BEST PRACTICES POCKET GUIDE

ADVANCING EFFICIENT HOME BUILDING

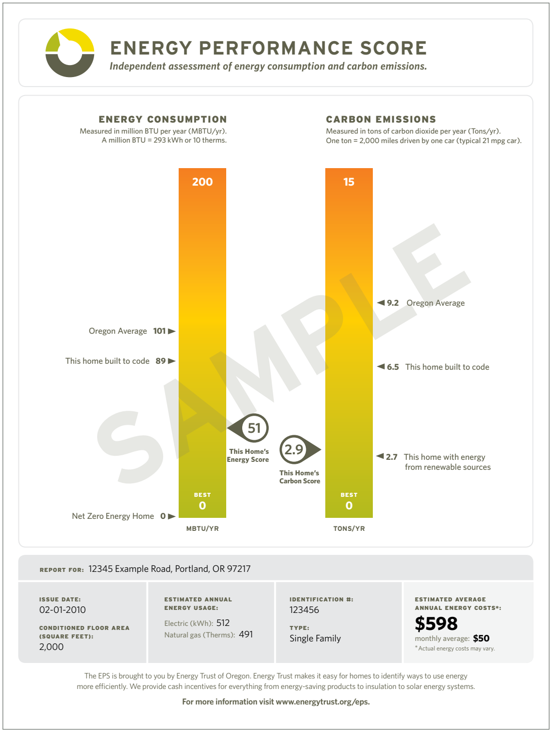
Energy Trust of Oregon

CONTENTS

Energy Trust of Oregon works with designers, homebuilders and contractors throughout Oregon to build energy-efficient new homes. The construction of energy-efficient homes is a process that starts at the decision to build a home. That process continues through the home's design, to the selection of contractors, the construction of the home and finally to the homebuyer's understanding of a home's energy-efficient features.

This pocket guide helps builders, designers, contractors and other building professionals understand the systems and components that can be used to construct energy-efficient, healthy and durable homes. The recommendations in this guide can be used to improve energy performance and meet Energy Trust program participation requirements. If you are participating in other home certification programs, make sure you meet specific requirements as necessary.

The Energy Performance Score is used by Energy Trust to provide a measurement that shows a participating home's estimated energy consumption, utility costs and carbon emissions. A lower EPS corresponds to improved efficiency in a home. The recommendations in this guide can be used by builders to build homes with improved, and therefore, lower scores on the EPS scale. If you would like to learn more about the EPS, visit: **www.energytrust.org/eps**.



BEFORE YOU BUILD

ENERGY TRUST PROGRAM REQUIREMENTS

In order for a builder to receive cash incentives and an Energy Performance Score on the home, they must follow the best practices within this guide and complete the following:

- ☐ **Insulation quality inspections**
- ☐ **Compliance with ENERGY STAR® Thermal Bypass Checklist**
- ☐ **Installation of approved whole home mechanical ventilation**
- ☐ **Installation of zonal pressure relief**
- ☐ **Combustion Appliance Zone testing**
- ☐ **Ducts sealed with mastic paste**

DESIGN PHASE

Efficiency in plans

Homes should be designed and constructed to minimize heat loss from the home during cold weather. Clear communication before, during and after the design phase is essential to assure that the best practice techniques discussed in this guide are included in plans and carried out during construction by contractors.

Conditioned spaces

Any space that is intentionally heated during the winter is identified as a conditioned space. Spaces that are not intentionally heated, such as vented crawl spaces, vented attics and garages, are examples of unconditioned spaces. A continuous thermal barrier must be installed between conditioned and unconditioned spaces. Thermal barriers are created when insulation is properly installed and in contact with an air barrier. These details should be shown on drawings and specifications and explained to all contractors.

Glazing

Excessive glazing significantly increases heat loss and energy costs in homes. In most cases, reducing the glazing area will reduce the amount of energy needed to heat and cool a home. If properly implemented, site selection, window orientation and shading can promote the use of solar heat and prevent over heating in the summer.

SUBCONTRACTOR COMMUNICATIONS

Verification

Verifiers guide you through the energy-efficient building process and inspect homes to ensure that they meet program requirements. Your verifier is the key point of contact for all of your program questions. While verifiers are official Energy Trust of Oregon trade allies, they operate as independent businesses and set their own fees.

Verifiers visit each site twice to check that best practices are followed.

The ***first*** visit occurs immediately after wall insulation, but before drywall. These are some of the energy-efficient measures the verifier will check on the first visit:

- Wall insulation is installed correctly
- Proper air sealing and Thermal Bypass Checklist compliance
- Duct work properly installed and sealed
- Mechanical ventilation components installed correctly
- Correct U-Values for windows

The ***second*** visit occurs when the house is complete. At this visit, the verifier will check other energy-efficient measures, including:

- Air leakage test using a blower door
- Duct leakage test results
- Model numbers from the equipment and appliances
- Fluorescent lights are in place and in the correct amount
- Attic and under-floor insulation is the correct R-value and has been properly installed
- Ventilation system operates correctly
- Combustion Appliance Zone testing

Verifiers may charge a re-inspection fee if additional visits are required.

Duct leakage testing

To meet program requirements, duct leakage testing is required on all forced air systems, unless the entire duct system meets program requirements for being located inside conditioned space.

A Performance Tested Comfort Systems approved technician or verifier, must perform the duct tightness test. For a list of qualified technicians, see www.energytrust.org or www.ptcsnw.com.

SUBCONTRACTOR COMMUNICATIONS CONT.

Combustion Appliance Zone testing

The program requires that homes with combustion appliances have a Combustion Appliance Zone test, which checks for negative pressure induced by imbalances or leaks in the duct system that may cause back drafting of a gas appliance. CAZ testing must be performed by a program approved performance testing technician. Please contact your verifier for further information about CAZ testing.

Heat pump commissioning

Commissioning is required on all ducted air-source heat pumps. This requires the installation contractor to use an approved method of testing and documenting system air flow, controls and refrigerant charge. The installation contractor must be trained in an approved commissioning method and must submit proper documentation to the verifier. For a list of qualified technicians, see www.energytrust.org or www.ptcsnw.com.

Ducts inside conditioned space

Placing duct work and mechanical equipment inside the conditioned space of the house will help reduce winter heat loss by approximately 20 percent and will improve the EPS. It is necessary to develop a plan and work with designers, HVAC companies, framers, verifiers and other contractors in order to properly accomplish this.

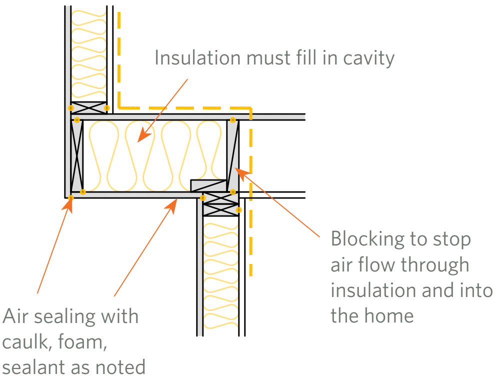
Other subcontractors

All subcontractors delivering products or services that are related to program requirements or best practices should be given a copy of this guide to allow them to include the appropriate products or services in their bids. To attain additional copies, contact your builder outreach specialist or trade ally coordinator at 1.877.283.0698. You can also go online at www.energytrust.org/ta for more information.

