testing Methods



Addressing the Air Barriers When Renovating Commercial/Institutional Buildings

Addressing the Air Barriers When Renovating Commercial/Institutional Buildings

Quantified Test Methods:

- ASTM E779 - *Standard Test Methods for Determining Airtightness of Buildings Using an Orifice Blower Door*
- ASTM E1827 - *Standard Test Methods for Determining Airtightness of Buildings Using an Orifice Blower Door*
- ASTM E3158 - *Standard Test Method for Measuring the Air Leakage Rate of a Large or Multizone Building*
- *Army Corps of Engineers (USACE) Air Leakage Test Protocol for Building Envelopes*
- *National Environmental Balancing Bureau (NEBB) Procedural Standards for Building Enclosure Testing*
- ABAA T0001-2016 - *Standard Test Method for Building Enclosure Airtightness Compliance Testing*

Addressing the Air Barriers When Renovating Commercial/Institutional Buildings

This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.

Designation: E779 – 10

Standard Test Method for Determining Air Leakage Rate by Fan Pressurization[1]

This standard is issued under the fixed designation E779; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

1. Scope

1.1 This test method measures air-leakage rates through a building envelope under controlled pressurization and de-pressurization.

1.2 This test method is applicable to small temperature differentials and low-wind pressure differential, therefore strong winds and large indoor-outdoor temperature differentials shall be avoided.

1.3 This test method is intended to quantify the air tightness of a building envelope. This test method does not measure air change rate or air leakage rate under normal weather conditions and building operation.

NOTE 1—See Test Method E741 to directly measure air-change rates using the tracer gas dilution method.

1.4 This test method is intended to be used for measuring the air tightness of building envelopes of single-zone buildings. For the purpose of this test method, many multi-zone buildings can be treated as single-zone buildings by opening interior doors or by inducing equal pressures in adjacent zones.

1.5 Only metric SI units of measurement are used in this standard. If a value for measurement is followed by a value in other units in parentheses, the second value may be approximate. The first stated value is the requirement.

1.6 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.* For specific hazard statements see Section 7.

2. Referenced Documents

2.1 *ASTM Standards:*[2]

E631 Terminology of Building Constructions

E741 Test Method for Determining Air Change in a Single Zone by Means of a Tracer Gas Dilution

E1258 Test Method for Airflow Calibration of Fan Pressurization Devices

3. Terminology

3.1 For definitions of terms used in this test method, refer to Terminology E631.

3.2 *Definitions of Terms Specific to This Standard:*

3.2.1 *air-change rate, n*—air-leakage rate in volume units/h divided by the building space volume with identical volume units, normally expressed as air changes/h, ACH.

3.2.2 *air-leakage, n*—the movement/flow of air through the building envelope, which is driven by either or both positive (infiltration) and negative (exfiltration) pressure differences across the envelope.

3.2.3 *air-leakage graph, n*—the graph that shows the relationship of measured airflow rates to the corresponding measured pressure differences, plotted on a log-log scale.

3.2.4 *air-leakage rate, n*—the volume of air movement/unit time across the building envelope including airflow through joints, cracks, and porous surfaces, or a combination thereof driven by mechanical pressurization and de-pressurization, natural wind pressures, or air temperature differentials between the building interior and the outdoors, or a combination thereof.

3.2.5 *building envelope, n*—the boundary or barrier separating different environmental conditions within a building and from the outside environment.

3.2.6 *effective leakage area, n*—the area of a hole, with a discharge coefficient of 1.0, which, with a 4 Pa pressure difference, leaks the same as the building, also known as the sum of the unintentional openings in the structure.

3.2.7 *height, building, n*—the vertical distance from grade plane to the average height of the highest ceiling surface.

3.2.8 *interior volume, n*—deliberately conditioned space within a building, generally not including attics and attached structures, for example, garages, unless such spaces are connected to the heating and air conditioning system, such as a crawl space plenum.

3.2.9 *single zone, n*—a space in which the pressure differences between any two places, differ by no more than 5 % of

[1] This test method is under the jurisdiction of ASTM Committee E06 on Performance of Buildings and is the direct responsibility of Subcommittee E06.41 on Air Leakage and Ventilation Performance.

Current edition approved Jan. 15, 2010. Published April 2010. Originally approved in 1981. Last previous edition approved in 2003 as E779 – 03. DOI: 10.1520/E0779-10.

[2] For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

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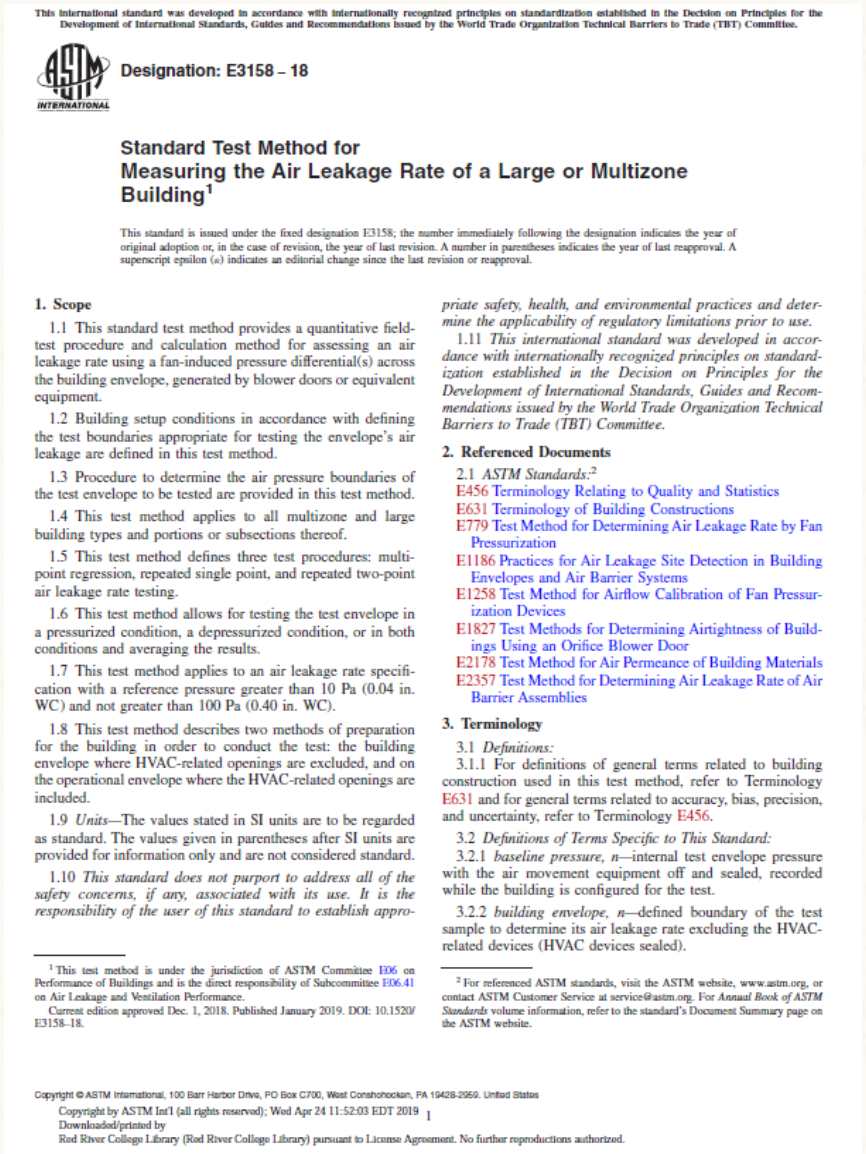

This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.

Designation: E3158 – 18

Standard Test Method for Measuring the Air Leakage Rate of a Large or Multizone Building[1]

This standard is issued under the fixed designation E3158; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

1. Scope

1.1 This standard test method provides a quantitative field-test procedure and calculation method for assessing an air leakage rate using a fan-induced pressure differential(s) across the building envelope, generated by blower doors or equivalent equipment.

1.2 Building setup conditions in accordance with defining the test boundaries appropriate for testing the envelope's air leakage are defined in this test method.

1.3 Procedure to determine the air pressure boundaries of the test envelope to be tested are provided in this test method.

1.4 This test method applies to all multizone and large building types and portions or subsections thereof.

1.5 This test method defines three test procedures: multi-point regression, repeated single point, and repeated two-point air leakage rate testing.

1.6 This test method allows for testing the test envelope in a pressurized condition, a depressurized condition, or in both conditions and averaging the results.

1.7 This test method applies to an air leakage rate specification with a reference pressure greater than 10 Pa (0.04 in. WC) and not greater than 100 Pa (0.40 in. WC).

1.8 This test method describes two methods of preparation for the building in order to conduct the test: the building envelope where HVAC-related openings are excluded, and on the operational envelope where the HVAC-related openings are included.

1.9 *Units*—The values stated in SI units are to be regarded as standard. The values given in parentheses after SI units are provided for information only and are not considered standard.

1.10 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety, health, and environmental practices and determine the applicability of regulatory limitations prior to use.*

1.11 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

2. Referenced Documents

2.1 *ASTM Standards:*[2]

E456 Terminology Relating to Quality and Statistics
E631 Terminology of Building Constructions
E779 Test Method for Determining Air Leakage Rate by Fan Pressurization
E1186 Practices for Air Leakage Site Detection in Building Envelopes and Air Barrier Systems
E1258 Test Method for Airflow Calibration of Fan Pressurization Devices
E1827 Test Methods for Determining Airtightness of Buildings Using an Orifice Blower Door
E2178 Test Method for Air Permeance of Building Materials
E2357 Test Method for Determining Air Leakage Rate of Air Barrier Assemblies

3. Terminology

3.1 *Definitions:*

3.1.1 For definitions of general terms related to building construction used in this test method, refer to Terminology E631 and for general terms related to accuracy, bias, precision, and uncertainty, refer to Terminology E456.

3.2 *Definitions of Terms Specific to This Standard:*

3.2.1 *baseline pressure, n*—internal test envelope pressure with the air movement equipment off and sealed, recorded while the building is configured for the test.

