Thermal Enclosure System

ENERGY STAR® Qualified Homes

THERMAL ENCLOSURE SYSTEM RATER CHECKLIST

Rater Checklist: Section 5

ENERGY STAR Certified Homes, Version 3 (Rev. 07)
Thermal Enclosure System Rater Checklist

5. Air Sealing	Must Correct	Builder Verified [1]	Rater Verified	N/A
5.1 Penetrations to unconditioned space fully sealed with solid blocking or flashing as needed and gaps sealed with caulk or foam				
5.1.1 Duct / flue shaft	☐	☐	☐	☐
5.1.2 Plumbing / piping	☐	☐	☐	☐
5.1.3 Electrical wiring	☐	☐	☐	☐
5.1.4 Bathroom and kitchen exhaust fans	☐	☐	☐	☐
5.1.5 Recessed lighting fixtures adjacent to unconditioned space ICAT labeled and fully gasketed. Also, if in insulated ceiling without attic above, exterior surface of fixture insulated to ≥ R-10 in CZ 4 and higher to minimize condensation potential.	☐	☐	☐	☐
5.1.6 Light tubes adjacent to unconditioned space include lens separating unconditioned and conditioned space and are fully gasketed [23]	☐	☐	☐	☐
5.2 Cracks in the building envelope fully sealed				
5.2.1 All above-grade sill plates adjacent to conditioned space sealed to foundation or sub-floor with caulk, foam, or equivalent material. Foam gasket also placed beneath above-grade sill plate if resting atop concrete or masonry and adjacent to conditioned space [24, 25]	☐	☐	☐	☐
5.2.2 At top of walls adjoining unconditioned spaces, continuous top plates or sealed blocking using caulk, foam, or equivalent material	☐	☐	☐	☐
5.2.3 Drywall sealed to top plate at all unconditioned attic / wall interfaces using caulk, foam, drywall adhesive (but not other construction adhesives), or equivalent material. Either apply sealant directly between drywall and top plate or to the seam between the two from the attic above.	☐	☐	☐	☐
5.2.4 Rough opening around windows & exterior doors sealed with caulk or foam [26]	☐	☐	☐	☐
5.2.5 Marriage joints between modular home modules at all exterior boundary conditions fully sealed with gasket and foam	☐	☐	☐	☐
5.2.6 All seams between Structural Insulated Panels (SIPs) foamed and / or taped per manufacturer's instructions	☐	☐	☐	☐
5.2.7 In multifamily buildings, the gap between the common wall (e.g. the drywall shaft wall) and the structural framing between units fully sealed at all exterior boundaries	☐	☐	☐	☐
5.3 Other openings				
5.3.1 Doors adjacent to unconditioned space (e.g., attics, garages, basements) or ambient conditions made substantially air-tight with weatherstripping or equivalent gasket	☐	☐	☐	☐
5.3.2 Attic access panels and drop-down stairs equipped with a durable ≥ R-10 insulated cover that is gasketed (i.e., not caulked) to produce continuous air seal when occupant is not accessing the attic [27]	☐	☐	☐	☐
5.3.3 Whole-house fans equipped with a durable ≥ R-10 insulated cover that is gasketed and either installed on the house side or mechanically operated [27]	☐	☐	☐	☐

Rater Name: _____ Rater Pre-Drywall Inspection Date: _____ Rater Initials: _____

Rater Name: _____ Rater Final Inspection Date: _____ Rater Initials: _____

Builder Employee: _____ Builder Inspection Date: _____ Builder Initials: _____

Notes:

1. At the discretion of the Rater, the builder may verify up to eight items specified in this Checklist. When exercised, the builder's responsibility will be formally acknowledged by the builder signing off on the checklist for the item(s) that they verified.
2. *For Prescriptive Path:* All windows, doors, and skylights shall meet or exceed ENERGY STAR Program Requirements for Residential Windows, Doors, and Skylights – Version 5.0 as outlined at www.energystar.gov/windows. *For Performance Path:* All windows, doors and skylights shall meet or exceed the component U-factor and SHGC requirements specified in the 2009 IECC – Table 402.1.1. If no NFRC rating is noted on the window or in product literature (e.g., for site-built fenestration), select the U-factor and SHGC value from Tables 4 and 14, respectively, in 2005 ASHRAE Fundamentals, Chapter 31. Select the highest U-factor and SHGC value among the values listed for the known window characteristics (e.g., frame type, number of panes, glass color, and presence of low-e coating). Note that the U-factor requirement applies to all fenestration while the SHGC only applies to the glazed portion. The following exceptions apply:
   a. An area-weighted average of fenestration products shall be permitted to satisfy the U-factor requirements;
   b. An area-weighted average of fenestration products ≥ 50% glazed shall be permitted to satisfy the SHGC requirements;
   c. 15 square feet of glazed fenestration per dwelling unit shall be exempt from the U-factor and SHGC requirements, and shall be excluded from area-weighted averages calculated using a) and b), above;
   d. One side-hinged opaque door assembly up to 24 square feet in area shall be exempt from the U-factor requirements and shall be excluded from area-weighted averages calculated using a) and b), above;
   e. Fenestration utilized as part of a passive solar design shall be exempt from the U-factor and SHGC requirements, and shall be excluded from area-weighted averages calculated using a) and b), above. Exempt windows shall be facing within 45 degrees of true South and directly coupled to thermal storage mass that has a heat capacity > 20 btu / ft³x°F and provided in a ratio of at least 3 sq. ft. per sq. ft. of South facing fenestration. Generally, thermal mass materials will be at least 2 in. thick.