NOTES ON DRAWINGS WITHIN THIS GUIDE

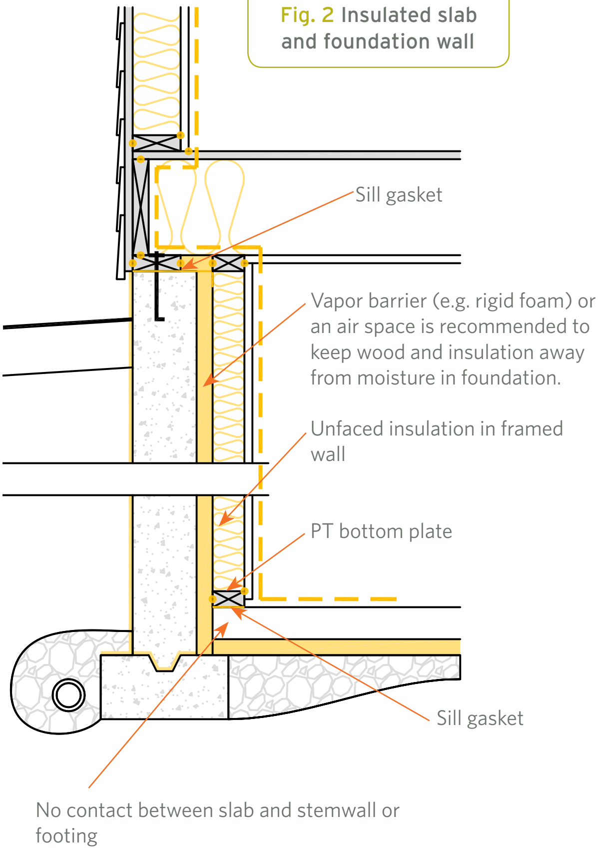
Throughout the guide, drawings are used to illustrate best practices in meeting program requirements and recommendations. In all drawings, the yellow dashed line (— — —) indicates the location of the recommended primary air barrier. Additionally, in all drawings, the yellow dots (• • • •) indicate points where air sealing (either by caulking, foam, fire caulk or construction adhesive, depending on local codes) will help meet the air tightness recommendations of Energy Trust.

Fig 1. Air Sealing



Foundations and slabs represent locations of substantial heat loss during cold weather and possible entrance of moisture into homes. Slabs and foundation walls between conditioned and unconditioned spaces, must be properly insulated in order to reduce heat loss during cold weather and to minimize the possibility of condensation on cold surfaces.

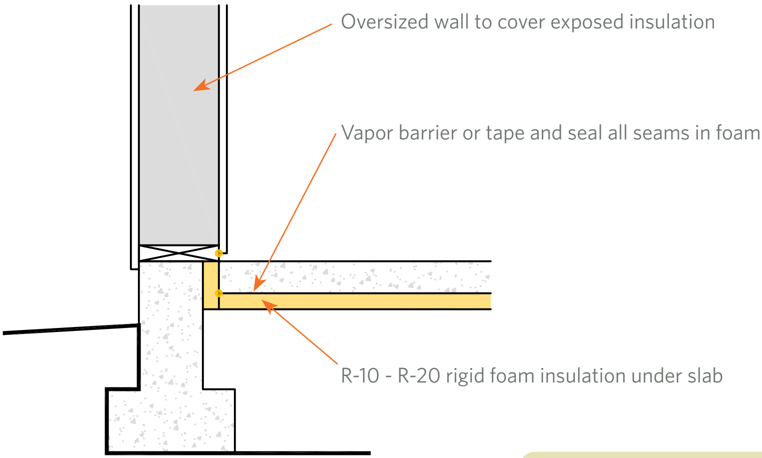
Fig. 2 Insulated slab and foundation wall



Notes: *Foundations and slabs should be designed to minimize moisture intrusion. Materials in contact with concrete should be able to withstand moisture.*

Using closed cell foam on the foundation wall, such as the taped foam board in this detail, provides a thermal break as well as a vapor retarder between the ground and the interior framing.

Fig. 3 Oversized mudsill to cover edge insulation



Note: *Installing a vapor barrier and/or taping the seams of vapor impermeable foam board, minimizes moisture intrusion from below the slab.*

INTERMEDIATE & ADVANCED FRAMING

Framing techniques

Framing techniques can affect the amount of heat transfer through the building envelope. Incorporating air sealing and increasing insulation can improve the Energy Performance Score of a home.

A framing member that runs continuously from the interior drywall to the exterior sheathing allows more heat loss than insulated cavities; this is referred to as "thermal bridging." There are a variety of framing techniques that eliminate unnecessary framing members and/or add insulation to reduce thermal bridging and help improve energy efficiency.

Fig. 4 Modified corner allowing full insulation

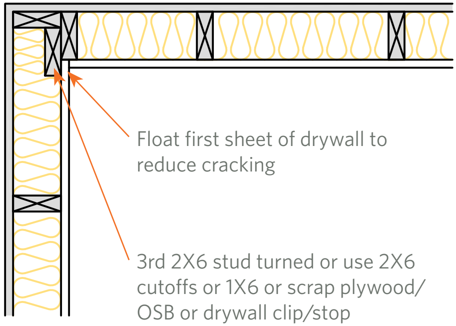
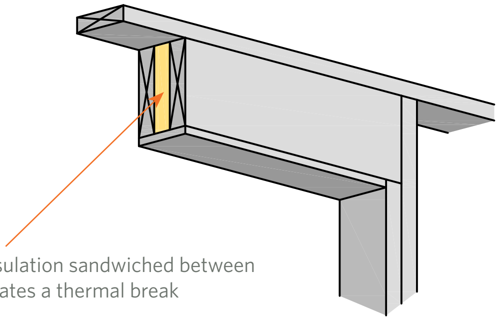


Fig. 5 Insulated header in 2 x 6 wall

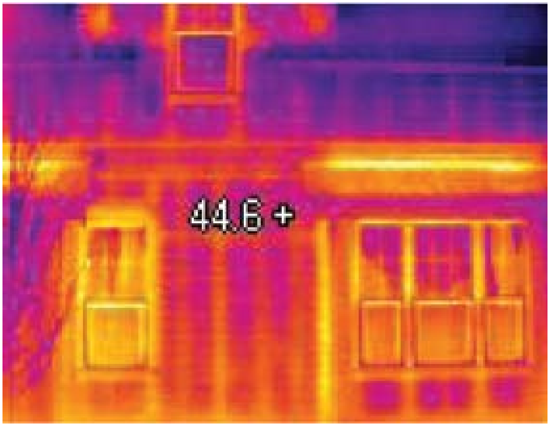


Wall Systems

Walls are the largest source of heat loss in most new homes. The typical wall built in Oregon is called R-21, because that is the R-Value of the insulation installed in the wall cavity. The framing and thermal bridging reduce actual insulating value of a standard R-21 wall to about R-17. Improving walls by providing additional insulation and/or minimizing thermal bridges will significantly reduce heat loss and improve occupant comfort. It can also considerably improve the home's EPS.

Figure 6 is an infrared camera image that shows thermal bridging occurring. On the following pages, Figure 7 and 8 depict a double stud wall and a rain screen with foam board.

Fig. 6 Infrared camera image of thermal bridging



Note: *Adding one to four inches of continuous exterior rigid insulation or building a double stud wall reduces thermal bridging.*