3.2.2 *building envelope, n*—defined boundary of the test sample to determine its air leakage rate excluding the HVAC-related devices (HVAC devices sealed).

[1] This test method is under the jurisdiction of ASTM Committee E06 on Performance of Buildings and is the direct responsibility of Subcommittee E06.41 on Air Leakage and Ventilation Performance.

Current edition approved Dec. 1, 2018. Published January 2019. DOI: 10.1520/E3158-18.

[2] For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

Addressing the Air Barriers When Renovating Commercial/Institutional Buildings

Understanding the Different Types of Air Leaks and the Associated Problems

Orifice: High Energy, usually is not Damaging to the Building

Channel: Moderate Energy Concerns, High Risk of Damage to the Building

Diffuse: Low Energy Concerns, High Risk of Damage to the Building

Flow within the Building: Low Energy Concerns, Risk of Damage to the Building

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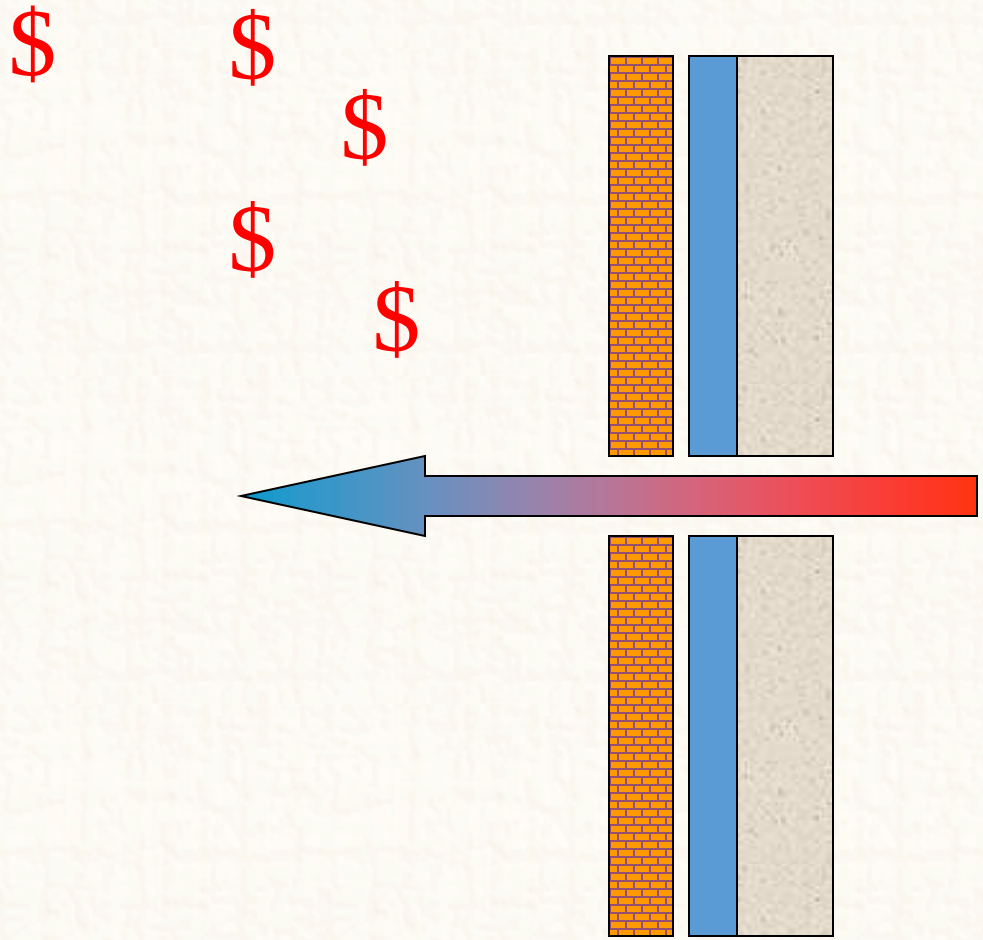

Types of Leaks

Orifice Leak

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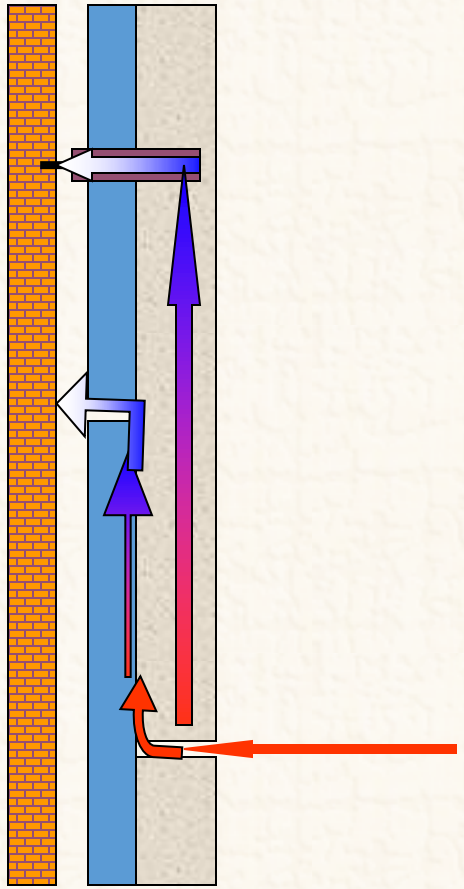

Types of Leaks

Channel Leak

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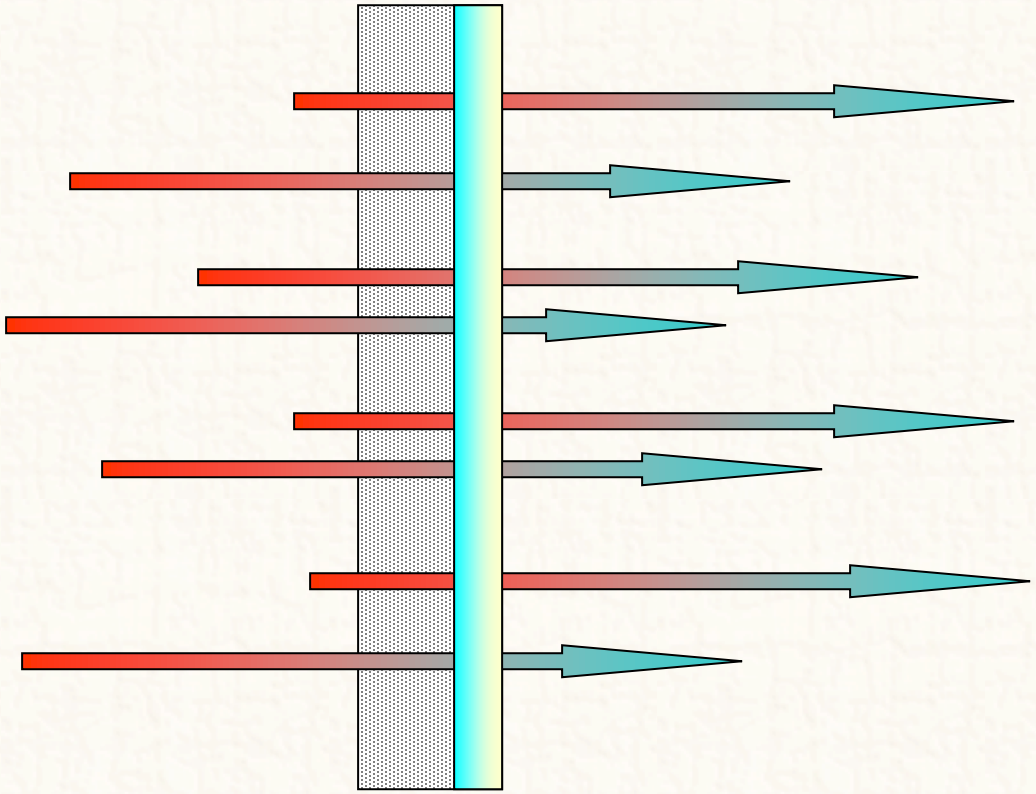
Types of Leaks

Diffuse



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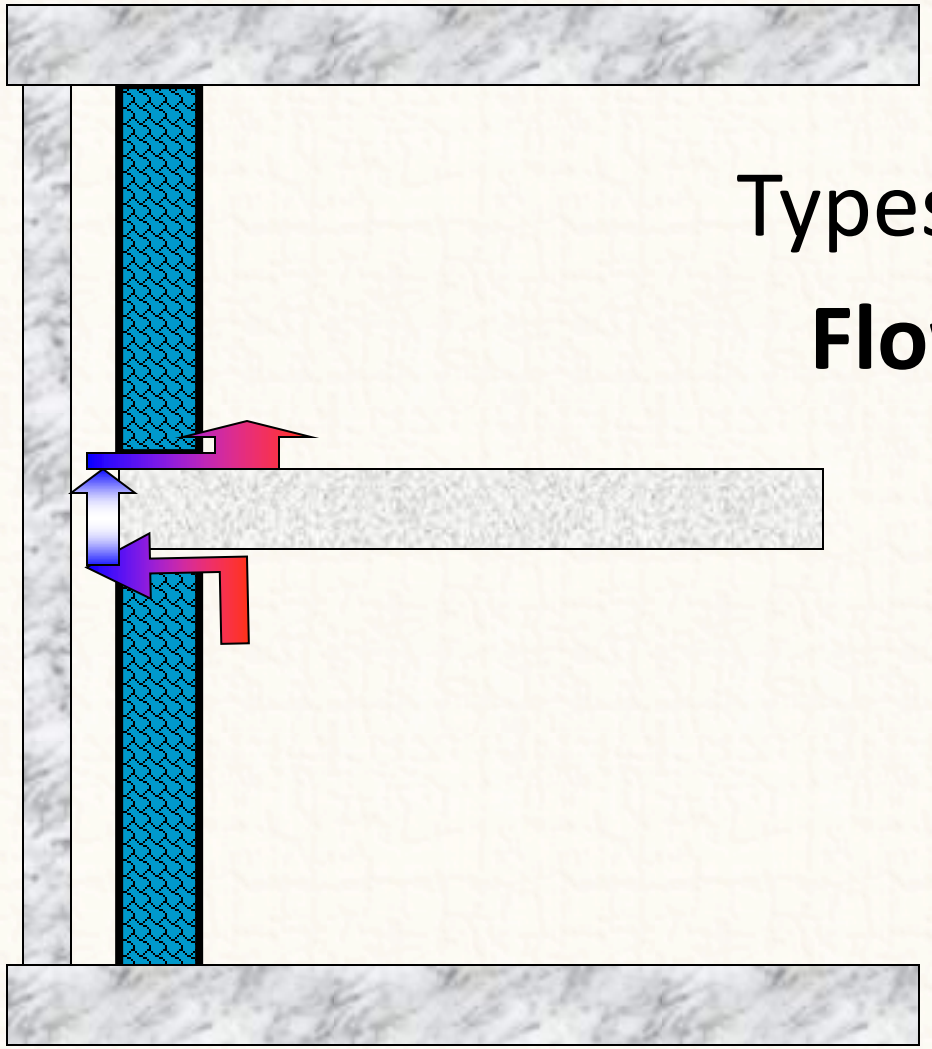

Types of Leaks

Flow Leak

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So, What Do I Have?

