mass save Energy Code Technical Support Program

Commercial Air Barriers: Three Options for Compliance

Massachusetts Codes and Standards
Compliance Support Program

PERFORMANCE SYSTEMS DEVELOPMENT We Speak Building leidos

Learning Objectives

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- Examine the ***basic requirements*** for commercial building air barriers in the Massachusetts First Edition and reference IECC 2015 and ASHRAE 90.1-2013.
- Understand ***the benefits of the air barrier systems*** to the environment, building owner, and occupants
- Discuss ***performance test standards*** relating to air barrier systems, including the NFPA 285 fire test.
- Determine what **complies as a performance-based air barrier system** and how to **enforce that requirement**

Who Is Mass Save®?

Energy Code Technical Support Program

- Mass Save® is an initiative sponsored by Massachusetts' gas and electric utilities and energy efficiency service providers, including
  - The Berkshire Gas Company
  - Blackstone Gas Company
  - Cape Light Compact
  - Columbia Gas of Massachusetts
  - Eversource Energy
  - Liberty Utilities
  - National Grid
  - Unitil
- The Sponsors of Mass Save work closely with the Massachusetts Department of Energy Resources to provide a wide range of services, incentives, trainings, and information promoting energy efficiency that help residents and businesses manage energy use and related costs.

Today…

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Here's What You Need to Know:

- New Requirements for Air Barriers Included in the MA 9th Edition and Referenced 2015 IECC and ASHRAE 90.1-2013, Amended for Massachusetts:
  - **Basic Requirements**
  - **What Makes an Air Barrier**
  - **Air Barrier Requirements and IECC 2015, ASHRAE 90.1-2013**

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Agenda

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- Basic Requirements
- Benefits of Air Barriers
- Air Barrier Test Standards
- What a Code Enforcement Official Might Review and Inspect

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BASIC REQUIREMENTS

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New Mandatory Requirements

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1. Air Barriers

2. Continuous Insulation for vast majority of buildings

3. Compliance to NFPA-285 Fire Test

Air Barriers and Construction

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IECC 2015C 402.5.1 and C402.5.1.1

- Continuous air barrier for all assemblies
- Across joints
- Joints & seams to be sealed
- Penetrations & joints sealed and compatible with material and location
- Recessed-lighting: compliant fixtures
- Placement: inside, outside, or within assemblies composing envelope

ABAA Program, or Auditor – Third Party?

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Changes in Energy codes and C.I., Air Barriers

	2009	2015
Roofs (above deck)	R-20 CI	R-25 CI
Metal Bldg. Roofs	R-13 + R-13	R-13 + R-11 LS
Attic	R-38	R-38
Walls, above grade		
Mass	R-5.7 CI	R-5.7 CI
Metal Bldg. (Metal Façade)	R-16 Click to add text Click to add text Click to add text	R-13 + R-6.5 CI (1" thick foil faced PISO)
Metal Framed (Masonry/Stone Façade)	R-13	R-13 + R-5 CI (1" thick XPS or foil faced PISO, R-6.5)
Wood framed and Other	R-13	R-13 + R-3.7 CI or R-20

Graphic credit: Michael C. DeWein

This is the Effective R-value that has been presented many times. **It is now part of the Energy Code!**

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TABLE C402.1.4.1
EFFECTIVE *R*-VALUES FOR STEEL STUD WALL ASSEMBLIES

NOMINAL STUD DEPTH (inches)	SPACING OF FRAMING (inches)	CAVITY *R*-VALUE (insulation)	CORRECTION FACTOR (F_c)	EFFECTIVE *R*-VALUE (ER) (Cavity *R*-Value × F_c)
$3^1/_2$	16	13	0.46	5.98
		15	0.43	6.45
$3^1/_2$	24	13	0.55	7.15
		15	0.52	7.80
6	16	19	0.37	7.03
		21	0.35	7.35
6	24	19	0.45	8.55
		21	0.43	9.03
8	16	25	0.31	7.75
	24	25	0.38	9.50

Graphic credit: Table from 2015 IECC

From the 2015 IECC…

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C402.1 General (Prescriptive)

Building thermal envelope assemblies for buildings that are intended to comply with the code on a prescriptive basis, in accordance with the compliance path described in Item 2 of Section C401.2.

