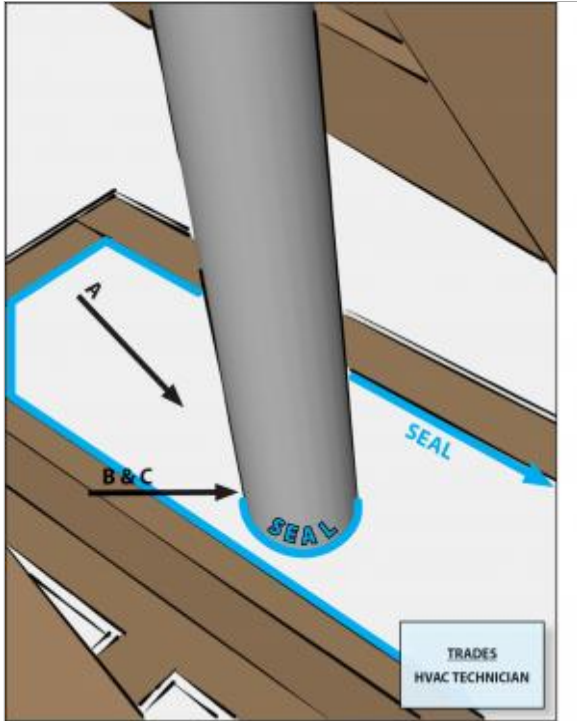


Air Sealing Duct and Flue Shafts

Last Updated: 03/06/2016

Scope



Air seal around all duct shafts and flues installed through ceilings, walls, or flooring to keep conditioned air from leaking into unconditioned space.

Air seal around all duct shafts and flues installed through ceilings, walls, and flooring to keep conditioned air from leaking into unconditioned space.

- To air seal around duct shafts, use caulk, canned foam, or rigid air barrier material cut to fit and caulked or foamed in place around the duct shafts.
- To air seal around combustion flues, use fire-rated caulk and UL-rated collars or sheet metal cut to fit and sealed with fire-rated caulk, while maintaining proper clearance between flue and combustible materials.
- Construct a sheet metal shield around combustion flues to maintain 3 inches of clearance between the flue and attic insulation. Make the shield 4 inches higher than the expected insulation height.

See the [Compliance Tab](#) for related codes and standards requirements, and criteria to meet national programs such as DOE's Zero Energy Ready Home program, ENERGY STAR Certified Homes, and Indoor airPLUS.

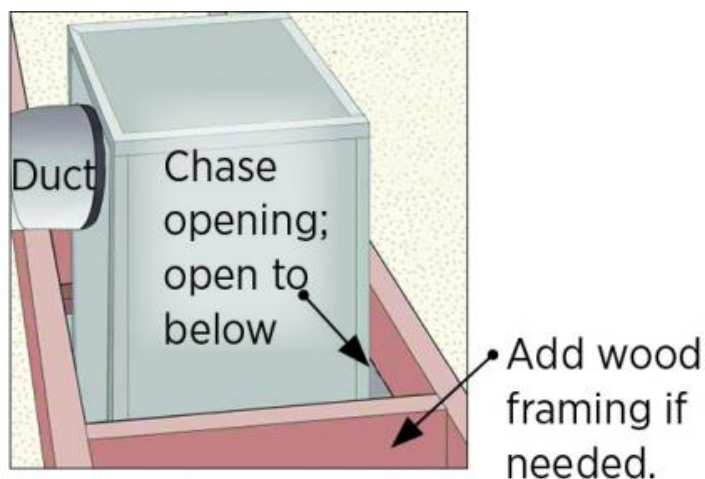
Description

Install air barriers around duct and flue shafts in the attic floor to prevent air leakage between the living space and the attic and to allow full insulation levels to be installed around the duct or flue. Air barrier material around duct shafts can include thin sheet goods such as rigid insulation, dry wall, OSB, or plywood. Air barriers around flue shafts should be made of a heat-resistant material such as sheet metal. These materials may be installed by insulators, framers, or drywallers. This task should be included in the contract for the appropriate trade depending on the workflow at specific job sites.

Air barrier effectiveness is measured at the whole-house level. High-performance branding programs and the IECC code require that builders meet specified infiltration rates at the whole-house level. See the “compliance” tab for these specified infiltration rates.

