


A Process for Energy Code Compliance and Enforcement Part 2

Energy Code Inspections in 15 Minutes or Less


Performance Systems Development (PSD)

Based on the Residential Provisions of the 2020 Energy Conservation Construction Code of New York State

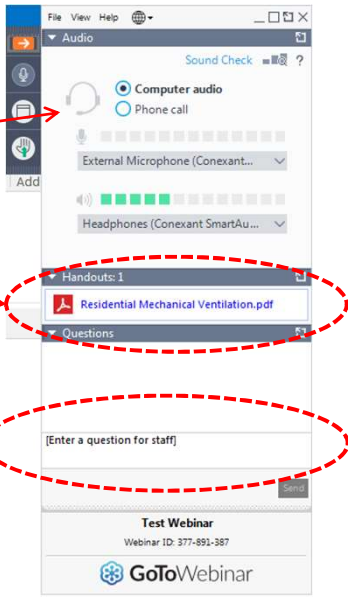


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Logistics



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- Handouts
- Recordings:
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- Questions



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CONTINUING EDUCATION



This webinar is approved for:

- 1.5 hours NYDOS
 - In-service Training
 - Topic 3 – Energy Code
- 1.5 AIA LU | HSW
- 1.5 BPI CEUs
- 1.5 NARI CEUs

NYDOS Course Number

T02-07-2863

Everyone will receive a certificate of attendance via email within 2 weeks



6

All Attendees



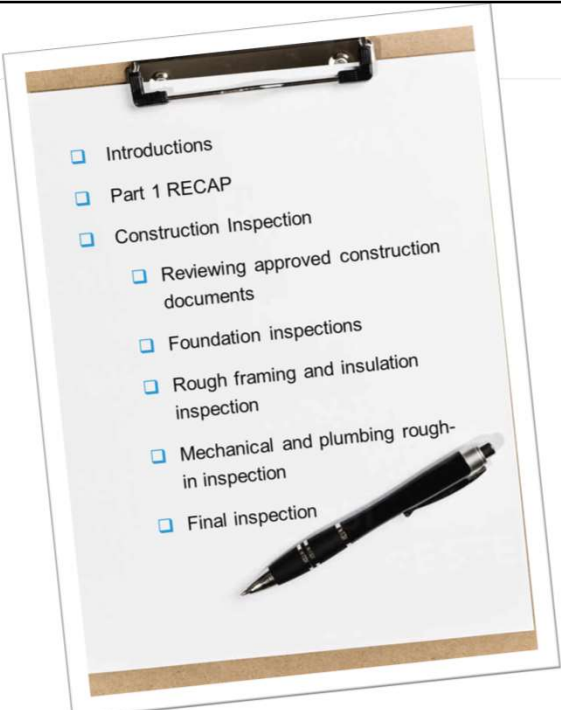
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- Login using a computer or tablet,
- Login no later than 15 minutes after the scheduled start time,
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 - The scheduled end time if the webinar ends late, or
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Continuing ed: Please allow at least three weeks for training to show up in your training histories.

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Today's Agenda



- Introductions
- Part 1 RECAP
- Construction Inspection
 - Reviewing approved construction documents
 - Foundation inspections
 - Rough framing and insulation inspection
 - Mechanical and plumbing rough-in inspection
 - Final inspection

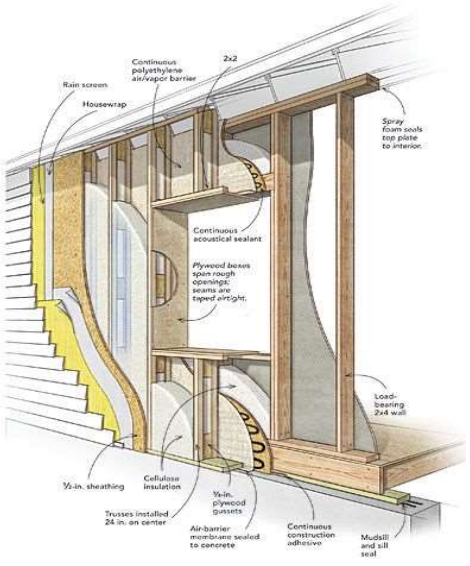
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Learning Objectives

After taking this course, attendees will be able to...

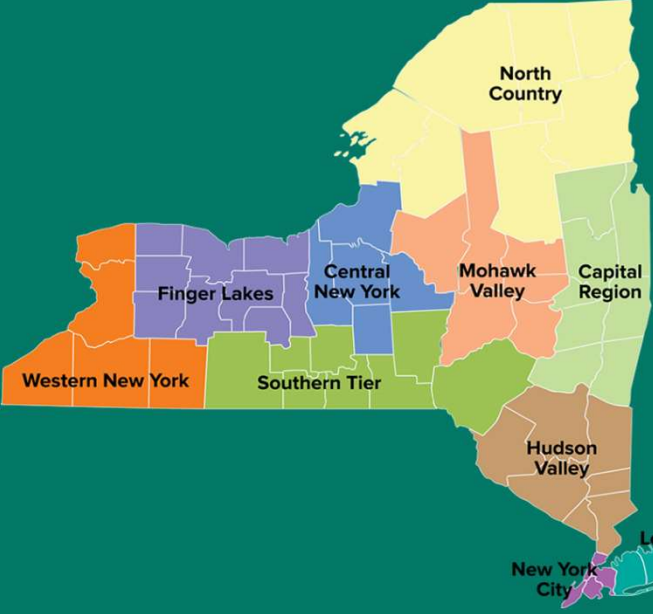
- Describe a process for inspecting residential projects that includes assessing the highest impact energy code provisions
- Understand the inputs to forms and checklists such as “Duct and Envelope Testing (DET)” verification and HVAC sizing and integrate them into your organization’s compliance documentation or enforcement processes
- Have a better understanding of the air leakage testing process of newly built homes
- Describe how third-party energy professionals such as duct and envelope testers and HERS Raters can fit into the inspection process



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POLL 1



Where do you perform work? Choose all that apply.

1. New York City
2. Long Island
3. Capital Region / Hudson Valley
4. Mohawk Valley / North Country
5. Central / Southern Tier / Finger Lakes / Western NY


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Overview of DOE Energy Code Field Study Results

High-priority items - Not all Energy Code requirements are created equal

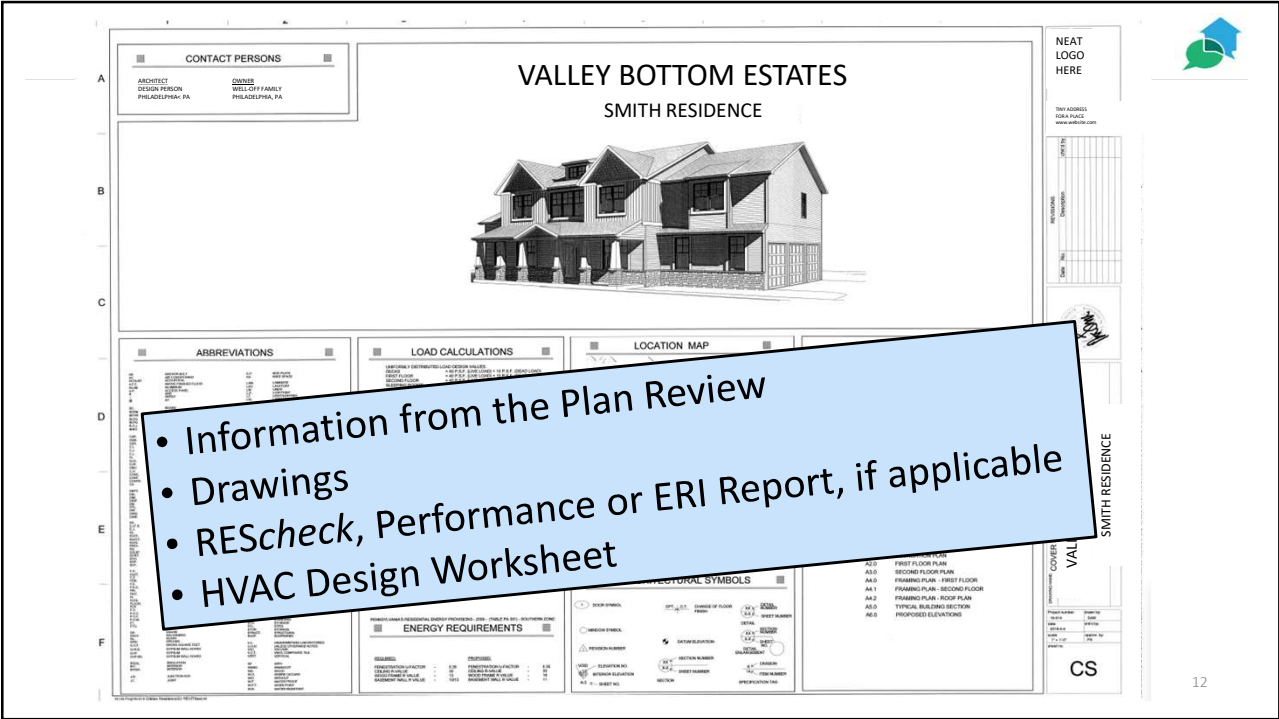
- 1. Envelope tightness (ACH at 50 Pascals)**
- 2. Duct tightness (cfm per 100 ft² of CFA at 25 Pascals)**
- 3. Wall insulation (assembly U-factor)**
4. Lighting (% high-efficacy)
5. Windows U-factor
6. Window SHGC
7. Ceiling insulation (R-value)
- 8. Foundation insulation (R-value)**