Fig. 7 Double stud wall

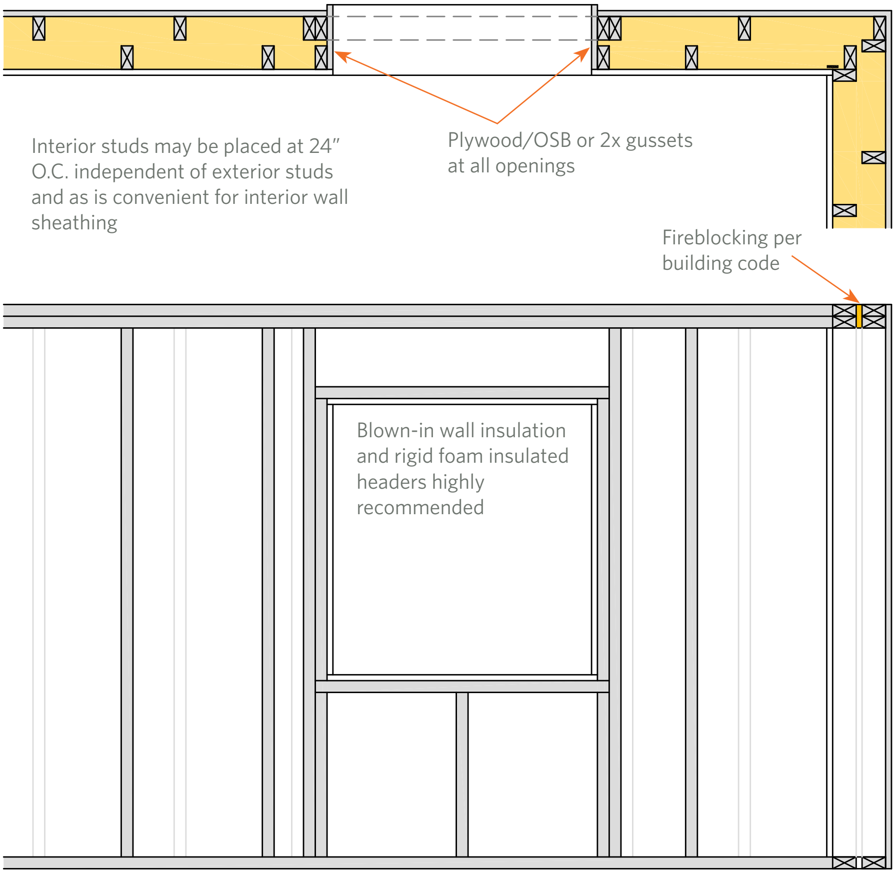
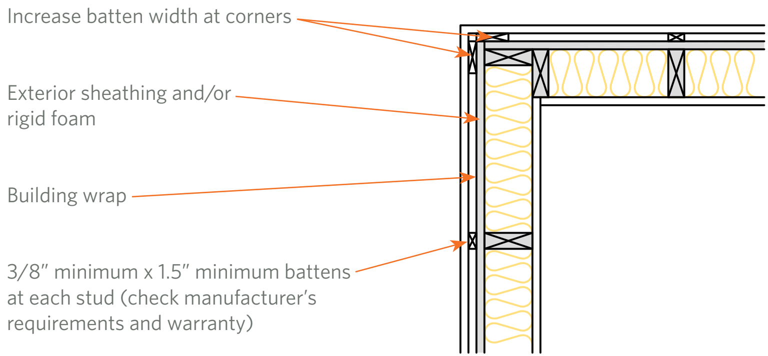


Fig. 8 Rainscreen with foam board



Note: *Exterior foam increases wall temperatures, thereby reducing the possibility of condensation inside the wall itself.*

THERMAL BYPASS CHECKLIST

Energy Trust Program Requirement:

☐ Compliance with ENERGY STAR Thermal Bypass Checklist

The ENERGY STAR Thermal Bypass Checklist was developed to identify and address key locations of air leakage and thermal transmission in a house. The Thermal Bypass Checklist is a required component of Energy Trust's new homes program and will help identify areas requiring special attention to air sealing, framing practices and insulation installation.

This checklist should be consulted throughout the building process, by all trades on site. Your verifier will be able to assist you with understanding and meeting requirements and will be inspecting your project for compliance to the Thermal Bypass Checklist.

It is available from your verifier and can also be found online at: **www.energytrust.org/ta** under the "Forms" tab.

In addition to increased heating and cooling costs, uncontrolled air leakage can cause discomfort. Careful attention should be paid to sealing any penetrations in the building envelope. Plumbing, electrical and mechanical penetrations should be sealed to minimize air leakage between conditioned and unconditioned spaces.

Air leakage can occur at locations between conditioned and unconditioned spaces where incomplete air barriers exist, or at unsealed connections between air barrier materials. Air barrier materials should consist of rigid materials (plywood, oriented strand board, gypsum wall board or lumber) or semi-rigid materials (sheet metal, foam board or treated cardboard) that do not allow air to flow through. **Fibrous insulation and housewrap products cannot be used as air barrier materials.**

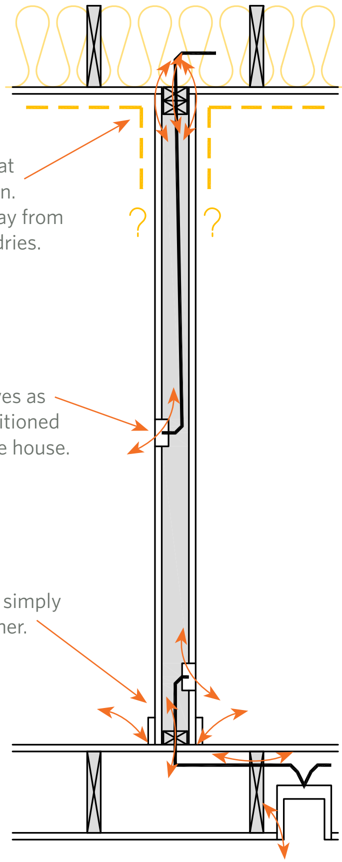
Providing complete and sealed air barriers will stop air leakage. Air sealing materials such as spray foam, caulk and adhesives can be used to reduce air leakage between air barrier materials.

When second story floor joists cross over a wall between the garage and a conditioned space, the space between the joists must be blocked and sealed.

Tips: *Air sealing materials such as spray foam, caulk and adhesives can be used to reduce air leakage between air barrier materials.*

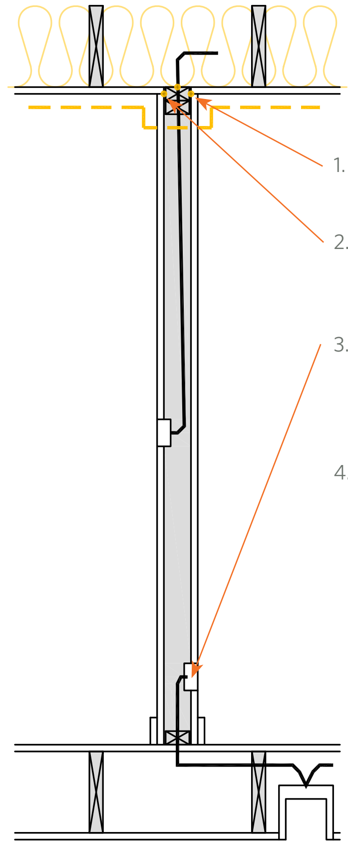
Air can flow through interior partitions to and from unconditioned spaces. Seal the top plate to the ceiling drywall from the attic with silicone caulk or latex foam expanding foam BEFORE insulation is installed.

Fig. 9 Poorly defined air barrier



1. Air barrier is broken at attic/wall intersection. Top plate shrinks away from drywall when wood dries.
2. Wall cavity then serves as ‘duct’ linking unconditioned attic to the rest of the house.
3. Sealing one gap may simply shift leakage to another.