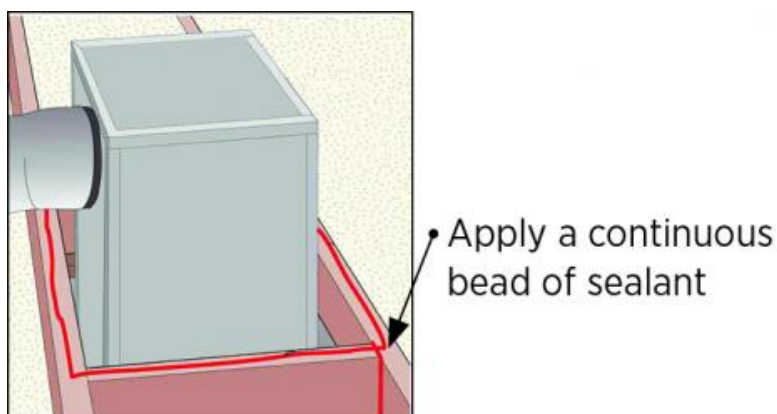
How to Seal a Rigid Duct Chase

1. Install wood framing cross pieces in the attic rafter bays on each side of the duct chase, if needed.



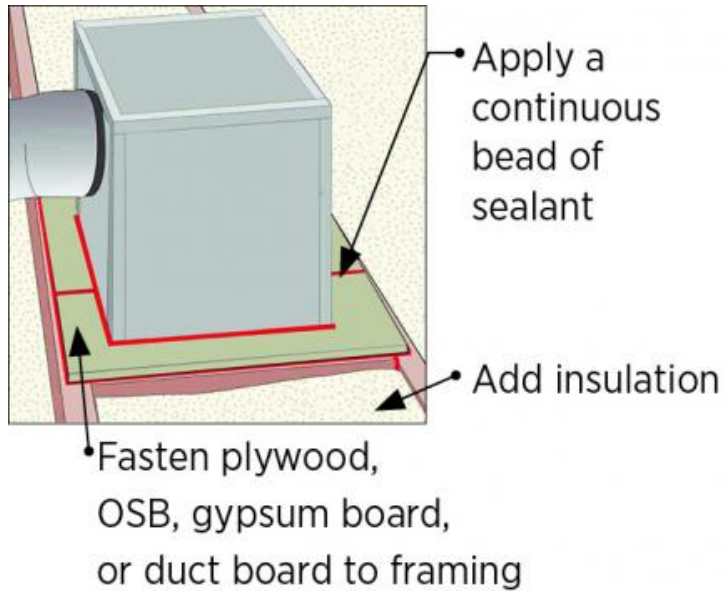
Install wood framing cross pieces in the attic rafter bays on each side of the duct chase

2. Seal all wood framing joints surrounding the chase with sealant. Lay a generous continuous bead of sealant along the top edge of the chase framing.



Seal all wood framing joints surrounding the chase with sealant and lay a bead of sealant along top edge of chase framing

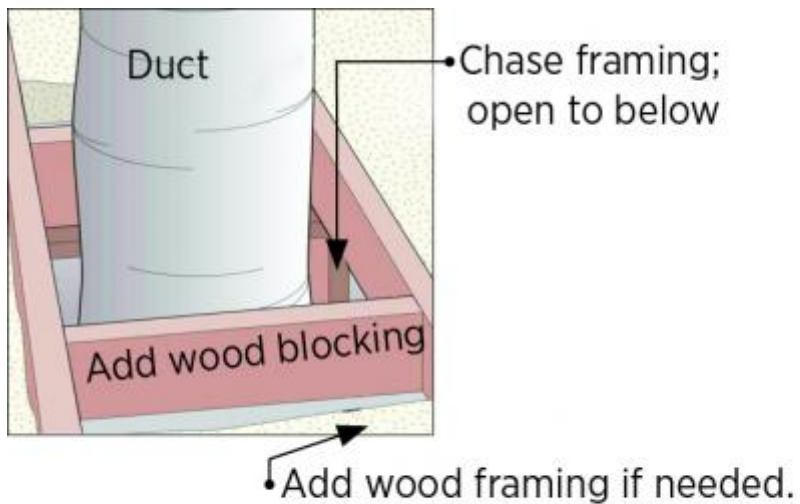
3. Measure and cut the air-blocking material (plywood, rigid foam, or drywall) to fit around the duct. Place the blocking material on the framing leaving a 1/4-in. gap between the rigid duct and the material. Fasten the material in place with nails or screws. Seal the material to the duct with sealant. Also seal any joints in the blocking material. Cover the material with insulation to the specified attic insulation depth.



Cut plywood, rigid foam, or drywall to fit around duct. Fasten to framing and caulk edges and seams