5.1 Air Sealing

- Penetration to unconditioned space fully sealed
  - Solid blocking or flashing as needed and gaps sealed with caulk or foam
    - Duct / flue shaft
    - Plumbing / piping
    - Electrical wiring
    - Bathroom and kitchen exhaust fans
    - Recessed lighting fixtures
      - Adjacent to unconditioned space ICAT labeled and fully gasketed
      - Insulated ceiling without attic above
      - exterior surface of fixture insulated to ≥ R-10 in Climate Zone 4 and higher
    - Light tubes adjacent
      - Lens separating unconditioned and conditioned space
      - Full gasketed

5.1.1 Penetrations, Gaps and Holes to Unconditioned Space Fully Sealed

THERMAL ENCLOSURE SYSTEM RATER CHECKLIST

5 AIR SEALING

1 PENETRATIONS, GAPS, AND HOLES TO UNCONDITIONED SPACE FULLY SEALED

A. Chase not capped.

Chase capped with rigid air barrier and duct work penetrations properly sealed.

B. Penetration hole is larger than duct and not sealed.

Neatly cut and sealed penetration.

C. Fibrous insulation does not air seal.

Penetrations have been neatly cut and properly sealed with foam.

D. Vent sleeve not completely sealed.

Vent and air barrier sealed.

Last Updated: 10/28/11

5.1.2 Penetrations, Gaps and Holes to Unconditioned Space Fully Sealed

THERMAL ENCLOSURE SYSTEM RATER CHECKLIST

5 AIR SEALING

1 PENETRATIONS, GAPS, AND HOLES TO UNCONDITIONED SPACE FULLY SEALED

A. Holes have been cut excessively larger than needed making it difficult to seal.

Neatly cut hole has been properly sealed with foam.

A. Holes have been cut excessively larger than needed making it difficult to seal.

Neatly cut holes have been properly sealed with foam.

B. Hole has not been air sealed.

Neatly cut holes have been properly sealed with caulk and foam.

B. Fibrous insulation is not an air barrier and cannot be used for sealing holes.

Neatly cut holes have been properly sealed with foam.

Last Updated: 10/28/11

5.1.3 Penetrations, Gaps and Holes to Unconditioned Space Fully Sealed

THERMAL ENCLOSURE SYSTEM RATER CHECKLIST

5 AIR SEALING

1 PENETRATIONS, GAPS, AND HOLES TO UNCONDITIONED SPACE FULLY SEALED

A. Holes have been cut excessively larger than needed making it difficult to seal.

Wiring penetrations have been neatly sealed with foam.

A. Hole was not neatly cut with a saw making it difficult to seal.

Wiring penetrations have been neatly sealed with foam.

B. Hole has not been air sealed.

Wiring penetrations have been neatly sealed with foam.

B. Fibrous insulation is not an air barrier and cannot be used for sealing holes.

Neatly cut hole has been properly sealed with foam.

Last Updated: 10/28/11

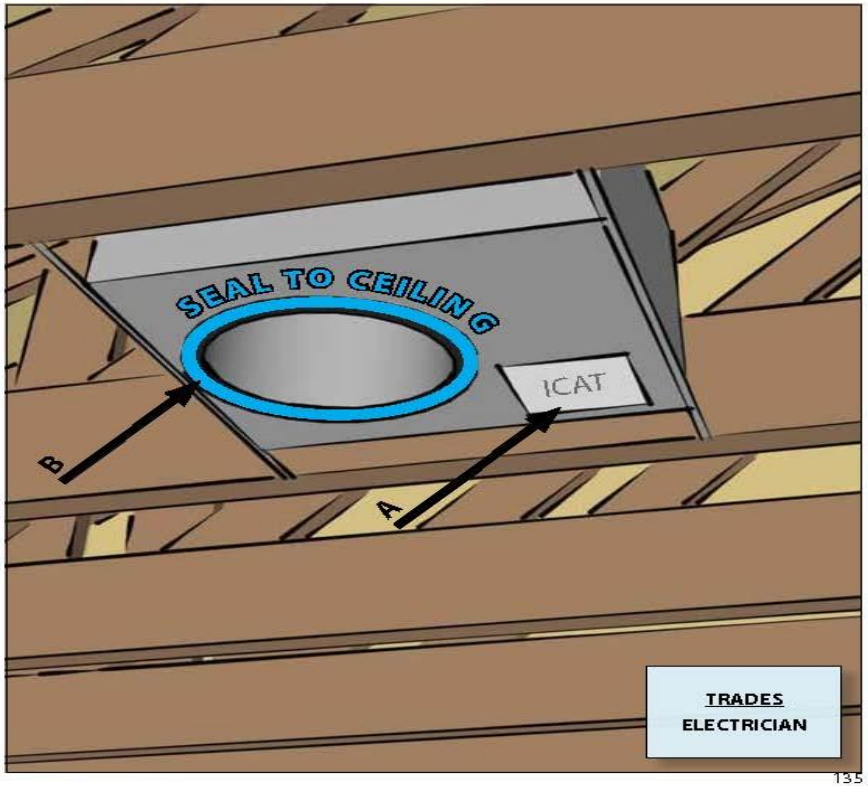
5.1.4 Penetrations, Gaps and Holes to Unconditioned Space Fully Sealed

	THERMAL ENCLOSURE SYSTEM RATER CHECKLIST
5	AIR SEALING
1	PENETRATIONS, GAPS, AND HOLES TO UNCONDITIONED SPACE FULLY SEALED

DETAIL 5.1.5

Recessed lighting fixtures adjacent to unconditioned space ICAT labeled and fully gasketed. Also, if in insulated ceiling without attic above, exterior surface of fixture insulated to ≥ R-10 in CZ 4 and higher to minimize condensation potential.