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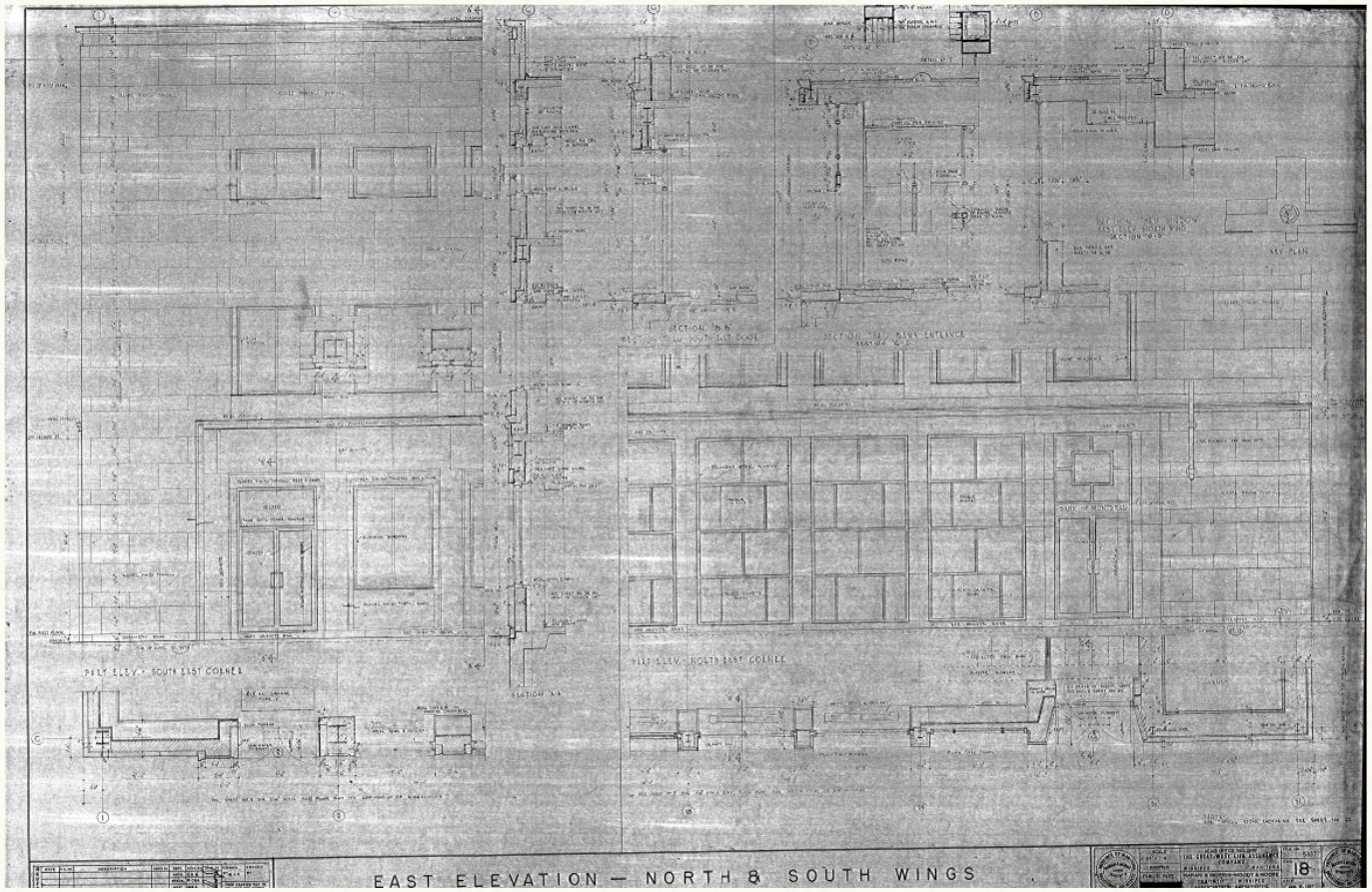

If we are lucky, drawings may be available and better still you can read them

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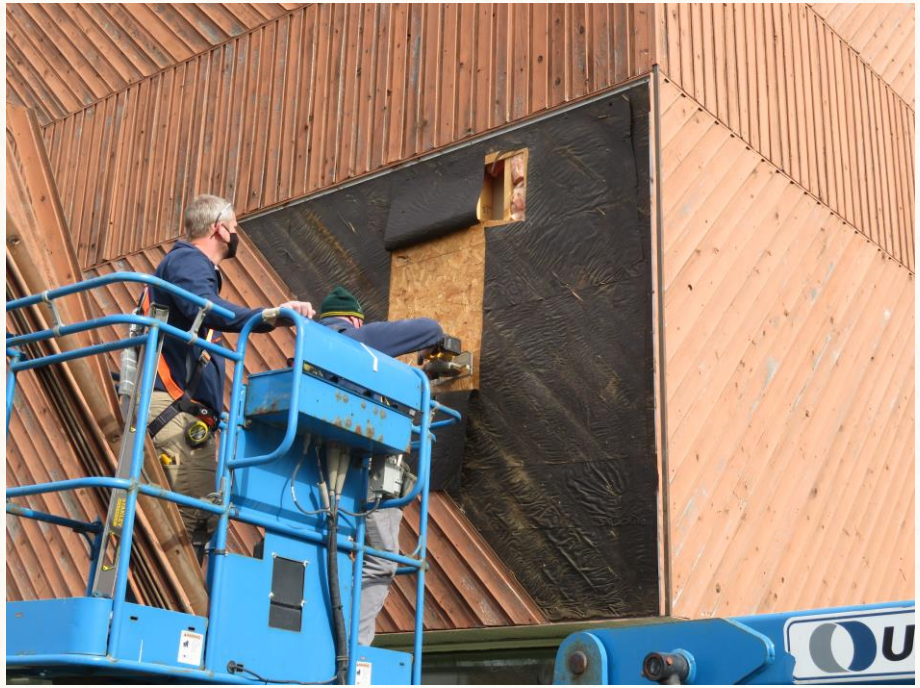
Addressing the Air Barriers When Renovating Commercial/Institutional Buildings



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Nothing on the Inside Approach

The "nothing on the inside" approach can be defined as having no insulation, no air barrier, and no vapor barrier, on the inside of masonry walls; the masonry is either exposed or covered by an interior finish on a stud wall or furring strips.

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Nothing on the Inside Approach

Exterior masonry walls with no insulation have stood for 50 to 100 years. 50 to 100 years ago, exterior walls were exposed to indoor climates different from today’s.

Building Enclosures were not subjected to +45% indoor relative humidity, and most operated under negative pressure (with combustion equipment), drawing in large amounts of cold, dry air through the enclosure. Energy conservation was not an issue, and occupants' comfort was not as critical.

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Mutable Layers

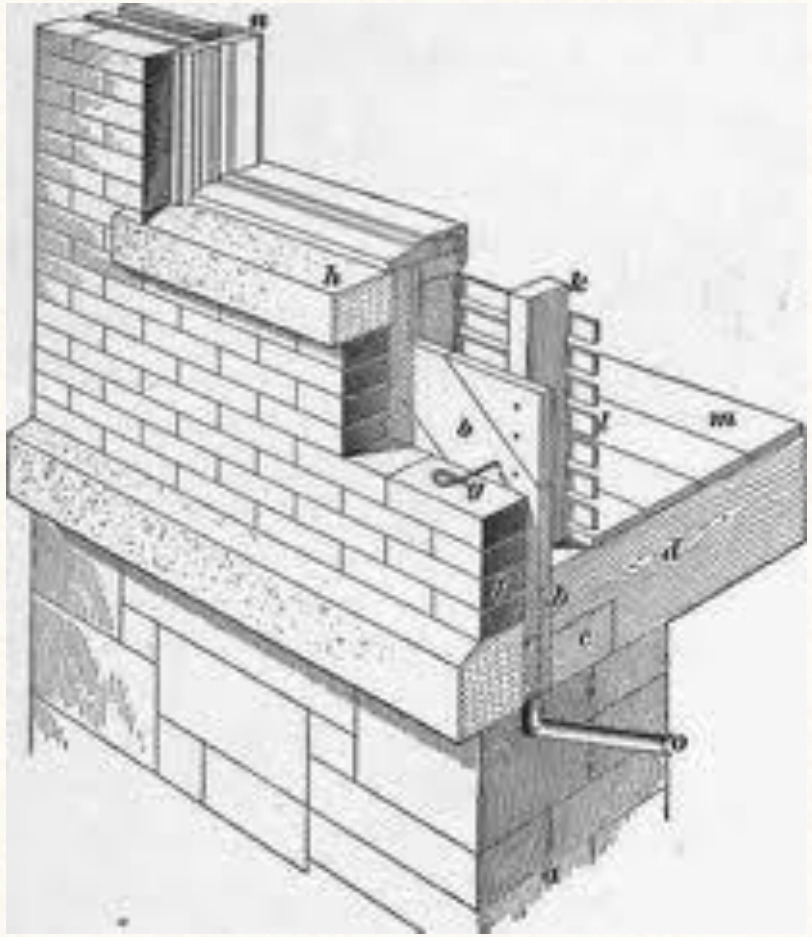
What can we designate as an air barrier by default