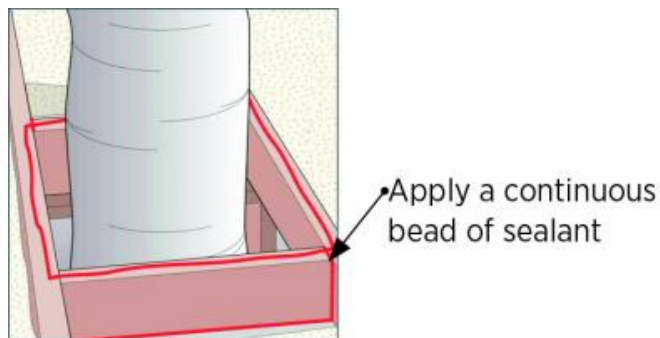
How to Air Seal a Flex Duct Chase

1. Install wood framing cross pieces in the attic rafter bays on each side of the duct chase, if needed.



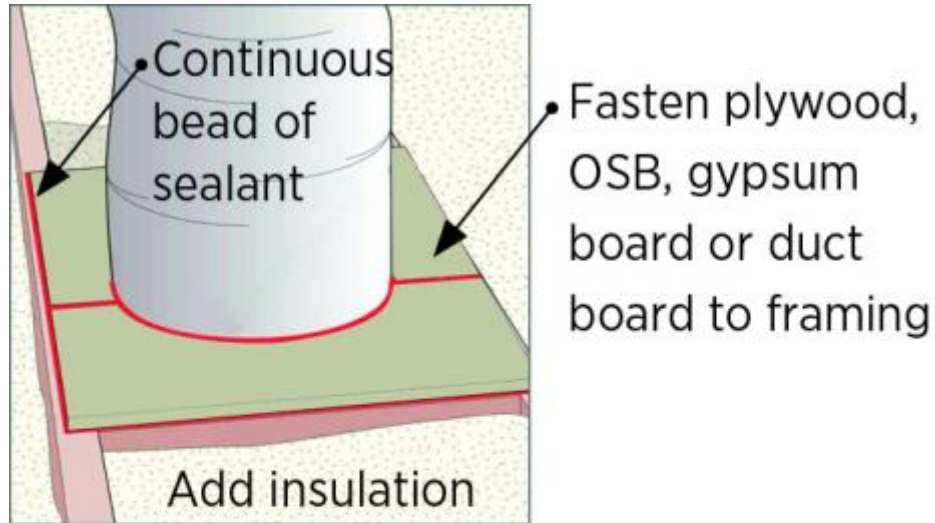
Install wood framing cross pieces in the attic rafter bays on each side of the duct chase

2. Seal all wood framing joints surrounding the chase with sealant. Lay a generous continuous bead of sealant along the top edge of the chase framing.



Seal all wood framing joints surrounding the chase with sealant and lay a bead of sealant on top edge of chase framing

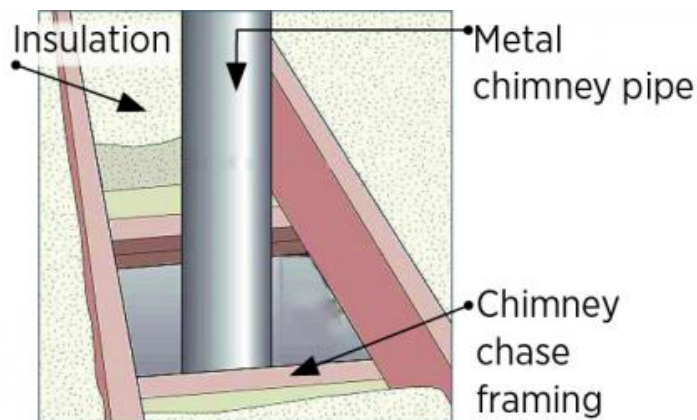
3. Measure and cut the air-blocking material (plywood, rigid foam, or drywall) to fit around the duct. Cut the material into two halves and then cut half circles in each to encompass the flex duct. Place the blocking material on the framing and in contact with the duct. Fasten the material with nails or screws. Seal the blocking material to the duct with sealant. Also seal the joints in the blocking material. Cover the blocking material with insulation to the required levels.



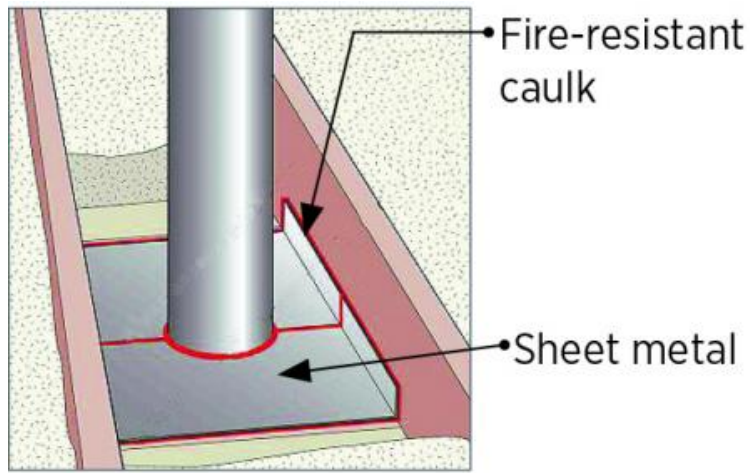
Cut plywood, rigid foam, or drywall to fit around duct. Fasten to framing and caulk edges and seams

How to Air Seal a Metal Chimney or Flue Vent Pipe – Option 1 – Air Seal at the Bottom of the Framing

1. Cut two pieces of sheet metal to cover the chase opening. Allow 1 inch of overlap. Fasten the sheet metal to the framing and seal all edges and seams with fire-rated caulk.

