

Third-Party Residential Energy Code Verification

April 25, 2018

Massachusetts Energy Code Technical
Support Program

Who Is Mass Save®?

- Mass Save® is an initiative sponsored by Massachusetts' gas and electric utilities and energy efficiency service providers, including
 - The Berkshire 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.



Presented by:
Performance Systems Development

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Agenda



- Permit Application Requirements
 - Information required on Construction Documentation
- Mass Save Energy Code Checklist
- Third-Party Verification
 - REScheck
 - Simulated Performance Alternative Reports
 - Air Infiltration Reports
 - Ventilation Verification
 - Duct Leakage Reports
 - HERS, ENERGYSTAR & Passive House Reports
- Summary
- Questions

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Prescriptive Compliance

Details required on construction drawings



Construction documents should be drawn up to scale and the following information should be shown on the drawings:

- Envelope insulation R values
- Fenestration U value and SHGC
- Mechanical system design criteria
- Mechanical system sizes, types and efficiencies
- Service water heating systems equipment types, sizing and efficiencies
- Duct sealing, duct and pipe insulation and location
- Air sealing details

Residential New Construction Checklist



LOW-RISE RESIDENTIAL NEW CONSTRUCTION
 Massachusetts Energy Code 9th Edition
 Final Documentation / Inspection Checklist (v 09-26-2017)
 (To be submitted to the Building Department when the Permit is issued)
FOR BBRs REVIEW - Valid through December 31, 2017

Applicant Name: _____ Applicant Phone: _____
 Project Address: _____ Application Date: _____
 Approved by: _____ Approval Date: _____

Indicate which Compliance Path is being used (R401.2)

Path 1 Path 2 Path 3 (Mandatory for Stretch Code)

Path 1. Prescriptive - Sections R401 through R404 (Includes energy system calculations for energy audits as required)

Option A: Fenestration (R401.1.2)	Windows and doors	Skylight	Ceiling	Roof	Mass wall	Floor	Basement wall	Basement floor	Attic	Unfinished wall	Finished wall
U-0.30	U-0.55	R-49	R-20 or R-13.5	R-11	R-13	R-15	R-15	R-10 / 2 R	R-15	R-15	R-19

Option B: Certified ENERGY STAR® Homes, version 3.1 (R401.1.2)
 Must include calculations based on the values in table.

Option C: Total UA alternative (R402.1.5 plus MA amendment R402.1.5.1)
 RISECHECK™ version 4.0.0 or later

Path 2. Simulated Performance Alternative: Section R405 and the provision of sections R401 through R404 labeled "mandatory"
 1. A statement indicating that the proposed design complies with Section R405.2
 2. A statement indicating that the proposed design characteristics of the proposed design, the results for both the standard reference design and the proposed design, and the user inputs to the compliance software to generate the results.
 3. A site-specific energy analysis report.
 4. The name and version of the compliance software used and generating the report.

Path 3. RISENET® RISE Index Score and Approved Alternatives (R406): MANDATORY FOR STRETCH CODE COMPLIANCE
 (To be submitted to the Building Department when the Permit is issued. Send one mailed below.)

A. RISENET® RISE Index Score with MA amendments
 Preliminary rating based on items with Index less than or equal to Table below:

Renewable energy source	Minimum RISE Index Score	
	New	White House
Roof	60	65
Water PHE 0.5 kW, 0% Renewable primary heating system	60	65
Solar PV, 0% Renewable primary heating & water heating system	60	65
Solar PV, 0% Renewable primary heating & water heating system	60	65

B. Certified ENERGY STAR® homes, version 3.1 (R406.1.2) (Must accompany RISENET rating based on table)

C. Certified Passive House or Passive House US performance method (Must accompany RISENET rating based on table)

1. Address of other identification of the residential building. 2. Name and version of the compliance software tool.
 3. Name and version of the compliance software tool. 4. An inspection checklist documenting the building component characteristics of the rated object.

General Mandatory Requirements - APPLIED TO ALL PROJECTS

Water temperature setback control indicated in specifications (R403.2) on page # _____

Mechanical ventilation rate (R403.5): _____ CFM
 Method by whom ventilation rate was calculated (select one):
 1. ENERGY STAR® Homes v3.1
 2. ASHRAE 62.2-2013
 3. MA amendment formal

Equipment sizing calculations submitted (Manual J and Manual S), and efficiency rating indicated in specifications (R403.7)

Solar Ready Zone indicated in construction documents on page # _____ (R403.1 and 102.2) Note: This requirement applies to buildings with a solar ready zone that is intended for more than 75 percent of daylight hours annually.

Less than 500 square feet of roof area is oriented between 110° and 270° of true north.
 Buildings with a solar ready zone that is intended for more than 75 percent of daylight hours annually.

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 Massachusetts Energy Code 9th Edition
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FOR BBRs REVIEW - Valid through December 31, 2017

Applicant Name: _____ Applicant Phone: _____
 Project Address: _____ Application Date: _____
 Approved by: _____ Approval Date: _____

1. Insulation, windows, doors, skylights: One of the following alternatives must be checked

A. Prescriptive (U-0.30, U-0.55, R-49, R-20 or R-13.5, R-11, R-13, R-15, R-15, R-10 / 2 R, R-15, R-19)

B. UA Equivalent
 Insulated materials match values submitted per Path 1B on opposite side of this form. UA equivalent values match RISECHECK™ equivalent.

C. Annual Energy Cost
 Insulated materials match values per Path 2 or opposite side of this form.

D. Energy Rating Index (ERI) and Approved Alternatives (R405)
 (Check one of the following alternatives. All RISE Index per Table below. A.1 and marked "optional" is required from Water.)

Certified ENERGY STAR® Homes, Version 3.1
 Final ENERGY STAR Homes certificate
 Certified ENERGY STAR Homes "optional"

Certified Passive House
 Final Report submitted in compliance with PHD or PHDUS, 2015 Standards stored on Certified Passive House Computer

2. Air barrier - Mandatory (Table R402.4.1)
 Membrane or barrier is properly installed, and connections between components are properly sealed.

3. Air leakage testing - Mandatory (R402.4.1.2)
 Blower door test results received, including and over 2 ACH50.

4. Duct sealing - Mandatory (R403.2) - All ducts, air handlers and filter boxes are sealed

5. Duct leakage and leakage (R403.3 and A1)
 Duct leakage test results received. Exception if all ducts and air handlers are within the building envelope. Leakage test not used. Leakage per 100 sq. ft. of conditioned floor area is equal to or less than 0.3 cfm/100 sq. ft. of conditioned floor area. Leakage test not used. Leakage per 100 sq. ft. of conditioned floor area is equal to or less than 0.3 cfm/100 sq. ft. of conditioned floor area. Leakage test not used. Leakage per 100 sq. ft. of conditioned floor area is equal to or less than 0.3 cfm/100 sq. ft. of conditioned floor area.

6. Duct insulation (R403.3.1)
 Space conditioning ductwork or chilled water ductwork is R-8 or R-4.1 R-5.1 minimum. Space conditioning ductwork in all other areas must be R-4, (R-4.2 if < 3" diameter). Exception: ducts or pipes that are located completely inside the building thermal envelope.

7. Building framing cavities are not used as ducts or plenums - Mandatory (R403.3.6)

8. Hot water boiler outdoor temperature setback - Mandatory (R403.2) - Installation verified

9. Mechanical ventilation - Mandatory (R403.5) or amended
 Blower door test results received, including and over 2 ACH50. Documentation collected from RISENET, RISENET software, or RISENET Professional.


10. Lighting - Mandatory (R404.1)
 Minimum 75% of light fixtures in permanent fixtures must be high-efficiency (i.e., fluorescent or LED) or minimum 75% of light fixtures in permanent fixtures must contain only high-efficiency lamps.

11. Certificate - Mandatory (R401.2)
 Performance certification being provided. Includes Measurement of Factors, duct R-values, blower door and duct leakage test results, and final RISENET Index Score (when applicable), is posted in the space where the heating system is located as a public notice.

Notes: _____

Residential Checklist

Plan Review Application Form


**Energy Code
Technical Support
Program**

Indicate which Compliance Path is being used (R401.2)

Path 1
 Path 2
 Path 3 (Mandatory for Stretch Code)

Path 1. Prescriptive – Sections R401 through R404: Indicate page number in plans/specifications where details are found:

	Windows and doors	Skylight	Ceiling	Wood frame wall	Mass wall	Floor	Basement wall	Slab insulation / depth	Crawlspace wall
<input type="radio"/> Option A: R-value (R402.1.2)	Maximum value				Minimum value				
	U-0.30	U-0.55	R-49	R-20 or R-13+5	R-13 / R-17	R-30	R-15 / R-19	R-10 / 2 ft.	R-15 / R-19
<input type="radio"/> Option B: Equivalent U-factor (R402.1.4): Must include calculations based on R-values in plans.	Maximum value								
	U-0.30	U-0.55	U-0.026	U-0.060	U-0.082	U-0.033	U-0.050	U-0.55 / 2 ft.	U-0.055
<input type="radio"/> Option C: Total UA alternative (R402.1.5 plus MA amendment R402.1.5.1)							<input type="radio"/> REScheck™ version 4.6.0 or later		
							<input type="radio"/> REScheck-Web™		

Path 2. Simulated Performance Alternative: Section R405 and the provision of sections R401 through R404 labeled “mandatory”

Annual energy cost of proposed design not greater than annual energy cost of standard reference home per software calculations submitted by designer.