Fig. 10 Well defined air barrier



1. Seal drywall to framing
2. Seal top plate penetrations
3. No need to seal drywall penetrations in interior walls
4. Sealing exterior leaks eliminate interior leaks

Fig. 11 Attic hatch

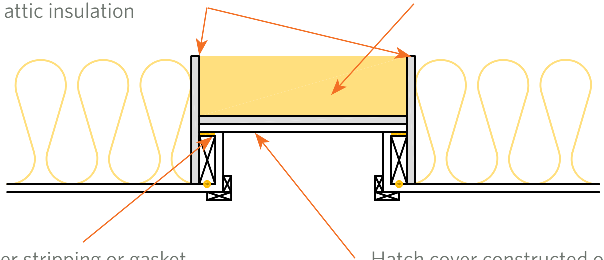


Fig. 12 Airtight light fixture

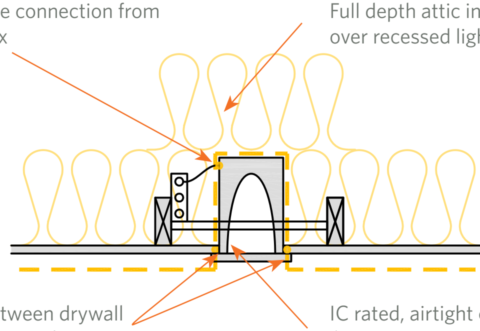


Fig. 13 Window air sealing

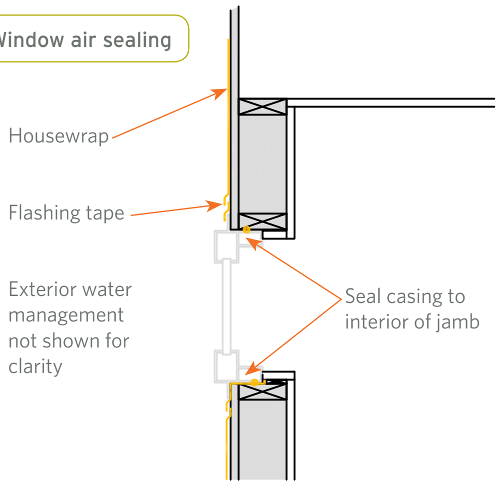


Fig. 14 Air sealing at common wall

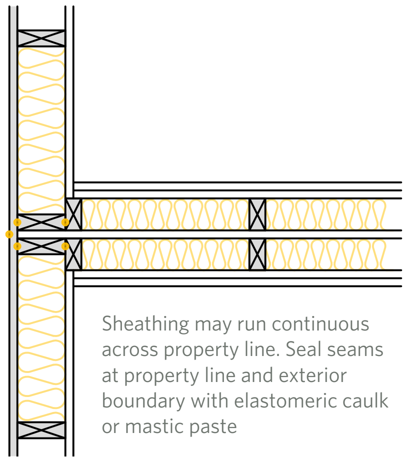


Fig. 15 Air sealed interior soffit

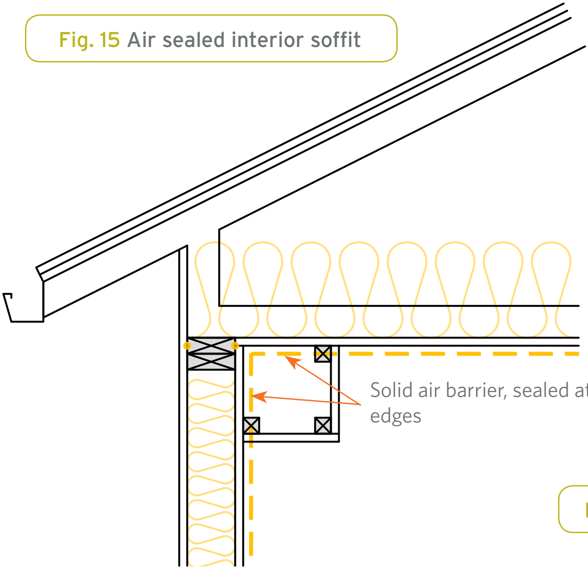
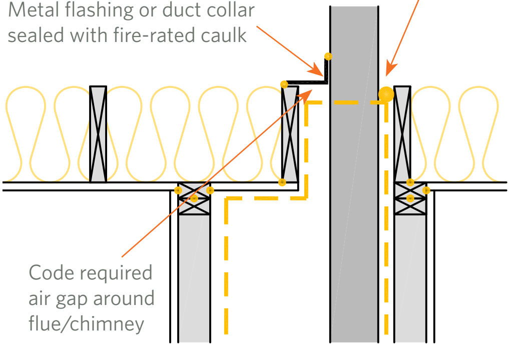
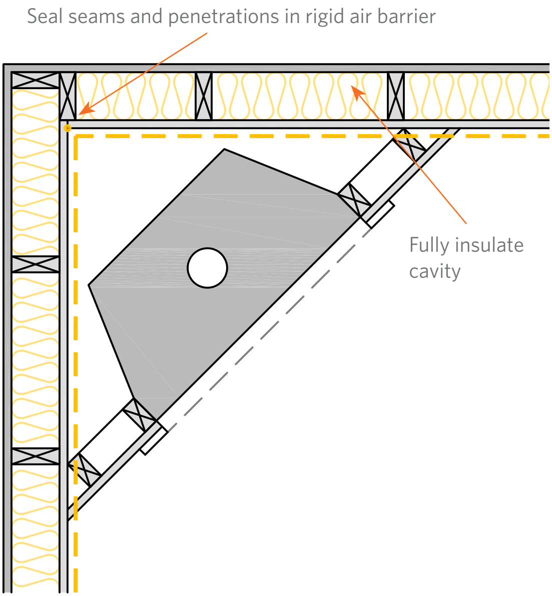


Fig. 16 Air sealed chases



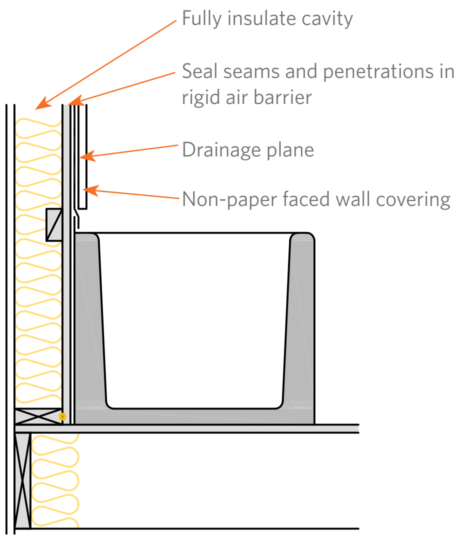
Note: *Unsealed duct chases are often one of the largest leaks in a house. Ducts can be sealed directly to the framing with spray foam.*

Fig. 17 Air sealed fireplace



Note: *Fully insulate walls and sheath interior surface of exterior walls before installing tubs, showers or fireplaces.*

Fig. 18 Air sealing behind tub/shower



Note: *Install tubs/showers on interior walls, when possible, to avoid the complications associated with air sealing and insulating at exterior walls.*