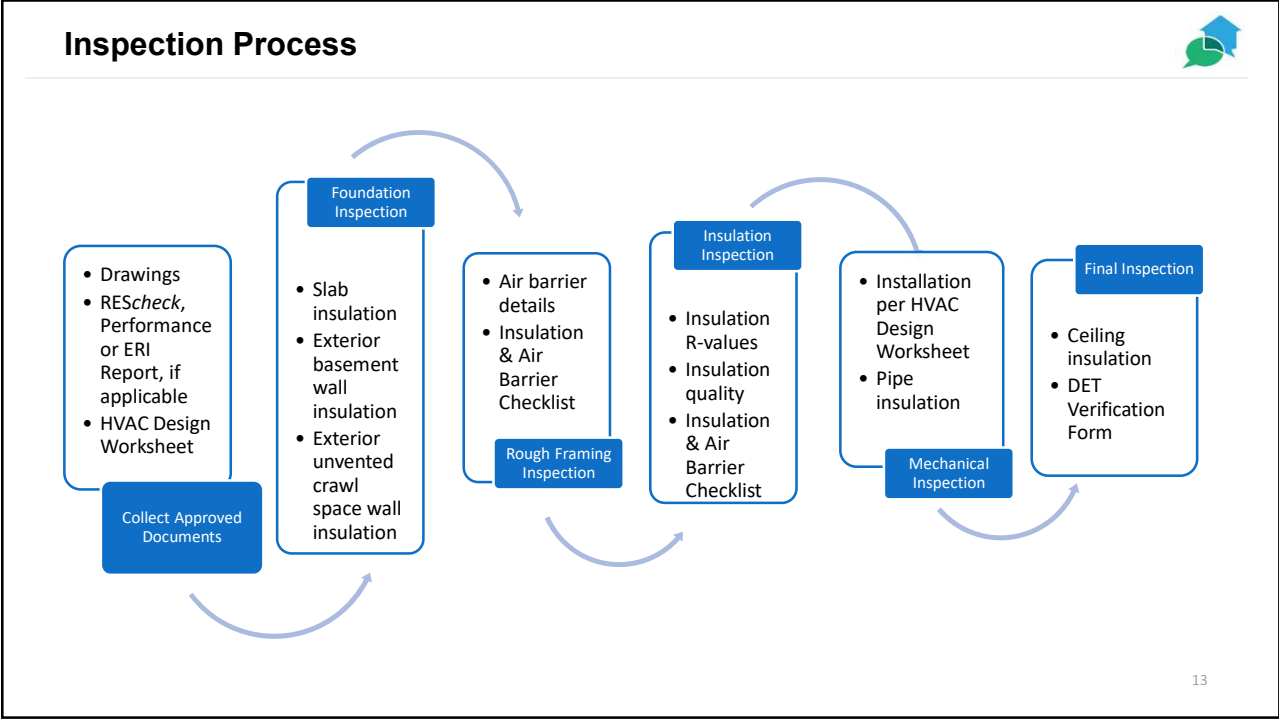
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Field Inspections Specified in the 2020 NYS ECCC



[NY] R106.2.1 Footing and Foundation Inspection

Inspections associated with footings and foundations shall verify compliance with:

- **R-value, location, thickness, depth of burial and protection of insulation**

[NY] R106.2.2 Framing and Rough-In Inspection

Inspections at framing and rough-in shall be made before application of interior finish and shall verify compliance with:

- **The types of insulation, R-values, location and proper installation; fenestration U-factors and SHGC and proper installation; air leakage controls as required by the code**

[NY] R106.2.3 Plumbing Rough-In Inspection

Inspections at plumbing rough-in shall verify compliance as to:

- **The types of insulation, R-values and protection, and required controls.**

[NY] R106.2.4 Mechanical Rough-In Inspection

Inspections at mechanical rough-in shall verify compliance with:

- **Installed HVAC equipment type and size, required controls, system insulation, R-value, system air leakage control, programmable thermostats, dampers, whole-house ventilation, and minimum fan efficiency.**

[NY] R106.2.5 Final Inspection

- **The final inspection shall include verification of the installation of all required building systems, equipment and controls and their proper operation and the required number of high-efficacy lamps and fixtures.**

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R106.2.1 Foundation Inspection



Insulation:

- ✓ R-value
- ✓ Location (slabs, exterior bsmt/crawl wall)
- ✓ Thickness
- ✓ Depth of buried insulation
- ✓ Protection



ORGANIZATION LETTERHEAD

FOUNDATION INSULATION INSPECTION
(Based on the 2020 ICC/ENVS)

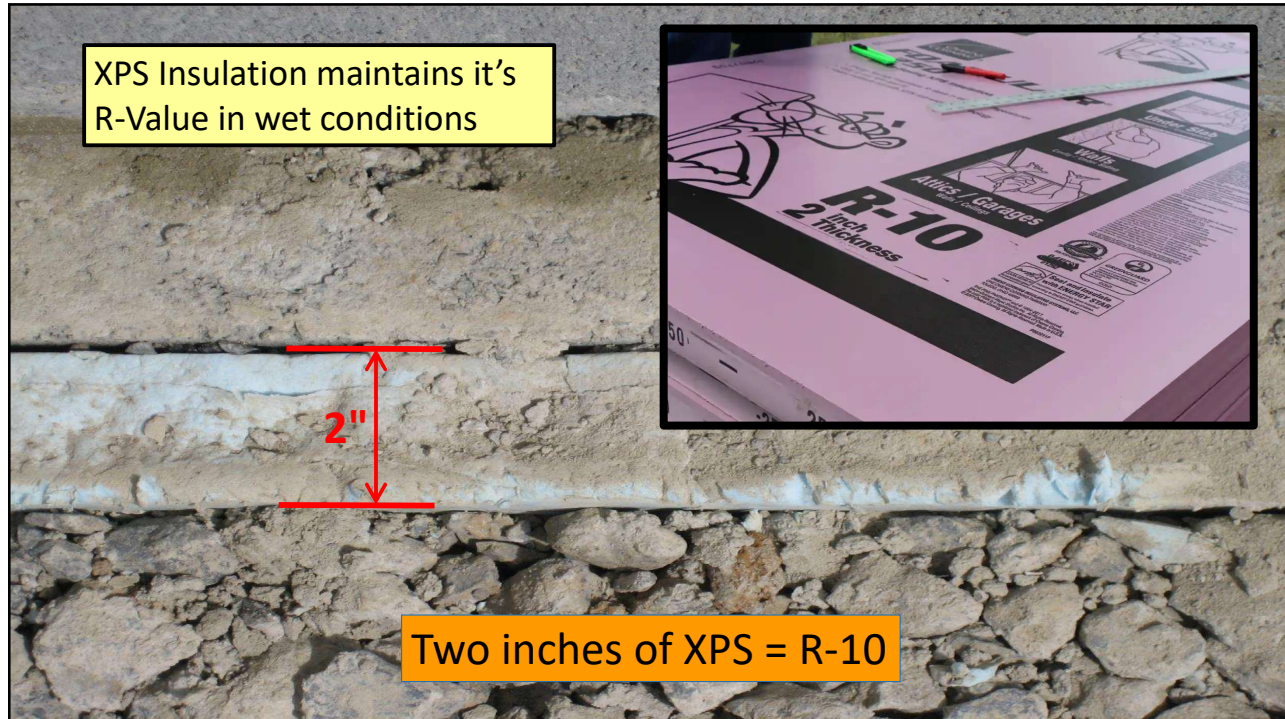
House Address: _____ Permit #: _____ Date: _____
 Permit holder: _____ Phone: _____

FOUNDATION INSPECTION	
Slab-on-grade	<input type="checkbox"/> Where floor surface is ≤ 12 inches below grade, slab perimeter is insulated to R-10 or meets supplemental documentation ¹
	<input type="checkbox"/> Insulation extends downward from the top of the slab creating a thermal break
	<input type="checkbox"/> Insulation extends below grade vertically or horizontally for 2 feet in C24 and C25 and 4 feet in C26
Basement walls (if design specifies exterior insulation)	<input type="checkbox"/> Exterior slab insulation (if applicable) is covered with stucco, fiber cement board, or other protection
	<input type="checkbox"/> Exterior basement wall insulation is R-value meets [NY] Table R402.1.2 or supplemental documentation ¹
	<input type="checkbox"/> Exterior basement wall insulation extends from the top of the wall to the basement floor
Unvented crawl space walls	<input type="checkbox"/> Above-grade portion of exterior insulation is covered with stucco, fiber cement board, or other protection
	<input type="checkbox"/> Exposed earth in unvented crawl spaces are covered with a Class I vapor retarder with overlapping joints taped
	<input type="checkbox"/> Exterior crawl space wall insulation R-value, if applicable, meets [NY] Table R402.1.2 or supplemental documentation ¹
<input type="checkbox"/> Exterior crawl space wall insulation, if applicable, extends from the floor to 24 inches below grade <input type="checkbox"/> Above-grade portion of exterior insulation is covered with stucco, fiber cement board, or other protection	

Notes:



¹ Supplemental documentation may include: Energy Certificate, Simulated Performance Alternative Report, EN Alternative Report
 Document designed by Performance Systems Development of NY, LLC. Page 1 of 5

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Perimeter Slab Insulation

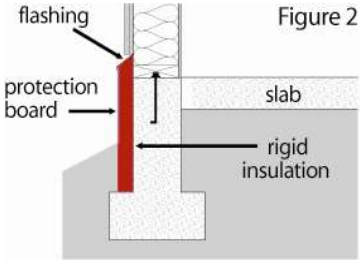


Figure 2

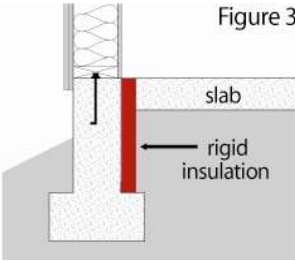


Figure 3

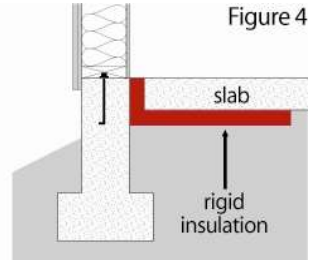
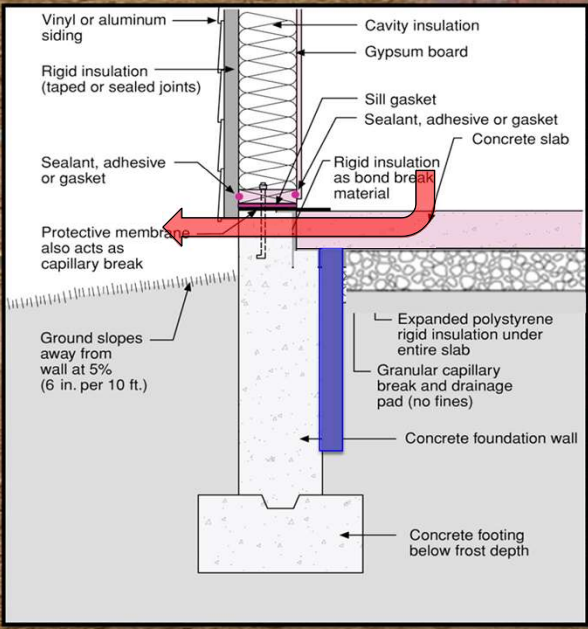
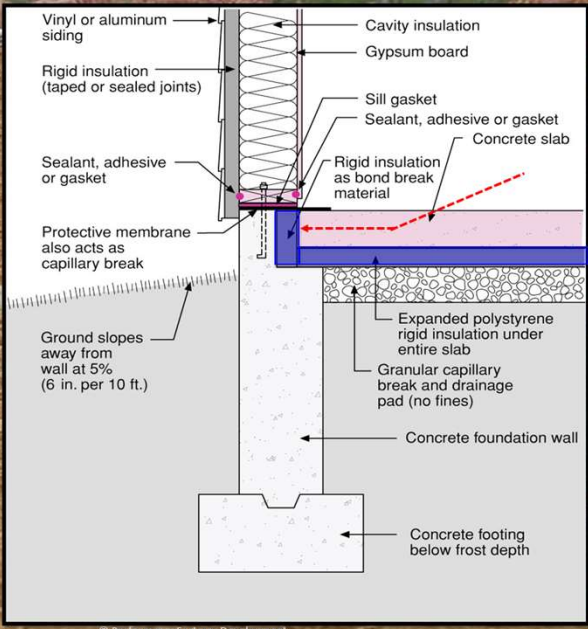