Air leakage of building envelope assemblies shall comply with Section C402.5.

From the 2015 IECC…

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C402.5 Air leakage—thermal envelope (Mandatory)
The thermal envelope of buildings shall comply with Sections C402.5.1 through C402.5.8, or the building thermal envelope shall be tested in accordance with ASTM E 779.

C402.5.1 Air barriers

A continuous air barrier shall be provided throughout the building thermal envelope.

Air Barrier Compliance Alternatives

C402.5

- Thermal envelope must comply with:
  - **Materials** OR
  - **Assembly** provision OR
  - **Tested** in Accordance with ASTM E779 @0.3 in. water gauge

Building thermal envelope with a tested air leakage rate of ≤ 0.40 cfm/ft² complies with air leakage requirements

Photo credit: Michael C. DeWein

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ASHRAE 90.1 - 2013

American Society of Heating, Refrigeration, and Air-Conditioning Engineers

5.4.3.1 Continuous Air Barrier – **The entire building envelope shall be designed and constructed with a continuous air barrier**.

LEED

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- LEED v4.0 Buildings require air barrier systems as a mandatory building component.
- **Air Barrier Systems can contribute to LEED certification.**
- **Simply using an Air Barrier or any product does not guarantee any LEED points.**
  - There is no such thing as a LEED certified product!

And…IGCC!

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International Green Construction Code

606.1.2 and 606.1.2.1 - Air leakage mitigation measures and sealing of the building envelope.

Caulk, gasket, and weather-strip sealed with an air barrier film:

1. All joints, seams and penetrations.
2. Site-built windows, doors and *skylights.*
3. Openings between window and door assemblies and their respective jambs and framing.
4. Utility penetrations.

Air Barriers by IECC 2015 Definition

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1. Plywood of not less 3/8" thickness
2. OSB of not less 3/8" thickness
3. Extruded polystyrene of not less than ½" thickness
4. Foil Polyisocyanurate board of not less than ½" thickness
5. Closed cell spray foam of not less than 1 ½ thickness
6. Open cell spray foam of not less than 4.5" thickness
7. Exterior or Interior Gypboard of not less than ½" thickness
8. Cement board of not less than ½" thickness
9. BUR Membrane
10. Modbit Membrane
11. Fully Adhered Single Ply Membrane
12. Cementitious Page-Gypsum/Plaster > 5/8"
13. Fully Grouted CMU
14. Cast-in-Place CMU

Air Barrier – Materials Examples

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Liquid-applied

Photo credit: Air Barrier Association of America

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Air Barrier – Materials Examples

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Spray Foam – High Density

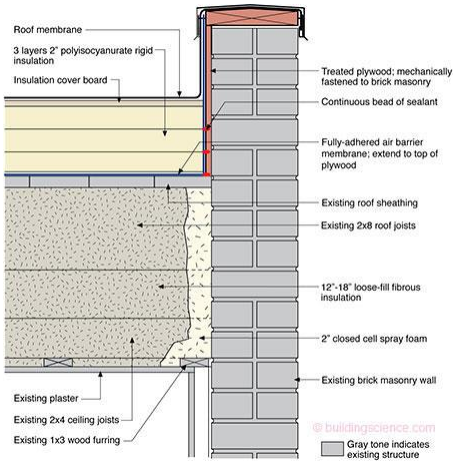

Photo credit: Air Barrier Association of America

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Occupants, owners, environment

BENEFITS OF AIR BARRIERS

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Benefits of an Air Barrier System

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- Conserve Energy
- Lower Initial Construction Costs
- Reduced Maintenance Costs
- Improve Indoor Air Quality

Energy Efficiency

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- According to the DOE controlling air leakage can reduce energy costs by up to 40%
- National Institute of Standards and Technology (NIST)
  - Air Barriers reduce air leakage by up to 83%
  - Reduce Gas Consumption by up to 40%
  - Reduce Electric Consumption by up to 25%

Photo credit: Michael C. DeWein

Lower Initial Construction Costs

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- Air Barriers prevent the leaking of conditioned air, therefore, smaller mechanical systems are needed. **Helps with RIGHT-sizing!**