Attach Compliance Report, which includes:

- Building street address or other building site identification
- A statement indicating that the proposed design complies with Section R405.3
- A site-specific energy analysis report
- The name of the individual performing the analysis and generating the report
- The name and version of the compliance software tool
- An inspection checklist documenting the building component characteristics of the proposed design, the results for both the standard reference design and the proposed design, and the user inputs to the compliance software to generate the results

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Residential Checklist

Plan Review Application Form


**Energy Code
Technical Support
Program**

Path 3. Energy Rating Index (ERI) and Approved Alternatives (R406): MANDATORY FOR STRETCH CODE COMPLIANCE

Submitted documentation prior to issuing building permit. Select one method below.

A. RESNET® HERS Index Score with MA amendments:
Preliminary rating based on plans with Index less than or equal to Table R406.4.1

Renewable energy source	Maximum HERS Index Score	
	New construction	Whole house renovations; additions
None	55	65
Solar PV > 2.5 kW, OR renewable primary heating system	60	70
Solar PV, OR renewable primary heating & solar thermal DHW	62	72
Solar PV & renewable primary heating & solar thermal DHW	67	77

B. Certified ENERGY STAR® homes, version 3.1 (R406.1.2): Attach preliminary HERS rating based on plans.

C. Certified Passive House or Passive House US performance method: Attach list of compliance features, a statement that the estimated specific space heat demand is based on plans, and the following information:

- Address or other identification of the residential building.
- Name of individual completing the compliance report.
- Name and version of the compliance software tool.
- An inspection checklist documenting the building component characteristics of the rated design.

General Mandatory Requirements: APPLIES TO ALL PROJECTS

Boiler temperature setback control indicated in specifications (R403.2) on page # _____

Mechanical ventilation rate (R403.6): _____ CFM

Method by which ventilation rate was calculated (select one):

1. ENERGY STAR® Homes v3.1
 2. ASHRAE 62.2-2013
 3. MA amendment formula

Equipment sizing calculations submitted (Manual J and Manual S), and efficiency rating indicated in specifications (R403.7)


Solar Ready Zone indicated in construction documents on page # _____ (RB103.1 and 103.2) Note: This requirement applies only to new construction of one- and two-family dwellings and townhouses, excluding additions, and has the following exceptions:

- less than 600 square feet of roof area is oriented between 110° and 270° of true north;
- buildings with a permanently installed on-site renewable energy system;
- buildings with a solar-ready zone that is shaded for more than 70 percent of daylight hours annually.

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Residential Checklist

Final Documentation/Inspection Checklist



**Energy Code
Technical Support
Program**

1. Insulation, windows, doors, skylights: One of the following alternatives must be checked									
	Windows and doors	Skylight	Ceiling	Wood frame wall	Mass wall	Floor	Basement wall	Slab R-value / depth	Crawlspace wall
	Maximum value				Minimum value				
<input type="radio"/> A. Prescriptive	U-0.30	U-0.55	R-49	R-20 or R-13+5	R-13 / R-17	R-30	R-15 / R-19	R-10 / 2 ft.	R-15 / R-19
<input type="radio"/> B. UA Equivalent	Installed materials match values submitted per Path 1B on opposite side of this form, OR installed values match REScheck™ submittal								
<input type="radio"/> C. Annual Energy Cost	Installed values match submittal per Path 2 on opposite side of this form.								
<input type="radio"/> D. Energy Rating Index (ERI) and Approved Alternatives: MANDATORY FOR STRETCH CODE COMPLIANCE (One of the following options)									
<input type="radio"/> Certified RESNET® HERS Index Score with MA amendments:	Copy of final rating certificate with HERS Index per Table R406.4.1 and marked "confirmed" is received from Rater								
<input type="radio"/> Certified ENERGY STAR® Homes, Version 3.1:	Following copies are received from Rater: <ul style="list-style-type: none"> • Final ENERGY STAR Homes certificate • Certified HERS Score marked "confirmed" • ENERGY STAR Thermal Enclosure System Checklist signed by Rater 								
<input type="radio"/> Certified Passive House (or PHIUS):	Copy of final report documenting compliance with PHI or PHIUS+ 2015 standards signed by certified Passive House Consultant								

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Residential Checklist

Final Documentation/Inspection Checklist


**Energy Code
Technical Support
Program**

<input type="checkbox"/> 2. Air barrier - Mandatory (Table R402.4.1.1) – Continuous air barrier is properly installed, and connections between components are properly sealed
<input type="checkbox"/> 3. Air leakage testing - Mandatory (R402.4.1.2) – Blower door test results received. Leakage is not over 3 ACH50
<input type="checkbox"/> 4. Duct sealing - Mandatory (R403.3.2) – All ducts, air handlers and filter boxes are sealed
<input type="checkbox"/> 5. Duct testing and leakage (R403.3.3 and .4) – Duct leakage test results received. Exception if all ducts and air handlers are within the building envelope. Leakage is not over 4 cubic ft. per 100 sq. ft. of conditioned floor area. (3 cubic ft. if test was performed at rough-in and without air handler installed) NOTE: Leakage may be higher if house complies using performance path (R406)
<input type="checkbox"/> 6. Duct insulation (R403.3.1) – Space conditioning ductwork in vented attics must be R-8 (or R-6 if <3" diameter). Space conditioning ductwork in all other areas must be R-6. (R-4.2 if <3" diameter.) Exception: ducts or portions thereof located completely inside the building thermal envelope.
<input type="checkbox"/> 7. Building framing cavities are not used as ducts or plenums - Mandatory (R403.3.5)
<input type="checkbox"/> 8. Hot water boiler outdoor temperature setback - Mandatory (R403.2) – Installation verified
<input type="checkbox"/> 9. Mechanical ventilation - Mandatory (R403.6.2 as amended) – Measurement and verification documentation collected from HERS Rater, HERS Inspector, or BPI Certified Professional.
<input type="checkbox"/> 10. Lighting - Mandatory (R404.1) – Minimum 75% of light bulbs in permanent fixtures must be high-efficiency (e.g., fluorescent or LED) or minimum 75% of permanently installed fixtures must contain only high-efficiency lamps.
<input type="checkbox"/> 11. Certificate - Mandatory (R401.3) – Permanent certificate listing insulation R-values, fenestration U-factors, duct R-values, blower door and duct leakage test results, and final HERS Index Score (when applicable), is posted in the space where the heating system is located or a utility room

These mandatory requirements can be performed by a third-party

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Prescriptive, Equivalent U-factor, Total UA Alternative

PRESCRIPTIVE COMPLIANCE PATH

Prescriptive Compliance Path

Indicate which Compliance Path is being used (R401.2)

Path 1
 Path 2
 Path 3 (Mandatory for Stretch Code)

Path 1. Prescriptive – Sections R401 through R404: Indicate page number in plans/specifications where details are found:

	Windows and doors	Skylight	Ceiling	Wood frame wall	Mass wall	Floor	Basement wall	Slab insulation / depth	Crawlspace wall
	Maximum value			Minimum value					
<input type="radio"/> Option A: R-value (R402.1.2)	U-0.30	U-0.55	R-49	R-20 or R-13+5	R-13 / R-17	R-30	R-15 / R-19	R-10 / 2 ft.	R-15 / R-19
	Maximum value								
<input type="radio"/> Option B: Equivalent U-factor (R402.1.4): Must include calculations based on R-values in plans.	U-0.30	U-0.55	U-0.026	U-0.060	U-0.082	U-0.033	U-0.050	U-0.55 / 2 ft.	U-0.055
<input type="radio"/> Option C: Total UA alternative (R402.1.5 plus MA amendment R402.1.5.1)							<input type="radio"/> REScheck™ version 4.6.0 or later		
							<input type="radio"/> REScheck-Web™		



Path 2. Simulated Performance Alternative: Section R405 and the provision of sections R401 through R404 labeled "mandatory"

Annual energy cost of proposed design not greater than annual energy cost of standard reference home per software calculations submitted by designer.

Attach Compliance Report, which includes:

1. Building street address or other building site identification	6. An inspection checklist documenting the building component characteristics of the proposed design, the results for both the standard reference design and the proposed design, and the user inputs to the compliance software to generate the results
2. A statement indicating that the proposed design complies with Section R405.3	
3. A site-specific energy analysis report	
4. The name of the individual performing the analysis and generating the report	
5. The name and version of the compliance software tool	

Total UA Alternative

REScheck

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REScheck
Code Sections

Section N1102.1.5.1: REScheck Version 4.6.2 or later and REScheck – Web are approved software tools for demonstrating UA compliance.