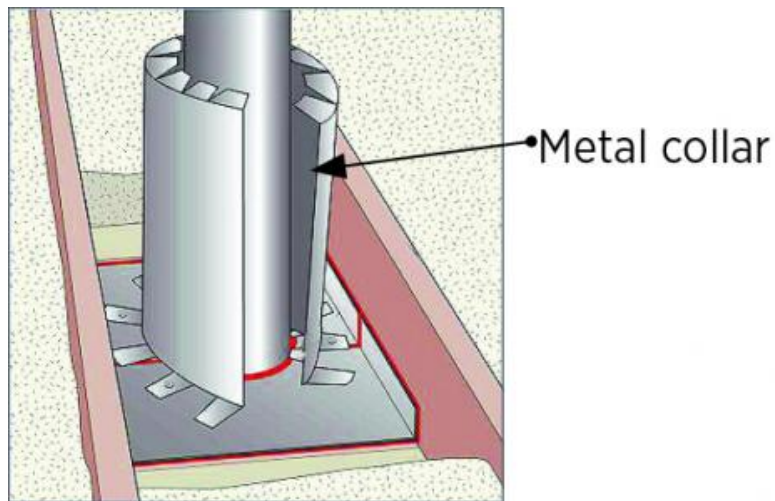


Ceiling opening for chimney chase



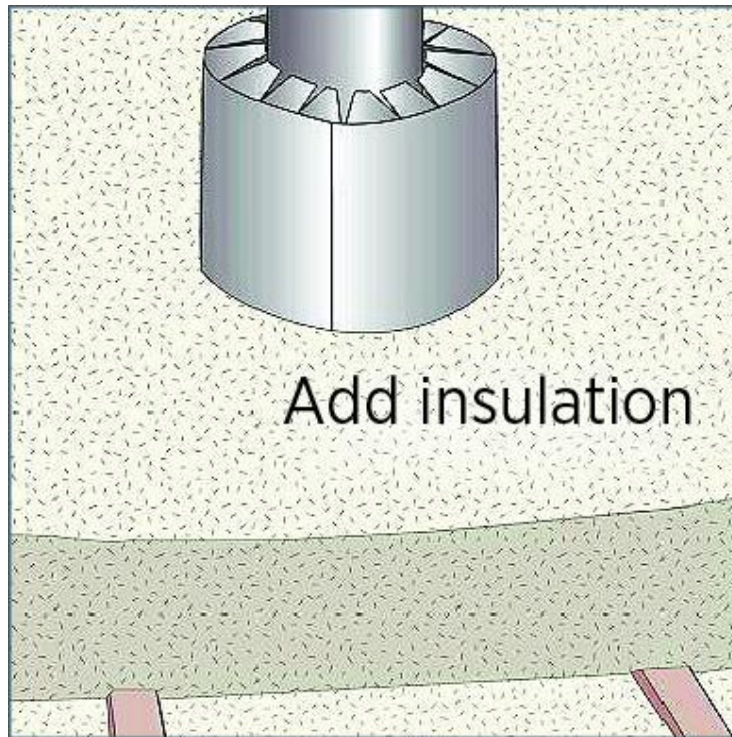
Cut sheet metal to cover the chase opening. Fasten sheet metal to framing and seal edges with fire-rated caulk

2. Use sheet metal to make a shield that will wrap around the pipe with a 3-inch clearance. Fold in the tabs at the top and every other tab at the bottom to maintain a 3-inch clearance. With tabs folded, the shield should be 4 inches taller than the finished insulation level. Seal the edges together with fire-rated caulk.



Form a sheet metal shield around the flue pipe

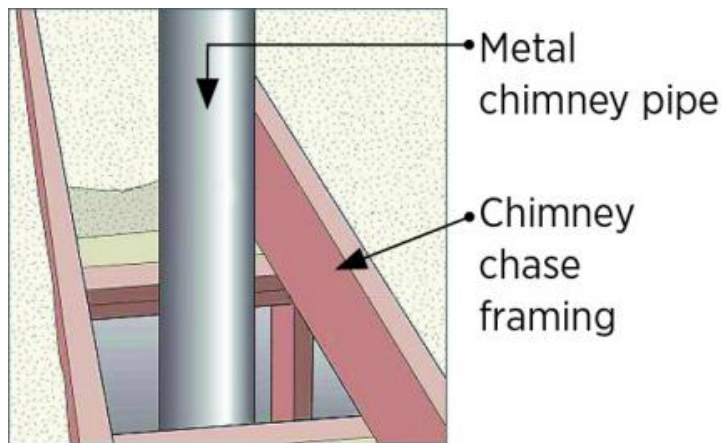
3. Cover the shield with insulation to the required height. The insulation should cover the rafters.