Figure 4

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Heated Slabs

For heated slabs, a Min of R-5 insulation shall be provided under the full slab area in addition to the required slab edge insulation

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Basement Walls

Heat transfers from warm to cold very quickly through masonry. Insulating this brick veneer detail on the inside is much better

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Crawl Space Walls

In unvented crawlspaces, it is critical to keep ground moisture out of the crawl space itself by properly installing a Class I vapor retarder

House

No Insulation

Unvented Crawl Space

Vapor Barrier

Class I vapor retarder

- Lapped 6"
- Extending up wall 6"

Insulation permanently fastened

Insulation extends downward from floor to grade – Rim/Band Joist area is air sealed and insulated

Then vertically or horizontally an ADDITIONAL 24"

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Crawl Space Wall Insulation

- Insulation is permanently attached to walls
- Exposed earth in unvented crawl spaces is required to have a Class I vapor retarder with overlapping joints taped

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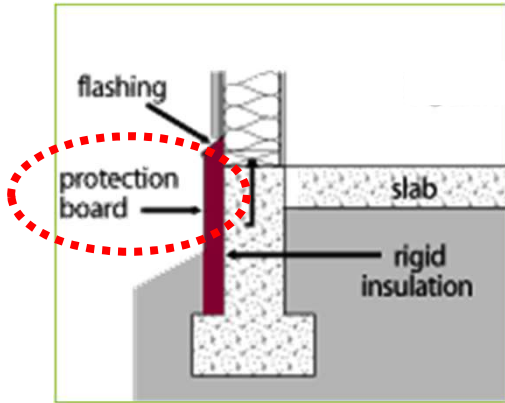
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R303.2.1 Protection of Exposed Foundation Insulation



Exterior insulation shall have a rigid, opaque and weather-resistant protective covering:

- Covering shall extend a minimum of 6" below grade



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Rough Framing Inspection Air Sealing



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R106.2.2 Framing and Rough-in Inspection (Pre-Drywall)



Insulation

- R-values
- Correct location
- Proper installation

Air leakage controls

- Insulation & Air Barrier Checklist

Fenestration

- U-factors
- SHGCs
- Proper installation



Image courtesy of Dan Augustine

Inspections to occur before application of interior finish

COMPONENT	TABLE R402.4.1.1 AIR BARRIER AND INSULATION INSTALLATION ^a	
	AIR BARRIER CRITERIA	INSULATION INSTALLATION CRITERIA
General requirements	A continuous air barrier shall be installed in the building envelope. The exterior thermal envelope contains a continuous air barrier. Breaks or joints in the air barrier shall be sealed.	Air-permeable insulation shall not be used as a sealing material.
Ceiling/attic	The air barrier in any dropped ceiling or soffit shall be aligned with the insulation and any gaps in the air barrier shall be sealed. Access openings, drop down stairs or knee wall doors to unconditioned attic spaces shall be sealed.	The insulation in any dropped ceiling/soffit shall be aligned with the air barrier.
Walls	The junction of the foundation and sill plate shall be sealed. The junction of the top plate and the top of exterior walls shall be sealed. Knee walls shall be sealed.	Joists within corners and headers of frame walls shall be insulated by completely filling the cavity with a material having a thermal resistance, R-value, of not less than R-3 per inch. Exterior thermal envelope insulation for framed walls shall be installed in substantial contact and continuous alignment with the air barrier.
Windows, skylights and doors	The space between framing and skylights, and the jambs of windows and doors, shall be sealed.	---
Rim joints	Rim joints shall include the air barrier.	Rim joints shall be insulated.
Floors, including cantilevered floors and floors above garages	The air barrier shall be installed at any exposed edge of insulation.	Floor framing cavity insulation shall be installed to maintain permanent contact with the underside of subfloor decking. Alternatively, floor framing cavity insulation shall be in contact with the top side of sheathing, or continuous insulation installed on the underside of floor framing, and shall extend from the bottom to the top of all perimeter floor framing members.
Crawl space walls	Exposed earth in unvented crawl spaces shall be covered with a Class I vapor retarder with overlapping joints taped.	Crawl space insulation, where provided instead of floor insulation, shall be permanently attached to the walls.
Shafts, penetrations	Duct shafts, utility penetrations, and flue shafts opening to exterior or unconditioned space shall be sealed.	---
Narrow cavities	---	Batts to be installed in narrow cavities shall be cut to fit or narrow cavities shall be filled with insulation that on installation readily conforms to the available cavity space.
Garage separation	Air sealing shall be provided between the garage and conditioned spaces.	---
Recessed lighting	Recessed light fixtures installed in the building thermal envelope shall be sealed to the finished surface.	Recessed light fixtures installed in the building thermal envelope shall be air tight and IC rated.
Plumbing and wiring	---	In exterior walls, batt insulation shall be cut neatly to fit around wiring and plumbing or insulation that on installation readily conforms to available space, shall extend behind piping and wiring.
Shower/tub on exterior wall	The air barrier installed at exterior walls adjacent to showers and tubs shall separate the wall from the shower or tub.	Exterior walls adjacent to showers and tubs shall be insulated.
Electrical/phone box on exterior walls	The air barrier shall be installed behind electrical and communication boxes. Alternatively, air-sealed boxes shall be installed.	---
HVAC register boots	HVAC supply and return register boots that penetrate building thermal envelope shall be sealed to the subfloor, wall covering or ceiling penetrated by the boot.	---
Concealed sprinklers	Where required to be sealed, concealed fire sprinklers shall only be sealed in a manner that is recommended by the manufacturer. Caulking or other adhesive sealants shall not be used to fill voids between fire sprinkler cover plates and walls or ceilings.	---

a. Inspection of log walls shall be in accordance with the provisions of ICC 400.

A continuous air barrier shall be installed in the building envelope

The exterior thermal envelope contains a continuous air barrier.

Breaks or joints in the air barrier shall be sealed.

The air barrier in any dropped ceiling or soffit shall be aligned with the insulation and any gaps in the air barrier shall be sealed.

Access openings, drop down stairs or knee wall doors to unconditioned attic spaces shall be sealed.

Air sealing shall be provided between the garage and conditioned spaces.

R402.4.1 Building Thermal Envelope

ORGANIZATION LETTERHEAD

AIR BARRIER & INSULATION INSTALLATION CHECKLIST
(Based on ECCCNYIS Table R402.4.1.1)

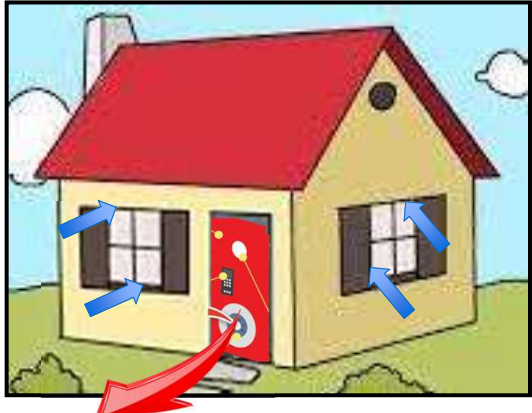
House Address: _____ Permit #: _____ Date: _____
 Permit holder: _____ Phone: _____

PRE-DRYWALL INSPECTION	
General	<input type="checkbox"/> A continuous air barrier is installed in the building envelope. <input type="checkbox"/> The exterior thermal envelope contains a continuous air barrier. <input type="checkbox"/> Breaks or joints in the air barrier are sealed. <input type="checkbox"/> Air-permeable insulation shall not be used as a sealing material.
Ceiling/attic	<input type="checkbox"/> The air barrier in any dropped ceiling/joist are aligned with the insulation and any gaps in the air barrier are sealed. <input type="checkbox"/> Recessed lighting fixtures installed in the building envelope are air tight & IC rated. <input type="checkbox"/> Insulation is installed in all wall assemblies that separate conditioned space from unconditioned space or the outside. <input type="checkbox"/> Insulation R-value meets [NY] Table R402.1.2 or supplemental documentation ¹
Walls	<input type="checkbox"/> The junction of the foundation and sill plate are sealed. <input type="checkbox"/> The junction of the top plate and the top of exterior walls are sealed. <input type="checkbox"/> Knee walls have an air barrier on the attic side of the wall. <input type="checkbox"/> Walls are framed to allow the corner to be insulated or exterior continuous insulation installed. Corners are insulated with a material that is at least R-3 per inch. <input type="checkbox"/> Headers of frame walls are insulated by completely filling available space with a material that is at least R-3 per inch. <input type="checkbox"/> Exterior thermal envelope insulation for framed walls are installed in substantial contact and continuous alignment with the air barrier.
Windows, skylights and doors	<input type="checkbox"/> The space between window/door jambs & framing and skylights & framing are sealed. <input type="checkbox"/> Window and door U-factors and SHGCs meets [NY] Table R402.1.2. Skylight U-factors are 0.55 or below. Or, values match supplemental documentation ¹ .
Rim joints	<input type="checkbox"/> Rim joints are insulated and sealed to the floor joists, subfloor, and wall plate <input type="checkbox"/> Insulation R-value meets [NY] Table R402.1.2 or supplemental documentation ¹ for wood frame walls
Floors (including above garage and cantilevered floors)	<input type="checkbox"/> Insulation is installed in all floor assemblies that separate conditioned space from unconditioned space or the outside. <input type="checkbox"/> Insulation R-value meets [NY] Table R402.1.2 or supplemental documentation ¹ <input type="checkbox"/> The air barrier is installed at any exposed edge of insulation. <input type="checkbox"/> Floor framing cavity insulation is installed to maintain permanent contact with the underside of subfloor decking. ¹

Air Barrier & Insulation Installation Checklist

¹ Exception: _____
 Document de _____ Page 3 of 5

R402.4.1.2 Air leakage-Thermal Envelope-Testing (Mandatory)



Blower door test

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POLL #2

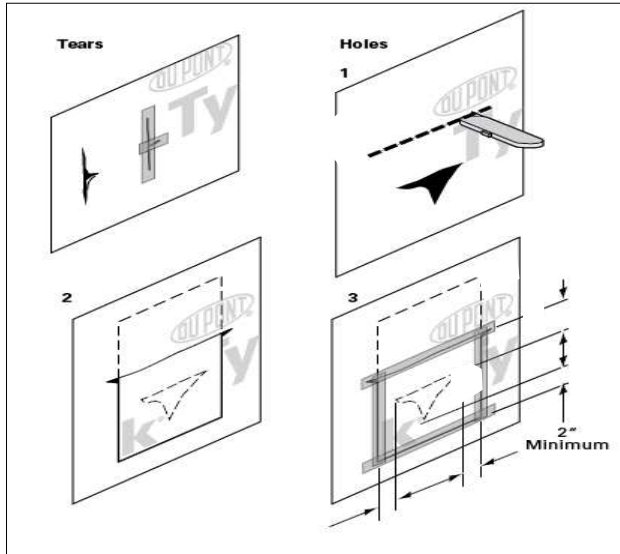
True or False

All insulation & air sealing components must be visually inspected and a blower door test completed?

