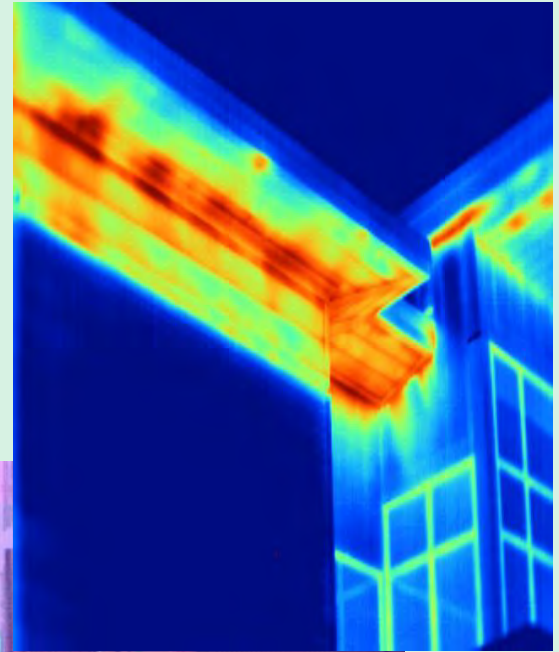


NEBBinar: Building Enclosure Testing

September 25, 2013



Moderator



Jim Huber, NEBB Vice President and President of Complete Commissioning

Jim Huber is the President of Complete Commissioning. He has over 29 years of industry experience, is a Certified Energy Manager, and has extensive experience with BACNET, LON, MODBUS, and other building automation protocols and communication networks. He has programming, tuning, and testing experience with multiple systems and applications, as well as building systems commissioning, sound and vibration measurement, and testing and balancing.

Speaker



Phil Emory, NEBB's Building Enclosure Committee

Phil is a graduate of Montana State University in Mechanical Engineering and is the Sr. Project Manager for Neudorfer Engineers. He has been involved in the Engineering and Construction industry since 1985. Phil's experience includes Mechanical Design, Mechanical Construction, Test & Balance, Air Barrier Testing and is a ASTN Level II Thermographer. He is currently serving on the ABBA Whole Building Tightness Committee and is co-author of the NEBB's BET Procedural Standard.

Agenda

History of Building Enclosure Testing

Building Enclosure in Codes

Specification for Building Testing

Scope Responsibility

Leak Detection

Question and Answers

United States 2005 Energy Policy Act

The 2005 Energy Policy Act requires that Federal facilities be built to achieve at least 30% energy savings over the 2004 ASHARE Standard 90.1-2004



United States Army Corp of Engineers

On **October 30, 2009** the United States Army Corp of Engineers (USACE) issued a directive in **ECB 2009-29** which required that all new building and those undergoing major renovations shall have an air leakage rate that does not exceed set values when tested in accordance with the US Army Corps of Engineers Air Leakage Test Protocol for Building Envelopes.



United States Army Corp of Engineers

Fall of 2008 NEI began whole building testing per the US Army Corps of Engineers Air Leakage Test Protocol for Measuring air Leakage in Buildings.

- ASTM E 779-10 Standard Test Method for Determining Air Leakage Rate by Fan Pressurization
- ASTM E 1827-11 Standard Test methods for Determining Airtightness of Buildings Using an Orifice Blower Test
- ASTM E 1186-03 Standard Practices for Air Leakage Site Detection in Building Envelopes and Air Barrier Systems

The current Protocol and specification as of May 1, 2012 requires the test to be performed in both directions, pressurization and depressurization with a combined average passing score of 0.25 cfm/ft² at a differential pressure of 75 Pa.



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Washington State & Seattle Energy Code

2009 Washington State Energy Code Effective January 1, 2011

- ASTM E 779-10 Standard Test Method for Determining Air Leakage Rate by Fan Pressurization or approved similar test
- Allowable Leakage Rate of 0.40 cfm/ft² at a differential pressure of 75 Pa.

2009 Seattle Energy Code Effective January 1, 2011

- ASTM E 779-10 Standard Test Method for Determining Air Leakage Rate by Fan Pressurization or approved similar test
- Allowable Leakage Rate of 0.40 cfm/ft² at a differential pressure of 75 Pa within an upper 95% confidence interval for air leakage.