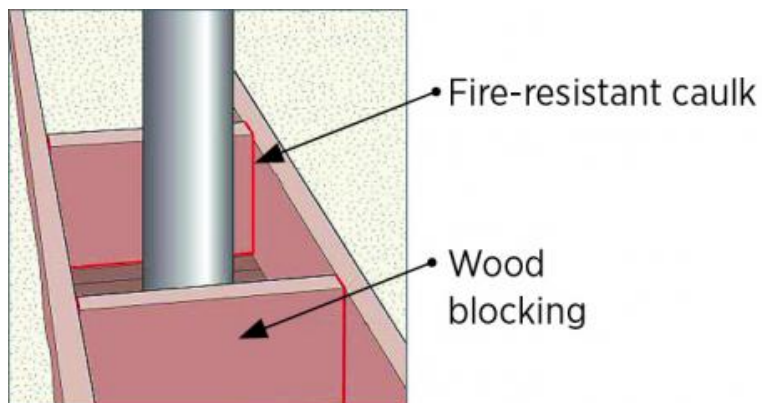
Fill area around shield with insulation

How to Air Seal a Metal Chimney or Flue Vent Pipe – Option 2 – Air Seal at the Top of the Framing

1. Cut two pieces of framing lumber equal in height to the ceiling joists. Fasten wood cross pieces to joists keeping at least 3 inches of clearance to the pipe. Caulk this wood blocking to the framing.



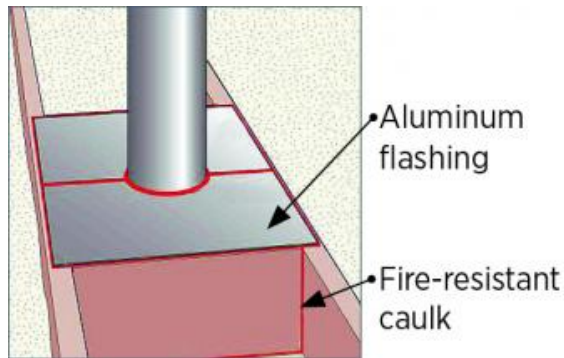
Ceiling opening for chimney pipe chase



Cut wood blocking to frame in flue pipe

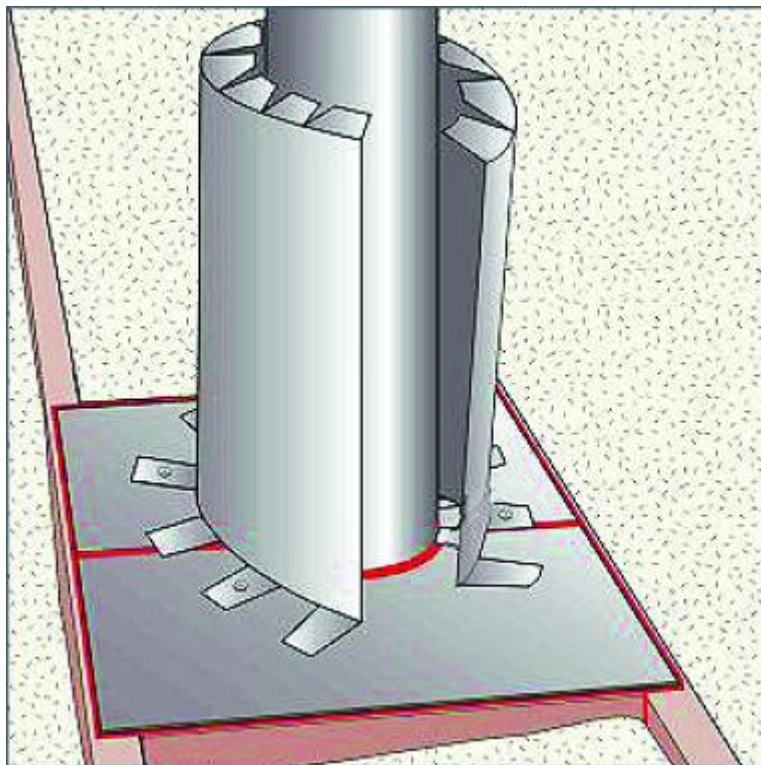
2. Cut two pieces of sheet metal or aluminum flashing to fit around the chimney pipe with 1 inch of overlap. Fasten the sheet

metal to the framing and seal all edges and seams with fire-rated caulk.