Where is the possibility of flanking air movement

Air Leakage across joints and junctions

What kind of leak and how do we identify the path

Can we quantify the amount of air leakage



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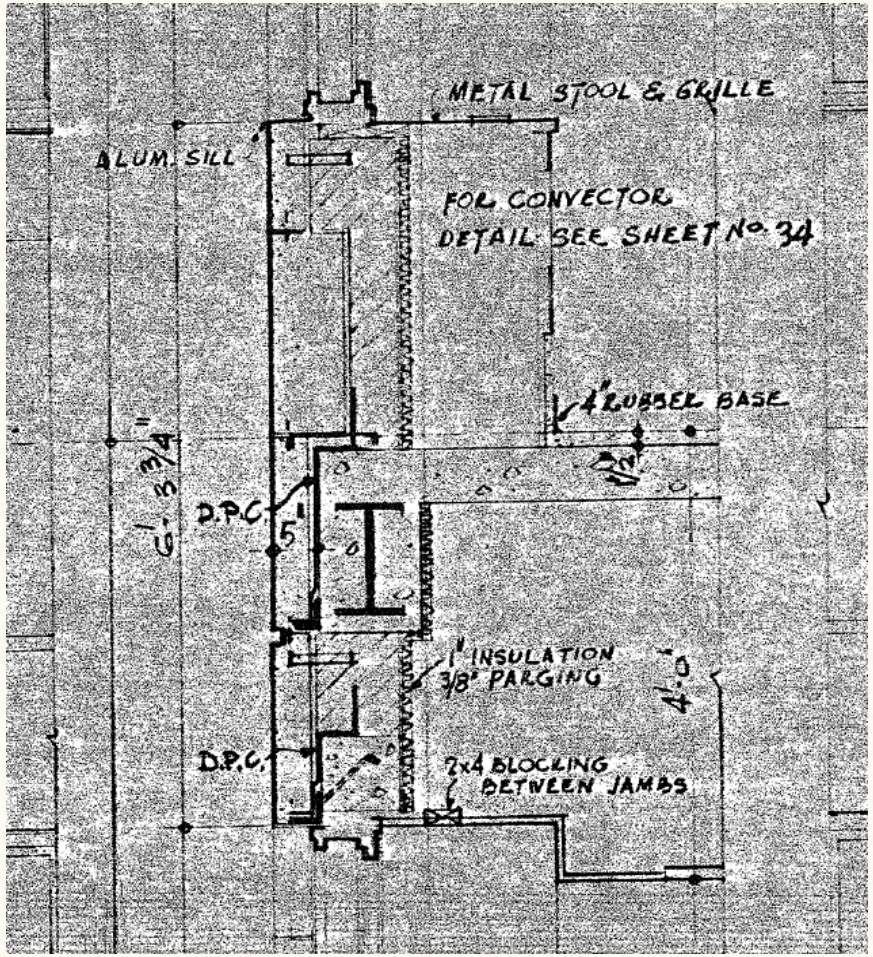

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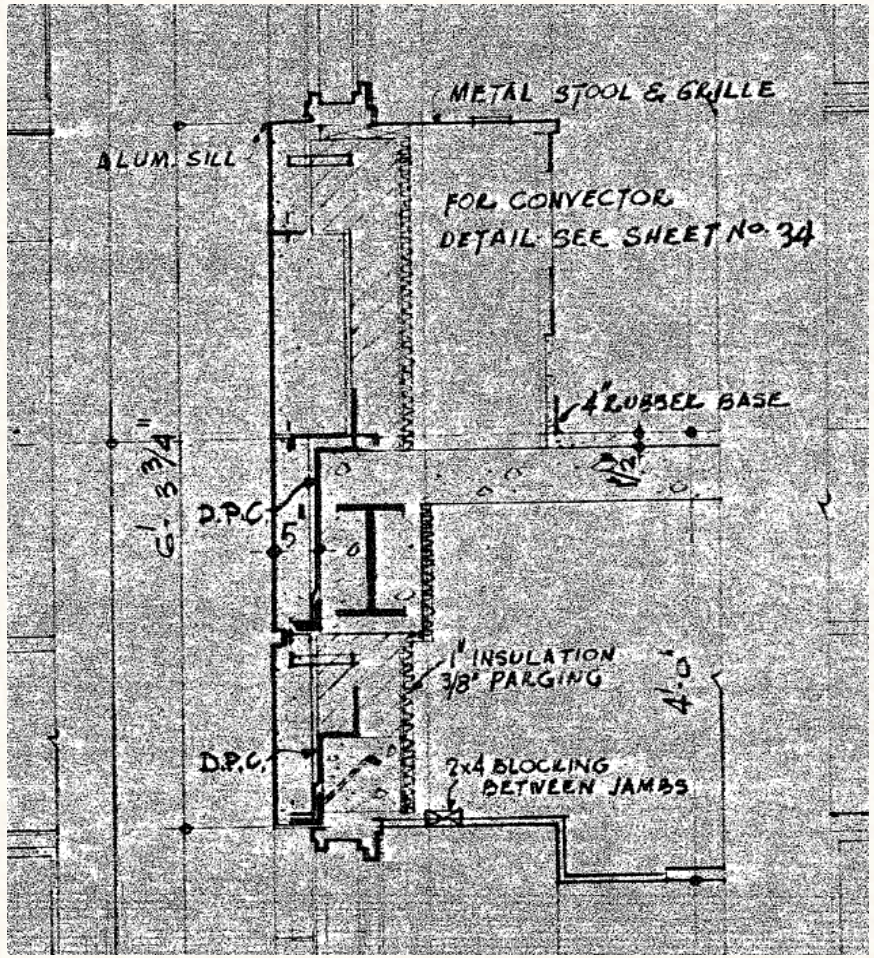

Where is the Plane of Airtightness

OR

Resistance to Air Flow across the Whole Wall Assembly

Interior Drywall/Plaster is by passed Convector Grills and above the Ceiling

Insulation 1” Cork Board

Adhesive

Concrete Masonry Units

Limestone Cladding

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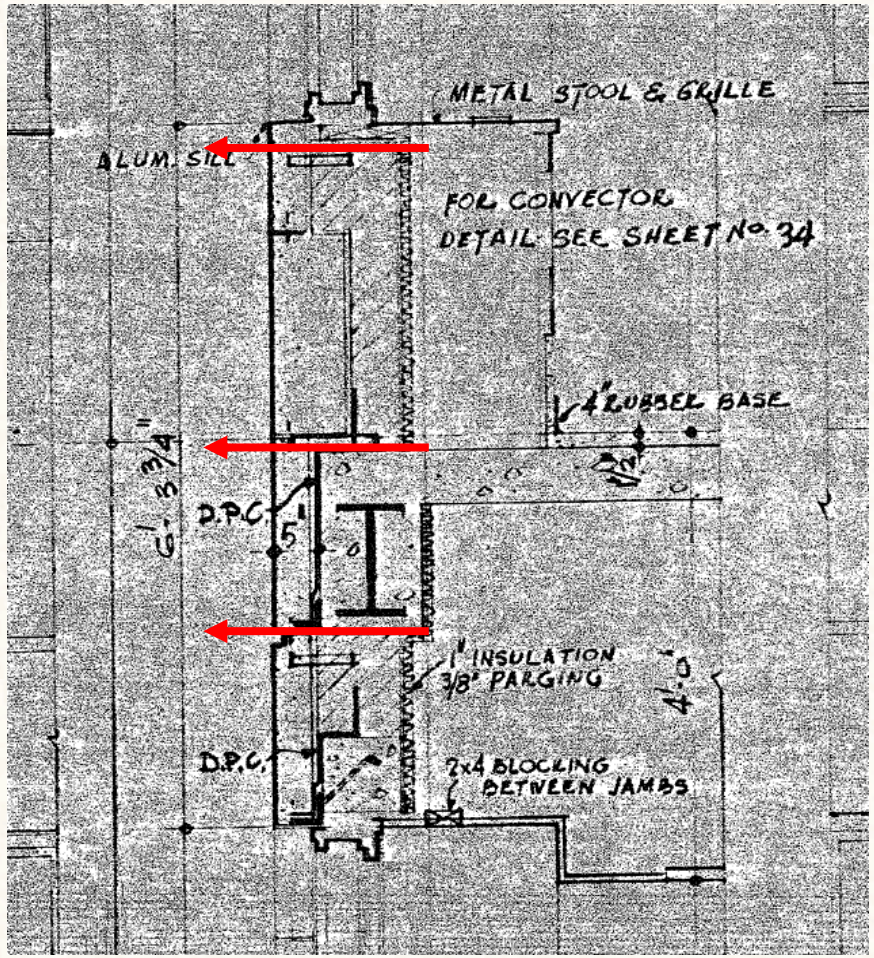

Air Leaks at Joints and Junctions

Wall to Floor
Wall To 700 Windows
Above Ceiling to Floor
Exterior Wall to Columns

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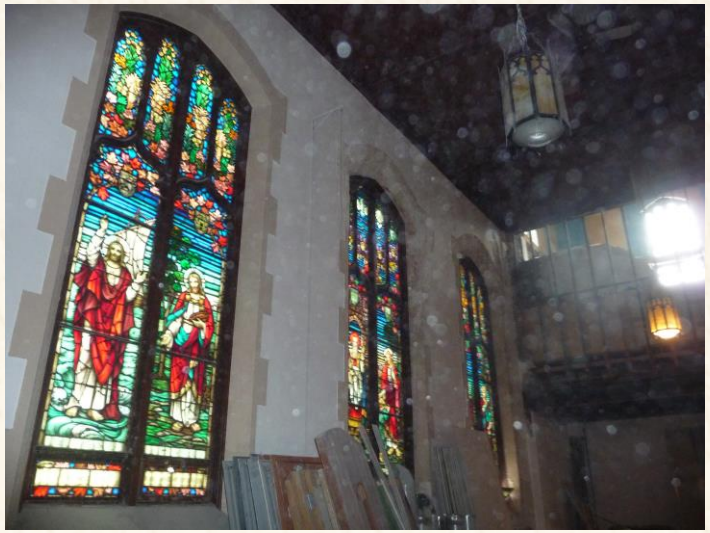

Addressing the Air Barriers When Renovating Commercial /Institutional Buildings

Warning

Mass masonry walls can hold substantial amounts of water. They dry by absorbing, storing, and later releasing the moisture to both the exterior and interior of the building enclosure. The use of spray foam will both increase drying time by limiting drying to only the exterior as well as reduce the thermal drive from the interior. This may result in increased freeze thaw cycling of the masonry.

