Weatherization and its impact on system sizing

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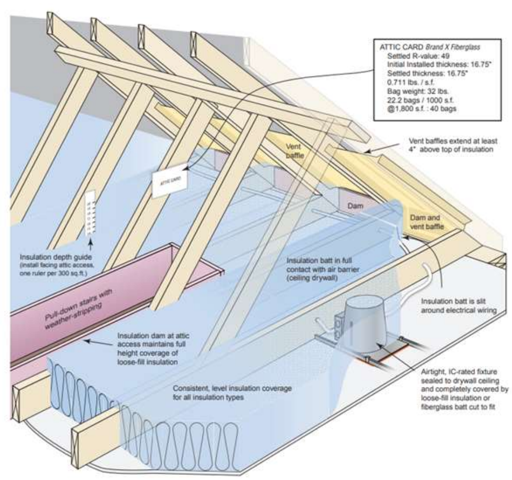
Agenda

- Introduction to Weatherization
  - Defining weatherization
  - Importance of energy efficiency and comfort
- Weatherization Techniques and Benefits
  - Air sealing
  - Insulation methods
  - Where and why, air seal & insulate
  - Duct sealing
  - Window and door upgrades
  - Benefits: cost savings, sustainability, comfort



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Weatherization in the Heat Pump Industry

Definition: Weatherization involves enhancing a building's energy efficiency and comfort by sealing air leaks, adding insulation, and improving ventilation.

Relevance to Heat Pumps: Weatherization is critical for optimizing the performance and efficiency of heat pump systems, contributing to reduced energy consumption and increased comfort.

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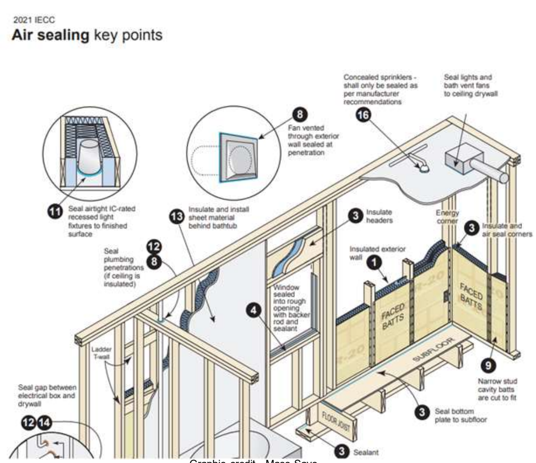
Weatherization Techniques and Benefits for Heat Pump Installers

- Air Sealing
  - Sealing top plates, wire protrusions, chimney chases, and other openings between conditioned space and attic spaces
  - Sealing rim joist in basement/crawlspace
  - Installing 6mm poly-vapor barrier to dirt crawlspace floors
  - Weatherstripping on attic access hatches and exterior doors
  - Sealing plumbing penetrations under kitchen/bathroom sinks



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Insulation – Various types, various benefits

Insulation Type	Description	Pros	Cons
Fiberglass Insulation	Composed of fine glass fibers.	- Cost-effective	- No air sealing properties
		- Easy to install	- Settling over time
Cellulose Insulation	Made from recycled paper products.	- Environmentally friendly	- Settling over time
		- Excellent airflow reduction	- Susceptible to moisture damage
Spray Foam Insulation	Expands to fill gaps and cracks.	- Excellent air sealing	- Higher cost
		- High R-value per inch	- Requires specialized equipment to install
		- Resistant to mold and moisture	- Petroleum based product

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Examples of Where to Insulate

1. In unfinished attic spaces, insulate between and over the floor joists to seal off living spaces below.
   - 1A attic access door
2. In finished attic rooms with or without dormer, insulate...
   - 2A between the studs of "knee" walls;
   - 2B between the studs and rafters of exterior walls and roof;
   - 2C ceilings with cold spaces above;
   - 2D and extend insulation into joist space to reduce air flows.
3. Insulate all exterior walls, including...
   - 3A walls between living spaces and unheated garages, shed roof, or storage areas;
   - 3B foundation walls above ground level;
   - 3C foundation walls in heated basements, full wall either interior or exterior.
4. Insulate floors above cold spaces, such as vented crawl spaces and unheated garages. Also insulate...
   - 4A any portion of the floor in a room that is cantilevered beyond the exterior wall below;
   - 4B slab floors built directly on the ground;
   - 4C as an alternative to floor insulation, foundation walls of unvented crawl spaces;
   - 4D extend insulation into joist space to reduce air flows.
5. Insulate band joists.
6. Caulk and seal around all windows and doors.