Fig. 19 Air sealing and insulating attic rooms

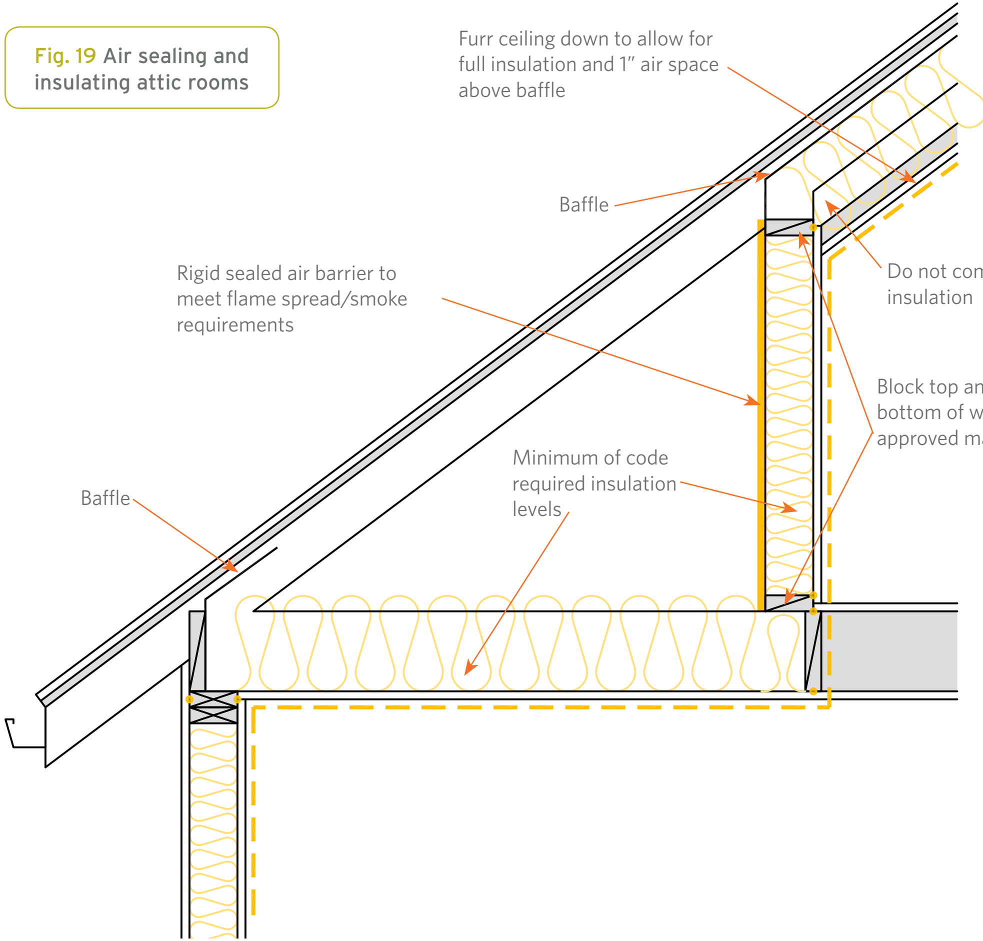
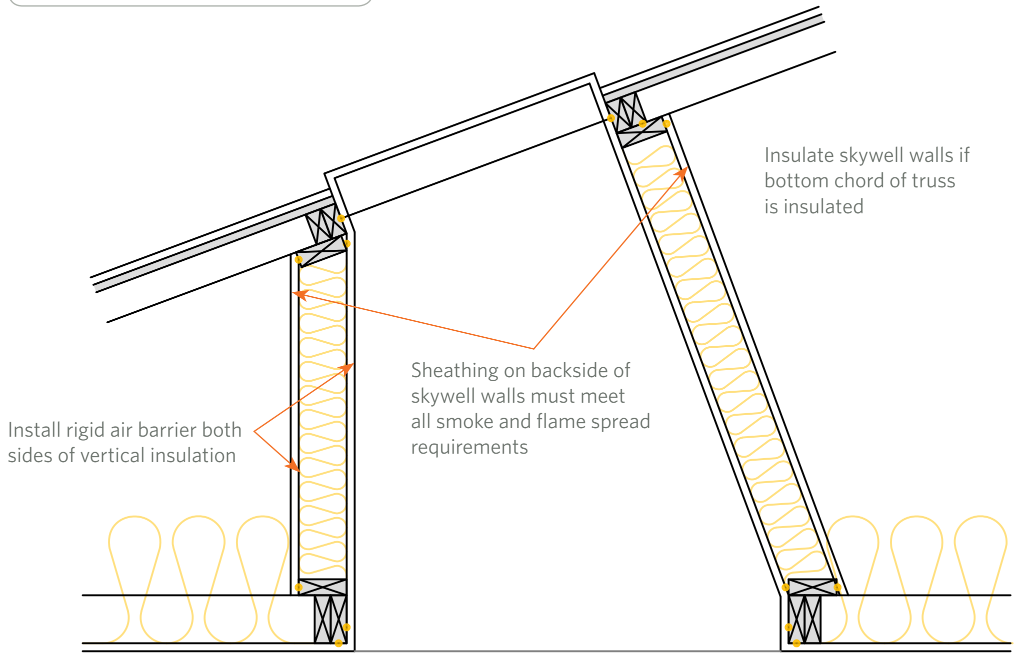


Fig. 20 Insulating skylight shafts



Energy Trust Program requirement:

- ☐ Quality insulation inspections

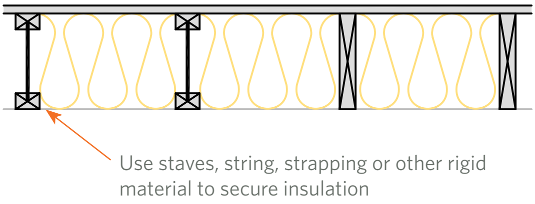
Notes: Floor insulation is in contact with the sub floor above and fills cavity (see fig. 21).

Over garages and exterior areas, a full air barrier is needed on the underside of the floor system.

All insulation should be installed to the manufacturer's specifications. Building cavities must be filled completely with no voids, gaps or compression. Insulation should be cut to fit and placed around electrical boxes, plumbing pipes and mechanical equipment in wall cavities, floor and rafter bays or attic spaces. As required by the Thermal Bypass Checklist, all insulation must be in contact with the appropriate air barrier to complete the thermal barrier.

If open web joists are used above unconditioned spaces, spray applied or loose fill insulation is required in the floor. Open web joists require specific attention to assure air sealing is performed between conditioned and unconditioned spaces.

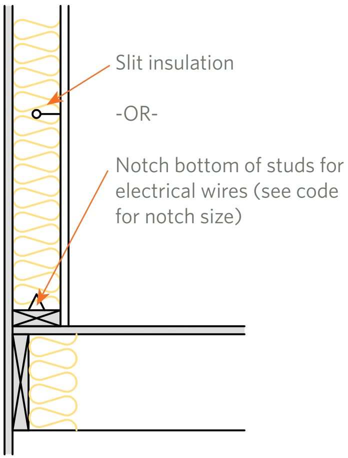
Fig. 21 Proper floor insulation installation

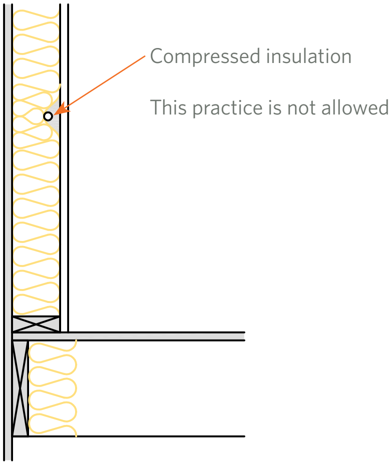


Insulation is rated by its resistance to heat transfer (R-value). The higher the R-value, the more effective it is at reducing heat transfer.

Common R-values per inch	
Solid lumber	R-1.25
Straw bale	R-2.1
Fiberglass batt	R-2.6 to 4.3
Loose fill cellulose	R-3.0 to 3.8
Cotton batt	R-3.0 to 3.6
EPS foam board	R-3.6 to 4.4
XPS foam board	R-5
Polyisocyanurate	R-5.6 to 8.0
Low-density spray foam	R-3.5 to 3.8
HD spray foam	R-6.0 to 7.0

Fig. 22 Utilities in exterior wall cavities





Area-Weighted average R-Value

Because building assemblies are constructed of various materials, they do not have the same insulation properties (R-Value) in every location. In order to determine the effective R-Value of an assembly, an average R-Value is calculated based on the area of each material in the assembly. This is referred to as an Area-Weighted R-Value.

R-Values are used to express thermal resistance of a material and can be added together, but not multiplied. U-Values are used to express heat transmission through an assembly or material and are the inverse of R-Values ($U=1/R$). U-Values cannot be added, but they can be multiplied. For this reason, an Area-Weighted R-Value for an assembly has to be calculated using U-Values. Continue reading for an example of this calculation.