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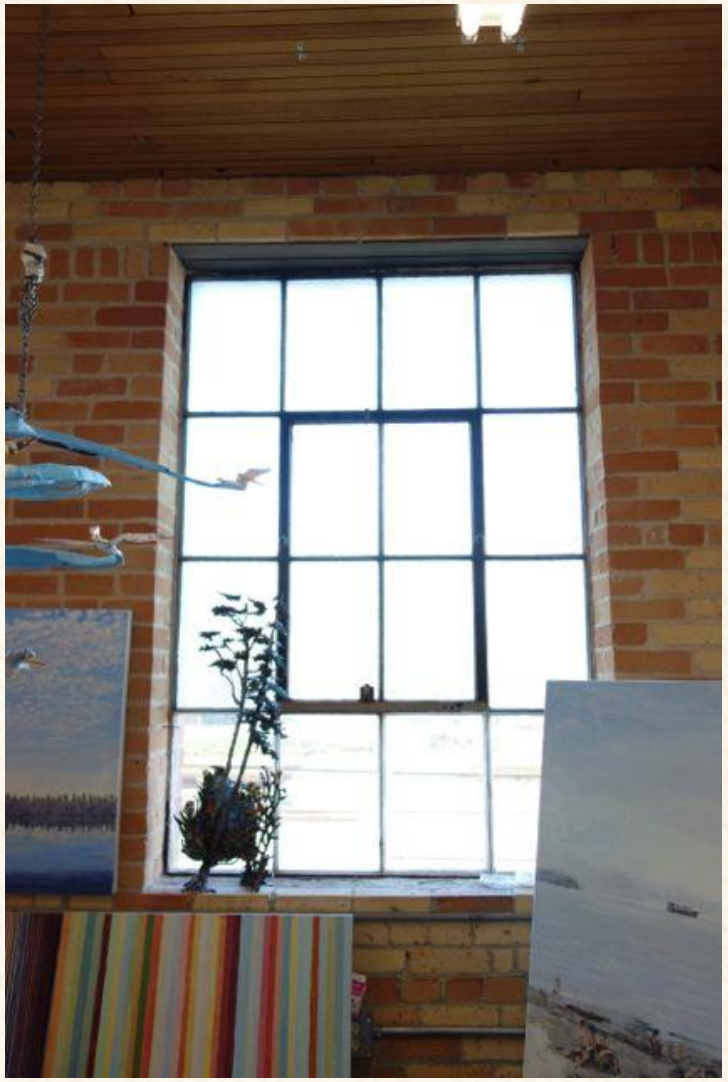

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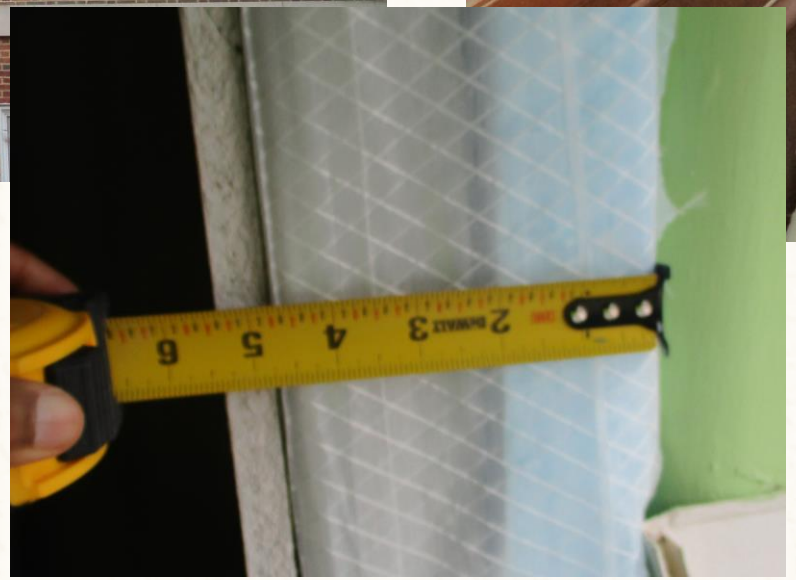

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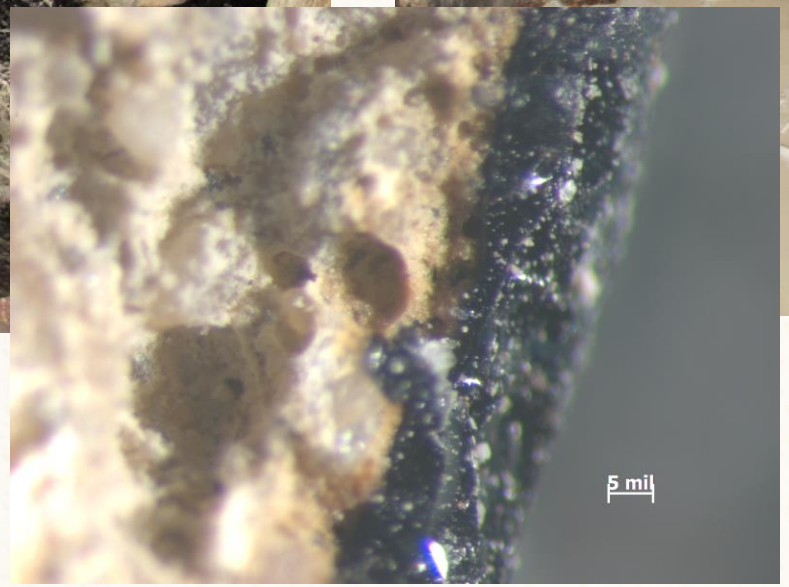
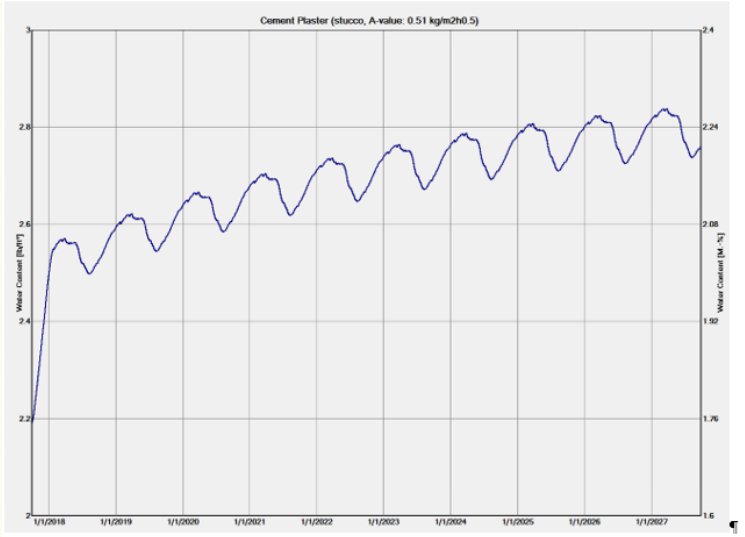
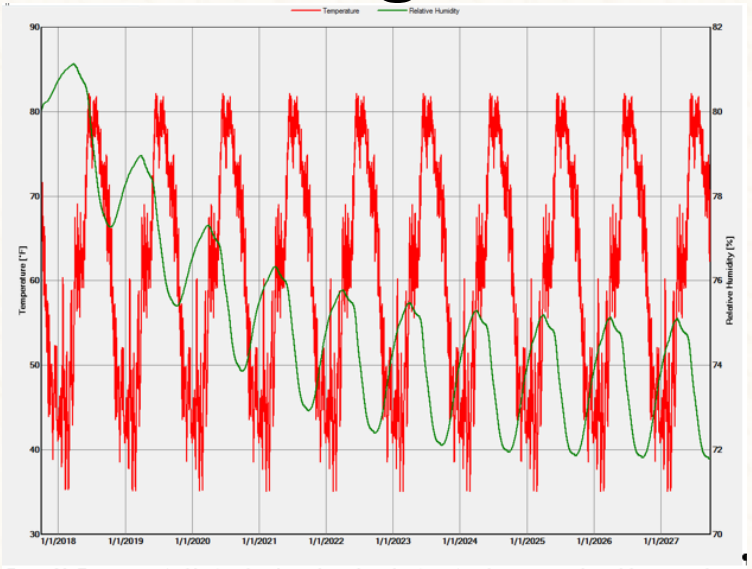