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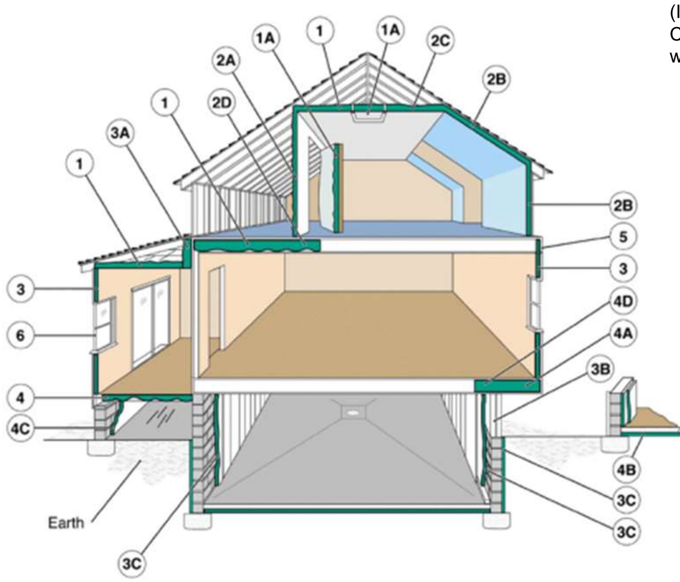

Figure 2.1. Building America research has identified key areas where insulation can improve a home's comfort, durability, and energy efficiency. (Source: 2008b)

(Insulation A Guide for Contractors to Share with Homeowners 2012)

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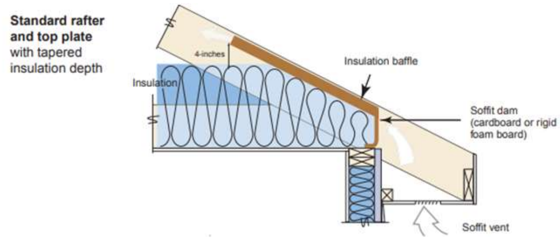
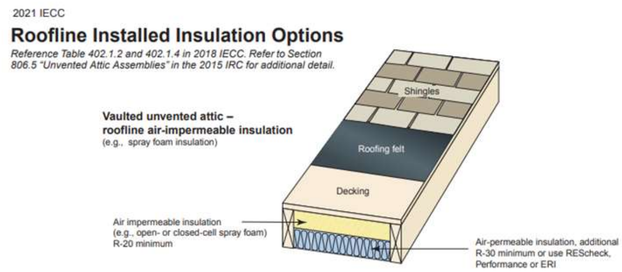
Attic Ventilation

- When insulating an attic floor, it is important to make sure there is an appropriate amount of ventilation
- Ventilation in attics can help to reduce ice dams by keeping the roof deck cooler and wicks moisture out of the attic to prevent condensation on the cold roof deck
- Alternatively, unvented attics with spray foam is also an option. Bring the ductwork "inside"





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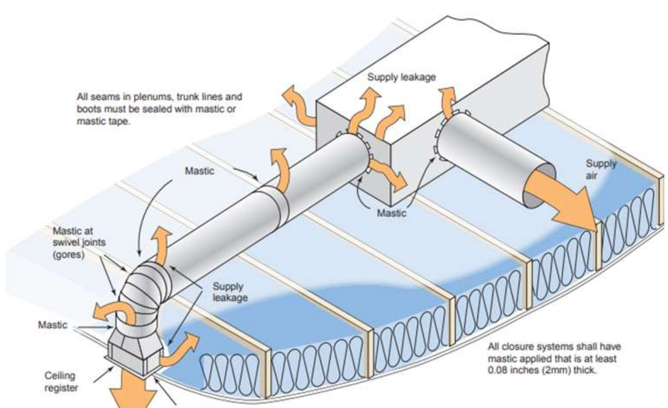
Duct Sealing