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REScheck

General Information



REScheck Software Version 4.6.5

Compliance Certificate

Project North Meadows Development

Energy Code: **2015 IECC**
 Location: **Boston, Massachusetts**
 Construction Type: **Single-family**
 Project Type: **New Construction**
 Orientation: **Bldg. faces 0 deg. from North**
 Conditioned Floor Area: **2,000 ft²**
 Glazing Area: **15%**
 Climate Zone: **5 (5641 HDD)**
 Permit Date: **3/17/00**
 Permit Number:

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REScheck

Compliance Statement



Compliance: Passes using UA trade-off

Compliance: **0.6% Better Than Code** Maximum UA: **328** Your UA: **326**

The % Better or Worse Than Code Index reflects how close to compliance the house is based on code trade-off rules. It DOES NOT provide an estimate of energy use or cost relative to a minimum-code home.

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REScheck

Envelope Parameters



Envelope Assemblies

Assembly	Gross Area or Perimeter	Cavity R-Value	Cont. R-Value	U-Factor	UA
Ceiling 1: Flat Ceiling or Scissor Truss	729	38.0	0.0	0.030	22
Ceiling 2: Flat Ceiling or Scissor Truss	592	30.0	0.0	0.035	21
Wall 1: Wood Frame, 16" o.c. Orientation: Unspecified	1,647	19.0	6.0	0.043	58
Door 1: Glass Orientation: Unspecified	84			0.310	26
Window 1: Vinyl Frame, Double Pane with Low-E Orientation: Unspecified	204			0.320	65
Door 2: Solid Orientation: Unspecified	20			0.350	7
Wall 2: Wood Frame, 16" o.c. Orientation: Unspecified	276	19.0	0.0	0.060	15
Door 3: Solid Orientation: Unspecified	18			0.350	6
Floor 1: All-Wood Joist/Truss, Over Unconditioned Space	938	21.0	0.0	0.044	41
Floor 2: All-Wood Joist/Truss, Over Outside Air	32	30.0	0.0	0.033	1
Floor 3: Slab-On-Grade:Unheated Insulation depth: 2.0'	82		8.0	0.779	64

Passing REScheck does not mean passing the entire code. Lighting, Mechanical & Mandatory requirements still have to be complied with.

REScheck

Inspection Checklist



REScheck Software Version 4.6.5
Inspection Checklist
 Energy Code: 2015 IECC

Requirements: 5.0% were addressed directly in the REScheck software

Text in the "Comments/Assumptions" column is provided by the user in the REScheck Requirements screen. For each requirement, the user certifies that a code requirement will be met and how that is documented, or that an exception is being claimed. Where compliance is itemized in a separate table, a reference to that table is provided.

Section # & Req. ID	Pre-Inspection/Plan Review	Plans Verified Value	Field Verified Value	Complies?	Comments/Assumptions
103.1, 103.2 [PR1]	Construction drawings and documentation demonstrate energy code compliance for the building envelope. Thermal envelope represented on construction documents.			<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	
103.1, 103.2, 403.7 [PR3]	Construction drawings and documentation demonstrate energy code compliance for lighting and mechanical systems. Systems serving multiple dwelling units must demonstrate compliance with the IECC Commercial Provisions.			<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	
302.1, 403.7 [PR2]	Heating and cooling equipment is sized per ACCA Manual S based on loads calculated per ACCA Manual J or other methods approved by the code official.	Heating: Btu/hr _____ Cooling: Btu/hr _____	Heating: Btu/hr _____ Cooling: Btu/hr _____	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	

1 High Impact (Tier 1) 2 Medium Impact (Tier 2) 3 Low Impact (Tier 3)

SIMULATION VERIFICATION REPORT

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Simulated Performance Alternative

Code Sections

IECC Section R405.4: Some of the documentation requirements are:

- Compliance software used
- For permit application
 - Building identification
 - Statement saying the proposed design complies with Performance Method
 - Site-specific energy analysis report
 - Name of the individual performing the analysis
- The code official can also ask for reference building design characteristics & documentation of actual values used in the software calculations for proposed design.

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Simulated Performance Alternative



Indicate which Compliance Path is being used (R401.2)

Path 1
 Path 2
 Path 3 (Mandatory for Stretch Code)

Path 1. Prescriptive – Sections R401 through R404: Indicate page number in plans/specifications where details are found:

	Windows and doors	Skylight	Ceiling	Wood frame wall	Mass wall	Floor	Basement wall	Slab insulation / depth	Crawlspace wall
<input type="radio"/> Option A: R-value (R402.1.2)	Maximum value			Minimum value					
	U-0.30	U-0.55	R-49	R-20 or R-13+5	R-13 / R-17	R-30	R-15 / R-19	R-10 / 2 ft.	R-15 / R-19
<input type="radio"/> Option B: Equivalent U-factor (R402.1.4): Must include calculations based on R-values in plans.	Maximum value								
	U-0.30	U-0.55	U-0.026	U-0.060	U-0.082	U-0.033	U-0.050	U-0.55 / 2 ft.	U-0.055
<input type="radio"/> Option C: Total UA alternative (R402.1.5 plus MA amendment R402.1.5.1)							<input type="radio"/> REScheck™ version 4.6.0 or later		
							<input type="radio"/> REScheck-Web™		

Path 2. Simulated Performance Alternative: Section R405 and the provision of sections R401 through R404 labeled "mandatory"

Annual energy cost of proposed design not greater than annual energy cost of standard reference home per software calculations submitted by designer.

Attach Compliance Report, which includes:

1. Building street address or other building site identification
2. A statement indicating that the proposed design complies with Section R405.3
3. A site-specific energy analysis report
4. The name of the individual performing the analysis and generating the report
5. The name and version of the compliance software tool
6. An inspection checklist documenting the building component characteristics of the proposed design, the results for both the standard reference design and the proposed design, and the user inputs to the compliance software to generate the results

Simulated Performance Alternative



2015 IECC Energy Cost Compliance

Property Excel Builder 123 Main Street Swansea, MA 02777	Organization Mass Save Raters 781-555-0382 Rakesh Koti	HERS Confirmed 2018-02-02 Rating No:MassSaveEX005 Rater ID:1863955
Weather: How Bedford AP, MA Mass Save Example Mass Save Sample 2.blg	Builder Excel Builder	

Annual Energy Cost	\$/yr	
	2015 IECC	As Designed
Heating	1943	2045
Cooling	279	197
Water Heating	752	722
SubTotal - Used to Determine Compliance	2974	2964
Lights & Appliances	1356	1249
Photovoltaics	-0	-0
Service Charge	0	0
Total	4330	4213

Mandatory Requirements

Annual Energy Cost Check	PASSES
Duct Insulation R-Value Check (per Section 405.2)	PASSES
Window U-Value and SHGC Check (per Section 402.5)	PASSES
Home Infiltration (Section 402.4.1)	PASSES
Duct Testing (Section 403.3.3)	PASSES
Mechanical Ventilation (Section 403.6)	PASSES
Mechanical Ventilation Fan Efficacy (Section 403.6.1)	PASSES
Mandatory Requirements Check Box (2015 IECC)	PASSES

This home MEETS the annual energy cost requirements of Section 405 of the 2015 International Energy Conservation Code based on a climate zone of 5A. In fact, this home surpasses the requirements by 0.3%.

Name Rakesh Koti	Signature
Organization Mass Save Raters	Date 4 April 2018

Simulated Performance Alternative



Annual Energy Cost

	\$/yr	
	2015 IECC	As Designed
Heating	1943	2045
Cooling	279	197
Water Heating	752	722
SubTotal - Used to Determine Compliance	2974	2964
Lights & Appliances	1356	1249
Photovoltaics	-0	-0
Service Charge	0	0
Total	4330	4213

Simulated Performance Alternative



Mandatory Requirements

Annual Energy Cost Check	PASSES
Duct Insulation R-Value Check (per Section 405.2)	PASSES
Window U-Value and SHGC Check (per Section 402.5)	PASSES
Home Infiltration (Section 402.4.1)	PASSES
Duct Testing (Section 403.3.3)	PASSES
Mechanical Ventilation (Section 403.6)	PASSES
Mechanical Ventilation Fan Efficacy (Section 403.6.1)	PASSES
Mandatory Requirements Check Box (2015 IECC)	PASSES

This home **MEETS** the annual energy cost requirements of Section 405 of the 2015 International Energy Conservation Code based on a climate zone of 5A. In fact, this home surpasses the requirements by 0.3%.

Name | Rakesh Koti
 Organization | Mass Save Raters

Signature |
 Date | 4 April 2018

These have to be verified!

Simulated Performance Alternative

Building Component Report



Building Summary

2015 IECC Reference

Property Excel Builder 123 Main Street Swansea, MA 02777	Organization Mass Save Raters 781-555-8282 Rakesh Koti	HERS Confirmed 2018-02-02 Rating No.:MassSaveEx005 Rater ID:1863955
Weather: New Bedford AP, MA Mass Save Example Mass Save Sample 2.blg	Builder Excel Builder	

General Building Information

Area of Conditioned. Space(sq ft)	2533
Volume of Conditioned. Space	23523
Year Built	2017
Housing Type	Single-family detached
Level Type(Apartments Only)	None
Floors on or Above-Grade	2
Number of Bedrooms	4
Foundation Type	Unconditioned basement
Enclosed Crawl Space Type	N/A
Number of Stories Including Conditioned Basement	2
Thermal Boundary Location	REM Default



AIR INFILTRATION REPORT

Envelope Air Leakage Verification Form – Code Sections



IECC R402.4.1.2: The code official can require the testing to be conducted by an approved third party. A signed report should be submitted by the third-party.