2012 Amendments Effective July 1, 2013

- 2012 IECC Compliance
- Washington State Energy Code will require all buildings (not just over 5 stories). If the building fails then corrections have to be documented to waive further requirements.



Building Envelope Pressure Testing

State Energy Codes

Florida

Maryland

Massachusetts

Minnesota

New York

Rhode Island

Washington & Seattle

(Utah)



Building Envelope Testing

Code Requirement Comparison cfm/ft² @ 75 Pa

Washington State / Seattle 0.40

LEED 0.30

ASHRAE 90.1 Average 0.30

USACE 0.25

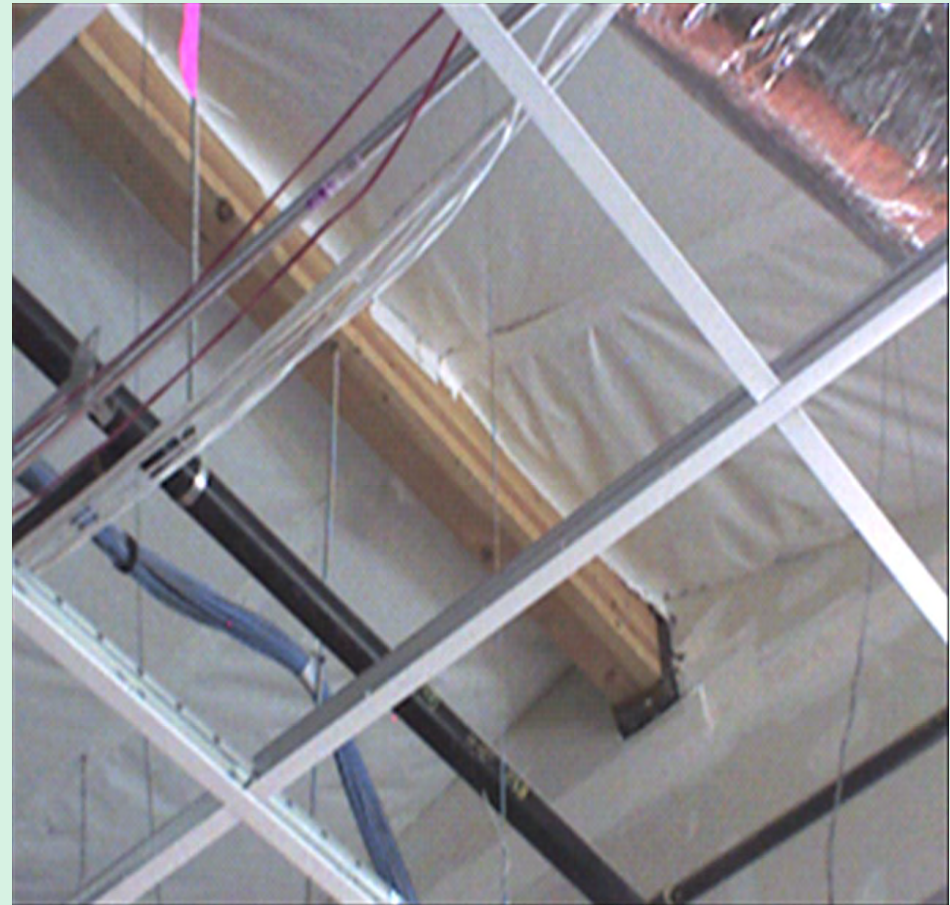
ASHRAE 90.1 Tight 0.10

Sample Project

Highest pressure obtained during a negative pressure test: 39 Pa (fails to meet minimum of 50 Pa)

Actual Leakage @ 75 Pa was 0.57 cfm/ft²

Don't take this lightly!



Air Barrier Contract Documents

- “The air barrier component of each assembly shall be joined and sealed in a flexible manner to the air barrier component of adjacent assemblies, allowing for the relative movement of these assemblies and components.”
- “All air barrier components of each envelope assembly shall be clearly identified on construction documents and the joints, interconnections and penetrations of the air barrier components shall be detailed.”
- “Construction documents shall also contain a diagram showing the building’s pressure boundary in plan(s) and section(s) and a calculation of the area of the pressure boundary to be considered in the test.”
- The air barrier is continuous through all six sides (floors, walls and ceiling) of the test zone.