Photo credit: Air Barrier Association of America

Reduce Maintenance Costs

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- **Less strain on Mechanical Systems.**
- **Reduction in moisture helps prevent:**
  - Corrosion
  - Mold Growth

Photo credit: Air Barrier Association of America

Indoor Air Quality

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- **An effective air barrier keeps pollutants and allergens out of the building, leading to:**
  - Healthier more productive employees
  - Fewer sick days
  - Fewer doctor visits
  - More alert employees

Photo credit: Air Barrier Association of America

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AIR BARRIER TESTING STANDARDS

Testing – ASTM E2178

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- Determines air permanence of a material at a pressure difference of 75Pa.
- Air leakage must not exceed 0.004cfm/ft² to be classified as a air barrier material.
- Only tests the air barrier material not the air barrier system.

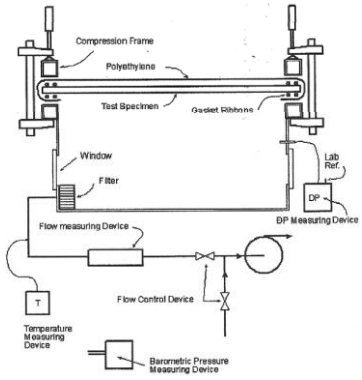

Photo credit: Air Barrier Association of America

Testing – ASTM E2357

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The only test method that gives the user any information on the performance of an installed air barrier assembly and determines the air leakage rate after being conditioned under real world loads

"Data from ASTM E 2357 is critical to every design professional."

-Mr. Laverne Dalgleish, Executive Director of the Air Barrier Association of America

Testing – ASTM E2357

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- Determines air permeance of an air barrier system.
- Uses negative and positive pressure in 3 testing phases.
- Simulates wind gusts up to 99 mph.
- Important to verify that air barrier systems are tested on the same substrate and same application as specified.

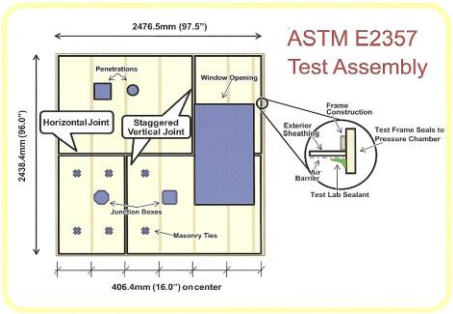

Photo credit: Air Barrier Association of America

Testing – ASTM E2357

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Photo credit: Air Barrier Association of America

NFPA 285 Fire Tested Assemblies

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- Construction Types I, II, III, or IV must have exterior walls constructed of non-combustible materials.
- NFPA 285 may be required in the International Building Code (IBC) when combustible products are used.
- This includes the exterior insulation, the air barrier assembly, the veneer, etc.

NFPA 285 Fire Tested Assemblies

Energy Code Technical Support Program

- Determines combustible materials
- 30 minute test on a full scale two story wall assembly.

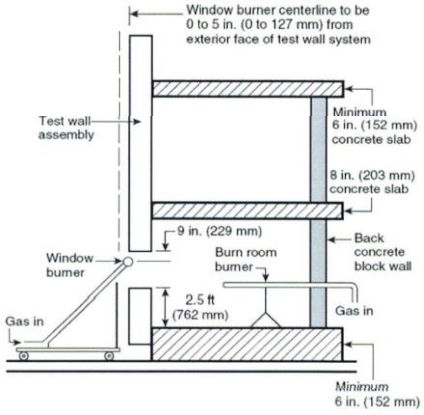

Photo credit: Air Barrier Association of America

NFPA 285 Fire Tested Assemblies

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- To pass, the wall assembly must demonstrate limited fire spread vertically and horizontally away from the window.