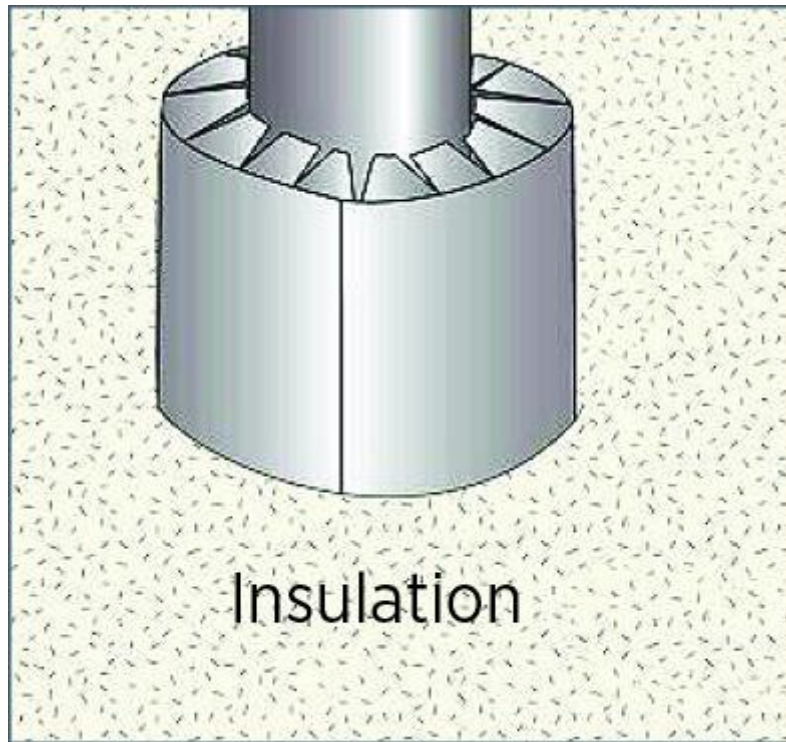
Cut sheet metal to fit around flue, fasten to wood blocking, and seal with caulk

3. Use sheet metal to make a shield that will wrap around the pipe with a 3-inch clearance. Fold in tabs at the top and every other tab at the bottom to maintain a 3-inch clearance. With tabs folded, the shield should be 4 inches taller than finished insulation level. Seal the edges together with fire-rated caulk.



Form sheet metal shield around pipe keeping 3-inch clearance

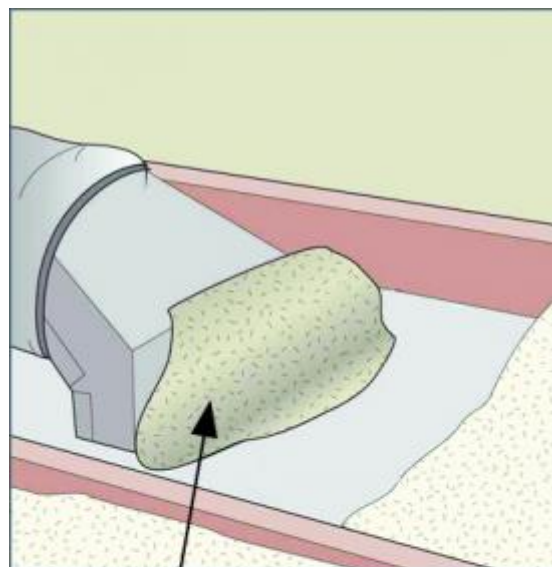
4. Cover the shield with insulation to the required height.



Cover shield with insulation to required attic insulation height

How to Seal a Duct Boot to the Ceiling

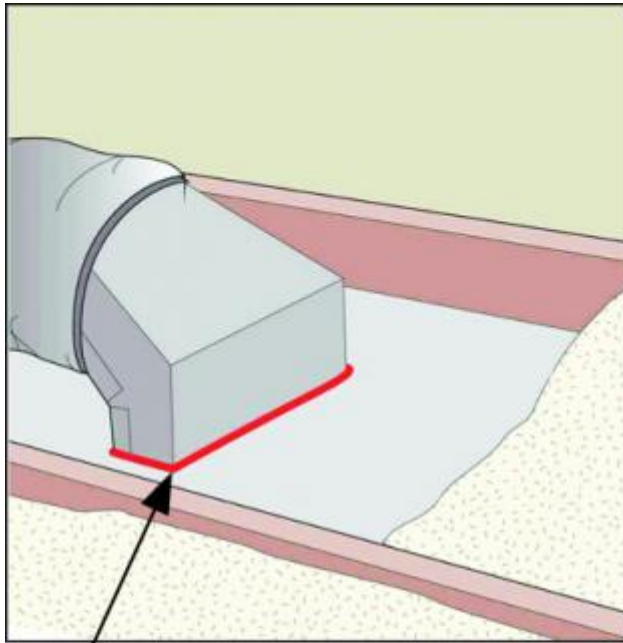
1. Seal all sides of the duct boot to the gypsum board with spray foam or caulk. Apply mastic or metal tape to all duct seams and joints.