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Breaks or joints in the air barrier are to be filled or repaired



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Garage Separation



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Image source: EPA, ENERGY STAR

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Shafts and Penetrations



Duct shafts, utility penetrations, knee walls and flue shafts open to the exterior or unconditioned space must be sealed



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Duct Penetrations in the Building Envelope



Air permeable insulation does not stop air leakage



Air impermeable caulks and sealants does stop air leakage

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Image source: EPA, ENERGY STAR

33

Shower/Tub

Air-permeable insulation should never be used as an air sealing material

34
Image source: EPA, ENERGY STAR

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Plumbing and Electrical Penetrations

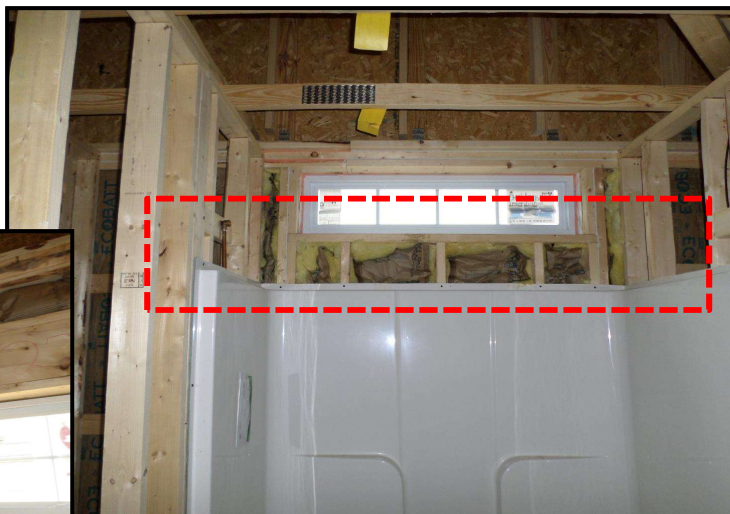
Image source: EPA, ENERGY STAR

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Table 402.4.1.1 Air Barrier & Insulation Installation



- Showers and tubs on exterior walls are required to have insulation and an air barrier separating them from the exterior wall



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Air Barrier & Insulation Installation Criteria Checklist (Cont'd)



ORGANIZATION LETTERHEAD	
Unvented crawl space walls	<input type="checkbox"/> Exposed earth in unvented crawl spaces are covered with a Class I vapor retarder with overlapping joints taped.
Shfts and penetrations	<input type="checkbox"/> Insulation R-value meets (NY) Table R402.1.2 or supplemental documentation ¹ and is permanently attached to the crawlspace walls.
Narrow cavities	<input type="checkbox"/> Duct shafts, utility penetrations, and flue shafts opening to exterior or unconditioned space are sealed.
Garage separation	<input type="checkbox"/> Blats in narrow cavities are cut to fit, or narrow cavities are filled by insulation that on installation readily conforms to the available cavity space.
Plumbing and wiring	<input type="checkbox"/> Air sealing are provided between the garage and conditioned space.
Shower/tub on exterior wall	<input type="checkbox"/> Batt insulation is cut neatly to fit around wiring and plumbing in exterior walls, or insulation that on installation readily conforms to available space shall extend behind piping and wiring.
Fire/smoke boxes on exterior walls	<input type="checkbox"/> Exterior walls adjacent to showers and tubs are insulated.
HVAC register boots	<input type="checkbox"/> The air barrier installed at exterior walls adjacent showers and tubs shall separate them from the showers and tubs.
Concealed sprinklers	<input type="checkbox"/> Fire/smoke boxes are installed.
Roof/ceiling insulation	<input type="checkbox"/> HVAC register boots that penetrate building thermal envelope are sealed to the subfloor or drywall.
	<input type="checkbox"/> When required to be sealed, concealed fire sprinklers shall only be sealed in a manner that is recommended by the manufacturer. Caulking or other adhesive sealants shall not be used to fill voids between fire sprinkler cover plates and walls or ceilings. Insulation will be inspected during final insulation inspection. (Leave remaining boxes unchecked.)
	<input type="checkbox"/> Insulation is installed in each ceiling assembly that separates conditioned space from unconditioned space or outdoors.
	<input type="checkbox"/> Insulation R-value is R-49 or greater. (A minimum of R-28 insulation is allowed if the full height of uncompressed insulation extends over the top of the walls.) Or, R-value matches supplemental documentation ¹ .
Notes:	

The air barrier installed at exterior walls adjacent to showers and tubs shall separate the wall from the showers and tubs.

Exterior walls adjacent to showers and tubs shall be insulated.



Document designed by Performance Systems Development of NY, LLC

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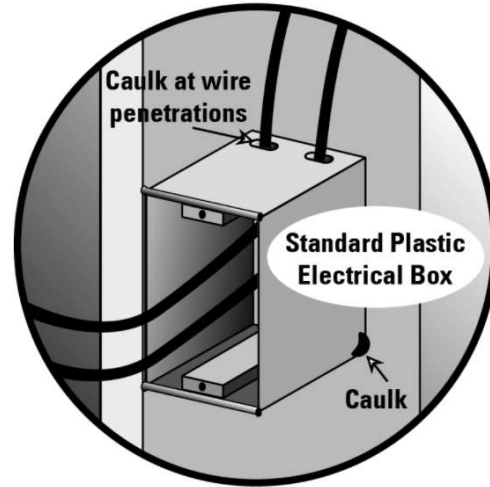
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Electrical/Phone/Cable Boxes on Exterior Walls



Air barrier extends behind boxes or air sealed-type boxes are installed.



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Electrical/Phone/Cable Boxes on Exterior Walls



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Table 402.4.1.1 Air Barrier & Insulation Installation



HVAC supply and return register boots that penetrate the building thermal envelope shall be sealed to the subfloor, wall covering or ceiling penetrated by the boot.



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Table 402.4.1.1 Air Barrier & Insulation Installation



- Recessed light fixtures must be designated as air tight and rated for Insulation Contact (IC Rated).
- Recessed light fixtures must also be sealed to finished surface (drywall).

(Exception – fixtures in conditioned spaces)

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Image source: EPA, ENERGY STAR

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R402.4.2 Fireplaces



- Fireplace exterior walls should be insulated with insulation enclosed on all 6-sides. Exposed insulation is no good.
- The walls should also be air sealed.
- New wood-burning fireplaces shall have tight-fitting flue dampers or doors, and outdoor combustion air.



42
Image source: EPA, ENERGY STAR

42

Table 402.4.1.1 Air Barrier & Insulation Installation



The space between framing and skylights, and the jambs of windows and doors, shall be sealed.





Minimal expanding foams can work very well here

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R402.1.2 Fenestration U-Factor and SHGC





World's Best Window Co.
 Series "2000" Casement
 Vinyl Clad Wood Frame
 Double Glazing • Argon Fill • Low E
 XYZ-X-1-00001-00001

ENERGY PERFORMANCE RATINGS

U-Factor (U.S./I-P)	Solar Heat Gain Coefficient
0.27	0.25

ADDITIONAL PERFORMANCE RATINGS

Visible Transmittance	Air Leakage (U.S./I-P)
0.51	< 0.3

Manufacturer stipulates that these ratings conform to the applicable NFRC procedures for determining whole product performance. NFRC ratings are determined for fixed set of environmental conditions and a specific product size. NFRC does not recommend any product and does not warrant the suitability of any product for any specific use. Consult manufacturer's literature for other product performance information.
 www.nfrc.org

NYS

Climate Zone	Fenestration U-factor	Skylight U-factor	SHGC
4	0.32	0.55	0.4
5	0.30	0.55	NR
6 Option 1	0.30	0.55	NR
6 Option 2	0.28	0.55	


NYStretch / NYC

Climate Zone	Fenestration U-factor	Skylight U-factor	SHGC
4	0.27	0.50	0.4
5	0.27	0.50	NR
6	0.27	0.50	NR

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R402.4.6 Tenant Separation Walls (Mandatory)




Tenant Separation Walls (Mandatory)

Fire separations between dwelling units in two-family dwellings and multiple single-family dwellings (townhouses) shall be insulated to no less than R-10 and the walls shall be air sealed in accordance with Section R402.4. of this chapter



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POLL #3



Choose all that apply:

All connections and by-passes between attached garages and conditioned space must be sealed:

1. To improve energy efficiency
2. To improve health and safety
3. To minimize pollutants from the garage
4. To meet code
5. All of the above

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FRAMING AND ROUGH-IN INSPECTION

Insulation Installation

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R106.2.2 Framing and Rough-In Inspection



Inspections at framing and rough-in shall be made before application of interior finish and shall verify compliance with:

- **The types of insulation, R-values, location and proper installation;** fenestration U-factors and SHGC and proper installation; air leakage controls as required by the code