A. Install ICAT labeled recessed lighting fixtures.
B. Seal all gaps, and holes to unconditioned space with caulk or foam.
C. Install a proper trim kit with a gasket.



Last Updated: 10/28/11

5.1.5 Penetrations, Gaps and Holes to Unconditioned Space Fully Sealed

THERMAL ENCLOSURE SYSTEM RATER CHECKLIST

5 AIR SEALING

1 PENETRATIONS, GAPS, AND HOLES TO UNCONDITIONED SPACE FULLY SEALED

ENERGY STAR

A. Non ICAT recessed light installed.

ICAT labeled recessed light with trim kit installed.

A. Non ICAT recessed light installed.

ICAT labeled recessed light installed but still needs gasket.

B. Recessed can light has not been sealed to drywall.

Recessed can light penetration sealed with caulk to drywall.

C. No gasket installed.

ICAT recessed light sprayed with foam to act as gasket against the drywall.

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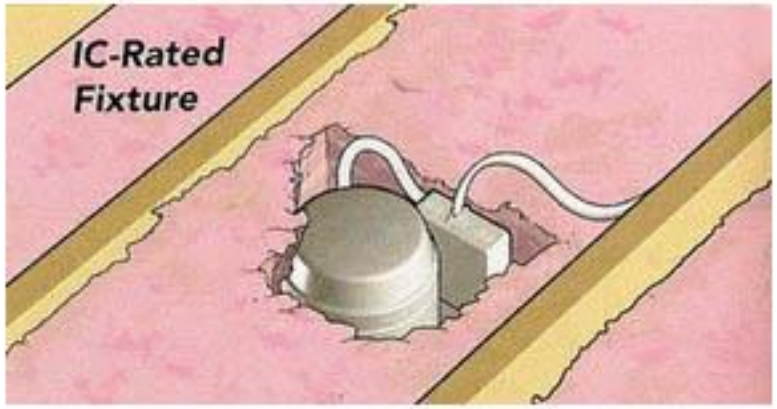
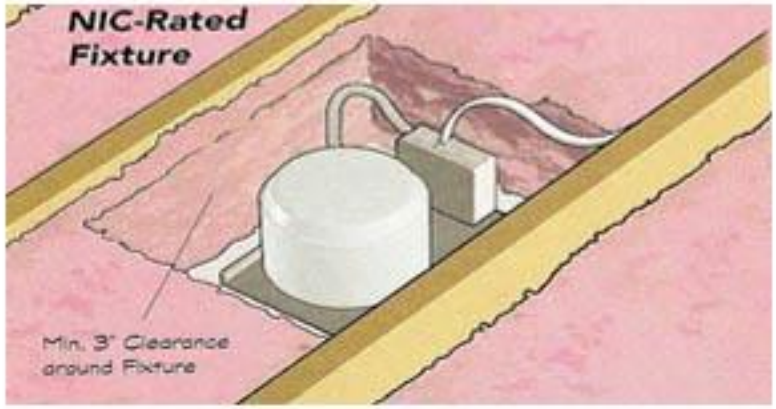
5.1.5 Penetrations, Gaps and Holes to Unconditioned Space Fully Sealed



Insulation Contact Rated Housing: Recessed downlights that are installed in an insulated ceiling must be able to withstand the heat build up the insulation causes and be made specifically for this type of application. These recessed fixtures are called IC Rated.



Non-Insulation Rated Housing: Non-IC Rated Recessed Light Fixtures are generally preferred if your ceiling is not insulated. Some downlights are listed for both IC and Non-IC use, but with different wattages or bulbs.

5.2 Air Sealing (cont.)

- Cracks in the building envelope fully sealed
  - All above-grade still plates adjacent to conditioned space to foundation or sub-floor
    - Caulk
    - Foam
    - Equivalent material
  - Foam gasket also replace beneath above-grade still plate if resting atop concrete or masonry and adjacent to conditioned space
  - Top walls adjoining unconditioned spaces