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Envelope Air Leakage Verification Form



<input type="checkbox"/>	2. Air barrier - Mandatory (Table R402.4.1.1) – Continuous air barrier is properly installed, and connections between components are properly sealed
<input type="checkbox"/>	3. Air leakage testing - Mandatory (R402.4.1.2) – Blower door test results received. Leakage is not over 3 ACH50 ←
<input type="checkbox"/>	4. Duct sealing - Mandatory (R403.3.2) – All ducts, air handlers and filter boxes are sealed
<input type="checkbox"/>	5. Duct testing and leakage (R403.3.3 and .4) – Duct leakage test results received. Exception if all ducts and air handlers are within the building envelope. Leakage is not over 4 cubic ft. per 100 sq. ft. of conditioned floor area. (3 cubic ft. if test was performed at rough-in and without air handler installed) NOTE: Leakage may be higher if house complies using performance path (R406)
<input type="checkbox"/>	6. Duct insulation (R403.3.1) – Space conditioning ductwork in vented attics must be R-8 (or R-6 if <3" diameter). Space conditioning ductwork in all other areas must be R-6. (R-4.2 if <3" diameter.) <u>Exception: ducts or portions thereof located completely inside the building thermal envelope.</u>
<input type="checkbox"/>	7. Building framing cavities are not used as ducts or plenums - Mandatory (R403.3.5)
<input type="checkbox"/>	8. Hot water boiler outdoor temperature setback - Mandatory (R403.2) – Installation verified
<input type="checkbox"/>	9. Mechanical ventilation - Mandatory (R403.6.2 as amended) – Measurement and verification documentation collected from HERS Rater, HERS Inspector, or BPI Certified Professional.
<input type="checkbox"/>	10. Lighting - Mandatory (R404.1) – Minimum 75% of light bulbs in permanent fixtures must be high-efficiency (e.g., fluorescent or LED) or minimum 75% of permanently installed fixtures must contain only high-efficiency lamps.
<input type="checkbox"/>	11. Certificate - Mandatory (R401.3) – Permanent certificate listing insulation R-values, fenestration U-factors, duct R-values, blower door and duct leakage test results, and final HERS Index Score (when applicable), is posted in the space where the heating system is located or a utility room

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Energy Code Technical Support Program
Savings through energy efficiency




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Energy Code Technical Support Program
Savings through energy efficiency

Envelope Air Leakage Verification Form

Your Municipality or Company Letterhead Here

Residential Envelope Air Leakage Verification Form

Project Address: _____ Permit #: _____
 Builder/Owner: _____ Builder/Owner Phone Number: _____

Testing has been done in accordance with ASTM E 779 and reported at a pressure of 0.2-inch w.g. (50 Pascals)

Conditioned floor area: _____ ft²
 Average ceiling height: _____ ft
 Volume of conditioned space: _____ ft³
 Blower door test result: _____ CFM50

Show CFM50 to ACH50 conversion:

ACH50 = CFM50 x 60 / conditioned volume

_____ CFM50 x 60 / _____ ft³ = _____ ACH50

Pass Fail

Testing company name: _____ Test date: _____

A blower door test has been performed for the location above, and the building envelope air leakage was measured to be under the maximum leakage rate as outlined in the 2015 International Energy Conservation Code/Chapter 11 of the 2015 International Residential Code.

Signature: _____ Date: _____

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Envelope Air Leakage Verification Form



Residential Envelope Air Leakage Verification Form

Project Address: _____ Permit #: _____

Builder/Owner: _____ Builder/Owner Phone Number: _____

Testing has been done in accordance with ASTM E 779 and reported at a pressure of 0.2-inch w.g (50 Pascals)

Envelope Air Leakage Verification Form



Conditioned floor area: _____ ft²

Average ceiling height: _____ ft

Volume of conditioned space: _____ ft³

Blower door test result: _____ CFM50

Show CFM50 to ACH50 conversion:

$$ACH50 = CFM50 \times 60 / \text{conditioned volume}$$

$$_____ CFM50 \times 60 / _____ \text{ ft}^3 = _____ ACH50$$

Pass

Fail

Envelope Air Leakage Verification Form



Testing company name: _____ Test date: _____

A blower door test has been performed has been performed for the location above, and the building envelope air leakage was measured to be under the maximum leakage rate as outlined in the 2015 International Energy Conservation Code/Chapter 11 of the 2015 International Residential Code.

Signature: _____ Date: _____



VENTILATION VERIFICATION

Mechanical Ventilation Verification

Code Sections



Section N1103.6.2 (R403.6.2): Installed performance of the mechanical ventilation system shall be tested by

- HERS Rater
 - HERS Field Inspector
 - BPI Certified Professional
- in accordance with either RESNET Chapter 8 or ACCA Standard 5.

Mechanical Ventilation Verification



LOW-RISE RESIDENTIAL NEW CONSTRUCTION
 Massachusetts Energy Code v3 Edition
 Plan Review Application Form (v 09-25-2017)
(To be submitted by Applicant and approved by Code Official before Building Permit is issued)
FOR BIDS REVIEW - Valid through December 31, 2017

Applicant Name: _____ Applicant Phone: _____
 Project Address: _____ Application Date: _____
 Approved By: _____ Approval Date: _____

Indicate which Compliance Path is being used (R401.2)
 Path 1 Path 2 Path 3 (Mandatory for Stretch Code)

This is not the final ventilation rate. It is the design rate.

General Mandatory Requirements: APPLIES TO ALL PROJECTS

Boiler temperature setback control indicated in specifications (R403.2) on page # _____

Mechanical ventilation rate (R403.6): _____ CFM
 Method by which ventilation rate was calculated (select one):
 1. ENERGY STAR® Homes v3.1
 2. ASHRAE 62.2-2013
 3. MA amendment formula

Equipment sizing calculations submitted (Manual J and Manual S), and efficiency rating indicated in specifications (R403.7)

Solar Ready Zone indicated in construction documents on page # _____ (RB103.1 and 103.2) Note: This requirement applies only to new construction of one- and two-family dwellings and townhouses, excluding additions, and has the following exceptions:

1. less than 600 square feet of roof area is oriented between 110° and 270° of true north;
 2. buildings with a permanently installed on-site renewable energy system;
 3. buildings with a solar-ready zone that is shaded for more than 70 percent of daylight hours annually.

Mechanical ventilation system shall be tested and verified by

- HERS Rater
- HERS Field Inspector
- BPI Certified Professional

Solar PV v3.0 (w/ on-site renewable primary heating system)	60	70
Solar PV (w/ on-site renewable primary heating & solar thermal tank)	62	72
Solar PV v3.0 (w/ on-site renewable primary heating & solar thermal tank)	67	77

B. Certified ENERGY STAR® homes, version 3.1 (MAE v3.1) - **Passive House (PH) or Passive House (PH) with solar-ready zone**
(To be submitted by Applicant and approved by Code Official before Building Permit is issued)

C. Certified Passive House or Passive House US performance method
(To be submitted by Applicant and approved by Code Official before Building Permit is issued)

1. Address or other identification of the residential building. 3. Name and version of the compliance software tool.
 2. Name of individual completing the compliance report. 4. An inspection checklist documenting the building component characteristics of the rated design.

General Mandatory Requirements: APPLIES TO ALL PROJECTS

Boiler temperature setback control indicated in specifications (R403.2) on page # _____

Mechanical ventilation rate (R403.6): _____ CFM
 Method by which ventilation rate was calculated (select one):
 1. ENERGY STAR® Homes v3.1
 2. ASHRAE 62.2-2013
 3. MA amendment formula

Equipment sizing calculations submitted (Manual J and Manual S), and efficiency rating indicated in specifications (R403.7)

Solar Ready Zone indicated in construction documents on page # _____ (RB103.1 and 103.2) Note: This requirement applies only to new construction of one- and two-family dwellings and townhouses, excluding additions, and has the following exceptions:

1. less than 600 square feet of roof area is oriented between 110° and 270° of true north;
 2. buildings with a permanently installed on-site renewable energy system;
 3. buildings with a solar-ready zone that is shaded for more than 70 percent of daylight hours annually.

DUCT LEAKAGE VERIFICATION FORM

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Duct Leakage Verification

Code Sections

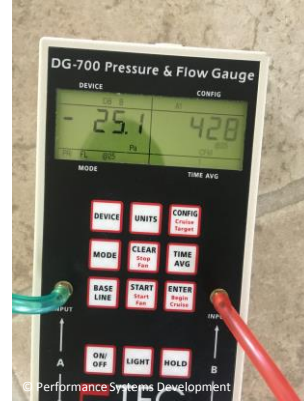
Section N1103.3.3 (R403.3.3): Post-construction or rough-in testing and verification should be done by

- HERS Rater, or
- HERS Field Inspector, or
- BPI Certified Professional

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basc.pnnl.gov



© Performance Systems Development

Total duct leakage
CFM₂₅

Duct Leakage Verification

Duct leakage test result:

Square footage of conditioned floor area served by HVAC system: _____ ft²

Tested leakage rate: _____ cfm₂₅

Formula: (cfm₂₅/ft² of conditioned floor area served) x 100 = Duct Leakage Result

_____ cfm₂₅ / _____ ft² of conditioned floor area x 100 = _____ cfm per 100 ft² @25 Pa

Pass Fail

Testing company name: _____ Test date: _____

A duct leakage test has been performed on the HVAC system for the location above, and the duct system meets the minimum leakage requirements outlined in the 2015 International Energy Conservation Code.