Image courtesy of Dan Augustine

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TABLE R402.4.1.1 AIR BARRIER AND INSULATION INSTALLATION ^a		
COMPONENT	AIR BARRIER CRITERIA	INSULATION INSTALLATION CRITERIA
General requirements	A continuous air barrier shall be installed in the building envelope. The exterior thermal envelope contains a continuous air barrier. Breaks or joints in the air barrier shall be sealed.	Air-permeable insulation shall not be used as a sealing material.
Ceiling/attic	The air barrier in any dropped ceiling or soffit shall be aligned with the insulation and any gaps in the air barrier shall be sealed. Access openings, drop down stairs or knee wall doors to unconditioned attic spaces shall be sealed.	The insulation in any dropped ceiling/soffit shall be aligned with the air barrier.
Walls	The junction of the foundation and sill plate shall be sealed. The junction of the top plate and the top of exterior walls shall be sealed. Knee walls shall be sealed.	Cavities within corners and headers of frame walls shall be insulated by completely filling the cavity with a material having a thermal resistance, R-value, of not less than R-3 per inch. Exterior thermal envelope insulation for framed walls shall be installed in substantial contact and continuous alignment with the air barrier.
Windows, skylights and doors	The space between framing and skylights, and the jambs of windows and doors, shall be sealed.	---
Rim joints	Rim joints shall include the air barrier.	Rim joints shall be insulated.
Floors, including cantilevered floors and floors above garages	The air barrier shall be installed at any exposed edge of insulation.	Floor framing cavity insulation shall be installed to maintain permanent contact with the underside of subfloor decking. Alternatively, floor framing cavity insulation shall be in contact with the top side of sheathing, or continuous insulation installed on the underside of floor framing, and shall extend from the bottom to the top of all perimeter floor framing members.
Crawl space walls	Exposed earth in inverted crawl spaces shall be covered with a Class I vapor retarder with overlapping joints taped.	Crawl space insulation, where provided instead of floor insulation, shall be permanently attached to the walls.
Shafts, penetrations	Duct shafts, utility penetrations, and flue shafts opening to exterior or unconditioned space shall be sealed.	---
Narrow cavities	---	Batts to be installed in narrow cavities shall be cut to fit or narrow cavities shall be filled with insulation that on installation readily conforms to the available cavity space.
Garage separation	Air sealing shall be provided between the garage and conditioned spaces.	---
Recessed lighting	Recessed light fixtures installed in the building thermal envelope shall be sealed to the finished surface.	Recessed light fixtures installed in the building thermal envelope shall be air tight and IC rated.
Plumbing and wiring	---	In exterior walls, batt insulation shall be cut neatly to fit around wiring and plumbing, or insulation, that on installation readily conforms to available space, shall extend behind piping and wiring.
Shower/tub on exterior wall	The air barrier installed at exterior walls adjacent to showers and tubs shall separate the wall from the shower or tub.	Exterior walls adjacent to showers and tubs shall be insulated.
Electrical/phone box on exterior walls	The air barrier shall be installed behind electrical and communication boxes. Alternatively, air-sealed boxes shall be installed.	---
HVAC register boots	HVAC supply and return register boots that penetrate building thermal envelope shall be sealed to the subfloor, wall covering or ceiling penetrated by the boot.	---
Concealed sprinklers	Where required to be sealed, concealed fire sprinklers shall only be sealed in a manner that is recommended by the manufacturer. Caulking or other adhesive sealants shall not be used to fill voids between fire sprinkler cover plates and walls or ceilings.	---

a. Inspection of log walls shall be in accordance with the provision of ICC 400.



Air-permeable insulation shall not be used as a sealing material.

Exterior thermal envelope insulation for framed walls is installed in substantial contact and continuous alignment with building envelope air barrier.


Floor framing cavity insulation shall be installed to maintain permanent contact with the underside of subfloor decking.

49

R303.2 Installation




Batts in narrow cavities are cut to fit, or narrow cavities are filled by sprayed/blown insulation



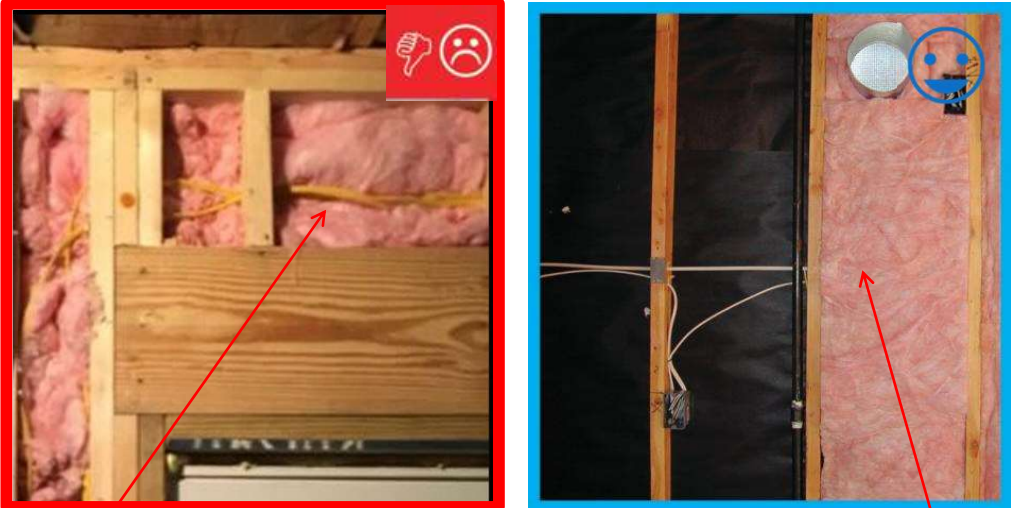
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50

R303.2 Installation



Batt insulation should be cut to fit around wiring and plumbing or sprayed/blown insulation extends behind piping and wiring.



51
Image source: EPA, ENERGY STAR

51

R303.2 Installation

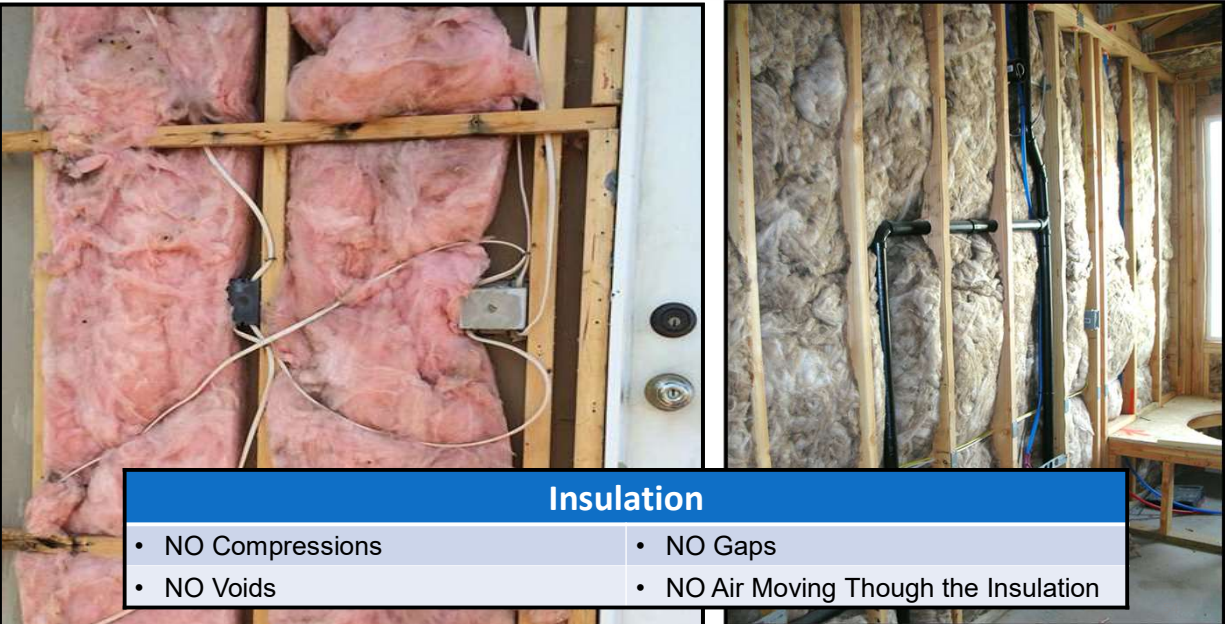
SPLIT BATT

52

R303.2 Installation

53

R303.2 Installation


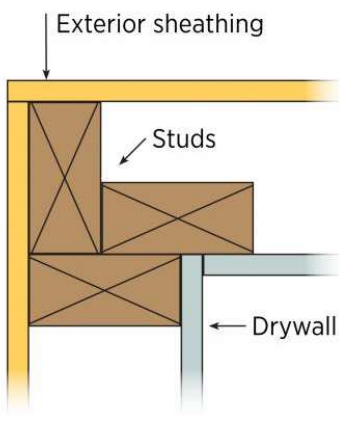



Insulation	
• NO Compressions	• NO Gaps
• NO Voids	• NO Air Moving Through the Insulation

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R303.2 Installation

Allow for insulation in corners and wall connections...



55

R303.2 Installation

Maintain insulation at full depth in wall cavities



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Other Insulation Installation Techniques

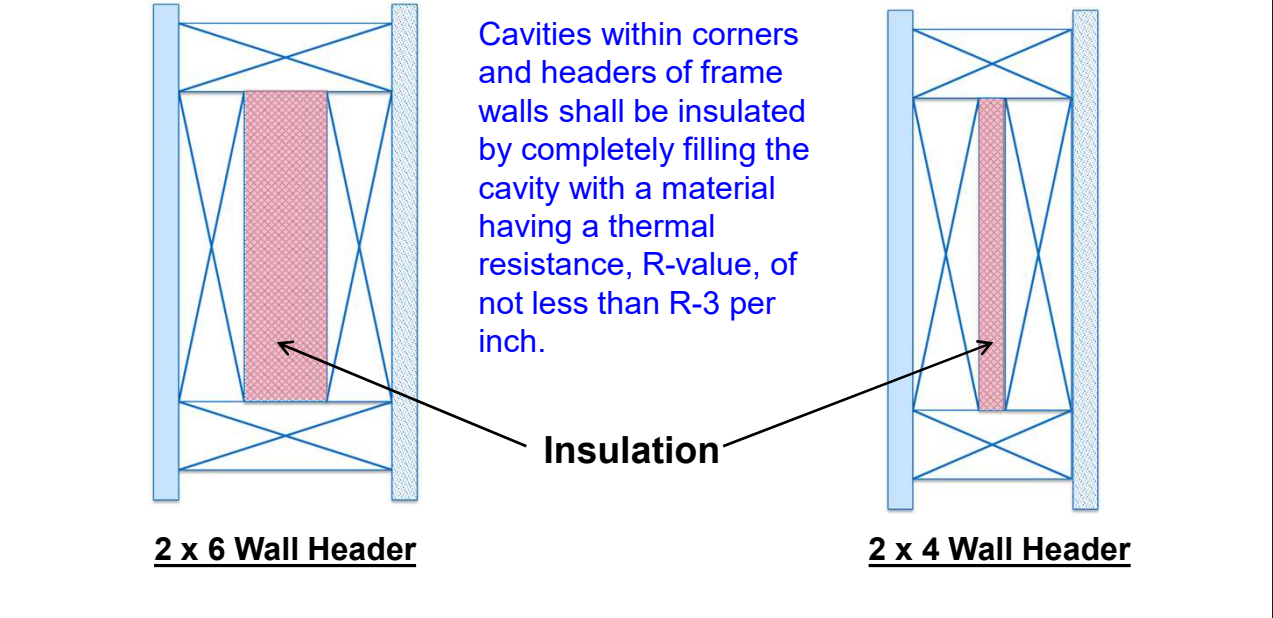


- Some insulation installations offer extremely tight construction
- Cavities are filled without gaps or compressions

- Less drafts, better blower door results and improved comfort!