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- Duct sealing and duct insulation allow more conditioned air to make it to the targeted locations
- HVAC works less to achieve the same results
- Insulated and sealed ductwork can be 2x more effective at delivering conditioned air to the home
- Whenever possible, ductwork should be installed within conditioned space
- Extra care should be taken to air seal any ductwork penetrations to prevent any air leakage between the attic and the living space

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Key Weatherization Benefits

- Money saved on heating and cooling costs
- Increased comfort by reducing drafts and uneven temperatures
- Reduced home energy consumption
- Reduced home's greenhouse gas emissions
- Reduced heating and cooling load
- Increase in heat pump performance
- Less likely to experience extreme temperature swings from extreme weather

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WEATHERIZATION IS ESPECIALLY IMPORTANT FOR HEAT PUMPS

- Ensuring a home is air-sealed and insulated will help reduce overall energy consumption and set your customers up for clean energy success.
- Proper and thorough weatherization of a home allows for equipment downsizing/smaller equipment
  - Weatherization improvements should always be taken into consideration when sizing a new or replacement HVAC system.

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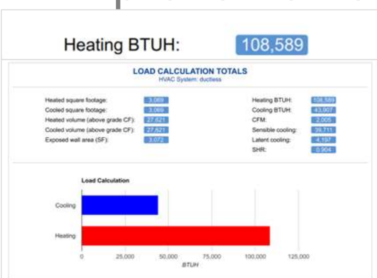
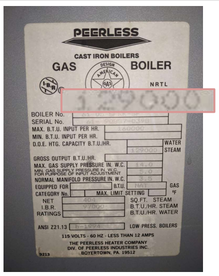
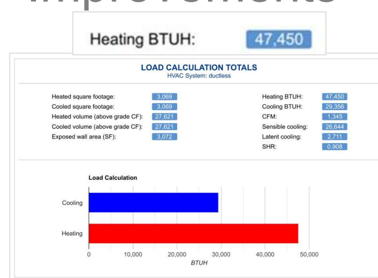
Before Improvements





After Improvements



Heating / Cooling	Outdoor Dry Bulb	Indoor Dry Bulb	Unit	Min	Rated	Max
Cooling	95°F	80°F	Btu/h	16,000	48,000	48,000
			kW	1.3	3.93	3.93
			COP	3.61	3.58	3.58
Cooling	82°F	80°F	Btu/h	12,670	-	48,200
			kW	0.75	-	3.36
			COP	4.95	-	4.2
Heating	47°F	70°F	Btu/h	27,000	54,000	54,000
			kW	1.4	4.22	4.22
			COP	5.65	3.75	3.75
Heating	17°F	70°F	Btu/h	11,620	38,000	54,000
			kW	0.92	4.13	6.87
			COP	3.7	2.7	2.3
Heating	5°F	70°F	Btu/h	8,020	-	54,000
			kW	0.74	-	7.91
			COP	3.18	-	2

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MASS SAVE INCENTIVES & FINANCING

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Program Overview

The Residential Coordinated Delivery (RCD, formerly Home Energy Services/HES) program offers comprehensive resources for homeowners, landlords, and tenants in Massachusetts to improve the efficiency of their homes and buildings

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Mass Save Weatherization Program

A no-cost home energy assessment by a BPI-certified energy auditor, accompanied by free Instant Savings Measures such as low-flow water fixtures, programmable thermostats, and smart power strips

75% - 100% coverage of eligible insulation upgrades and related weatherization measures

- Income-eligible customers can receive up to 100% coverage

No-cost air sealing in accessible attic spaces, crawlspaces, and basements

Access to the 0%-interest HEAT Loan for financing eligible insulation, mechanical, and window upgrades