Addressing the Air Barriers When Renovating Commercial /Institutional Buildings

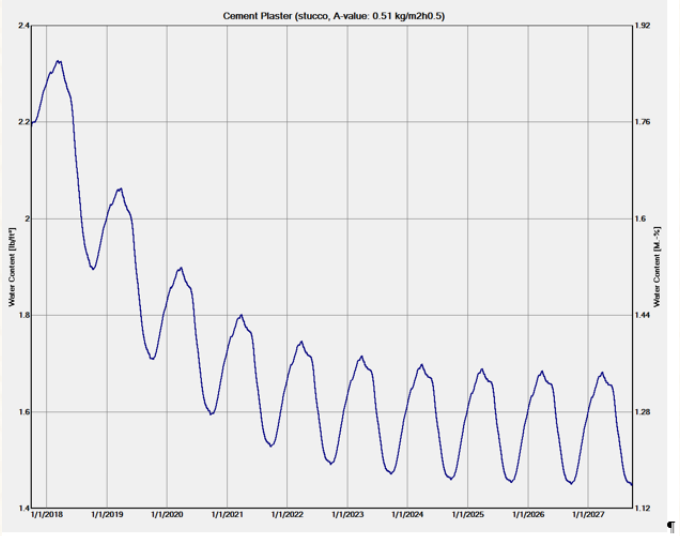
Figure·19.·Temperature·(red·line)·and·surface·relative·humidity·(green)·at·the·interior·surface·of·the·cement·plaster·in·Model·1.··Note·the·increased·trend·of·the·relative·humidity·when·the·vapor·barrier·is·used·on·the·interior·surface¶



Figure·20.·Water·Content·of·Cement·Plaster·in·Model·1·Note·the·increasing·trend·in·water·content·within·the·cement·plaster·layer.¶



Figure·23.·Temperature·(red·line)·and·surface·relative·humidity·(green)·at·the·interior·surface·of·the·cement·plaster·in·Model·2.··Note·the·decreasing·trend·of·relative·humidity·when·the·vapor·barrier·is·used·on·the·interior·surface.¶



Figure·24.·Water·Content·of·Cement·Plaster·in·Model·2¶

Addressing the Air Barriers When Renovating Commercial/Institutional Buildings

Common Test Methods:

- ASTM E783 - *Standard Test Method for Field Measurement of Air Leakage Through Installed Exterior Windows and Doors*
- ASTM E779 - *Standard Test Methods for Determining Airtightness of Buildings Using an Orifice Blower Door*
- ASTM E3158 - *Standard Test Method for Measuring the Air Leakage Rate of a Large or Multizone Building*
- ASTM E1186 - *Standard Practices for Air Leakage Site Detection in Building Envelopes and Air Barrier Systems*

Addressing the Air Barriers When Renovating Commercial/Institutional Buildings

Designation: E783 – 02 (Reapproved 2010)

Standard Test Method for Field Measurement of Air Leakage Through Installed Exterior Windows and Doors[1]

This standard is issued under the fixed designation E783; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

1. Scope

1.1 This test method provides a field procedure for determining the air leakage rates of installed exterior windows and doors.

1.2 This test method is applicable to exterior windows and doors and is intended to measure only such leakage associated with the assembly and not the leakage through openings between the assemblies and adjacent construction. The test method can be adapted for the latter purpose, provided the potential paths of air movement and the sources of infiltration and exfiltration can be identified, controlled, or eliminated.

1.3 This test method attempts to create and given set of natural environmental conditions. There is a strong possibility that the test method or the test apparatus may, by virtue of their design and use, induce air leakage that does not occur under natural environmental exposure.

1.4 This test method is intended for the field testing of installed exterior windows or doors. Persons interested in laboratory testing of fenestration products should reference Test Method E283.

1.5 Persons using this procedure should be knowledgeable in the area of fluid mechanics and instrumentation practices, and shall have a general understanding of fenestration products and components.

1.6 The values stated in SI units are to be regarded as standard. The values given in parentheses are mathematical conversions to inch-pound units that are provided for information only and are not considered standard.

1.7 *This standard does not purport to address all of the safety problems, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.* For specific precautionary statements, see Section 7.

2. Referenced Documents

2.1 *ASTM Standards:*[2]

E283 Test Method for Determining Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen

E631 Terminology of Building Constructions

3. Terminology

3.1 *Definitions*—Terms used in this test method are defined in Terminology E631.

3.2 *Definitions of Terms Specific to This Standard:*

3.2.1 *air leakage rate* (q_A or q_L)—the air leakage per unit of specimen area (A) or per unit length of operable crack perimeter (L), expressed as $m^3/s - m^2$ ($ft^3/min - ft^2$), or $m^3/s - m$ ($ft^3/min - ft$).

3.2.2 *extraneous air leakage* (Q_e) —the volume of air flowing per unit of time through the test chamber and test apparatus, exclusive of the air flowing through the test specimen, under a test pressure difference and test temperature difference, converted to standard conditions, expressed in m^3/s (ft^3/min).

3.2.2.1 *Discussion*—Extraneous leakage is the sum of all leakage other than that intended to be measured by the test.

3.2.3 *specimen air leakage* (Q_s)—the volume of air flowing per unit of time through the specimen, under a test pressure difference and test temperature difference, converted to standard conditions, expressed in m^3/s (ft^3/min).

3.2.4 *specimen area* (A)—the area determined by the overall dimensions of the frame that fits into the rough opening, expressed as m^2 (ft^2).

3.2.5 *test pressure differences*—the specified differential static air pressure across the specimen, expressed as Pa (lbf/ft^2).

3.2.6 *test specimen*—the assembled window or door unit as installed in the exterior wall of a building. The test specimen

[1] This test method is under the jurisdiction of ASTM Committee E06 on Performance of Buildings and is the direct responsibility of Subcommittee E06.51 on Performance of Windows, Doors, Skylights and Curtain Walls.

Current edition approved Oct. 1, 2010. Published November 2010. Originally approved in 1981. Last previous edition approved in 2002 as E783 – 02. DOI: 10.1520/E0783-02R10.

[2] For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

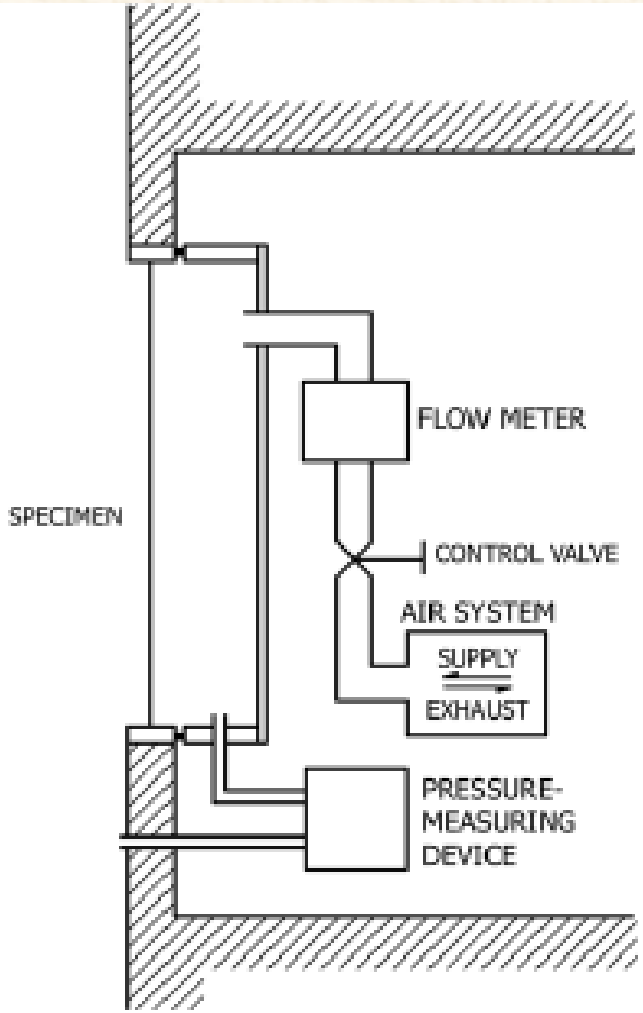
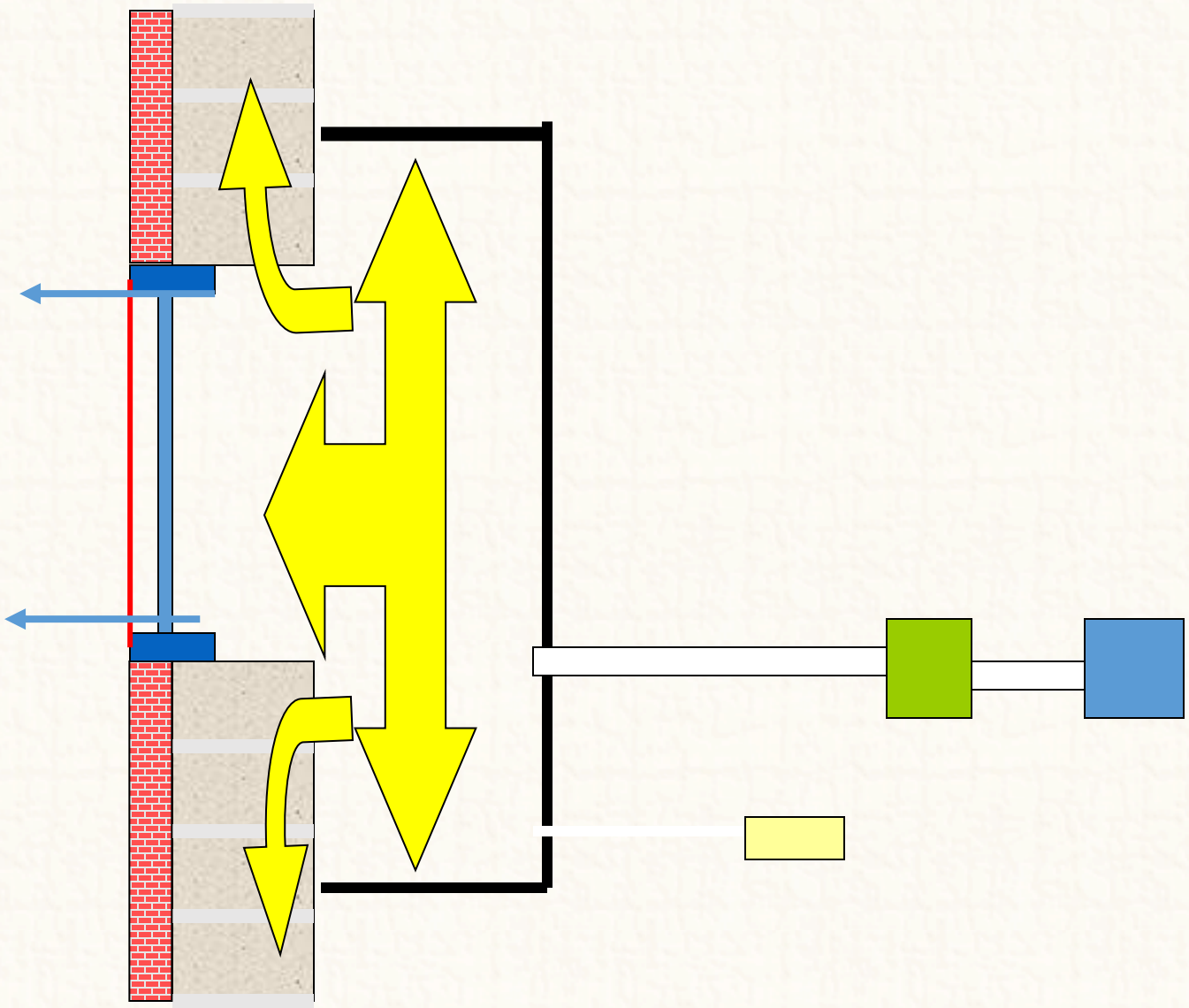