Signature: _____ Date: _____

Find a certified professional:

<http://www.nehers.org/find-hers-rater>

<http://www.bpihomeowner.org/find-a-contractor>

<http://www.bpihomeowner.org/find-a-contractor>

HERS Index Requirement, Projected Rating Report, Confirmed Rating Report

HERS CERTIFICATE

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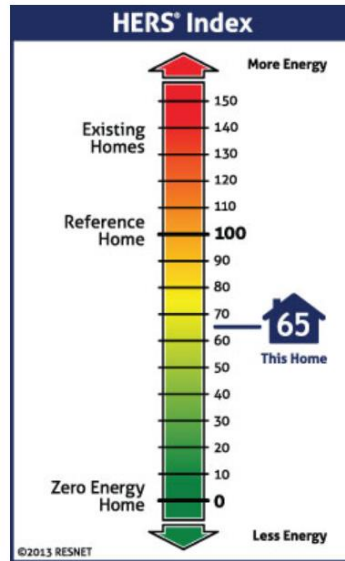
Who is a Rater?

Certified rater completes RESNET Rater training provided by a RESNET certified organization. The course is about:

- Building Science principles
- Blower door and duct leakage testing procedures
- Other on-site inspection processes
- Completing a Home Energy Rating
- Pass the RESNET Rater Test.

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What is a HERS Index?



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RESNET HERS

Code Sections

- **IECC Section R406.6:** Some of the documentation requirements are:
 - Building identification
 - Checklist documenting building characteristics of the rated building
 - Name of the individual performing the analysis
 - Compliance tool/software used with version
 - The code official can also ask for ERI reference building design characteristics & documentation of actual values used in the software calculations for proposed design.

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RESNET HERS— Projected Rating


Energy Code Technical Support Program

Home Energy Rating Certificate

Property
 Mass Builder: 123 Main Street, Swansea, MA 02777
HERS
 Rating Type: Projected Rating
 Rating Date: 6/2/17
 Registry ID: 518686332
 Certified Energy Rater: Ethan MacCormick
 Rating Number: MassSaveDemo

Projected Rating: Based on Plans - Field Confirmation Required.

HERS Index: 58

General Information			
Conditioned Area	2533 sq. ft.	House Type	Single-family detached
Conditioned Volume	23523 cubic ft.	Foundation	Unconditioned basement
Bedrooms	4		

Mechanical Systems Features			
Heating:	Fuel-fired air distribution, Propane, 95.0 AFUE.		
Heating:	Fuel-fired air distribution, Propane, 95.0 AFUE.		
Cooling:	Air conditioner, Electric, 16.0 SEER.		
Duct Leakage to Outside	94.00 CFM25.		
Ventilation System	Exhaust Only: 62 cfm, 20.0 watts.		
Programmable Thermostat	Heat=Yes; Cool=Yes		

Building Shell Features			
Coiling Flat	R-48.0	Slab	None
Sealed Attic	NA	Exposed Floor	R-30.0
Vaulted Ceiling	NA	Window Type	U-Value: 0.300, SHGC: 0.190
Above Grade Walls	R-21.0	Infiltration Rate	Htg: 1163 Clg: 1163 CFM50
Foundation Walls	R-0.0	Method	Blower door test

Lights and Appliance Features			
Percent Interior Lighting	100.00	Range/Oven Fuel	Propane
Percent Garage Lighting	100.00	Clothes Dryer Fuel	Electric
Refrigerator (kWh/yr)	717	Clothes Dryer CEF	3.42
Dishwasher (kWh/yr)	260	Ceiling Fan (cfm/Watt)	0.00

Estimated Annual Energy Cost			
Use	MMBtu	Cost	Percent
Heating	53.6	\$1762	50%
Cooling	1.9	\$112	3%
Hot Water	12.2	\$387	11%
Lights/Appliances	22.8	\$1254	36%
Photovoltaics	-0.0	\$-0	-0%
Service Charges		\$0	0%
Total	90.5	\$3515	100%

Criteria

This home meets or exceeds the minimum criteria for the following: Massachusetts Stretch Energy Code*


* Compliance is determined by the rater.

Performance Systems Dev
 124 Brindley St
 Ithaca, NY 14850
 607-277-6240

REM/Rate - Residential Energy Analysis and Rating Software v15.5
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 The Home Energy Rating Standard Disclosure for this home is available from the rating provider.

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RESNET HERS— Confirmed Rating


Energy Code Technical Support Program

Home Energy Rating Certificate

Property
 Mass Builder: 123 Main Street, Swansea, MA 02777
HERS
 Rating Type: Confirmed
 Rating Date: 6/2/17
 Registry ID: 518686332
 Certified Energy Rater: Ethan MacCormick
 Rating Number: MassSaveDemo

HERS Index: 58

General Information			
Conditioned Area	2533 sq. ft.	House Type	Single-family detached
Conditioned Volume	23523 cubic ft.	Foundation	Unconditioned basement
Bedrooms	4		

Mechanical Systems Features			
Heating:	Fuel-fired air distribution, Propane, 95.0 AFUE.		
Heating:	Fuel-fired air distribution, Propane, 95.0 AFUE.		
Cooling:	Air conditioner, Electric, 16.0 SEER.		
Duct Leakage to Outside	94.00 CFM25.		
Ventilation System	Exhaust Only: 62 cfm, 20.0 watts.		
Programmable Thermostat	Heat=Yes; Cool=Yes		

Building Shell Features			
Coiling Flat	R-48.0	Slab	None
Sealed Attic	NA	Exposed Floor	R-30.0
Vaulted Ceiling	NA	Window Type	U-Value: 0.300, SHGC: 0.190
Above Grade Walls	R-21.0	Infiltration Rate	Htg: 1163 Clg: 1163 CFM50
Foundation Walls	R-0.0	Method	Blower door test

Lights and Appliance Features			
Percent Interior Lighting	100.00	Range/Oven Fuel	Propane
Percent Garage Lighting	100.00	Clothes Dryer Fuel	Electric
Refrigerator (kWh/yr)	717	Clothes Dryer CEF	3.42
Dishwasher (kWh/yr)	260	Ceiling Fan (cfm/Watt)	0.00

Estimated Annual Energy Cost			
Use	MMBtu	Cost	Percent
Heating	53.6	\$1762	50%
Cooling	1.9	\$112	3%
Hot Water	12.2	\$387	11%
Lights/Appliances	22.8	\$1254	36%
Photovoltaics	-0.0	\$-0	-0%
Service Charges		\$0	0%
Total	90.5	\$3515	100%

Criteria

This home meets or exceeds the minimum criteria for the following: Massachusetts Stretch Energy Code*

* Compliance is determined by the rater.

Performance Systems Dev
 124 Brindley St
 Ithaca, NY 14850
 607-277-6240

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 The Home Energy Rating Standard Disclosure for this home is available from the rating provider.

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RESNET HERS– Confirmed Rating

General Information



Property	HERS			
Mass Builder	Rating Type:	Confirmed	Certified Energy Rater:	Ethan MacCormick
123 Main Street	Rating Date:	6/2/17	Rating Number:	MassSaveDemo
Swansea, MA 02777	Registry ID:	518686332		

HERS Index: 58

General Information

Conditioned Area	2533 sq. ft.	House Type	Single-family detached
Conditioned Volume	23523 cubic ft.	Foundation	Unconditioned basement
Bedrooms	4		

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RESNET HERS– Confirmed Rating

Mechanical Systems & Building Shell Features



Mechanical Systems Features

Heating:	Fuel-fired air distribution, Propane, 95.0 AFUE.
Heating:	Fuel-fired air distribution, Propane, 95.0 AFUE.
Cooling:	Air conditioner, Electric, 16.0 SEER.
Duct Leakage to Outside	94.00 CFM25.
Ventilation System	Exhaust Only: 62 cfm, 20.0 watts.
Programmable Thermostat	Heat=Yes; Cool=Yes

Building Shell Features

Ceiling Flat	R-48.0	Slab	None
Sealed Attic	NA	Exposed Floor	R-30.0
Vaulted Ceiling	NA	Window Type	U-Value: 0.300, SHGC: 0.190
Above Grade Walls	R-21.0	Infiltration Rate	Htg: 1163 Clg: 1163 CFM50
Foundation Walls	R-0.0	Method	Blower door test

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RESNET HERS– Confirmed Rating

Annual Energy Cost & Criteria



Estimated Annual Energy Cost			
Use	MMBtu	Cost	Percent
Heating	53.6	\$1762	50%
Cooling	1.9	\$112	3%
Hot Water	12.2	\$387	11%
Lights/Appliances	22.8	\$1254	36%
Photovoltaics	-0.0	\$-0	-0%
Service Charges		\$0	0%
Total	90.5	\$3515	100%

Criteria
This home meets or exceeds the minimum criteria for the following: Massachusetts Stretch Energy Code*
* Compliance is determined by the rater.