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Table 402.4.1.1 Air Barrier & Insulation Installation



Cavities within corners and headers of frame walls shall be insulated by completely filling the cavity with a material having a thermal resistance, R-value, of not less than R-3 per inch.

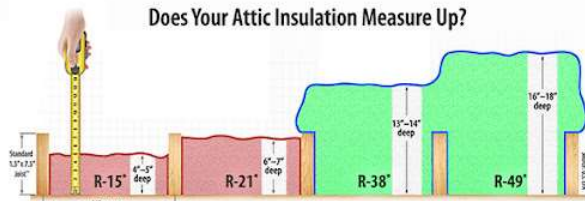
Insulation

2 x 6 Wall Header

2 x 4 Wall Header

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R402.2.1 Ceilings with Attic Spaces



Where R-49 insulation in the ceiling is required, installing R-38 over **100 percent** of the ceiling area shall satisfy the requirement for R-49 insulation

60

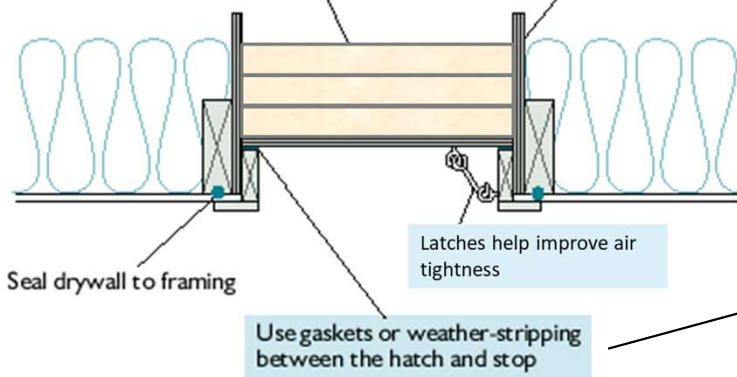
R402.2.4 Access Hatches and Doors



Attic hatch

Insulate to the same level as the surrounding surface and secure insulation permanently to the top of the hatch

Provide rigid sides to prevent loose fill insulation from spilling into living space




Provide access from the hatch to all equipment that prevents damaging or compressing the insulation



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R402.2.8 Floors

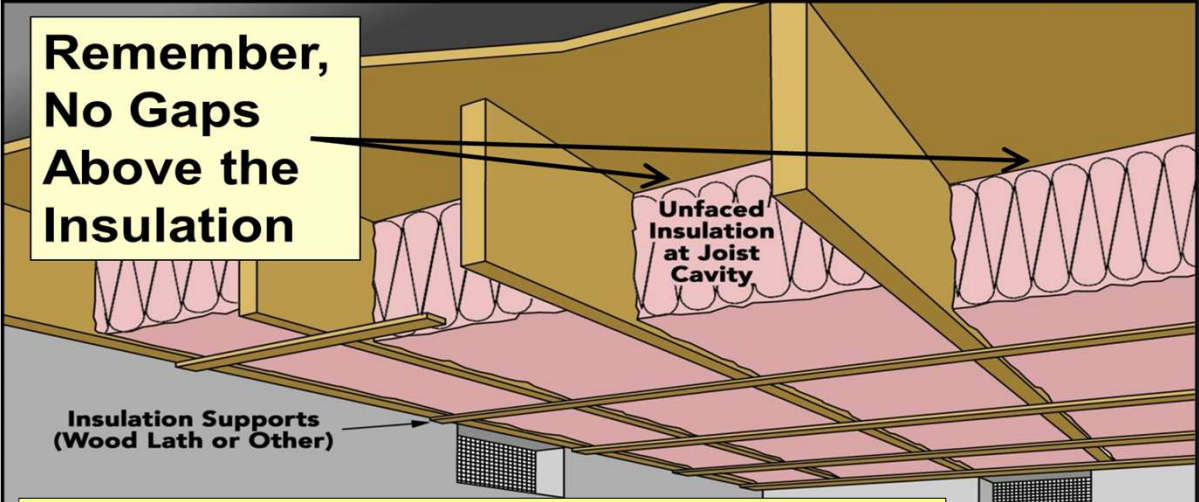


Insulation should be installed to maintain permanent contact with the underside of the subfloor decking

62
Image source: EPA, ENERGY STAR

62

R402.2.8 Floors



Remember, No Gaps Above the Insulation

Unfaced Insulation at Joist Cavity

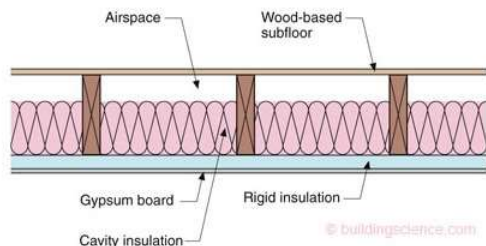
Insulation Supports (Wood Lath or Other)

Foundation Vent

This is for insulated basement ceilings, floors above vented crawl spaces, cantilevered floors, bonus room floors above garages and insulated floors above unconditioned space

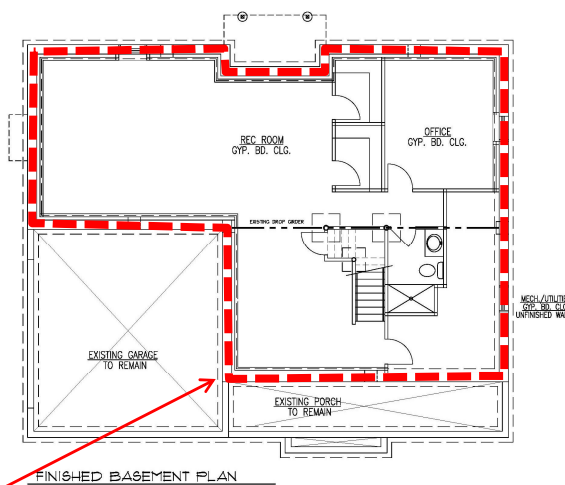
63

R402.2.8 Floors



The only time gaps are allowed above the insulation in an insulated floor system is:

1. when the insulation is installed in contact with sheathing or continuous insulation underneath the floor framing, AND
2. the entire perimeter of the floor system is insulated to the Energy Code's wood frame-wall requirements



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R402.2.9 Basement Walls



- Walls associated with conditioned basements shall be insulated from the top of the basement wall down to 10 feet below grade or to the basement floor, whichever is less.
- Walls associated with unconditioned basements shall comply with this requirement except where the floor overhead is insulated in accordance with this code

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Table 402.4.1.1 Air Barrier & Insulation Installation



The rim joists shall be insulated and include the air barrier.

66

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POLL #4



True or False

Attic hatches are required to have a minimum of R-10 insulation.

67

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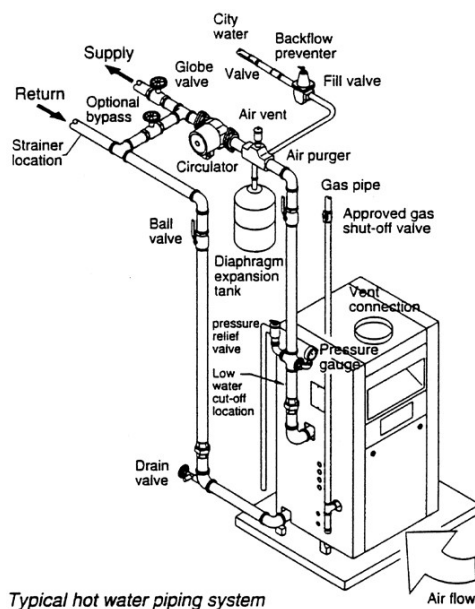


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R106.2.3 Plumbing Rough-in Inspection

Mechanical System Piping:

- ✓ Mechanical System Piping capable of carrying fluids greater than 105°F or less than 55°F shall be insulated to an R-Value of NOT less than R-3
- ✓ In addition, protection of pipe insulation shall be provided



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R106.2.3 Plumbing Rough-in Inspection



Service Hot Water Piping:

- ✓ Service or Domestic Hot Water Pipe Insulation Requirements are Prescriptive
- ✓ R-3 pipe insulation is required for service water heating pipes meeting any one of the following conditions:
 1. $\geq \frac{3}{4}$ " nominal diameter
 2. Located outside conditioned space
 3. Between the water heater and a manifold
 4. Underground or in a slab
 5. Serving more than one dwelling unit
 6. Supply and return piping in recirculating hot water systems other than demand recirculating systems

✓ Also, there are Requirements in Section R403.5 for Control of:

1. Circulating Hot Water Systems
2. Demand Recirculation Hot Water Systems



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R106.2.4 Mechanical Rough-in Inspection



- HVAC equipment type and size
- Controls
- System insulation and corresponding R-value
- Duct system air leakage control
- Programmable thermostats
- Dampers
- Whole-house ventilation and fan efficacy