FIG. 1 General Arrangement of Air Leakage Test Apparatus

Addressing the Air Barriers When Renovating Commercial/Institutional Buildings



Addressing the Air Barriers When Renovating Commercial/Institutional Buildings

Both Test Standards Quantify the Airtightness of the Building/s

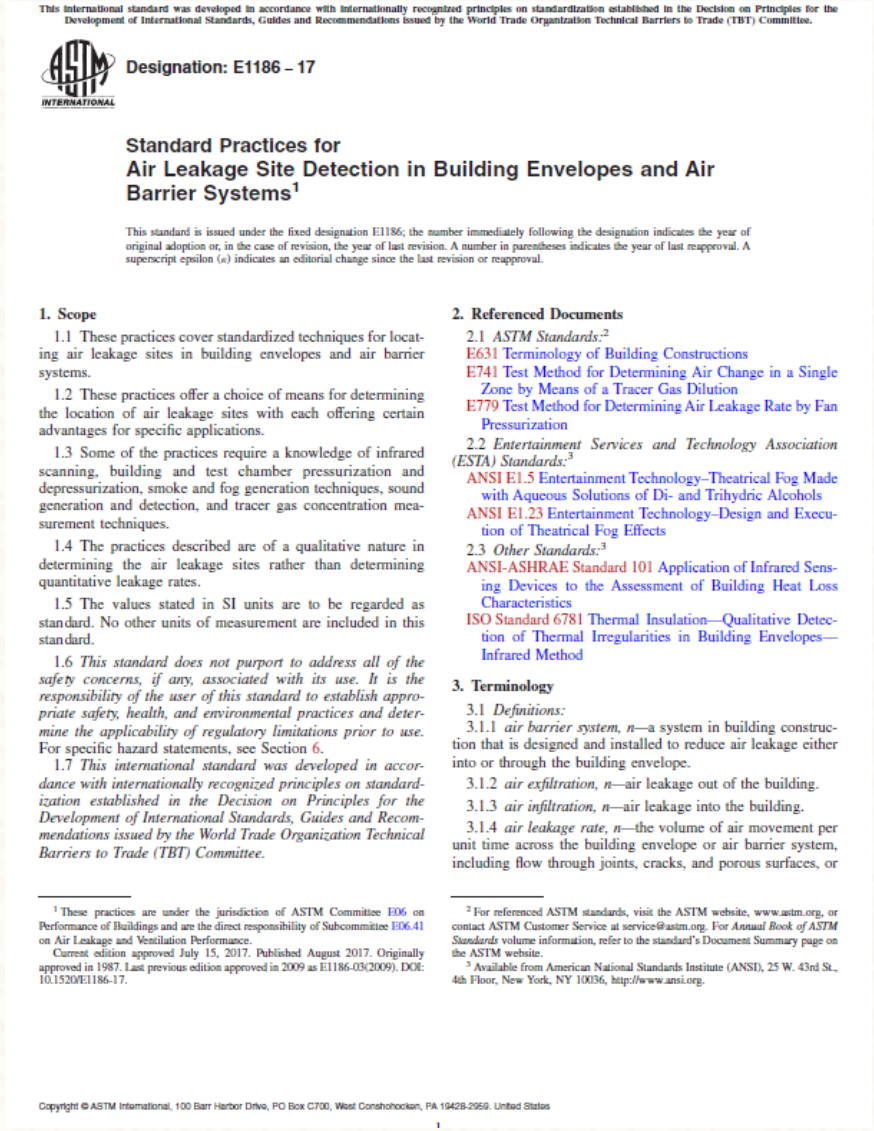
Should not be used to test an Air Barrier as a stand along component within the building.

ASTM E 3158 APPENDIX

X1.12 *Location of Air Leaks*:

X1.12.1 Compliance with a specified air leakage rate does not imply that all problematic leaks have been sealed. Air leaks might be important to address even in envelopes which are determined to meet specified air leakage rate. While this test determines the airtightness of an envelope, it does not identify the location of leakage sites. If air leakage sites are to be identified, refer to Practice E1186. The location of leaks, in addition to their cumulative leakage area, is also an important determinant of leakage under normal operating conditions.

Addressing the Air Barriers When Renovating Commercial/Institutional Buildings



This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.

Designation: E1186 – 17

Standard Practices for Air Leakage Site Detection in Building Envelopes and Air Barrier Systems[1]

This standard is issued under the fixed designation E1186; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

1. Scope

1.1 These practices cover standardized techniques for locating air leakage sites in building envelopes and air barrier systems.

1.2 These practices offer a choice of means for determining the location of air leakage sites with each offering certain advantages for specific applications.

1.3 Some of the practices require a knowledge of infrared scanning, building and test chamber pressurization and depressurization, smoke and fog generation techniques, sound generation and detection, and tracer gas concentration measurement techniques.

1.4 The practices described are of a qualitative nature in determining the air leakage sites rather than determining quantitative leakage rates.

1.5 The values stated in SI units are to be regarded as standard. No other units of measurement are included in this standard.

1.6 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety, health, and environmental practices and determine the applicability of regulatory limitations prior to use.* For specific hazard statements, see Section 6.

1.7 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

2. Referenced Documents

2.1 *ASTM Standards:*[2]

E631 Terminology of Building Constructions

E741 Test Method for Determining Air Change in a Single Zone by Means of a Tracer Gas Dilution

E779 Test Method for Determining Air Leakage Rate by Fan Pressurization

2.2 *Entertainment Services and Technology Association (ESTA) Standards:*[3]

ANSI E1.5 Entertainment Technology–Theatrical Fog Made with Aqueous Solutions of Di- and Trihydric Alcohols

ANSI E1.23 Entertainment Technology–Design and Execution of Theatrical Fog Effects

2.3 *Other Standards:*[3]

ANSI-ASHRAE Standard 101 Application of Infrared Sensing Devices to the Assessment of Building Heat Loss Characteristics

ISO Standard 6781 Thermal Insulation—Qualitative Detection of Thermal Irregularities in Building Envelopes—Infrared Method

3. Terminology

3.1 *Definitions:*

3.1.1 *air barrier system, n*—a system in building construction that is designed and installed to reduce air leakage either into or through the building envelope.

3.1.2 *air exfiltration, n*—air leakage out of the building.

3.1.3 *air infiltration, n*—air leakage into the building.

3.1.4 *air leakage rate, n*—the volume of air movement per unit time across the building envelope or air barrier system, including flow through joints, cracks, and porous surfaces, or

[1] These practices are under the jurisdiction of ASTM Committee E06 on Performance of Buildings and are the direct responsibility of Subcommittee E06.41 on Air Leakage and Ventilation Performance.

Current edition approved July 15, 2017. Published August 2017. Originally approved in 1987. Last previous edition approved in 2009 as E1186-03(2009). DOI: 10.1520/E1186-17.

[2] For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

[3] Available from American National Standards Institute (ANSI), 25 W. 43rd St., 4th Floor, New York, NY 10036, http://www.ansi.org.