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Specifications for Building Testing

Need for continuity and placing the Building Testing within the contract specifications

National Environmental Balancing Bureau (NEBB)

Building Enclosure Testing Procedural Standards

www.nebb.org

US Army Corps of Engineers

Air Leakage Test Protocol for Measuring Air Leakage in Buildings

Engineering And Construction Bulletin No. 2009-29 Issued October 30, 2009

www.wbdg.org/references/pa_dod_energy.php

Air Barrier Association of America

Section 01 41 00 The Air Barrier System *(which includes whole building testing)*



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Scope Responsibilities

Architect

- Design and Area Calculation

General Contractor

- Installation of the Air Barrier and Building Preparation for Testing

QA/QC Manager

- Verifies proper installation of the Air Barrier

Air Barrier Testing Agent

- Performs the Air Barrier Test and Certifies the Results



TESTING LIMITATIONS

- Wind
- Temperature
- Solar Loading
- Rain/Snow
- Building Configuration/Design
- Building Access

The test needs to be completed under the most stable environmental conditions possible at a time where the outside environmental conditions are at their optimal



Photo source *Infiltec*

WHEN TO TEST ?

Final Test

When the Air Barrier is Complete and no further penetrations of the air barrier are going to be made.

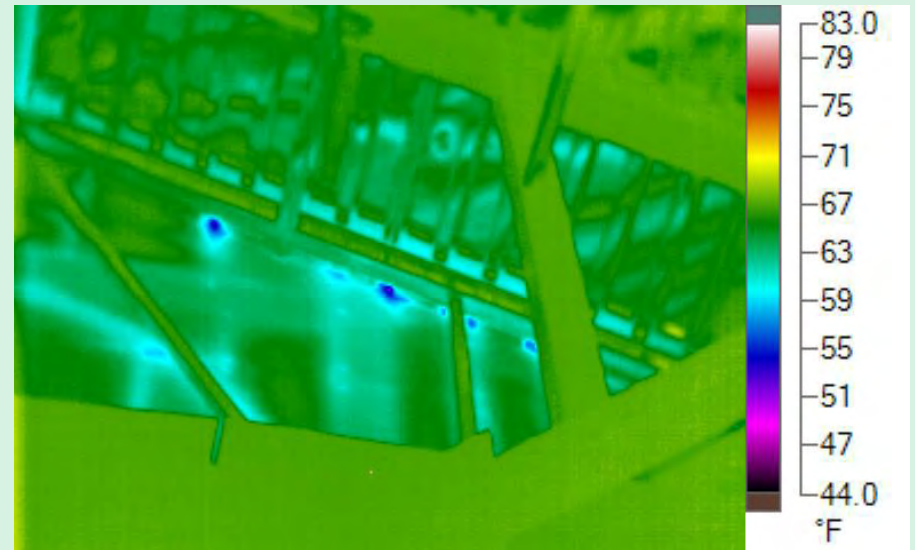
- For a Final Air Barrier Test the air barrier must be complete including all doors, windows and all penetrations of any type that will penetrate the air barrier.
- Weather Restrictions must be complied with
- Temperature Restriction must be complied with
- No other variance in the testing procedure unless approved and accepted by the governing authority



WHEN TO TEST ?

Preliminary Testing

- Not mandatory but have served as a great option to verifying testing the air barrier performance and different stages of construction.
- Better tool in lieu of mock-up testing
- Cost benefit in ensuring a passing final test