Photo credit: Michael C. DeWein & Air Barrier Association of America

IECC 2015

building & all joints must be durably sealed

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- The use of duct tape, packaging tape, scotch tape, and masking tape is **not allowed.**
- Sealing the building and joints must be done with a material that accommodate the anticipated building movement (needs to be elastomeric, >15/20% movement)
- Most universally compatible sealants:
  - Sikaflex 11FC / Sikaflex 102
  - York – Universeal (US-100)
  - BASF – Sonolastic 150
  - NOTE: All of the above sealants are elastomeric, chemically compatible with all wall components and very low VOC

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CODE COMPLIANT AIR BARRIER

Air Barrier Materials

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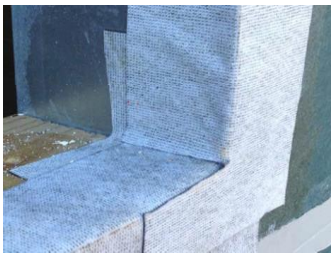
- Provides control of air movement through the building assembly.
- Must have air permeance of less than 0.004CFM/ft^2 @1.56 lb/ft^2 as tested by ASTM E2178-01
- Brief description of standards – **LATER!**

Photo credit: Air Barrier Association of America

Air Barrier Components



- A material used as part of an Air Barrier Assembly to connect between primary air barrier material and substrates.
- Most common air barrier components - primed & tapes and sealants.

Photo credit: Air Barrier Association of America

What is an Air Barrier Assembly?

- A combination of the primary **air barrier material** and the **air barrier components**.

Photo credit: Air Barrier Association of America

What is an Air Barrier System?

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- An AB system is a combination of an **air barrier assembly &** other building components.

Photo credit: Air Barrier Association of America

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ABAA AIR BARRIER SPECIFICATION

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ABAA

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Air Barrier Association of America

Mission: To promote, educate and develop an air barrier specialty trade and industry.

- www.airbarrier.org

- ABAA certifies contractors/installer
- Also Auditors and other AB Professionals
- *ABAA lists materials that meet all criteria and…*
- *ABAA certified contractors should be mandated in the specification.*

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ABAA Performance Standards

Liquid/Fluid Applied Membranes

Air Permeance	ASTM E 2178-03	Standard Test Method for Air Permeance of Building Materials
Water Resistance	AATCC 127 - 03	Water Resistance: Hydrostatic Pressure Test for 5 h
Fastener Sealability	ASTM D 1970-01	Standard Specification for Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection - Section 7.9 Nail Sealability
Pull Adhesion	ASTM D 4541-05	Modified Version of Standard Test Method for Pull-Off Adhesion Strength of Coatings on Concrete using Portable Pull-Off Adhesion Testers– Specify substrates and surface preparation for glass fiber faced gypsum sheathing and concrete block. Declare failure mode.
Crack Bridging	ES-AC 212 OR ASTM C 1305	Acceptance Criteria for Water-Restive Coatings used as Water-Restive Barriers over Exterior Sheating Standard Test Method for Crack Bridging Ability of Liquid Applied Waterproofing Membrane– Report thickness and joint treatment (158° for 2 weeks)
Water Vapor Transmission (at applied thickness)	ASTM E 96-00e1	Standard Test Methods for Water Vapor Transmission of Materials – Water and Desiccant Method

Photo credit: Air Barrier Association of America

Specifications

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- Specifications must be clear, and call out the appropriate test standards.
- Scheduling among the trades must be communicated.
- Involvement of the manufacturers representative should be mandatory.

Air Barrier Specification

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PERFORMANCE REFERENCES

- ASTM E 2178-01: Standard Test for Determining the Air Permeability of Building Materials.
- ASTM E 2357, Specimen 2, Standard Test Method for Determining Air Leakage of Air Barrier Systems **(Full Scale Wall Testing of the Air Barrier System).**
- Air Barrier System must be fully tested and listed at www.airbarriers.org/materials/assemblies_e.php.

Air Barrier Specification…

Submittals PRIOR to Commencing Work

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- **Manufacturer's independent Laboratory Report**
- **Independent documentation**
- **Copies of manufacturers' literature**
- **References**
- **Manufacturers' complete set of standard details for air/vapor retarders**

…AND to the CEO for Plan Review!

Air Barrier Specification

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Pre-installation conference …

- **Specify and discuss AIR BARRIER MEMBRANE AND THE THROUGH WALL FLASHING MEMBRANE PRIOR TO THE PRE-INSTALLATION CONFERENCE.**
- Convene conference four weeks prior to commencing work
- Attendance by the manufacturer's representative along with the installer is mandatory.