5.2.1 Cracks in The Building Envelope Fully Sealed

	THERMAL ENCLOSURE SYSTEM RATER CHECKLIST
5	AIR SEALING
2	CRACKS IN THE BUILDING ENVELOPE FULLY SEALED

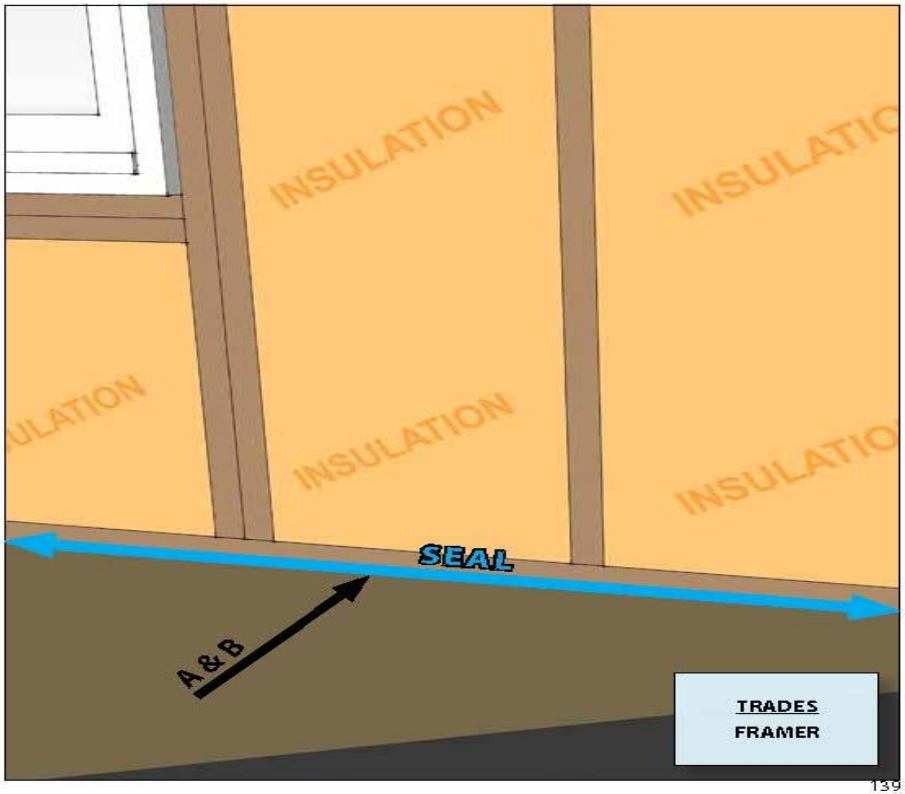
ENERGY STAR

DETAIL 5.2.1

All sill plates adjacent to conditioned space sealed to foundation or sub-floor with caulk. Foam gasket also placed beneath sill plate if resting atop concrete or masonry and adjacent to conditioned space

A. Locate all sill plates of all exterior walls, common walls, and vertical members at foundation step downs.

B. Install a gasket to prevent air leakage and seal all exterior wall sill plates to the sub-floor or foundation to prevent air leakage.



Last Updated: 10/28/11

5.2.1 Cracks in The Building Envelope Fully Sealed

THERMAL ENCLOSURE SYSTEM RATER CHECKLIST

5 AIR SEALING

2 CRACKS IN THE BUILDING ENVELOPE FULLY SEALED

ENERGY STAR

A. No foam gasket or air seal between sill plate and masonry foundation.

Foam gasket installed between sill plate and foundation.

A. Caulk is too far from sill plate to properly air seal.

Sill plate was sprayed with foam prior to installation atop foundation.

B. No foam gasket or air seal beneath sill plate.

Foam gasket installed beneath sill plate.

B. Foam sprayed at exterior sheathing and sill plate connection leaving gaps beneath sill plate.

Installed foamed exterior sheathing intersection as well as the sill plate to sub-floor connection.

Last Updated: 10/28/11

5.2.2 Air Sealing (cont.)

- Continuous top plates or sealed blocking
  - Caulk
  - Foam
  - Equivalent material
- Drywall sealed to top plate at all unconditioned attic / wall interfaces
  - Caulk
  - Foam
  - Drywall adhesive (but not other construction adhesives)
  - Equivalent material

5.2.2 Cracks in The Building Envelope Fully Sealed

	THERMAL ENCLOSURE SYSTEM RATER CHECKLIST
5	AIR SEALING
2	CRACKS IN THE BUILDING ENVELOPE FULLY SEALED

ENERGY STAR

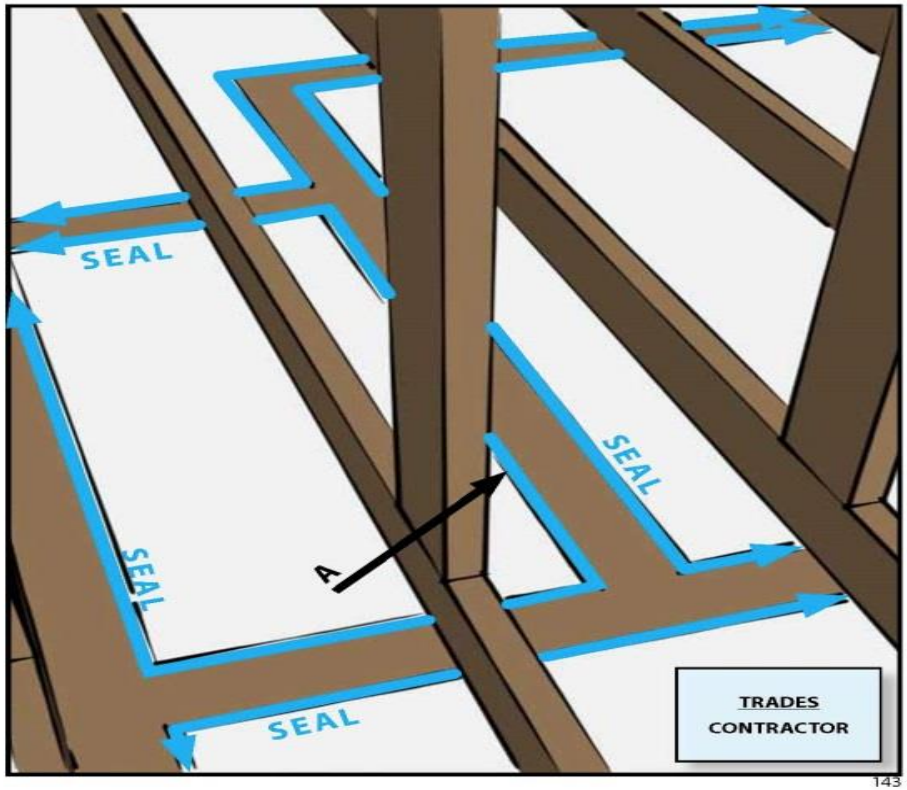
DETAIL 5.2.3

Sheetrock sealed to top plate at all attic/wall interfaces using caulk, foam, or equivalent material. Either apply sealant directly between sheetrock and top plate or to the seam between the two from the attic above. Construction adhesive shall not be used