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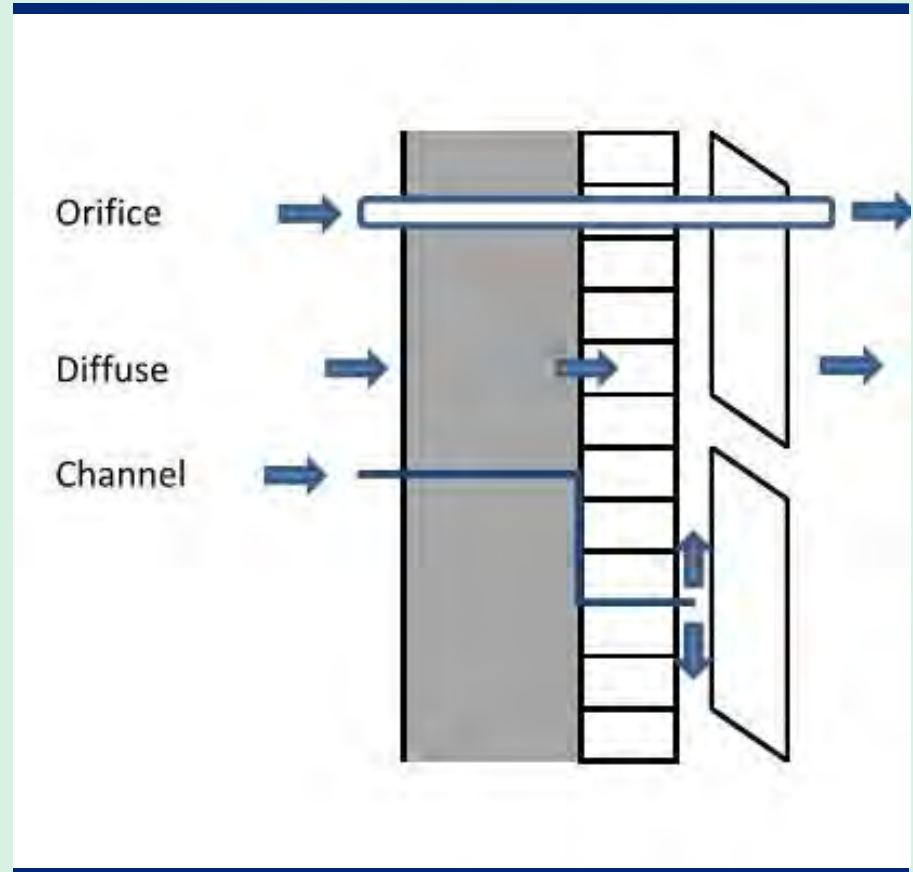
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TYPES OF AIR LEAKS

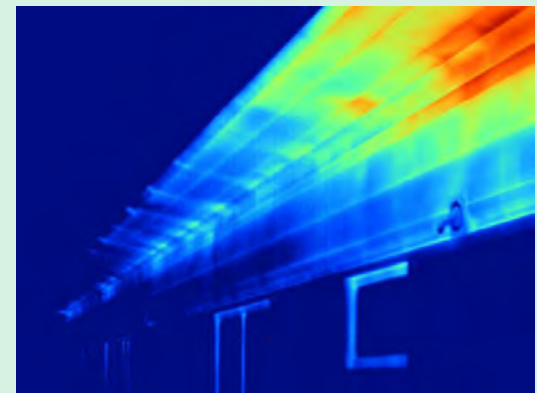
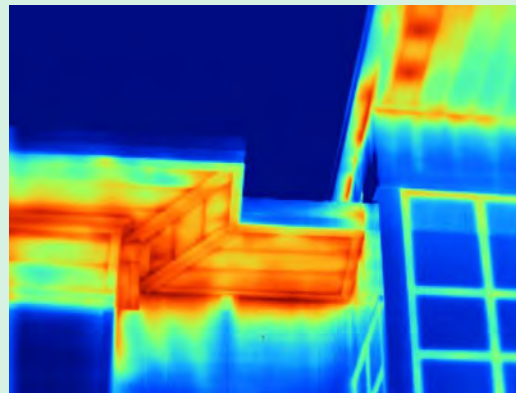
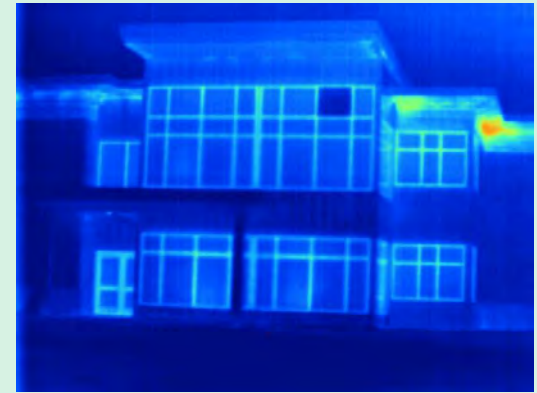
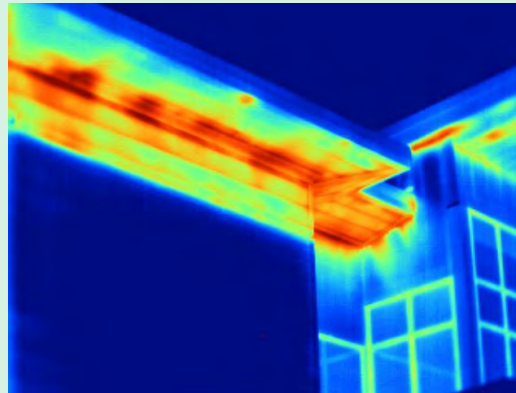
- **Orifice:** Direct Open Path
- **Diffuse:** Permeates directly through the material
- **Channel:** Migrates following the path of least resistance