ORGANIZATION LETTERHEAD	
ROUGH MECHANICAL & PLUMBING INSPECTION CHECKLIST (Based on the 2020 ECCCNY)	
House Address: _____	Permit #: _____ Date: _____
Permit holder: _____	Phone: _____
ROUGH MECHANICAL INSPECTION	
	<input type="checkbox"/> All thermostats are programmable
	<input type="checkbox"/> Air handler has manufacturer's designation of $\leq 2\%$ air leakage when tested per ASHRAE 139
Air Handler	<input type="checkbox"/> Cooling system capacity (or make and model) matches equipment specified on the Residential HVAC Equipment Design Worksheet
	<input type="checkbox"/> Heating system capacity (or make and model) matches equipment specified on the Residential HVAC Equipment Design Worksheet
HVAC Piping	<input type="checkbox"/> HVAC pipe insulation is R-3 minimum (e.g. hydronic systems, refrigerant lines) and outdoor insulation is protected
	<input type="checkbox"/> Ducts in unconditioned spaces are insulated
	<input type="checkbox"/> $\geq 3'$ diameter insulated to 2 R-8 in attics and 2 R-6 elsewhere
	<input type="checkbox"/> $< 3'$ diameter insulated to 2 R-6 in attics and 2 R-4.2 elsewhere
Ducts	<input type="checkbox"/> Ducts are sealed with UL 181 sealant compatible with the duct material
	<input type="checkbox"/> General contractor is aware of duct testing requirement when any ducts or air handlers are not located completely within conditioned space
Whole-house Mechanical Ventilation	<input type="checkbox"/> Ventilation fan capable of exhausting and/or supplying the continuous or intermittent ventilation rate specified in Item #5 of the Residential HVAC Equipment Design Worksheet has been installed
	<input type="checkbox"/> Fan has an HVI-rated fan efficacy meeting the requirements of Table R403.6.1 or fan make/model matches approved Residential HVAC Equipment Design Worksheet
ROUGH PLUMBING INSPECTION	
	Hot water pipes meeting any <u>one</u> of the following criteria are insulated to at least R-3
Service Hot Water Piping	<input type="checkbox"/> $\geq \frac{3}{4}$ " nominal diameter
	<input type="checkbox"/> Located outside conditioned space
	<input type="checkbox"/> Between the water heater and a manifold
	<input type="checkbox"/> Underground or in a slab
	<input type="checkbox"/> Serving more than one dwelling unit
	<input type="checkbox"/> Supply and return piping in recirculating hot water systems other than demand recirculating systems
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<small>Page 2 of 5</small>	

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ORGANIZATION LETTERHEAD

**RESIDENTIAL HVAC EQUIPMENT DESIGN WORKSHEET
 HEATING AND COOLING EQUIPMENT**

House Address: 123 Main Street Permit #: 9999999 Date: 4/1/2020

Permit Applicant: Very Good General Contractors Phone: 555-2340-4567

Requirements:

- R403.1.1 All thermostats are programmable
- R403.3.1 Ducts in unconditioned spaces are insulated
 - ≥ 3" diameter insulated to ≥ R-8 in attics and ≥ R-6 elsewhere
 - < 3" diameter insulated to ≥ R-6 in attics and ≥ R-4.2 elsewhere
- R403.3.2.1 Air handler has manufacturer's designation of ≤ 2% air leakage when tested per ASHRAE 193
- R403.3.3 Completed **Duct and Envelope Testing Form** will be submitted to the inspector
- R403.4 HVAC pipe insulation is R-3 minimum (e.g. hydronic systems, refrigerant lines) and outdoor insulation is protected
- R403.7 Manual J report, including heating and cooling design loads, is attached
- R403.7 Heating and cooling equipment have been selected in accordance with Manual S, based on loads calculated in accordance with Manual J (see below)

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Complete the following based on the attached Manual J report:

<p>Design loads:</p> <p>Design cooling load: <u>27,963</u> (Btu/h)</p> <p>Design heating load: <u>52,947</u> (Btu/h)</p>	<p>Equipment specifications:</p> <p>Cooling system output capacity: <u>30,000</u> (Btu/h)</p> <p>Cooling equipment make: <u>Goodperson</u></p> <p>Cooling equipment model: <u>AC2000-30</u></p> <p>Heating system output capacity: <u>54,000</u> (Btu/h)</p> <p>Heating equipment make: <u>Goodperson</u></p> <p>Heating equipment model: <u>GF2000-54</u></p>
---	---

- Manual S. Specified *cooling* equipment capacity is ≤ 1.15 times the design load or the next larger nominal size, whichever is greater. (Exception: Heat pumps may exceed the design load by 1.25 times or the next nominal size.)
- Manual S. Specified *heating* equipment capacity is ≤ 1.40 times the design load or the next larger nominal size, whichever is greater
- RCNYS R303.4 Whole-house mechanical ventilation worksheet has been completed (see reverse)

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Page 1 of 2

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Complete the following based on the attached Manual J report:

Design loads:
 Design cooling load 27,963 (Btu/h)
 Design heating load: 52,947 (Btu/h)

Equipment specifications:
 Cooling system output capacity 30,000 (Btu/h)
 Cooling equipment make: Goodperson
 Cooling equipment model: AC2000-30
 Heating system output capacity: 54,000 (Btu/h)
 Heating equipment make: Goodperson
 Heating equipment model: GF2000-54

Manual S. Specified *cooling* equipment capacity is ≤ 1.15 times the design load or the next larger nominal size, whichever is greater. (Exception: Heat pumps may exceed the design load by 1.25 times or the next nominal size.)

Manual S. Specified *heating* equipment capacity is ≤ 1.40 times the design load or the next larger nominal size, whichever is greater

RCNYS R303.4 Whole-house mechanical ventilation worksheet has been completed (see reverse)

Document designed by Performance Systems Development of NY, LLC Page 1 of 2

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RESIDENTIAL HVAC DESIGN FORM
WHOLE-HOUSE MECHANICAL VENTILATION DESIGN WORKSHEET

House Address: 123 Main Street Permit #: 9999999 Date: 4/1/2020
 Permit holder: Very Good General Contractors Phone: 555-2340-4567

1. Fill in the conditioned floor area and number of bedrooms for the dwelling:
 Conditioned Floor Area = 3,286 ft² Number of bedrooms = 4

2. Circle the required airflow value on the table below:

RCNYS Table M1505.4.3(1)
 Continuous Whole-House Mechanical Ventilation System Airflow Rate Requirements

Dwelling Unit Floor Area (square feet)	Number of Bedrooms				
	0-1	2-3	4-5	6-7	>7
< 1,500	30	45	75	75	90
1,501 – 3,000	45	60	75	90	105
3,001 – 4,500	60	75	90	105	120
4,501 – 6,000	75	90	105	120	135
6,001 – 7,500	90	105	120	135	150
> 7,500	105	120	135	150	165

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3. Does the fan operate continuously or intermittently? Continuous Intermittent

4. If the fan is to be operated intermittently on a pre-set schedule, multiply the airflow value from Table M1505.4.3 (above) by the appropriate value in Table M1505.4.3(2) (below).

RCNYS Table M1505.4.3(2)
Intermittent Whole-House Mechanical Ventilation Rate Factors

Run-time Percentage in Each 4-hour Segment	25%	33%	50%	66%	75%
Factor	4.0	3.0	2.0	1.5	1.3

5. Enter the required airflow = 180 CFM

6. R403.6.1. Fan efficacy. Enter the following information regarding the specified fan:

Rated fan airflow = 200 CFM Fan make: Great Fan

HVI-rated fan efficacy = 3.4 CFM/Watt

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3. Does the fan operate continuously or intermittently? Continuous Intermittent

4. If the fan is to be operated intermittently on a pre-set schedule, multiply the airflow value from Table M1505.4.3 (above) by the appropriate value in Table M1505.4.3(2) (below).

RCNYS Table M1505.4.3(2)
Intermittent Whole-House Mechanical Ventilation Rate Factors

Run-time Percentage in Each 4-hour Segment	25%
Factor	4.0

5. Enter the required airflow = 180 CFM

6. R403.6.1. Fan efficacy. Enter the following information regarding the specified fan:

Rated fan airflow = 200 CFM

HVI-rated fan efficacy = 3.4 CFM/Watt

TABLE R403.6.1
WHOLE-HOUSE MECHANICAL VENTILATION SYSTEM
FAN EFFICACY^a

FAN LOCATION	AIR FLOW RATE MINIMUM (CFM)	MINIMUM EFFICACY (CFM/WATT)	AIR FLOW RATE MAXIMUM (CFM)
HRV or ERV	Any	1.2 cfm/watt	Any
Range hoods	Any	2.8 cfm/watt	Any
In-line fan	Any	2.8 cfm/watt	Any
Bathroom, utility room	10	1.4 cfm/watt	< 90
Bathroom, utility room	90	2.8 cfm/watt	Any

For SI: 1 cfm = 28.3 L/min.

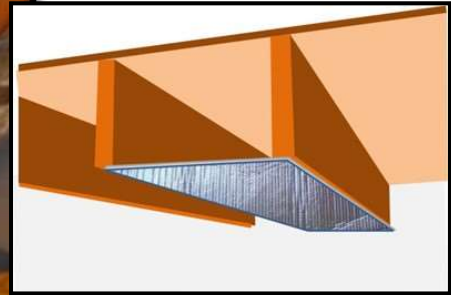
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R403.3.5 Building Cavities (Mandatory)

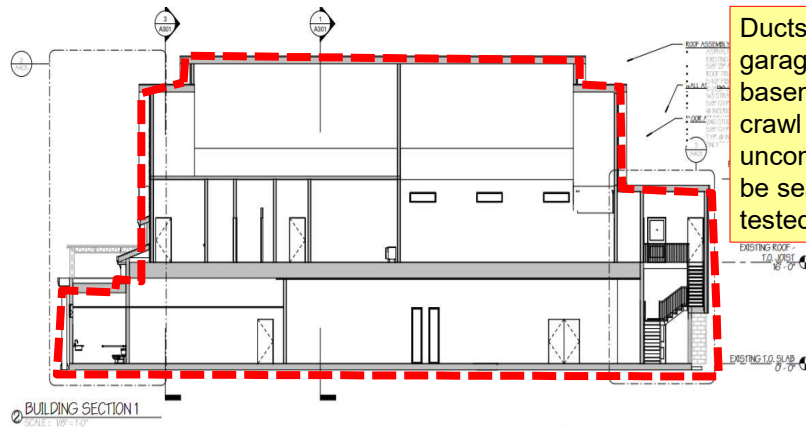


Building framing cavities shall not be used as ducts or plenums.



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R403.3 Duct Systems



Ducts running through garages, unconditioned basements, unconditioned crawl spaces and unconditioned attics must be sealed, insulated and tested

Duct insulation and duct pressure testing is not required for duct systems that are entirely within the building envelope. However, ALL ducts shall be sealed.