• Spray foam to cover ceiling boot penetration

Spray foam air seals the boot to the ceiling

2. Add insulation to the specified attic insulation depth.



- Caulk with a continuous bead of sealant

Caulk air seals the boot to the ceiling

Ensuring Success

Blower door testing, which is conducted as part of the whole-house energy performance test-out, may help indicate whether duct and flue openings to unconditioned space (such as an attic) have been successfully sealed. An infrared camera can be used in conjunction with the blower door testing to detect air leakage and heat loss at the duct and flue shaft openings, if a sufficient temperature difference exists between the unconditioned and the conditioned space of the house. An experienced technician can also check for air leaks beneath the knee walls with a smoke pencil or by feeling with the back of the hand.

Climate

No climate specific information applies.

Training

Right and Wrong Images



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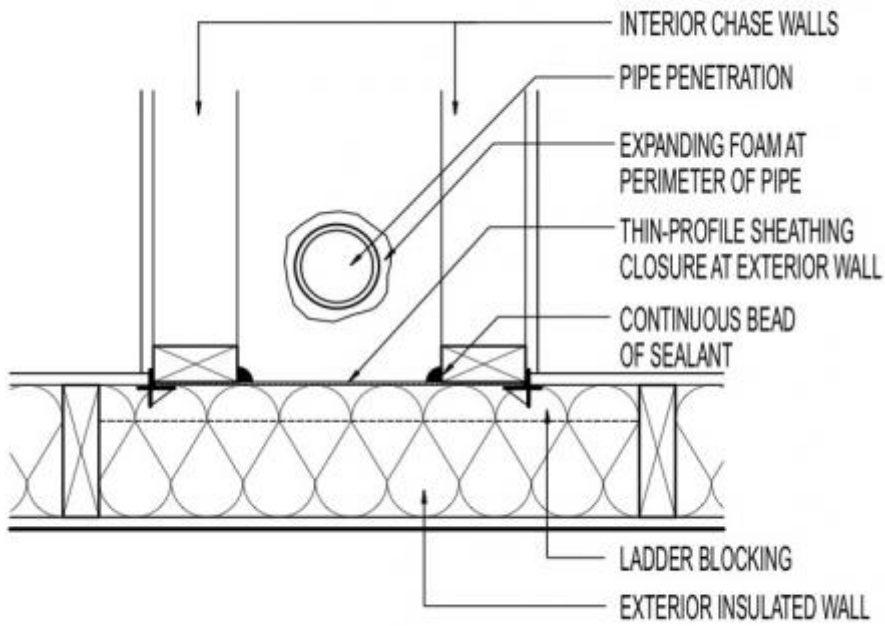


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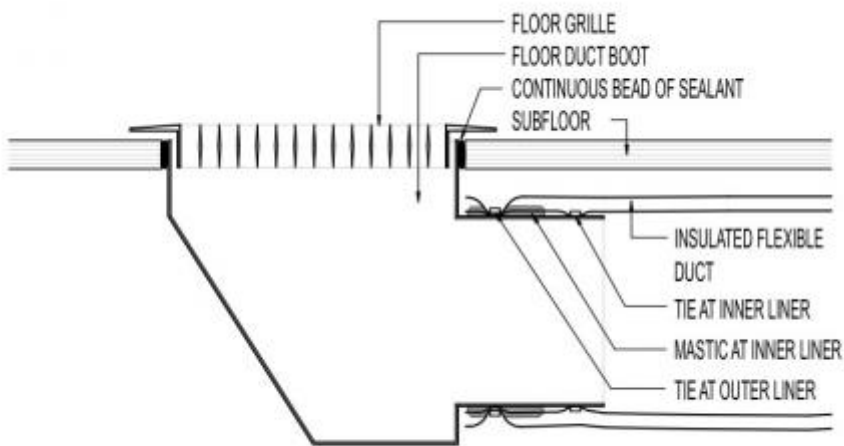


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CAD



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PDF: [511_CAD_4-3_flue_shaft_at_chase_wall_plan_view_5-01031_GBA-1-31-12.pdf](#)



CAD FILE: [511_CAD_4-1_sealed_duct_shaft_5-01033_GBA_1-31-12.dwg](#)
PDF: [511_CAD_4-1_sealed_duct_shaft_5-01033_GBA_1-31-12.pdf](#)

Compliance

The Compliance tab contains both program and code information. Code language is excerpted and summarized below. For exact code language, refer to the applicable code, which may require purchase from the publisher. While we continually update our database, links may have changed since posting. Please contact our [webmaster](#) if you find broken links.

[ENERGY STAR Certified Homes \(Version 3, Rev. 08\)](#)

ENERGY STAR Certified Homes (Version 3/3.1, Revision 08), Rater Field Checklist

Thermal Enclosure System:

4. Air Sealing (Unless otherwise noted below, "sealed" indicates the use of caulk, foam, or equivalent material):

4.1 Ducts, flues, shafts, plumbing, piping, wiring, exhaust fans, & other penetrations to unconditioned space sealed, with blocking / flashing as needed.