THERMAL IMAGING

Thermal imaging is required by the Corp of Engineers and the Thermographer must be certified.

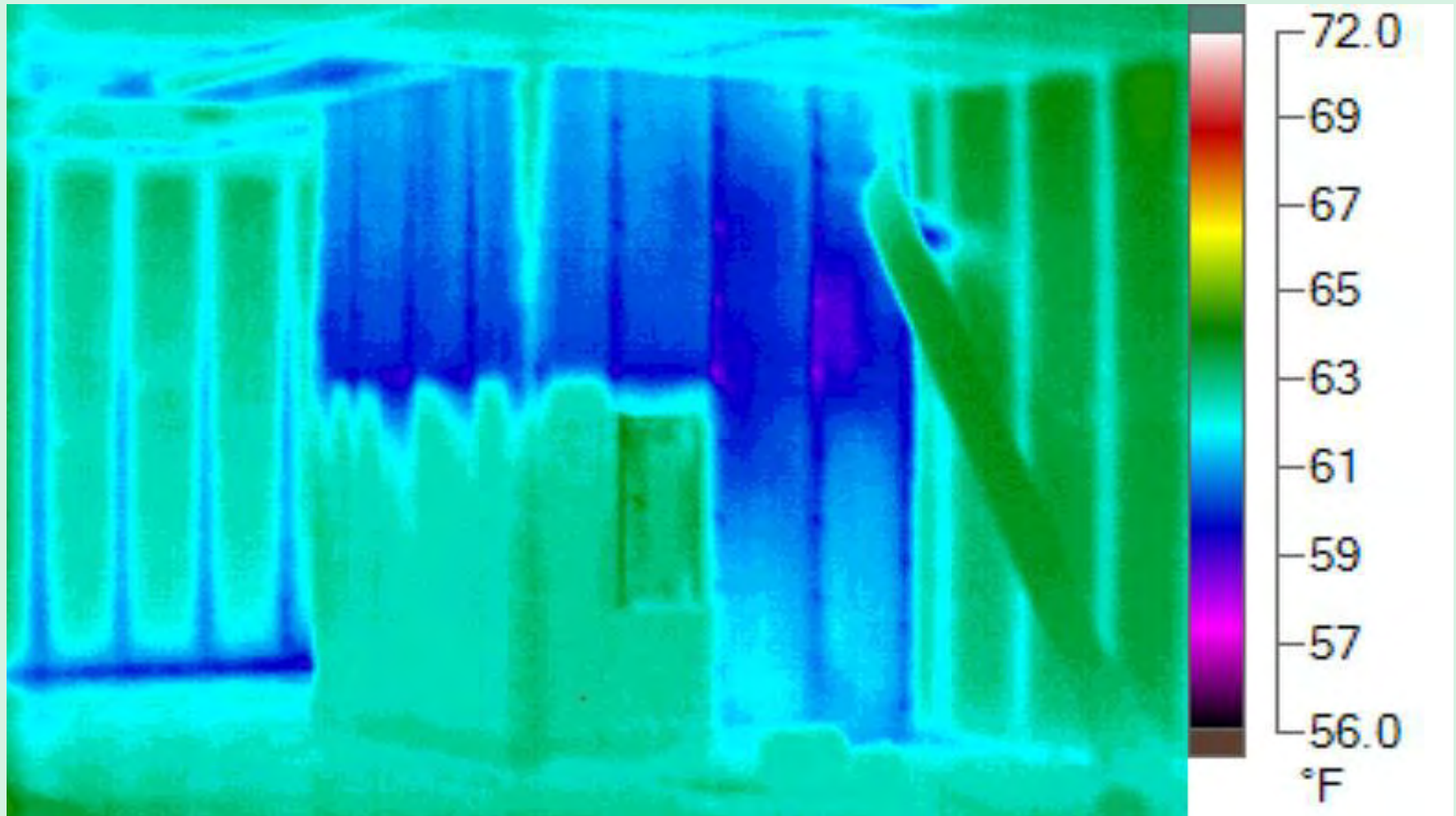
- Provides a Historical Document
- Clean versus smoke
- It is limited by temperature, wind and solar loading.