A. Before insulating the attic, seal all top plate to interior cladding connections with latex foam or caulk to stop air leakage between conditioned and unconditioned space.

OR

B. Before installing drywall, use spray foam sealant or gasket product on top plate to air seal once drywall is installed. If this method is used, make sure foam/gasket remains intact during drywall installation.



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5.2.3 Cracks in The Building Envelope Fully Sealed

THERMAL ENCLOSURE SYSTEM RATER CHECKLIST

5 AIR SEALING

2 CRACKS IN THE BUILDING ENVELOPE FULLY SEALED

ENERGY STAR

A. Top plate to drywall connection not sealed.

Top plate to drywall connection sealed from attic with foam.

A. Top plate to drywall connection not sealed.

Top plate to drywall connection sealed from attic with caulk.

A. Top plate to drywall connection not sealed.

Top plate to drywall connection sealed from attic with foam sealant.

BAD PIC OF WALL CAVITY WITHOUT TOP PLATE TO DRYWALL CONNECTION SEALED OR STUD BAY WITHOUT FOAM SEALANT ON TOP PLATE NEEDED

B.

GOOD PIC OF TOP PLATE TO DRYWALL CONNECTION SEALED USING GASKET/ FOAM PRIOR TO DRYWALL INSTALLATION NEEDED

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5.2.4 Air Sealing (cont.)

- Rough opening around window & exterior door sealed
  - Caulk
  - Foam

Cracks in The Building Envelope Fully Sealed

THERMAL ENCLOSURE SYSTEM RATER CHECKLIST

5 AIR SEALING

2 CRACKS IN THE BUILDING ENVELOPE FULLY SEALED

ENERGY STAR

DETAIL 5.2.4 [23]

Rough opening around windows and exterior doors sealed with caulk or foam

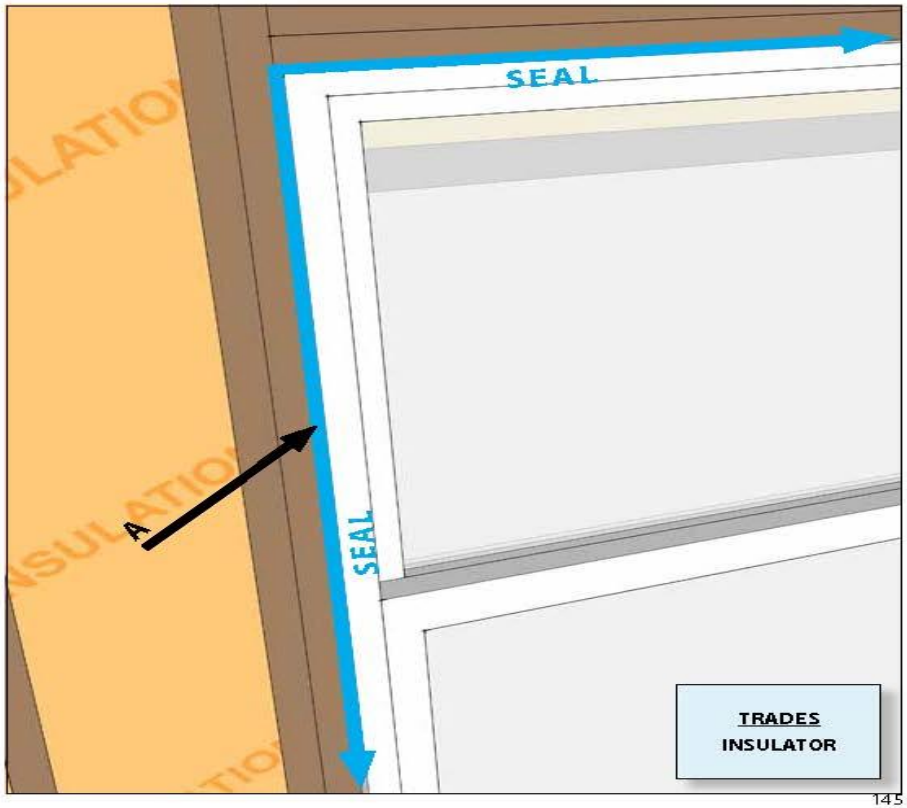
A. Install backer rod or low-expansion foam in openings around windows and doors.

B. Fibrous insulation is not an air barrier and cannot be used for sealing gaps.

C. Avoid using typical expansion foam as it might interfere with the functioning of the window or door.

FOOTNOTES

23. In Climate Zones 1 through 3, stucco over rigid insulation tightly sealed to windows and doors shall be considered equivalent to sealing rough openings with caulk or foam.



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5.2.5 Air Sealing (cont.)