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Projected Rating Report & Confirmed Rating Report

ENERGYSTAR V.3.1

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What is ENERGYSTAR ?



ENERGYSTAR is a label certifies that a home has undergone testing and verification to meet requirements set by US EPA. It is a voluntary certification.

Requirements can be found here:

<https://www.energystar.gov/newhomes>

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ENERGYSTAR v. 3.1

Code Sections



- Prior to issuance of the permit
 - Copy of preliminary HERS rating based on plans
 - Copy of ENERGYSTAR v.3.1 Home Report
 - Copy of Rater Design Review Checklist
- Prior to issuance of CO
 - Copy of certified HERS rating
 - Copy of signed ENERGY STAR Rater Field Checklist

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ENERGYSTAR v. 3.1 – Projected Rating



ENERGY STAR v3.1 Home Report

Property: Mass Builder, 123 Main Street, Swansia, MA 02777
 Organization: Mass Save Rater Corp, 781-555-8202, Ethan MacCormick
 HERS: Projected Rating 6/2/17, Rating Ho:MassSaveDemo, Rater ID:1863925
 Weather: Slow Bedford AP, MA, Sharp's Lot Rd, Mass Save, Swansia 02777
 Builder: MA Builder

Projected Rating: Based on Plans - Field Confirmation Required.

	ENERGY STAR	As Designed
Heating	21.0	29.6
Cooling	9.8	5.6
Water Heating	12.5	3.8
Lights and Appliances	25.7	22.8
Total	69.0	61.8

HERS Index of Reference Design Home: 65
 HERS Index Target: 65
 HERS Index w/o PV: 58
 HERS Index: 58

ENERGY STAR v3.1 Mandatory Requirements

- Duct leakage at post construction better than or equal to ENERGY STAR v3.1 requirements.
- Envelope insulation levels meet or exceed ENERGY STAR v3.1 requirements.
- Slab on Grade Insulation must be R-5, and at IECC 2009 Depth for Climate Zones 4 and above.
- Envelope Insulation achieves RESNET Grade I Installation, or Grade II with insulated sheathing.
- Windows meet the 2009 IECC Requirements - Table 402.1.1.
- Duct Insulation meets the EPA minimum requirements of R-6.
- Mechanical ventilation system is installed in the home.
- ENERGY STAR Checklists fully verified and complete.

This home **MEETS** or **EXCEEDS** the energy efficiency requirements for designation as an EPA ENERGY STAR Version 3.1 Qualified Home.
 HERS Index w/o PV <= HERS Index of Reference Design Home AND HERS Index <= HERS Index Target to comply.

Pollution Prevented	Reduction	Energy Cost Savings	\$/yr
Type of Emissions		Heating	814
Carbon Dioxide (CO2) - tons/yr	4.0	Cooling	147
Sulfur Dioxide (SO2) - lbs/yr	4.4	Water Heating	127
Nitrogen Oxides (NOx) - lbs/yr	8.0	Lights & Appliances	486
		Total	1774

The energy cost savings and pollution prevented are calculated by comparing the Rated Home to the Reference Home as defined in the Mortgage Industry National Home Energy Rating Systems Standards as promulgated by the Residential Energy Services Network (RESNET). In accordance with these guidelines, building inputs affecting setbacks, infiltration rates, window shading and the existence of mechanical systems may have been changed prior to calculating loads.

REM/Rate - Residential Energy Analysis and Rating Software v15.5
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ENERGYSTAR v. 3.1 Rater Design Review Checklist



Rater Design Review Checklist

ENERGY STAR Certified Homes, Version 3 / 3.1 (Rev. 08)

Home Address: _____ City: _____ State: _____ Permit Date: _____

	Must Correct	Rater 1 Verified
1. Partnership Status		
1.1 Rater has verified that builder is an ENERGY STAR partner using energystar.gov/partnerlocator	<input type="checkbox"/>	<input type="checkbox"/>
1.2 Rater has verified that HVAC contractor holds credential required to complete the HVAC Commissioning Checklist, unless all equipment to be installed in home to be certified is an exempted type, in which case check "N/A" <input type="checkbox"/> N/A HVAC Contractor Company Name: _____	<input type="checkbox"/>	<input type="checkbox"/>
2. High-Performance Fenestration		
2.1 Specified fenestration meets or exceeds 2009 IECC requirements ³	<input type="checkbox"/>	<input type="checkbox"/>
3. High-Performance Insulation		
3.1 Specified ceiling, wall, floor, and slab insulation levels comply with one of the following options:	<input type="checkbox"/>	<input type="checkbox"/>
3.1.1 Meets or exceeds 2009 IECC levels ^{4, 5, 6} OR:	-	-
3.1.2 Achieves ≤ 133% of the total UA resulting from the U-factors in 2009 IECC Table 402.1.3, per guidance in Footnote 4d, AND specified home infiltration does not exceed the following: ^{5, 6} 3 ACH50 in CZs 1, 2 2.5 ACH50 in CZs 3, 4 2 ACH50 in CZs 5, 6, 7 1.5 ACH50 in CZ 8	-	-
4. Review of HVAC Design Report⁷		
4.1 HVAC Design Report collected for records, with no items left blank	<input type="checkbox"/>	<input type="checkbox"/>
4.2 HVAC Design Report reviewed by Rater for the following parameters (HVAC Design Report Item # indicated in parenthesis):		
4.2.1 Cooling season and heating season outdoor design temperatures used in loads (3.3) are within the limits defined at energystar.gov/hvacdesignitemps for the State and County where the home will be built, or the designer has provided an allowance from EPA to use alternative values ⁸	<input type="checkbox"/>	<input type="checkbox"/>

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ENERGYSTAR v. 3.1 – Confirmed Rating



ENERGY STAR v3.1 Home Report

Property Mass Builder 123 Main Street Swansea, MA 02777	Organization Mass Save Rater Corp 781-555-8282 Ethan MacCormick	HERS Confirmed 6/2/17 Rating No:MassSaveDemo Rater ID:1863955
Weather: New Bedford AP, MA Sharps Lot Rd Mass Save Sample.blg	Builder MA Builder	

Normalized, Modified End-Use Loads (MMBtu/yr)		
	ENERGY STAR	As Designed
Heating	21.0	29.6
Cooling	9.8	5.6
Water Heating	12.5	3.8
Lights and Appliances	25.7	22.8
Total	69.0	61.8

HERS Index of Reference Design Home	65	58 HERS Index w/o PV
HERS Index Target	65	58 HERS Index

ENERGY STAR v3.1 Mandatory Requirements

<input checked="" type="checkbox"/>	Duct leakage at post construction better than or equal to ENERGY STAR v3.1 requirements.
<input checked="" type="checkbox"/>	Envelope insulation levels meet or exceed ENERGY STAR v3.1 requirements.
<input checked="" type="checkbox"/>	Slab on Grade Insulation must be > R-5, and at IECC 2009 Depth for Climate Zone 4 and above.
<input checked="" type="checkbox"/>	Envelope Insulation achieves RESNET Grade I installation, or Grade II with insulated sheathing.
<input checked="" type="checkbox"/>	Windows meet the 2009 IECC Requirements - Table 402.1.1.
<input checked="" type="checkbox"/>	Duct insulation meets the EPA minimum requirements of R-6.
<input checked="" type="checkbox"/>	Mechanical ventilation system is installed in the home.
<input checked="" type="checkbox"/>	ENERGY STAR Checklists fully verified and complete.

This home **MEETS or EXCEEDS** the energy efficiency requirements for designation as an EPA ENERGY STAR Version 3.1 Qualified Home.
HERS Index w/o PV <= HERS Index of Reference Design Home AND HERS Index <= HERS Index Target to comply.

Pollution Prevented		Energy Cost Savings		\$/yr
Type of Emissions	Reduction	Heating	Cooling	
Carbon Dioxide (CO ₂) - tons/yr	4.0			814
Sulfur Dioxide (SO ₂) - lbs/yr	6.6			147
Nitrogen Dioxide (NO ₂) - lbs/yr	8.0			327
		Lights & Appliances:		486
		Total		1774

The energy cost savings and pollution prevented are calculated by comparing the Rated Home to the Reference Home as defined in the Mortgage Industry National Home Energy Rating System Standards as promulgated by the Residential Energy Services Network (RESNET). In accordance with these guidelines, building inputs affecting setpoints, infiltration rates, window shading and the existence of mechanical systems may have been changed prior to calculating loads.