Summary of Practices

4.1 This standard presents the following seven practices for detecting air leakage sites in building envelopes:

4.1.1 Combined building depressurization (or pressurization) and infrared scanning,

4.1.2 Building depressurization (or pressurization) and smoke tracers or theatrical fog,

4.1.3 Building depressurization (or pressurization) and airflow measuring devices,

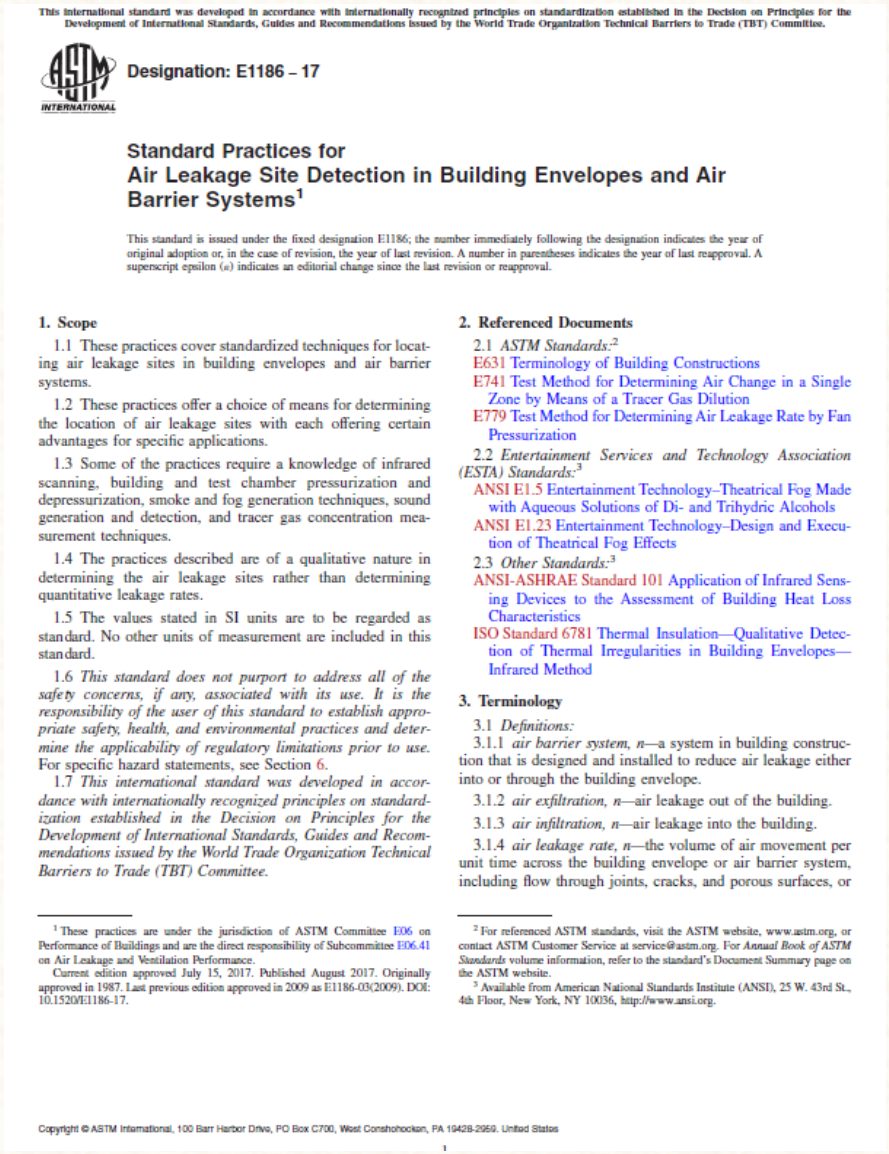
4.1.4 Generated sound and sound detection,

4.1.5 Tracer gas detection,

4.1.6 Chamber depressurization (or pressurization) and smoke tracers or theatrical fog, and

4.1.7 Chamber depressurization and leak detection liquids

Addressing the Air Barriers When Renovating Commercial/Institutional Buildings



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Designation: E1186 – 17

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Summary of Practices

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Most Used in Diagnostics in Older Buildings

4.1.1 Combined building depressurization (or pressurization) and infrared scanning

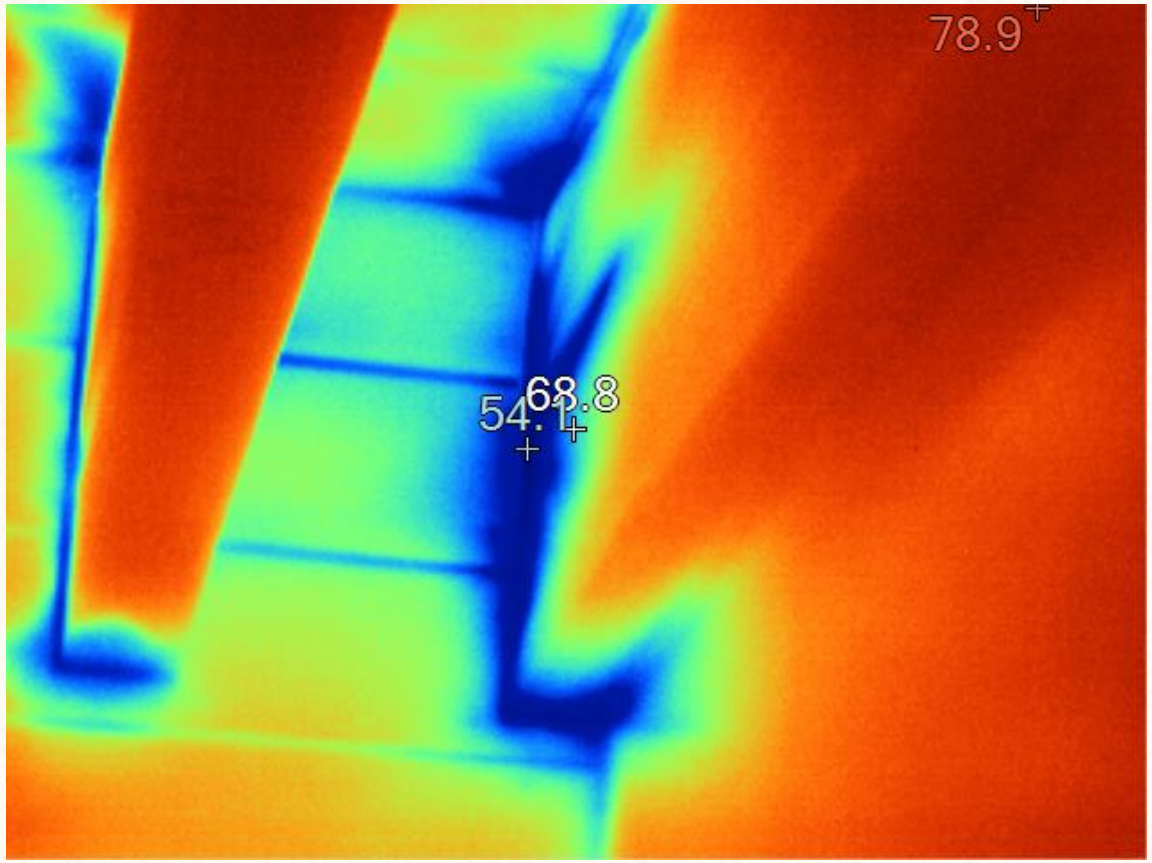
4.1.2 Building depressurization (or pressurization) and smoke tracers or theatrical fog,

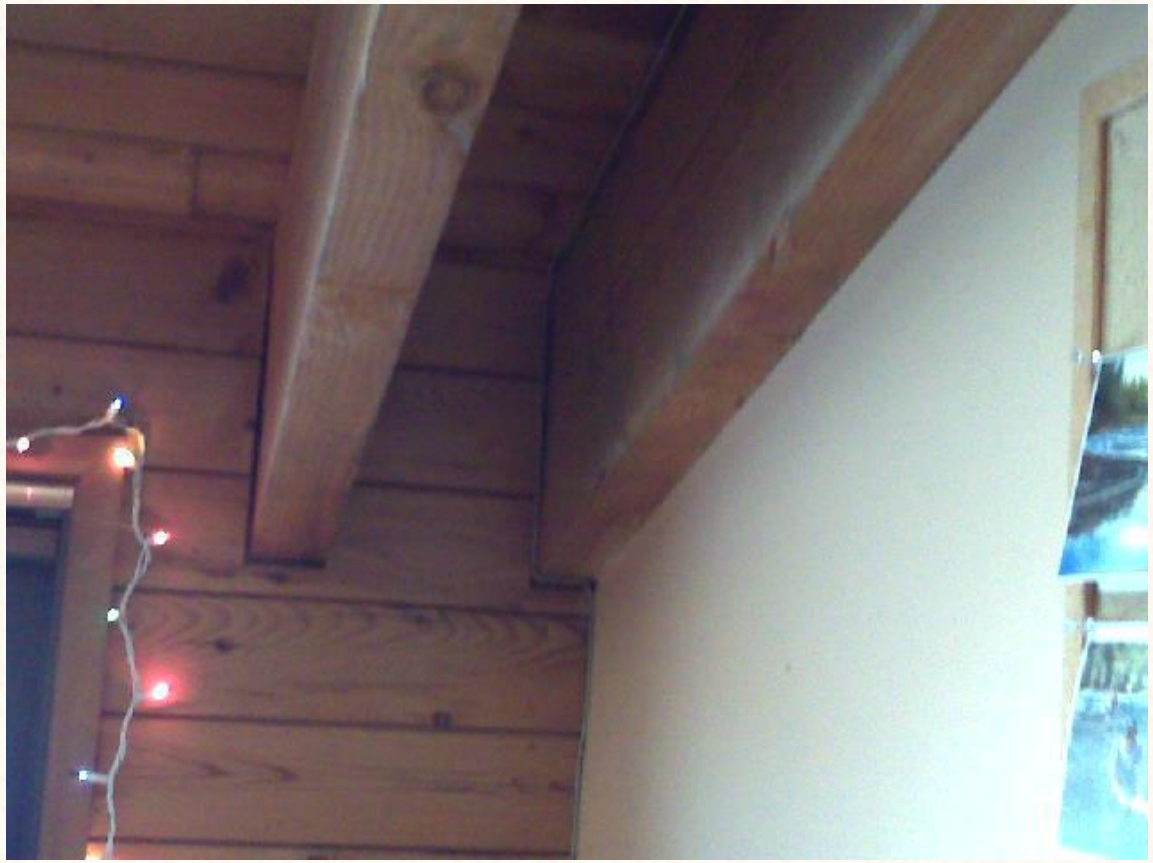
4.1.3 Building depressurization (or pressurization) and airflow measuring devices or Anemometers

Addressing the Air Barriers When Renovating Commercial/Institutional Buildings

4.1.1 Combined building depressurization (or pressurization) and infrared scanning

Identifies Air leakage and Thermal Bridging Learn to tell the difference





Addressing the Air Barriers When Renovating Commercial /Institutional Buildings

4.1.2 Building depressurization (or pressurization) and smoke tracers or theatrical fog,

Addressing the Air Barriers When Renovating Commercial /Institutional Buildings

4.1.3 Building depressurization (or pressurization) and airflow measuring devices or Anemometers

Both the Use of Hot Wire and Rotating Vane Anemometers

The Area of an Opening and Flow will Provide a Quantified Rate of Air Movement from a Zone in a Building

Bryan M. Monahan, PE

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