- Marriage joints between modular home modules at all exterior boundary conditions fully sealed
  - Gasket
  - Foam

5.2.5. Cracks in The Building Envelope Fully Sealed

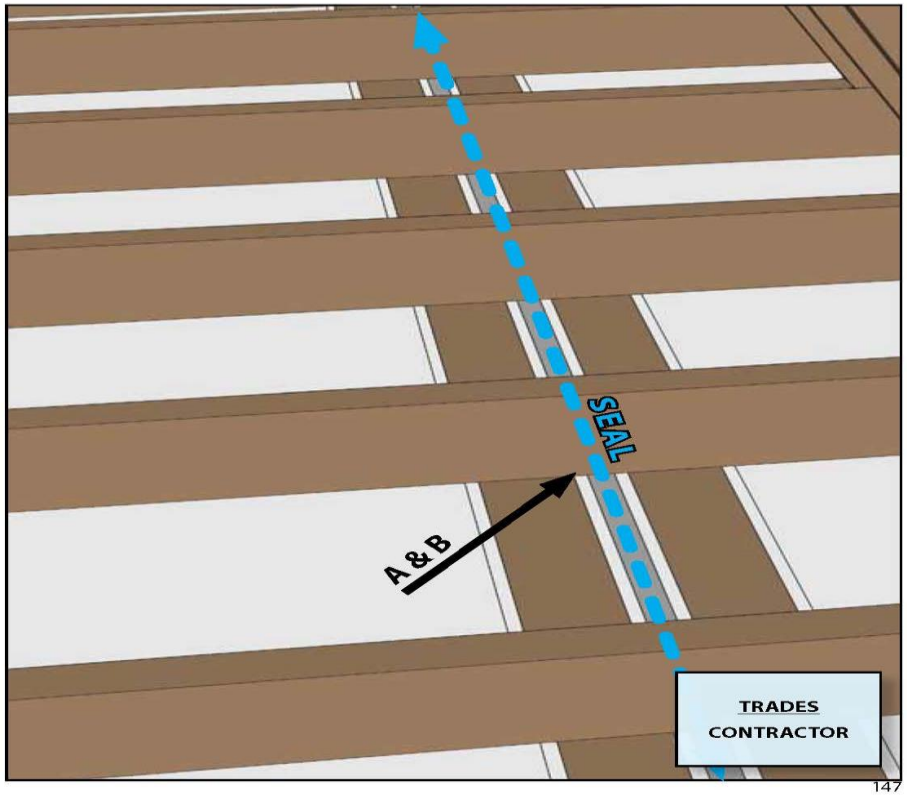
	THERMAL ENCLOSURE SYSTEM RATER CHECKLIST
5	AIR SEALING
2	CRACKS IN THE BUILDING ENVELOPE FULLY SEALED

DETAIL 5.2.5

Marriage joints between modular home modules at all exterior boundary conditions fully sealed with gasket and foam

A. Install a gasket along the entire seam of the exterior boundary where modules are attached together.

B. When modules are in place, seal the edge of the gasket to the module.



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5.2.5 Cracks in The Building Envelope Fully Sealed

	THERMAL ENCLOSURE SYSTEM RATER CHECKLIST
5	AIR SEALING
2	CRACKS IN THE BUILDING ENVELOPE FULLY SEALED

ENERGY STAR

A. No gasket installed at marriage wall connection prior to assembly.

Gasket installed at marriage wall connection prior to assembling modules.

A. No gasket installed at marriage wall connection prior to assembly.

Gasket installed at marriage wall connection prior to assembling modules.

BAD PIC OF MISALIGNED/ UNSEALED GASKET AFTER MODULES ARE ASSEMBLED NEEDED

B.

GOOD PIC OF SEALED GASKET AFTER MODULES ARE ASSEMBLED NEEDED

BAD PIC OF MISALIGNED/ UNSEALED GASKET AFTER MODULES ARE ASSEMBLED NEEDED

B.

GOOD PIC OF SEALED GASKET AFTER MODULES ARE ASSEMBLED NEEDED

5.2.6 Air Sealing (cont.)

- Seams between Structural Insulated Panels (SIPs)
  - Foamed and / or
  - Taped per manufacturer’