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ENERGYSTAR v. 3.1 – Confirmed Rating General Information



ENERGY STAR v3.1 Home Report

Property Mass Builder 123 Main Street Swansea, MA 02777	Organization Mass Save Rater Corp 781-555-8282 Ethan MacCormick	HERS Confirmed 6/2/17 Rating No:MassSaveDemo Rater ID:1863955
Weather: New Bedford AP, MA Sharps Lot Rd Mass Save Sample.blg	Builder MA Builder	

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ENERGYSTAR v. 3.1 – Confirmed Rating

Building Loads



Normalized, Modified End-Use Loads (MMBtu/yr)

	ENERGY STAR	As Designed	
Heating	21.0	29.6	
Cooling	9.8	5.6	
Water Heating	12.5	3.8	
Lights and Appliances	25.7	22.8	
Total	69.0	61.8	
HERS Index of Reference Design Home	65	58	HERS Index w/o PV
HERS Index Target	65	58	HERS Index

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ENERGYSTAR v. 3.1 – Confirmed Rating

Mandatory Requirements



ENERGY STAR v3.1 Mandatory Requirements


X	Duct leakage at post construction better than or equal to ENERGY STAR v3/3.1 requirements.
X	Envelope insulation levels meet or exceed ENERGY STAR v3/3.1 requirements.
X	Slab on Grade Insulation must be > R-5, and at IECC 2009 Depth for Climate Zones 4 and above.
X	Envelope insulation achieves RESNET Grade I installation, or Grade II with insulated sheathing.
X	Windows meet the 2009 IECC Requirements - Table 402.1.1.
X	Duct insulation meets the EPA minimum requirements of R-6.
X	Mechanical ventilation system is installed in the home.
X	ENERGY STAR Checklists fully verified and complete.




This home MEETS or EXCEEDS the energy efficiency requirements for designation as an EPA ENERGY STAR Version 3.1 Qualified Home.
HERS Index w/o PV <= HERS Index of Reference Design Home AND HERS Index <= HERS Index Target to comply.


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ENERGYSTAR v. 3.1 – Confirmed Rating



ENERGY STAR® CERTIFIED NEW HOME




Builder Name: MA Builder Permit Date/Number: Home Address: 123 Main Street Swansea, MA 02777	Rating Company: Mass Save Rater Corp Rater Identification Number: 1863955 Rating Date: 6/2/17 Version: 3.1
Standard Features of an ENERGY STAR Certified New Home Your ENERGY STAR certified new home has been designed, constructed, and independently verified to meet rigorous requirements for energy efficiency set by the U.S. Environmental Protection Agency (EPA), including:	
Thermal Enclosure System A complete thermal enclosure system that includes comprehensive air sealing, quality-installed insulation and high-performing windows to deliver improved comfort and lower utility bills. Air Infiltration Test: Hg: 1163 Cfg. 1163 CFM50 Primary Insulation Levels: Ceiling: R-48.0 Floor/Wall: R-4.0 AGWall: R-21.0 Floor: R-30.0 Primary Window Efficiency: U-Value: 0.350, SHGC: 0.190	Water Management System A comprehensive water management system to protect roofs, walls, and foundations. Flashing, a drainage plane, and site grading to move water from the roof to the ground and then away from the home. Water-resistant materials on below-grade walls and underneath slabs to reduce the potential for water entering into the home. Management of moisture levels in building materials during construction.
Heating, Cooling, and Ventilation System A high-efficiency heating, cooling system, and ventilation system that is designed and installed for optimal performance. Total Duct Leakage: 200.00 CFM25. Duct Leakage to Outdoors: 84.00 CFM25. Primary Heating (System Type + Fuel Type + Efficiency): Fuel-fired air distribution, Propane, 95.0 AFUE. Primary Cooling (System Type + Fuel Type + Efficiency): Air conditioner, Electric, 14.0 SEER.	Energy Efficient Lighting and Appliances Energy efficient products to help reduce utility bills, while providing high-quality performance. ENERGY STAR Qualified Lighting: 100% ENERGY STAR Qualified Appliances and Fans: Refrigerators: 0 Dishwashers: 0 Ceiling Fans: 0 Exhaust Fans: 0 Primary Water Heater (System Type + Fuel Type + Efficiency): Instant water heater, Propane, 0.92 EF, 0.0 Gal.
HERS® Index  <p>The HERS Index is a relative energy efficiency score based on the energy efficiency of the home. The HERS Index is calculated based on the energy efficiency of the home. The HERS Index is a relative energy efficiency score based on the energy efficiency of the home. The HERS Index is a relative energy efficiency score based on the energy efficiency of the home.</p>	

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ENERGYSTAR v. 3.1 – Confirmed Rating

General Information



Builder Name: MA Builder Permit Date/Number: Home Address: 123 Main Street Swansea, MA 02777	Rating Company: Mass Save Rater Corp Rater Identification Number: 1863955 Rating Date: 6/2/17 Version: 3.1
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ENERGYSTAR v. 3.1 – Confirmed Rating

Thermal Enclosure System



Thermal Enclosure System

A complete thermal enclosure system that includes comprehensive air sealing, quality-installed insulation and high-performing windows to deliver improved comfort and lower utility bills.



Air Infiltration Test: **Htg: 1163 Clg: 1163 CFM50**

Primary Insulation Levels:

Ceiling: R-48.0 FndWall: R-0.0

AGWall: R-21.0 Floor: R-30.0

Primary Window Efficiency:

U-Value: 0.300, SHGC: 0.190

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ENERGYSTAR v. 3.1 – Confirmed Rating

Heating, Cooling and Ventilation System



Heating, Cooling, and Ventilation System

A high-efficiency heating, cooling system, and ventilation system that is designed and installed for optimal performance.



Total Duct Leakage:

200.00 CFM25.

Duct Leakage to Outdoors:

94.00 CFM25.

Primary Heating (System Type • Fuel Type • Efficiency):

Fuel-fired air distribution, Propane, 95.0 AFUE.

Primary Cooling (System Type • Fuel Type • Efficiency):

Air conditioner, Electric, 16.0 SEER.

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ENERGYSTAR v. 3.1 – Confirmed Rating

Energy Efficient Lighting & Appliances



Energy Efficient Lighting and Appliances

Energy efficient products to help reduce utility bills, while providing high-quality performance.



ENERGY STAR Qualified Lighting: **100%**

ENERGY STAR Qualified Appliances and Fans:

Refrigerators: 0

Dishwashers: 0

Ceiling Fans: 0

Exhaust Fans: 0

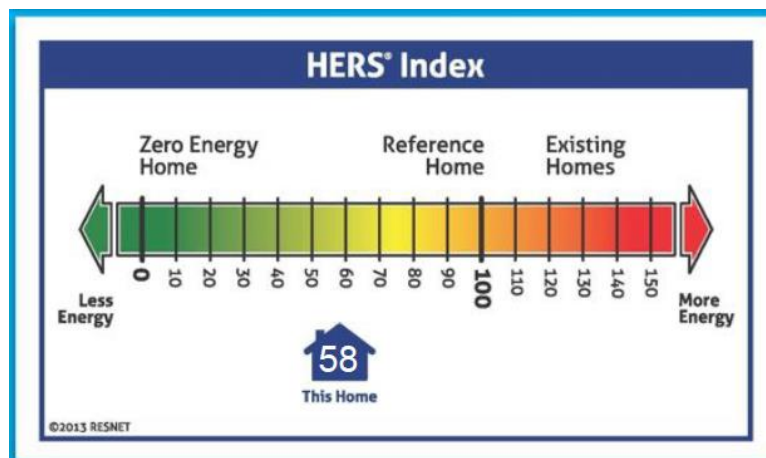
Primary Water Heater (System Type • Fuel Type • Efficiency):

Instant water heater, Propane, 0.92 EF, 0.0 Gal.

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ENERGYSTAR v. 3.1 – Confirmed Rating

HERS Index



Getting a HERS Rating is a part of ENREGYSTAR. There is no fixed HERS Rating to get ENERGYSTAR label.

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ENERGYSTAR v. 3.1 – Confirmed Rating

ENERGYSTAR Certificate


Energy Code Technical Support Program



CERTIFIED NEW HOME

Address:
123 Main Street
Swansea, MA

Built by:
MA Builder

Verified by:
Ethan MacCormick

Date:
6/2/17

ENERGY STAR® for Homes Version Number:
Version 3.1


Optional Information:
HERS Index: 58


This home has been independently verified to meet EPA's strict guidelines for energy efficiency.
[Learn more at energystar.gov](http://www.energystar.gov)

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ENERGYSTAR v. 3.1

Rater Field Checklist


Energy Code Technical Support Program



Rater Field Checklist

ENERGY STAR Certified Homes, Version 3 / 3.1 (Rev. 08)