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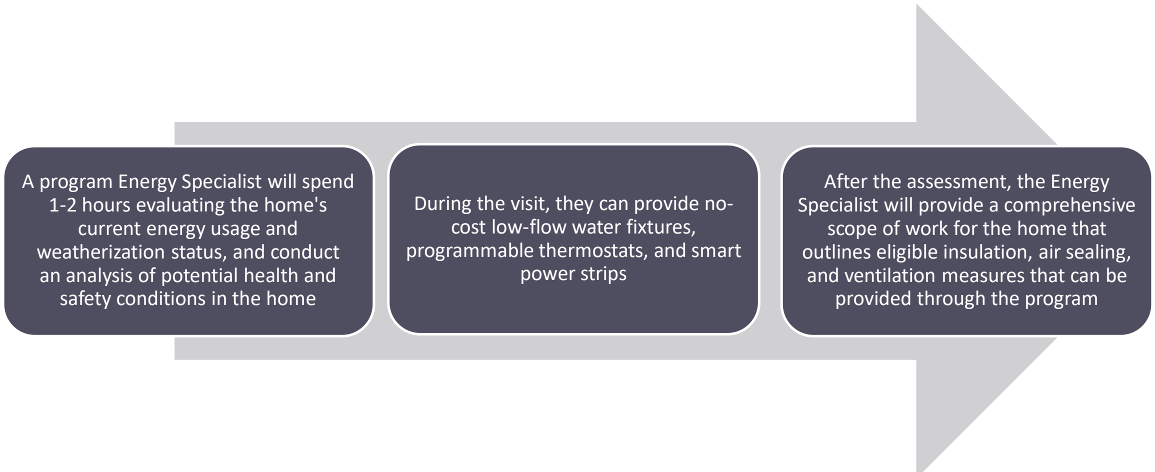
Home Energy Assessment



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Mass Save Weatherization Program

Independent Installation Contractors

If the Energy Auditor identifies eligible weatherization work that can be done in the home, and there are no roadblocks preventing the work from being done, the customer can sign a contract to have an Independent Installation Contractor (IIC) perform the work

The IIC will contact the customer directly to schedule the work

After the work is complete, the project could be subject to program QA/QC to ensure compliance and quality of the work

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Mass Save Weatherization Program

Eligibility Requirements

1-4 family homes and residences or Multi-family properties (5+ units)

→

Homes must be supplied by electricity and/or gas from a program sponsor

- Homes/units with municipal electric service that are not heated with natural gas from a program sponsor do not qualify

→

Any project roadblocks identified by the Energy Specialist must be addressed prior to performing any program-sponsored work

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WEATHERIZATION + WHOLE-HOME HEAT PUMP REQUIREMENT

In order to qualify for whole-home rebates, customer must complete:

- ✓ Virtual or on-site Home Energy Assessment
- ✓ Weatherization recommendations
- ✓ Whole-home heat pump installation form

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WEATHERIZATION + PARTIAL-HOME HEAT PUMP BONUS

$500 Weatherization Bonus

- Weatherization project cost must have exceeded $1,000 and have satisfied all weatherization recommendations made during a Home Energy Assessment
- Bonus form will be provided directly to customers

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Residential HEAT Loan

Up to $50,000* for energy-efficient home upgrades

0% interest for qualifying customers

Participation in the Heat Pump Installer Network required to grant access for heat pump installations

*Limit may vary based on lender. For more information, visit MassSave.com/HEATLoan.

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Mass Save recommendations and measures have a dramatic impact on load.

Insulate Walls

R3 → R12+

Insulate Attic

R13 → R49

Air Sealing

Very leaky house → Average or tight house

Energy Star Windows

U-Factor: 0.75 → 0.29

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What is the heating load?

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Did you guess?

- What info did you need or search for?