5.2.6 Cracks in The Building Envelope Fully Sealed

	THERMAL ENCLOSURE SYSTEM RATER CHECKLIST
5	AIR SEALING
2	CRACKS IN THE BUILDING ENVELOPE FULLY SEALED

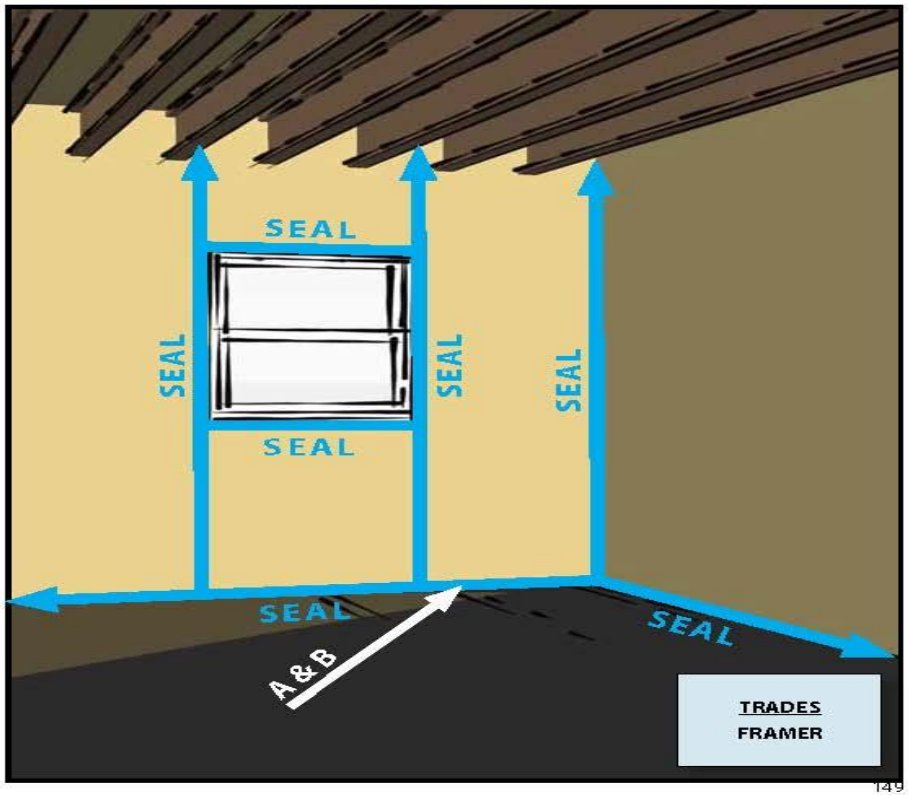
DETAIL 5.2.6

All seams between Structural Insulated Panels (SIPs) foamed and/or taped per manufacturer's instructions

A. Apply manufacturer-approved sealant inside the joints of all panels and at sub-floor or foundation connections.

B. When applying tape to walls, center on joints and provide overlap of tape to meet manufacturer's specifications.

C. When applying tape to roof panels, start from the lowest point of the panel and continue upward.



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5.2.7 Air Sealing (cont.)

- Multifamily buildings
  - Gap between the common walls (e.g. the drywall shaft wall)
  - Structure framing between units fully sealed at all exterior boundaries

5.2.7 Cracks in The Building Envelope Fully Sealed

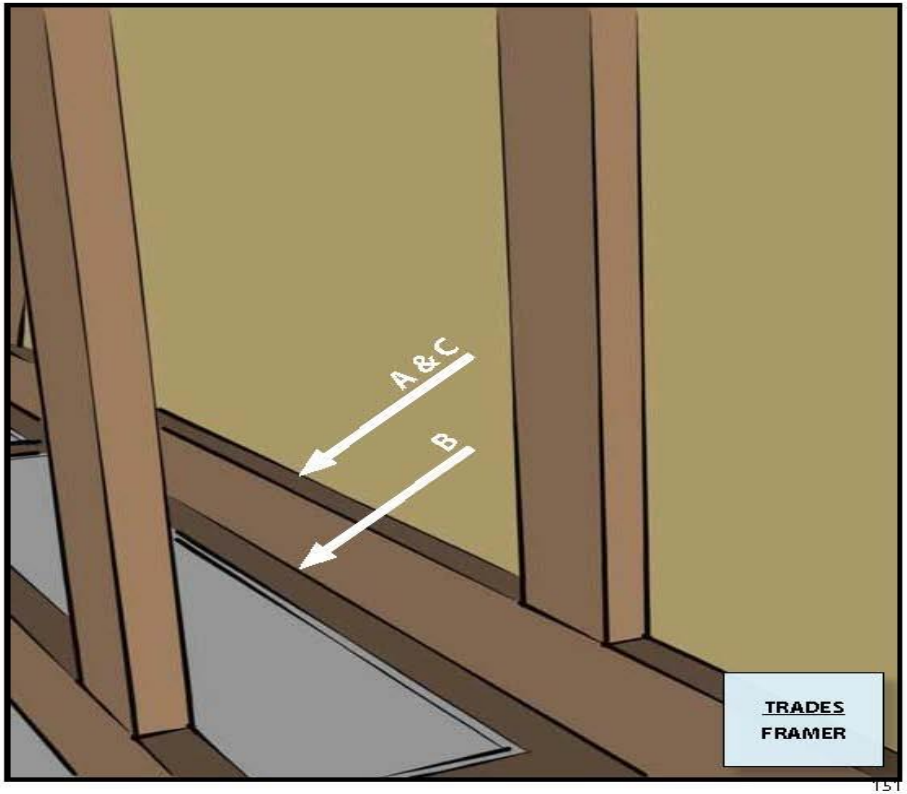
	THERMAL ENCLOSURE SYSTEM RATER CHECKLIST
5	AIR SEALING
2	CRACKS IN THE BUILDING ENVELOPE FULLY SEALED

ENERGY STAR

DETAIL 5.2.7

In multifamily buildings, the gap between the drywall shaft wall (i.e. common wall) and the structural framing between units fully sealed at all exterior boundaries

A. The gap between walls must be declared an approved assembly before being air sealed.
B. Seal the bottom plate to sub-floor.
C. Seal the bottom plate to sheathing connection.
D. Seal gap between units from exterior at all common wall locations with caulk, foam, or equivalent material. (Typically fire rated foam is required by code).



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5.3 Air Sealing (cont.)