Fig. 23 Standard vs. raised heel trusses

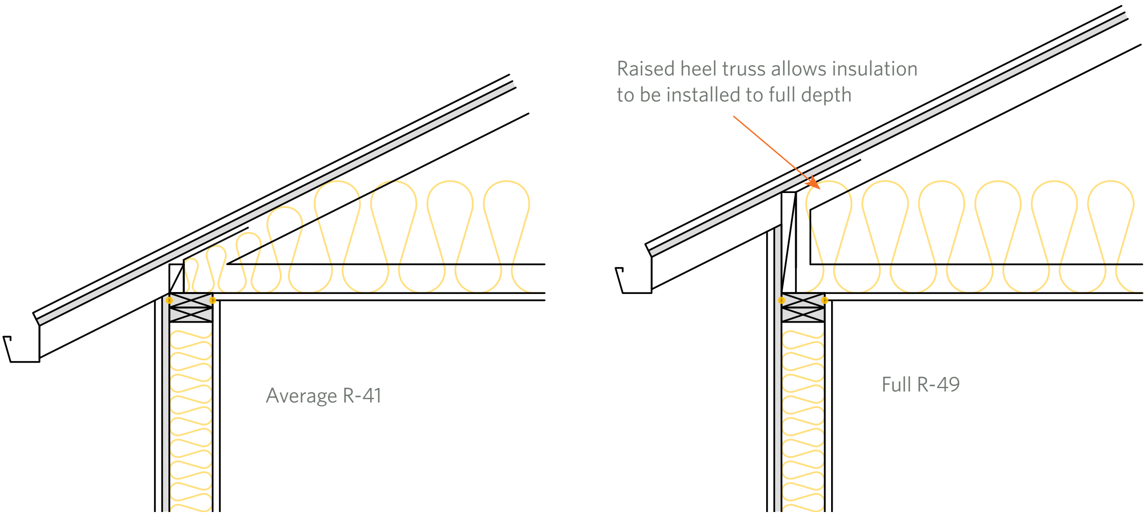


Figure 23 shows standard vs. raised heel trusses. R-49 insulation was installed in two 1050 sq. ft. attics. In the attic on the left, less insulation was installed due to space constraints at the wall-truss connection. Therefore, there are only 910 sq. ft. of R-49 insulation; the remaining 140 sq. ft. is insulated to R-20. The Area-Weighted R-Value for the left attic is reduced to R-41 as calculated below.

R-Value calculation

Wrong way

$RA_{Total} = RA_1 + RA_2$

R x 1050 = 20 x 140 + 49 x 910

R x 1050 = 2800 + 44590

$$R = \frac{47390}{1050} = 45.1$$

Instead convert R-Values to U-Values, average U-Values by area and then convert back to R-Value:

UA_{Total} is the Area Weighted U-Value for the entire assembly.

U_1 & U_2 are the U-Values for R_1 & R_2, respectively.

A_1 & A_2 are the areas of R_1 & R_2, respectively.

Correct Way

$$R = \frac{1}{U}$$

$UA_{Total} = U_1A_1 + U_2A_2$

$$U \times 1050 = \frac{1}{20} \times 140 + \frac{1}{49} \times 910$$

U x 1050 = 7 + 18.6

U x 1050 = 25.6

$$U = \frac{25.6}{1050} = 0.0244$$

$$R_{Total} = \frac{1}{U} = \frac{1}{0.0244} = 41$$

WINDOWS & DOORS

Windows lose heat more than five times faster than a typical wall assembly rated at R-21. To reduce heat loss in homes, window area should be limited.

Energy Trust requires that windows be tested and rated by the National Fenestration Rating Council and that the rating labels remain on windows until they are inspected by a verifier.

In addition to being rated by the NFRC, Energy Trust has established maximum glazing areas and U-Values for various energy efficiency levels. Skylights and glass doors (french and sliding doors) are considered glazing and must be included in glazing area and average U-Value calculations. Doors must be a minimum of R-5. Contact your verifier for the glazing requirements for your specific project.

Fig. 24 Example NFRC label

Energy Trust Program requirement:

- ☐ Installation of zonal pressure relief
- ☐ Combustion Appliance Zone testing
- ☐ Duct testing
- ☐ Heat pump commissioning
- ☐ Ducts sealed with mastic paste

Notes:

- Before investing in more efficient heating sources, consider improving the thermal envelope and distribution system efficiency.
- Ducts located in the conditioned space of the house should be sealed with mastic paste to assure conditioned air is transported to where it is intended.
- Duct tape may not be used to connect or hold duct work.
- Heating registers do not need to be located near exterior walls in most homes.

Heating system efficiency is determined by the efficiency of the heating equipment (typically a furnace or heat pump) and the efficiency of the distribution system (typically ducts). An efficient house must have an efficient heating source and distribution system.

Up to 20 percent of the heat distributed through a ducted heating system in a new home is lost to the surrounding space through leaks or conducted through insulation. When ducts and air handling units are installed in the garage, crawl space, unconditioned basements or attics much of the heat that is paid for is lost before entering the house.

Install ducts inside conditioned space

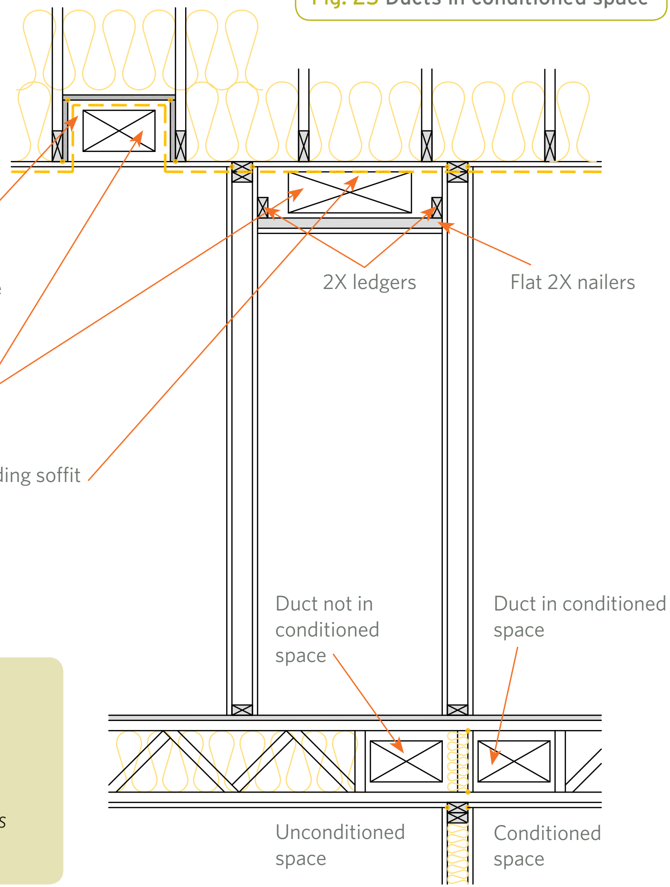
Homes should be designed to accommodate placement of ducts and heating systems inside conditioned spaces. When this is done, much less heat is lost, greatly improving the distribution system efficiency. Before construction begins, plan duct and heating system placement with your designer, HVAC contractor and other trades to avoid installation troubles. The complete duct system is considered inside the conditioned space when the following requirements are met:

- All ducts and heating equipment are located inside of the air/thermal barriers.
- Rim joists between floors are sealed.
- Joints and seams in duct work are mechanically fastened and sealed with mastic paste.
- Soffits containing duct work must be sealed.
- Chases containing duct work must be sealed and insulated.
- Exterior wall cavities cannot be used for duct work.

Additional requirements must be met to qualify for Energy Trust New Home incentive pathways requiring duct placement inside conditioned space. Consult with a program verifier to determine if all requirements are met.

Ducts in joists between conditioned and unconditioned spaces are not considered to be in conditioned space unless properly air sealed and insulated.