ROOM NAME	Area (ft²)	Htg load (Btuh)	Clg load (Btuh)	Htg AVF (cfm)	Clg AVF (cfm)
1st Floor	1580	21348	10017	927	927
2nd Floor	1080	17215	8338	1200	1200
Entire House	2660	38562	18355	2127	2179
Other equip loads		0	0		
Equip. @ 0.91 RSM			16703		
Latent cooling			2142		
TOTALS	2660	38562	18846	2127	2179

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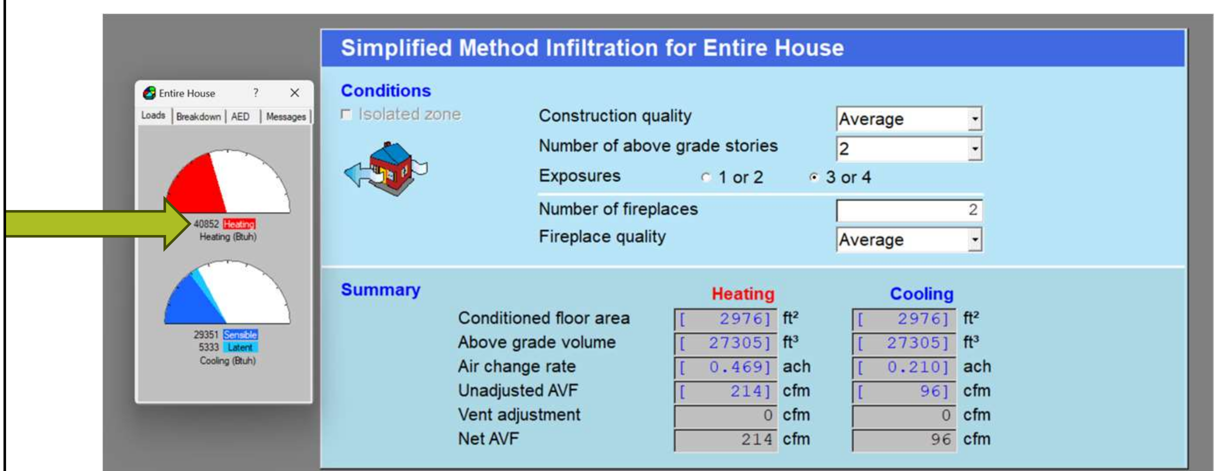
What is the load? Blower door "guestimates"



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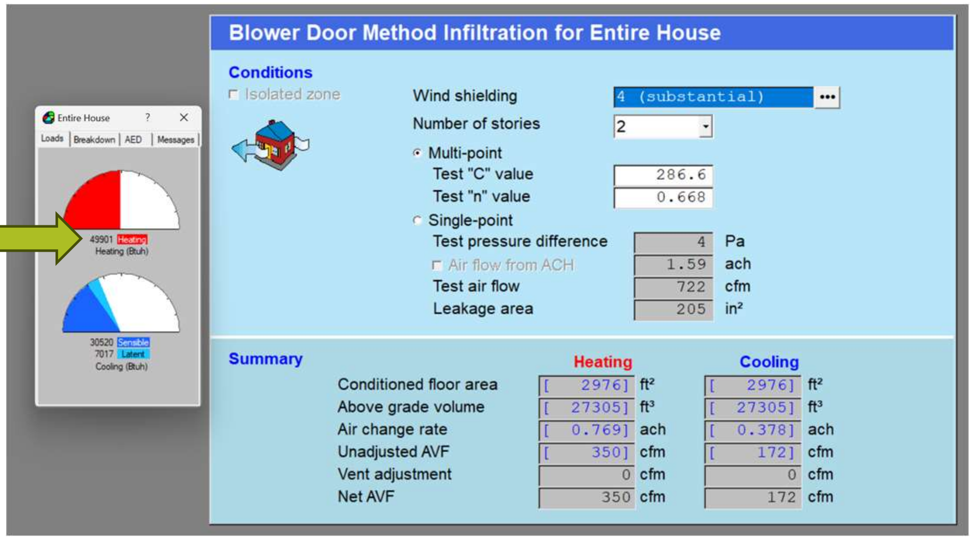
What is the load? Blower door tested



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Other load changes?

Measure	Heat load change in BTU	Existing Load 64,140
New Windows	5,549	New Load 58,591
Add Wall insulation	14,214	New Load 44,377
Add Roof insulation	25,578	New Load 18,799

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Helpful links & Questions?

- Mass Save Weatherization Page
  - https://www.masssave.com/en/residential/programs-and-services/home-energy-assessments/home-energy-assessments
- Mass Save Technical Support Page
  - https://www.masssave.com/trade-partners/energy-code-training-and-technical-support

Thank you!

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