HVAC System ³⁰ (HVAC Design Report Item # indicated in parenthesis)	Must Correct	Rater Verified ²	N/A ³
Appendix 7, Section 7.1 (Control Mechanical Tests), and verify the equipment meets the limits defined therein			
Rater Name: _____ Rater Pre-Drywall Inspection Date: _____ Rater Initials: _____			
Rater Name: _____ Rater Final Inspection Date: _____ Rater Initials: _____			
Builder Employee: _____ Builder Inspection Date: _____ Builder Initials: _____			
or undercut doors to achieve a Rater-measured pressure differential of 3 Pa with respect to the main body of the house when all bedroom doors are closed and all air handlers are operating. See Footnote 34 for alternative. ³⁴	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
6.3 All supply and return ducts in unconditioned space, including connections to trunk ducts, are insulated to $\geq R-6$ ³⁵	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
6.4 Rater-measured total duct leakage meets one of the following two options. See Footnote 37 for alternative: ^{36, 37, 38}	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
6.4.1 Rough-in: The greater of ≤ 4 CFM25 per 100 sq. ft. of CFA or ≤ 40 CFM, with air handler & all ducts, building cavities used as ducts, & duct boots installed. In addition, <u>all</u> duct boots sealed to finished surface, Rater-verified at final. ³⁹	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
6.4.2 Final: The greater of ≤ 8 CFM25 per 100 sq. ft. of CFA or ≤ 80 CFM, with the air handler & all ducts, building cavities used as ducts, duct boots, & register grilles atop the finished surface (e.g., drywall, floor) installed. ⁴⁰	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
6.5 Rater-measured duct leakage to outdoors the greater of ≤ 4 CFM25 per 100 sq. ft. of CFA or ≤ 40 CFM25 ^{36, 38, 41}	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
7. Whole-House Mechanical Ventilation System			
7.1 Rater-measured ventilation rate is within either ± 15 CFM or $\pm 15\%$ of design value (2.3) ⁴²	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
7.2 A readily-accessible ventilation override control installed and also labeled if its function is not obvious (e.g., a label is required for a standalone wall switch, but not for a switch that's on the ventilation equipment)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

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Building Information, Heating & Cooling Loads, Source & Site Energy, Building Envelope Summary, Ventilation Summary, Envelope areas and Transmission Losses

PHIUS+ 2015

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What is Passive House?

- Either Passive House or PHIUS (Passive House Institute US)
- Specific Space Heat Demand should be less than 10 kBtu/sq ft/year
- Extremely air-tight homes.
- Modeled using software packages specially tailored for Passive House
- Should be certified by a Certified Passive House Consultant.

Taking the Passive House route to show compliance is rare.

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PHIUS

Code Sections




- Prior to issuance of permit
 - List of compliance features
 - Estimated Specific Space Heat Demand based on plans
- Prior to issuance of CO
 - Copy of final report showing compliance with PHIUS+2015 standard
 - The report should indicate that the building achieves Specific Space Heat Demand less than or equal to 10 kBtu/sq ft/year

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PHIUS+ 2015

Building Information



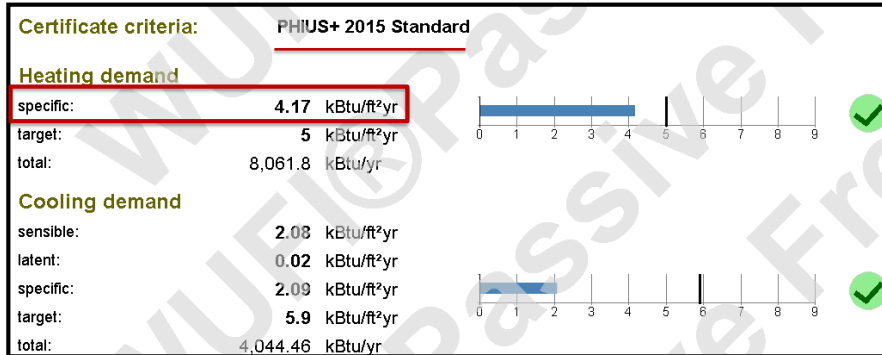
BUILDING INFORMATION		
Category:	Residential	
Status:	In planning	
Building type:	New construction	
Year of construction:		
Units:	1	
Number of occupants:	4 (Design)	
Boundary conditions		Building geometry
Climate:	BOSTON MA	Enclosed volume: 25,298.6 ft³
Internal heat gains:	0.9 Btu/hr ft²	Net-volume: 16,326 ft³
Interior temperature:	68 °F	Total area envelope: 5,332.2 ft²
Overheat temperature:	77 °F	AV ratio: 0.2 1/ft
		Floor area: 1,931.6 ft²

Source: <http://www.phius.org/software-resources/additional-resources>

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PHIUS+ 2015

Heating & Cooling Demand

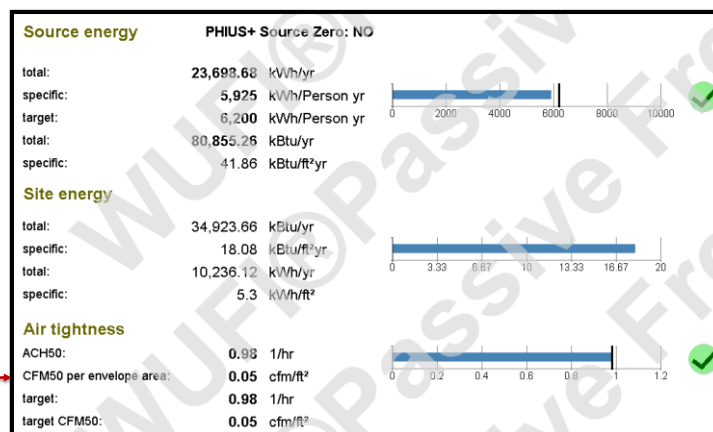


Source: <http://www.phius.org/software-resources/additional-resources>

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PHIUS+ 2015

Source/Site Energy & Air Tightness



Source: <http://www.phius.org/software-resources/additional-resources>

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Building Envelope Summary



Summary building envelope			
	Total area / length	Average U-value / Psi value	Transmission losses
Exterior wall ambient:	2,554.9 ft ²	0.017 Btu/hr ft ² °F	6,849.7 kBtu/yr
Exterior wall ground:	0 ft ²	0 Btu/hr ft ² °F	0 kBtu/yr
Basement:	1,151.4 ft ²	0.019 Btu/hr ft ² °F	1,113.5 kBtu/yr
Roof:	1,151.4 ft ²	0.011 Btu/hr ft ² °F	2,030.8 kBtu/yr
Windows:	474.5 ft ²	0.155 Btu/hr ft ² °F	11,771.1 kBtu/yr
Doors:	0 ft ²	0 Btu/hr ft ² °F	0 kBtu/yr
Thermal bridge ambient:	0 ft	0 Btu/hr ft °F	0 kBtu/yr
Thermal bridge perimeter:	0 ft	0 Btu/hr ft °F	0 kBtu/yr
Thermal bridge floor slab:	0 ft	0 Btu/hr ft °F	0 kBtu/yr

Source: <http://www.phius.org/software-resources/additional-resources>

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PHIUS+ 2015

Ventilation



VENTILATION	
Infiltration pressure test ACH50:	0.98 1/hr
Total extract air demand:	106 cfm
Supply air per person:	17.99 cfm
Occupancy:	4
Average air flow rate:	81.71 cfm
Average air change rate:	0.3 1/hr
Effective ACH ambient:	0.12 1/hr
Effective ACH ground:	0 1/hr
Energetically effective air exchange:	0.12 1/hr
Infiltration air change rate:	0.07 1/hr
Infiltration air change rate (heating load):	0.17 1/hr

Source: <http://www.phius.org/software-resources/additional-resources>

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Summary



- In REScheck, verify building areas building component types and insulation values
- The ventilation cfm can be either the design cfm or final value. Make sure to make the distinction
- Third party can conduct all mandatory testing requirements and submit reports
- HERS rating is required for ENERGYSTAR compliance.
- For both ENERGYSTAR and HERS, check to see if building characteristics are matching plans
- If you receive documentation for Passive House, always check for Specific Space Heat Demand.

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Energy Code Support



Questions about the energy code?

Energy Code Support Hotline:

855-757-9717

Energy Code Support Email:

energycodesma@psdconsulting.com

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Residential New Construction

Incentives for energy efficient building and renovating



- **Low-Rise New Construction**
 - Performance Path – based upon Electric and Fuel savings, plus a % adder as compared to MA baseline – incentives up to \$10,000
- **High-Rise New Construction and all Master Metered Natural Gas**
 - Incentives based upon modeling by Program Manager

Incentives also offered for existing buildings.
Visit www.MassSave.com for the details.

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Residential New Construction – Incentives



Blended Savings Approach (BSA)

Single Family BSA Incentive Calculation	
A	Electric Savings * \$0.35 / kWh
B	Fuel Savings * \$35 / MMBtu
C	Percent Savings * \$3,000
Participant Incentive	A + B + C
Rater Incentive	\$350

Multifamily BSA Incentive Calculation	
A	Electric Savings * \$0.35 / kWh
B	Fuel Savings * \$35 / MMBtu
C	Percent Savings * \$2,000
Participant Incentive	A + B + C
Rater Incentive	\$100

Details at:
www.masssave.com/en/saving/residential-rebates/new-construction

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We Speak Building



Energy Code Technical Support Program

Thanks!

Massachusetts Energy Code Technical Support Program



BLACKSTONE
GAS COMPANY



Columbia Gas
of Massachusetts
A Millcor Company

EVERSOURCE

Liberty Utilities

nationalgrid
HERE WITH YOU. HERE FOR YOU.

Unitil
90 years for life