Fig. 25 Ducts in conditioned space



Notes: *Assure proper sealing of exterior air barriers near duct runs. Install solid air barrier between duct runs and fibrous insulation.*

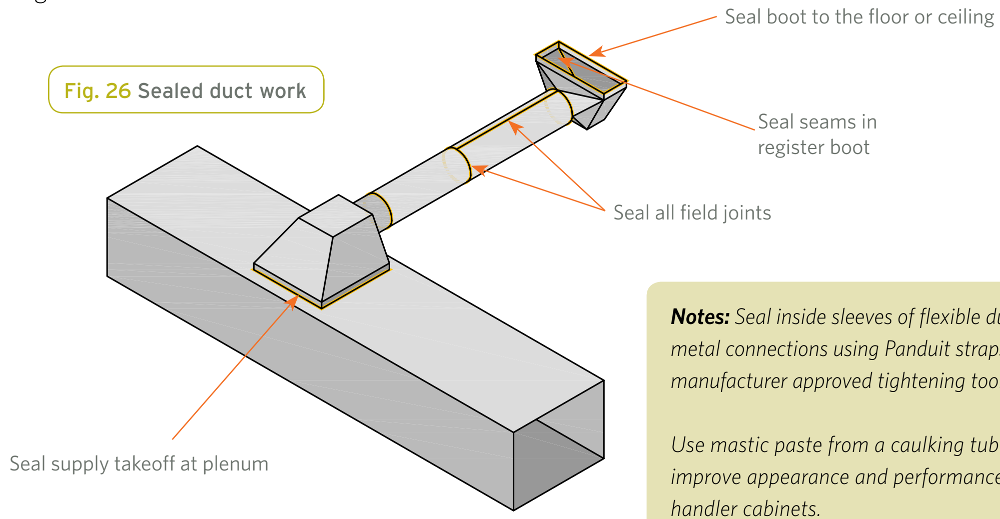
Seal duct joints with mastic paste; duct tape is not acceptable.

Duct sealing:

Seal all seams, joints (including elbow gores) and connections with mastic paste to minimize air leakage. Pay special attention to connections at the plenum, including start collars and behind air handler cabinets. Mastic paste is not required on blower cabinet service panels that are intended to be removed for unit service.

Test duct system leakage using approved performance testing technician.

Fig. 26 Sealed duct work



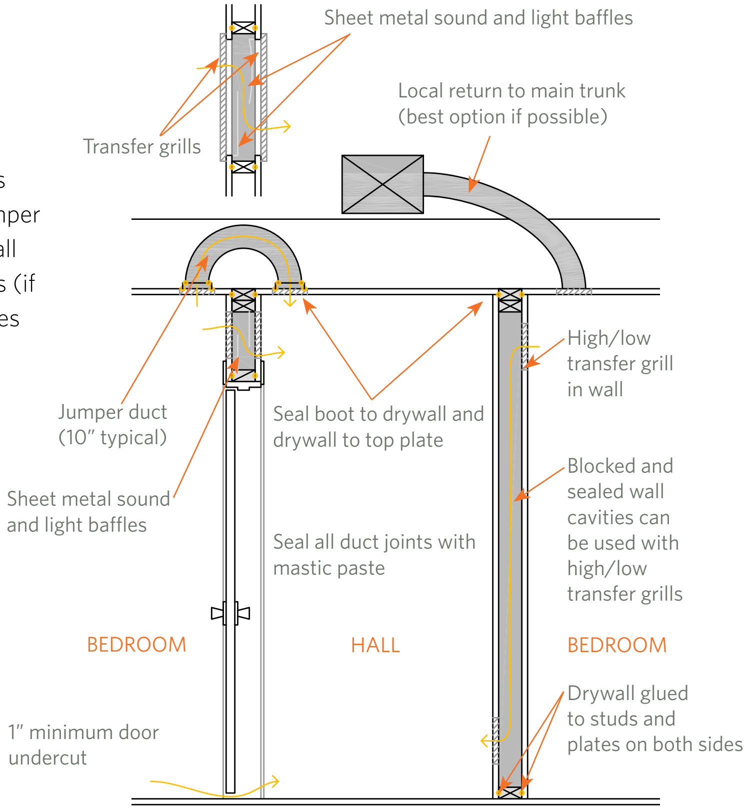
Notes: *Seal inside sleeves of flexible ducts to metal connections using Panduit straps and manufacturer approved tightening tool.*

Use mastic paste from a caulking tube to improve appearance and performance at the air handler cabinets.

Zonal Pressure Relief

Closing bedroom doors can restrict air movement between supply and return registers causing pressure imbalances in homes. This has been proven to increase house air leakage and can negatively affect occupant comfort. Properly designed duct systems will include return air pathways between all supply and return ducts registers. Return air pathways can include jumper ducts, transfer grills above doors, high-low wall transfer grills and occasionally door undercuts (if there is only one supply in the room and it does not have excessive flow).

Fig. 27 Zonal pressure relief



Heating design, selection and installation

Proper design, selection and installation of a heating and cooling system are essential for an efficient and comfortable home. Improperly designed or installed systems can lead to poor performance and comfort. Information specific to each house, such as surface areas and U-values, detailed air leakage and ventilation information, equipment efficiency and other information should be used to properly design heating and cooling systems, so that equipment is properly sized. Approved sizing methods must be used for homes using heat pumps as the primary heat source. Refer to Energy Trust requirements or your verifier for further information.

Heat Pump Commissioning:

Ducted heat pump systems must be installed using an approved commissioning protocol to assure proper performance (CheckMe! or Performance Tested Comfort Systems). Proper air flow, charge and control system installation is necessary.

Heating system alternatives

Heating systems that do not require ducts can be used to avoid energy losses and duct installation expenses.

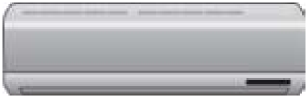
Ductless heat pumps:

Mini-split systems with variable speed compressors or "inverter drives" efficiently heat and cool homes. Ductless heat pumps can be used in conjunction with electric resistance wall heaters in well-designed homes to keep installation costs down.

As with any heating system, ductless heat pumps should be sized for each location using proper sizing calculations.

Fig. 28 Ductless mini-split heat pump

Fig. 29 Ductless head



Ductless Gas Heating:

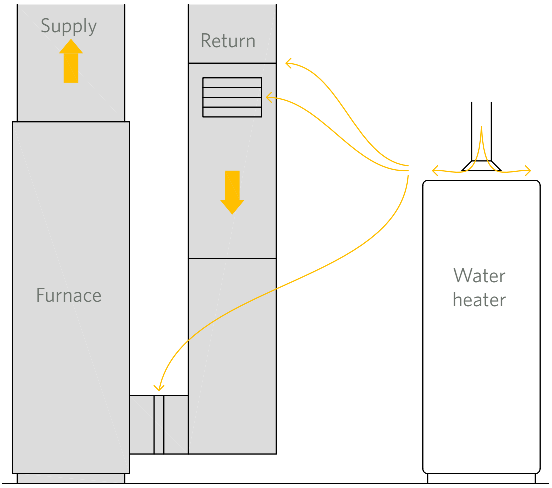
Small, efficient homes with open floor plans can be comfortably heated with an efficient furnace-rated fireplace or gas unit heater. The fireplace heater must be either sealed combustion or direct vented. It must be located in the main living area and controlled by a thermostat. Electric resistance wall heaters can be placed in bedrooms and bathrooms, if properly sized. Unvented combustion heating appliances are not permitted.

Combustion Appliance Zone testing

An approved performance tester is required to perform a CAZ test on all homes that have combustion appliances used for primary space and water heating. Sealed combustion systems, with supply and exhaust combustion air fully vented to the outside, are exempt from this test.

Room pressure imbalances can cause comfort and mechanical problems, and contribute to backdrafting. The HVAC contractor will correct any room-to-room pressure imbalance found during the CAZ test by providing return air pathways.

Fig. 30 Backdrafting scenario



Danger! *Leaks in return ducts depressurize the basement, garage or utility closet where equipment is located. Depressurization can cause gas water heaters and/or the furnace vents to backdraft. Backdrafted combustion gases, which may induce deadly carbon monoxide, are then circulated throughout the house.*

MECHANICAL VENTILATION SYSTEMS

Energy Trust Program Requirement:

- ☐ Whole home mechanical ventilation

Note:
Do not introduce fresh air from areas of poor air quality, such as roof vents, driveways, attics and crawl spaces or locations near exhaust vents.