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R403.3.4 Duct Leakage Testing (Prescriptive)



Total duct leakage shall not exceed:

Rough-in test:

With air handler: 4 cfm per 100 ft²

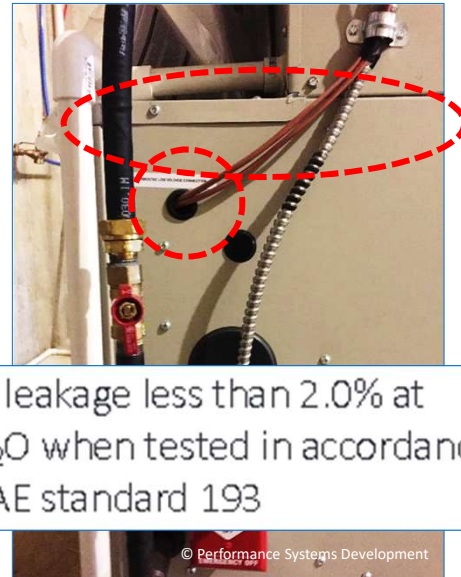
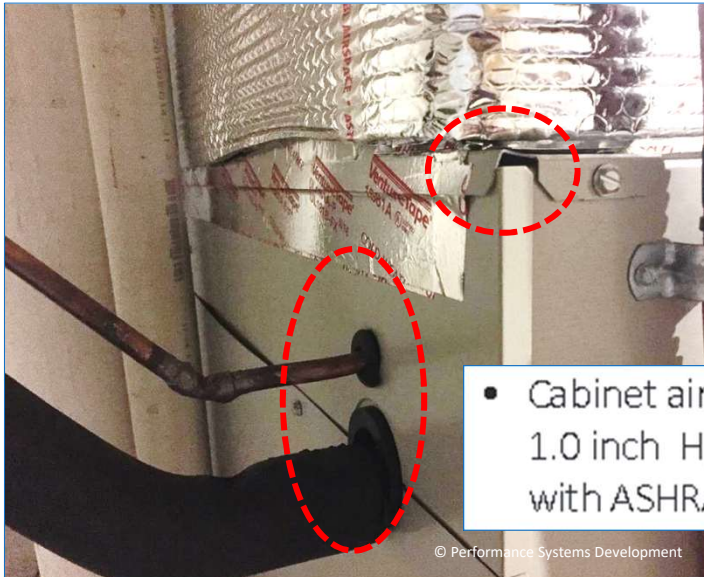
Without air handler: 3 cfm per 100 ft²

Post-construction test:

4 cfm per 100 ft² conditioned floor area

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Factory Sealed Air Handler



- Cabinet air leakage less than 2.0% at 1.0 inch H₂O when tested in accordance with ASHRAE standard 193

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POLL #5



When can building framing cavities be used as ducts or plenums?

1. Only when inside the building envelope
2. Only when outside of the building envelope
3. It is allowed anywhere
4. It is never allowed

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R106.2.5



- Ceiling insulation
- DET Verification Form
- Certificate

ORGANIZATION LETTERHEAD

FINAL INSPECTION-INSULATION AND DOCUMENTATION CHECKLIST
(Based on the 2020 ECCC NYS)

House Address: _____ Permit #: _____ Date: _____
 Permit holder: _____ Phone: _____


FINAL INSPECTION	
Ceiling/Attic	<input type="checkbox"/> Recessed light fixtures installed in the building thermal envelope are sealed to the drywall. <input type="checkbox"/> Insulation is installed in each ceiling assembly that separates conditioned space from unconditioned space or outdoors. <input type="checkbox"/> Insulation R-value is R-49 or greater. (A minimum of R-38 insulation is allowed if the full height of uncompressed insulation extends over the top of the walls.) Or, R-value matches supplemental documentation. ¹ <input type="checkbox"/> Access openings, drop-down stairs, or knee wall doors to unconditioned attic spaces are sealed.
Documentation	<input type="checkbox"/> Completed Duct B Envelope Testing Form received <input type="checkbox"/> Blower door test result is ≤ 5.0 ACH50 ² <input type="checkbox"/> Duct leakage test result is ≤ 4.0 cfm/100 sqft of conditioned floor area (3.0 cfm if tested without air handler) ³ or all ducts are located completely within the thermal envelope.

Notes:

¹ For Simulated Performance Alternative and Energy Rating Index paths, value must also be ≤ the value on the Energy Cost Report or Final CR Report
² Duct leakage rates may exceed the prescriptive limits, provided they are ≤ the value on the ECCC Energy Cost Report or Final CR Report
 Document designed by Performance Systems Development of NY, LLC Page 5 of 5

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R303.1.1 Building Thermal Envelope Insulation




For blown-in or sprayed fiberglass and cellulose insulation, the following information shall be included on the insulation certification:

1. initial installed thickness
2. settled thickness
3. settled R-value
4. installed density
5. coverage area
6. number of bags installed

For sprayed polyurethane foam (SPF) insulation, the following information shall be included on the insulation certification:




1. the installed thickness of the areas covered
2. the R-value of the installed thickness

This Attic Has Been Insulated To



R-

By A Professional Insulation Contractor
The insulation in this attic was installed by a qualified professional Contractor to the R-value stated above.

Certificate of Insulation

BUILDING ADDRESS: _____ CONTRACTOR: _____

 Installation Date: _____ License #: _____

Area Insulated	R-Value	Installed Thickness	Settled Thickness	Installed Density	No. Bags	Sq. Ft.
Attic						
Walls						
Floors						

I, _____ (print name) certify that this residence building has been insulated to the stated R-value and that the installation is in conformance with all applicable codes, standards, regulations and specifications.

Authorized Signature: _____ Date: _____

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R303.1.1.1 Building Thermal Envelope Insulation



The thickness of blown-in or sprayed fiberglass and cellulose roof and ceiling insulation shall be written in inches (mm) on markers that:

- Are 1 for every 300 ft²
- Show the minimum initial installed thickness
- Have numbers ≥ 1" high
- Facing the attic access opening

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Duct and Envelope Testing (DET) Form



RESIDENTIAL DUCT & ENVELOPE TESTING (DET) FORM

House Address: _____ Permit #: _____ Date: _____
 Permit holder: _____ Phone: _____

I. Building Envelope Air Leakage (mandatory):

Blower door test (Mandatory)

Test Result:
 Fan Flow at 50 Pascals: _____ CFM50
 Total Conditioned Volume: _____ ft³
 ACH50 = CFM50 x 60 / Volume = _____ ACH50*

Testing company: _____ Phone: _____
 Tester Name (print): _____ Signature: _____ Date: _____
 BPI or HERS certification number: BPI no: _____ HERS Rater no: _____ HERS RFI no: _____
*For Simulated Performance Alternative and Energy Rating Index Paths, value must match 2015 IECC Energy Cost Report or 2015 Final EIR Report

II. Heating and Cooling System Duct Leakage

I certify that all portions of the ducts are located entirely within the building thermal envelope. Testing is not required.
 Owner or approved third party signature: _____ Date: _____

Total duct leakage test

Energy code compliance path: Prescriptive (including REScheck) Performance or Energy Rating Index

Type of test performed: Rough-in with air handler Rough-in without air handler Post construction

Test Result System 1:
 Fan Flow at 25 Pascals (CFM25) _____ CFM
 Conditioned Floor Area (CFA) served by system _____ ft²
 CFM25 / CFA x 100 = _____ CFM/100 ft²

Test Result System 2 (if present):
 Fan Flow at 25 Pascals (CFM25) _____ CFM
 Conditioned Floor Area (CFA) served by system _____ ft²
 CFM25 / CFA x 100 = _____ CFM/100 ft²

Testing company: _____ Phone: _____
 Tester Name (print): _____ Signature: _____ Date: _____
 BPI or HERS certification number: BPI no: _____ HERS Rater no: _____ HERS RFI no: _____

Qualified professionals may be found at:
 Insert local electric utility directory here | <http://www.bpi.org/locator-tool?find-a-contractor>

Form created by Performance Systems Development

Fan Flow CFM50

Total Conditioned Volume ft³

Test result: ≤ 3.0 ACH50

Post construction? Rough-in
 With or W/O air handler?

Total Conditioned Area ft²

Test results: ≤ 4.0 CFM25 or
 ≤ 3.0 CFM25 w/o air handler

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R404.1 Lighting Equipment (Mandatory)



A minimum of 90% of the lamps (i.e., bulbs) in permanently installed fixtures shall be high efficacy

- 60 lumens per watt for lamps over 40 watts,
- 50 lumens per watt for lamps over 15 watts to 40 watts,
- 40 lumens per watt for lamps 15 watts or less.



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R404.1 Lighting Equipment (Mandatory)



$$750 \text{ Lumens} \div 43 \text{ Watts} = 17.4 \text{ Lumens/Watt}$$



For Lamps	Minimum Lamp Efficacy
Over 40 watts	60 lumens per watt
Over 15 watts to 40 watts	50 lumens per watt
15 watts or less	40 lumens per watt

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R401.3 Certificate (Mandatory)



A permanent certificate is required to be completed and posted on a wall in a utility room that indicates:

- the predominant R-values of insulation installed in or on ceilings, roofs, walls, foundation components such as slabs, basement walls, crawl space walls and floors and ducts outside conditioned spaces
- U-factors of fenestration and the solar heat gain coefficient (SHGC) of fenestration
- And the results from any required duct system and building envelope air leakage testing performed on the building



2018 IECC Energy Efficiency Certificate

Insulation Rating		R-Value	
Above-Grade Wall		26.00	
Below-Grade Wall		15.00	
Floor		35.00	
Ceiling / Roof		41.00	
Ductwork (unconditioned spaces): _____			
Glass & Door Rating		U-Factor	SHGC
Window		0.25	
Door		0.70	
Skylight		0.50	
Heating & Cooling Equipment		Efficiency	
Heating System: _____		_____	
Cooling System: _____		_____	
Water Heater: _____		_____	
Name: _____		Date: _____	
Comments			

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Field Inspection Summary



- ✓ Supplying Permit Applicants with the 1) Plan Submittal Requirement Checklist and 2) The HVAC Design Form (Heating & Cooling Worksheet & Mechanical Ventilation Worksheet) PRIOR to Field Inspections will help reduce Field Inspection time
- ✓ Field Inspection Checklists help in the field – try them!
- ✓ Air Sealing and Insulation shall be continuous (no gaps, leaks, by-passes or holes)
- ✓ Windows & Doors shall be identified by U-Value and SHGC on their NFRC Label
- ✓ ALL PROJECTS SHALL THE MEET MANDATORY REQUIREMENTS
- ✓ ALL PROJECTS SHALL BE TESTED FOR AIR LEAKAGE (Blower Door Testing)
- ✓ Ducts are either inside the Building Envelope or Tested for Duct Leakage – **ALL Ducts are Sealed**
- ✓ Projects submitted using REScheck, the Simulated Performance Path or ERI have Reports that are helpful to demonstrating compliance – use them!
- ✓ For more information on the other trainings in this series, please see

["https://psdconsulting.com/ny-energycode/"](https://psdconsulting.com/ny-energycode/)



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THANK YOU & QUESTIONS

NYDOS Course Number
T02-07-2863

Adam Smith
asmith@psdconsulting.com

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Please fill out the evaluation survey that will appear directly after the webinar!