LEAKS VERSUS THERMAL BRIDGING

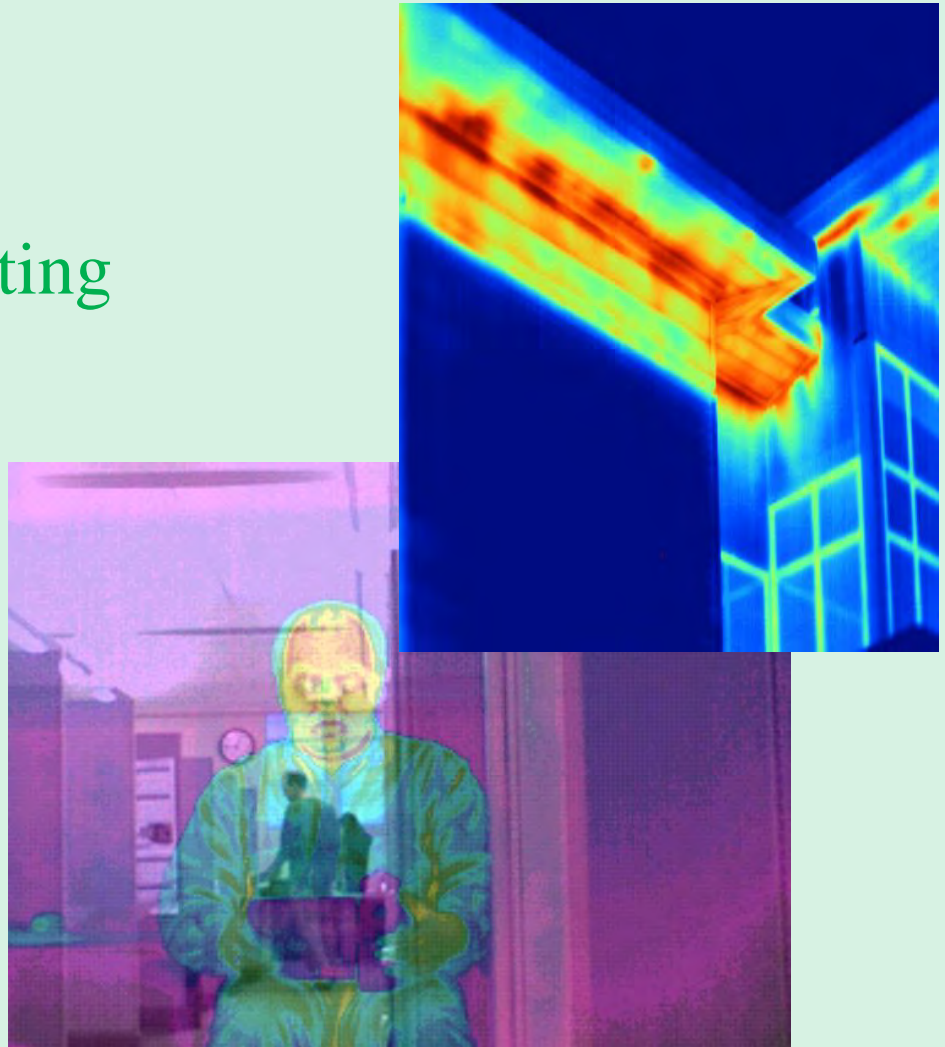


LEAKS VERSUS THERMAL BRIDGING



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Question and Answers



Contact Information



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