As homes are built tighter, whole home mechanical ventilation systems should be installed. A tightly constructed house with reliable whole house mechanical ventilation will have improved energy efficiency, comfort and indoor air quality. Mechanical ventilation can be provided using exhaust systems, supply systems or heat/energy recovery systems.

Program requirements specify that mechanical systems must be capable of providing 15 CFM per occupant (two people for first bedroom and one person for each additional bedroom) for a 24-hour period. Systems can be designed to run continuously at this rate or intermittently at a higher rate by using a programmable timer.

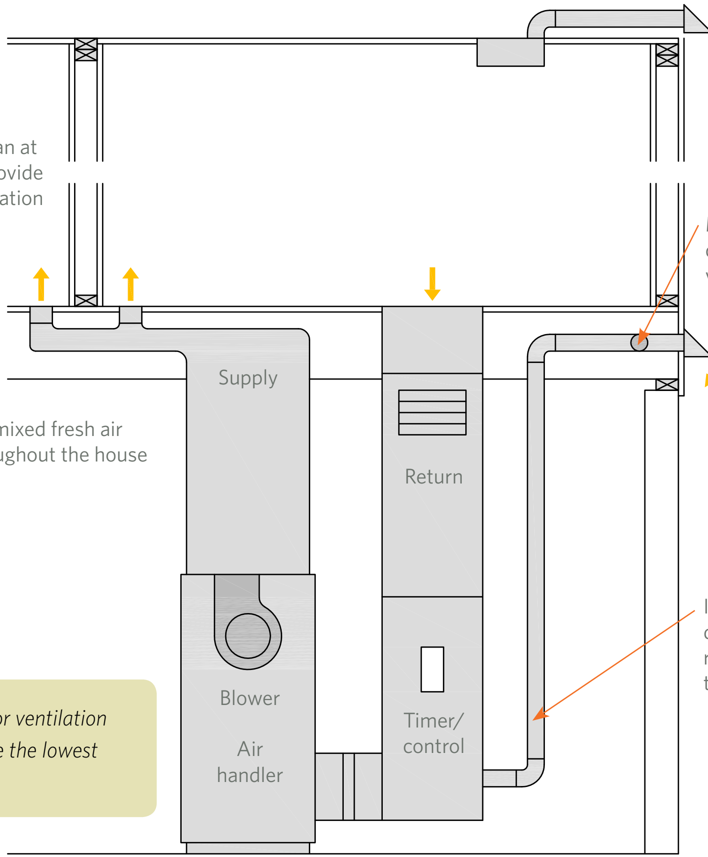
Whole house exhaust systems

Whole house exhaust fans must be rated for continuous operation, have a sone rating of 1.0 or less, be centrally located and operate with a 24-hour programmable control.

Whole house supply systems

Typically used in conjunction with a ducted HVAC system, outdoor air is drawn in through the cold air return and distributed throughout the house. An electronically operated mechanical damper controls the outdoor air. Optionally, the control can also activate an exhaust fan inside the house. Use control systems capable of prioritizing outdoor entry to occur at times of normal heating and cooling. Run blower at low speed during non-coincident heating/cooling cycles.

Fig. 31 Fresh air intake tied to HVAC

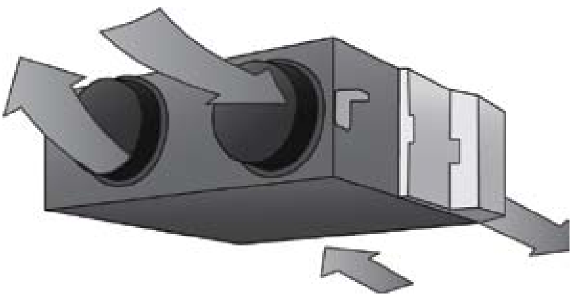


Note: *When fan is operating for ventilation purposes only, it should engage the lowest blower fan speed.*

Heat/Energy Recovery Ventilator

Heat/Energy Recovery Ventilator systems can be used to reduce energy loss from mechanical air exchange and temper incoming air. They provide balanced ventilation air and minimize pressure imbalances. These systems are most effective in homes with very tight construction and in colder climates.

Fig. 32 Heat/Energy Recovery Ventilator

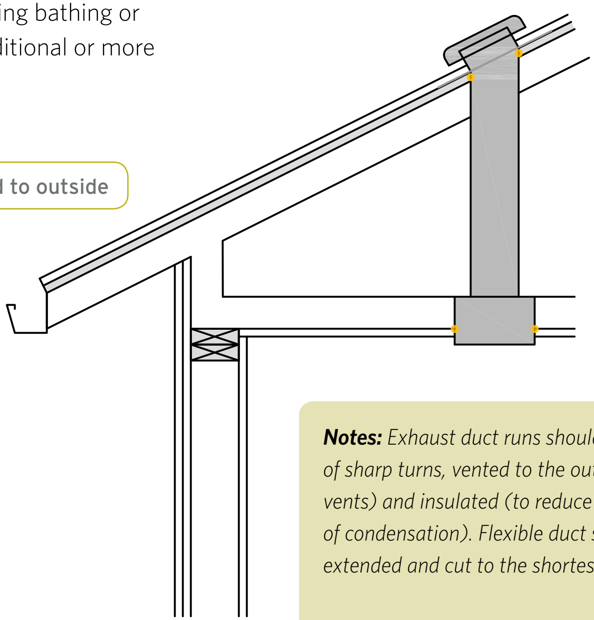


Note: *Whole home mechanical ventilation systems with supply air capabilities should be designed to provide fresh air to all habitable areas of the home.*

Spot ventilation

In addition to the whole house mechanical ventilation strategy, additional moisture loads from cooking and bathing should be addressed through spot ventilation. Install exhaust fans, (rated at 2.0 sones or less, with flow rates of 80 cubic feet per minute or greater) in rooms containing bathing or spa facilities. See local codes for additional or more stringent requirements.

Fig. 33 Exhaust ducts vented to outside



Notes: *Exhaust duct runs should be short, free of sharp turns, vented to the outside (not to roof vents) and insulated (to reduce the likelihood of condensation). Flexible duct should be fully extended and cut to the shortest possible length.*

Exhaust should have a dedicated roof vent not included in attic ventilation.

WATER HEATER & LIGHTING

Water heater

Energy Factors for water heaters are issued by the Gas Appliance Manufacturer's Association; higher EF ratings indicate higher efficiency. Please see program specifications for efficiency requirements for water heating type.

Note: *Direct vent water heaters and tankless water heaters are alternatives to standard tank systems and often have higher efficiency ratings.*

Lighting

Using high efficiency lights and appliances can reduce a home owner's energy consumption. Please refer to program specifications for lighting and appliance requirements.

Note: *There are no restrictions on where CFLs or ENERGY STAR qualified fixtures should be used. Generally, when choosing locations for CFLs or fixture locations, the best choices are lights that:*

- *Tend to stay on for long hours*
- *Are located in hard-to-reach locations*
- *Are connected to switches and not to dimmers*

RESOURCES

Contacting Energy Trust of Oregon

For more information about Energy Trust's new homes program and to find a verifier or technician, visit **www.energytrust.org/ta** or contact the trade ally coordinator at 1.877.283.0698.

For upcoming trainings:
www.energytrust.org/trainingcalendar

To find an Energy Trust approved architect or designer:
www.energytrust.org/adppa

Other resources:

ENERGY STAR® and other technical requirements please visit:

- www.northwestenergystar.com
- www.energystar.gov

Building sciences and energy efficiency please visit:

- www.energystar.gov
- www.oregon.gov/ENERGY
- www.nwalliance.org
- www.eeba.org
- www.buildingscience.com

NOTES

Energy Trust of Oregon 851 SW Sixth Avenue, #1200, Portland, Oregon 97204 1.866.368.7878 503.546.6862 ***fax*** **energytrust.org**