Air Barrier Specification…

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Membranes

Liquid air barrier…

One ABAA listed component elastomeric membrane, spray, trowel or brush applied

Air Barrier Specification

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PRIMARY AIR BARRIER…

- Apply by spray or roller
- Exterior Gypsum Sheathing, Plywood or OSB
- **Apply at same rate used to pass ASTM E2357 requirements and as listed by ABAA. (ABAA contractors live by this criteria)**

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Compatibility

Are They Compatible?

AIR BARRIERS & INSULATIONS

FLASHINGS	Spray Polyurethane Foam	Liquid Applied Asphaltic Air Barrier	Liquid Applied Acrylic Air Barrier	Membrane Applied Asphaltic Air Barrier	Polystyrene Foam Insulation	Maximum Warranty
Asphaltic copper fabric						None
Non-asphaltic copper fabric						Lifetime
Copper Drainage Plane						Lifetime
EPDM						10 years
PVC						5 years
PVC KEE Self Adhered						10 years
Peel & Stick						5 years

NOT COMPATIBLE
CAUTION
COMPATIBLE

PERFORMANCE SYSTEMS DEVELOPMENT We Speak Building

Photo credit: Air Barrier Association of America

QUESTIONS

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Energy Code Support

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Questions about the energy code?

Energy Code Support Hotline:

855-757-9717

Energy Code Support Email:

energycodesma@psdconsulting.com

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New Buildings and Major Renovations – Commercial

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- **Incentives for efficiency levels beyond code:**
  - **Whole building incentives**
  - **System incentives including**
    - Air Compressors
    - Chillers
    - Lighting and Lighting Controls
    - Gas-Fired Heating Equipment
    - Variable Speed Drives
    - Custom Measures
    - And more

We also offer incentives and rebates for existing buildings.
Please visit **www.MassSave.com** for the details

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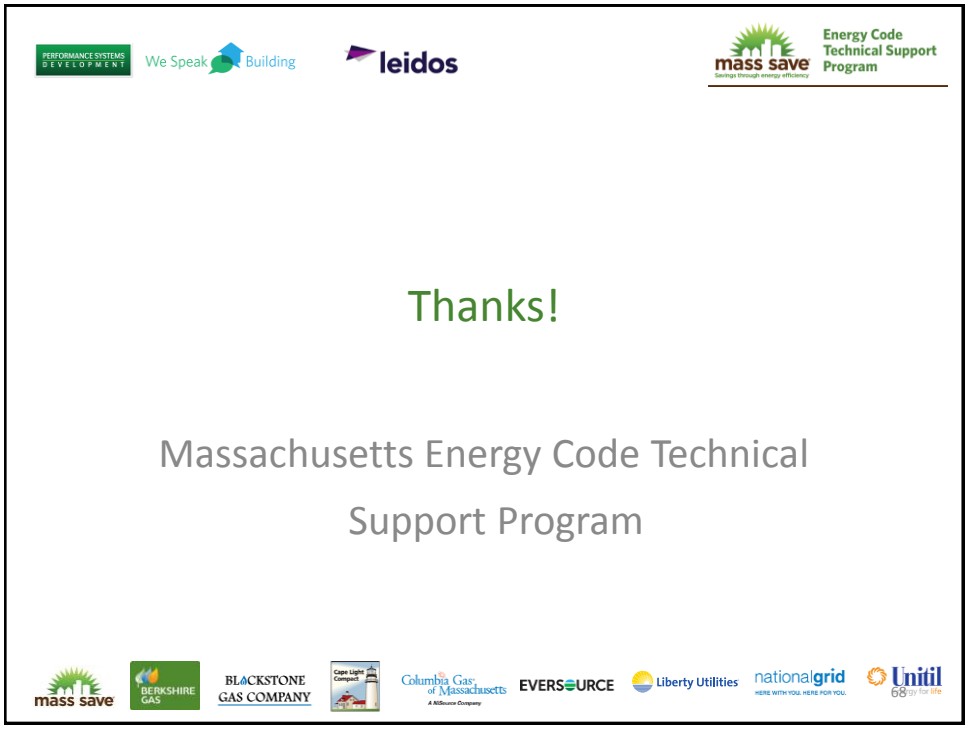
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