ENERGY STAR Revision 08 requirements are required for homes permitted starting 07/01/2016.

[DOE Zero Energy Ready Home](#)

Exhibit 1: Mandatory Requirements. Certified under ENERGY STAR Qualified Homes Version 3.

[2009 IECC](#)

Section 402.4.1. The building thermal envelope shall be durably sealed to limit infiltration...including all joints, seams, and penetrations.

[2012 IECC](#), [2015 IECC](#), and [2018 IECC](#)

Table R402.4.1.1 Air Barrier and Insulation Installation, Shafts/penetrations: Duct shafts, utility penetrations, and flue shafts opening to exterior or unconditioned space are air sealed.

Retrofit: [2009](#), [2012](#), [2015](#), and [2018 IECC](#)

Section R101.4.3 (Section R501.1.1 in 2015 and 2018 IECC). Additions, alterations, renovations, or repairs shall conform to the provisions of this code, without requiring the unaltered portions of the existing building to comply with this code. (See code for additional requirements and exceptions.)

[2009 IRC](#)

Section N1102.4.1 Building thermal envelope. Joints (including rim joist junctions), attic access openings, penetrations, and all other such openings in the building envelope that are sources of air leakage are sealed with caulk, gasketed, weatherstripped or otherwise sealed with an air barrier material, suitable film or solid material.

[2012 IRC](#), [2015 IRC](#), and [2018 IRC](#)

Table N1102.4.1.1 Shafts, Penetrations: Air Barrier and Insulation Installation, Shafts/penetrations: Duct shafts, utility penetrations, and flue shafts opening to exterior or unconditioned space are air sealed. General Requirements: Air barrier and thermal barrier: A continuous air barrier is installed in the building envelope including rim joists and exposed edges of insulation. Breaks or joints in the air barrier are sealed. Air permeable insulation is not used as a sealing material.

Retrofit: [2009](#), [2012](#), [2015](#), and [2018 IRC](#)

Section N1101.3 (Section N1107.1.1 in 2015 and 2018 IRC). Additions, alterations, renovations, or repairs shall conform to the provisions of this code, without requiring the unaltered portions of the existing building to comply with this code. (See code for additional requirements and exceptions.)

Appendix J regulates the repair, renovation, alteration, and reconstruction of existing buildings and is intended to encourage their continued safe use.

More Info.

Access to some references may require purchase from the publisher. While we continually update our database, links may have changed since posting. Please contact our [webmaster](#) if you find broken links.

Case Studies

1. [New Whole-House Solutions Case Study: Attention to Detail in High-Performance Homes 2012, Heritage Buildings, Leland NC](#)
(3MB)
Author(s): PNNL
Organization(s): PNNL
Publication Date: October, 2012
Case study about one builder's conversion to high-performance building in the hot-humid regions of the Atlantic seaboard.
2. [New Whole-House Solutions Case Study: Tommy Williams Homes: Longleaf Village & Belmont, Gainesville, FL](#)
(916KB)
Author(s): PNNL
Organization(s): PNNL
Publication Date: April, 2012
Case study about a production builder that achieves HERS scores of 60, compared to 85 for other builders that build new homes to Florida code.

References and Resources*

1. [DOE Zero Energy Ready Home National Program Requirements](#)
Author(s): Department of Energy
Organization(s): DOE
Publication Date: April, 2017
Standard requirements for DOE's Zero Energy Ready Home national program certification.
2. [ENERGY STAR Certified Homes, Version 3 \(Rev. 08\) National Program Requirements](#)
Author(s): U.S. Environmental Protection Agency
Organization(s): EPA
Publication Date: December, 2015
Webpage with links to Document outlining the program requirements for ENERGY STAR Certified Homes, Version 3 and 3.1 (Rev. 08).
3. [Guide to Attic Air Sealing](#)
Author(s): Lstiburek
Organization(s): Building Science Corporation
Publication Date: January, 2010
Fact sheet providing detailed information about air sealing attics.
4. [Thermal Enclosure System Rater Checklist Guidebook](#)
Author(s): U.S. Environmental Protection Agency
Organization(s): EPA
Publication Date: October, 2011
Guide describing details that serve as a visual reference for each of the line items in the Thermal Enclosure System Rater Checklist.

*Publication dates are shown for formal documents. Dates are not shown for non-dated media. Access dates for referenced, non-dated media, such as web sites, are shown in the measure guide text.

Contributors to this Guide

The following authors and organizations contributed to the content in this Guide.

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[Building Science Corporation](#), lead for the Building Science Consortium (BSC), a [DOE Building America Research Team](#)