- Doors adjacent to unconditioned
  - Attics
  - Garage
  - Basements
- Ambient conditions made sustainably air-tight
  - Weather-stripping
  - Equivalent gasket

5.3.1 Other Openings

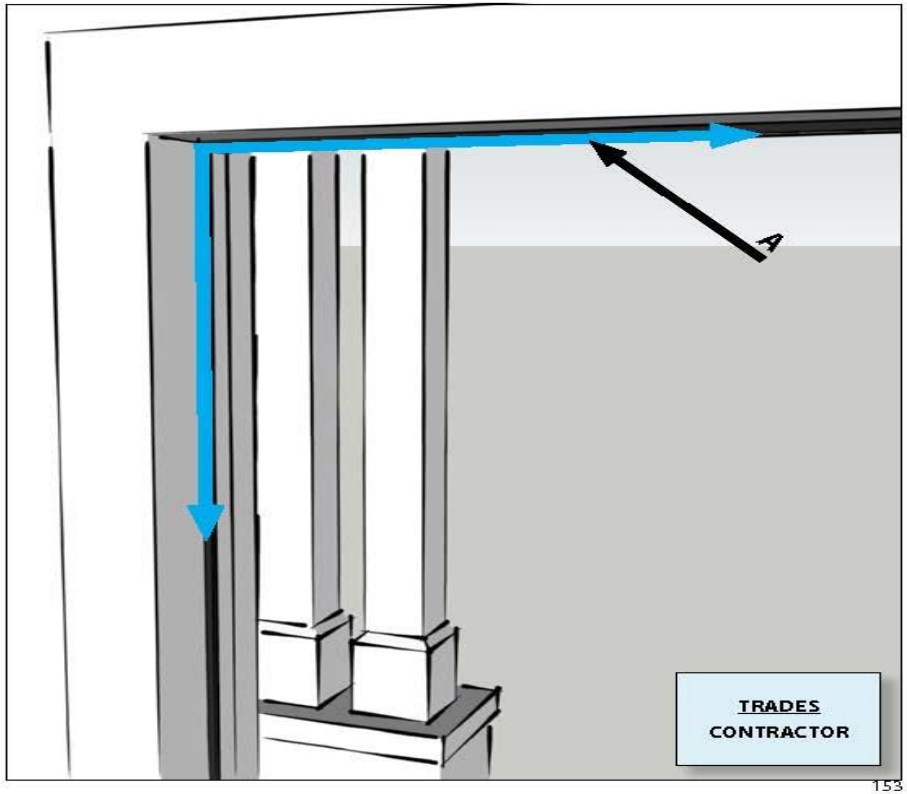
	THERMAL ENCLOSURE SYSTEM RATER CHECKLIST
5	AIR SEALING
3	OTHER OPENINGS

ENERGY STAR

DETAIL 5.3.1

Doors adjacent to unconditioned space (e.g., attics, garages, basements) or ambient conditions gasketed or made substantially air-tight

A. Install a continuous gasket, such as weather stripping, around all exterior door openings.



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5.3.2 Air Sealing (cont.)

- Attic access panels and Drop-down stairs
  - Equipped with durable ≥ R-10 insulated cover that is gasket
  - Not caulked

5.3.2 Other Openings

THERMAL ENCLOSURE SYSTEM RATER CHECKLIST

5 AIR SEALING

3 OTHER OPENINGS

ENERGY STAR

A. No blocking installed to prevent attic insulation from falling into stairs and opening.

Blocking has been installed around the perimeter of this attic access to prevent insulation falling into the house.

B. Drop down stairs do not have an insulation cover installed.

GOOD PIC OF ATTIC STAIRS WITH DURABLE INSULATED AND GASKETED COVER NEEDED

B. Attic access panel does not have an insulation cover installed.

Attic access hatch has been properly insulated by attaching a fiberglass batt, gasketed, and opening has blocking.

C./D. There is no weather stripping or gasket around the attic stair hatch.

From inside attic: this attic access door has a foam and rubber weather-stripping installed that remains in contact when closed.

Last Updated: 10/28/11

5.3.3 Air Sealing (cont.)

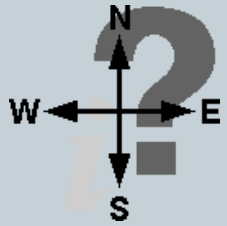
- Whole-house fans
  - Equipped with durable ≥ R-10 insulated that is gasket
  - Installed on the house side or mechanically operated

5.3.3 Whole-House Fans

Resources

Important Websites:

- www.ruralhome.org
- www.energystar.gov
- http://www.epa.gov/watersense
- www.usgbc.com
- http://greenhomeguide.com/program/leed-for-homes

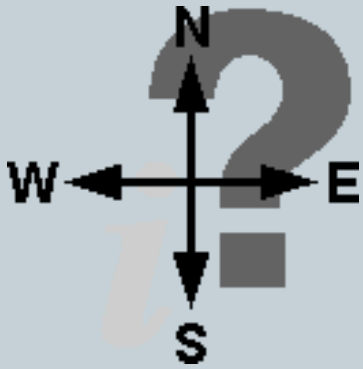


YouTube Videos:

- http://youtu.be/SvuXT1NQGis
  - Attic Air-Sealing: Part 1, Evaluation (GreenHomes America)

- http://youtu.be/cJViGzGmn7I
  - Swiftsure Energy Duct Testing

QUESTIONS



CONTACT

GENE GONZALES

Southwest Regional Director

Housing Assistance Council
7510 Montgomery NE, Suite 205
Albuquerque, NM 87109

Phone: (505) 883-1003
Email: eugene@ruralhome.org
Web: www.ruralhome.org

Wrap Up

Materials from today's webinar and the recording will be available on HAC's website.

www.ruralhome.org

HAC