

ENERGY TRUST OF OREGON  
EXISTING MULTIFAMILY

# WEATHERIZATION SPECIFICATIONS MANUAL

[energytrust.org](http://energytrust.org)

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## FOREWORD FROM ENERGY TRUST OF OREGON

The Existing Multifamily Weatherization Specifications Manual provides necessary information and clear direction to make your job easier and to increase and ensure the energy efficiency of your customer’s property.

The following weatherization specifications are only for retrofit weatherization jobs that qualify for Energy Trust of Oregon incentives and are not intended to address new construction or major remodeling projects.

New weatherization specifications go into effect June 1, 2013, based on the date of installation of the measure(s). Please begin to familiarize yourself with these updates and make sure your crews are aware of the changes. Trainings are available to any trade ally company or technician who desires a greater understanding of these specifications. To set an appointment for a weatherization specifications training, contact the Existing Multifamily Trade Ally Coordinator Daniel Wilkinson at [daniel.wilkinson@lmco.com](mailto:daniel.wilkinson@lmco.com) or call 503-729-0562.

Copies of the Existing Multifamily Weatherization Specifications Manual are available for no charge at [www.energytrust.org/ta](http://www.energytrust.org/ta).

Thank you for your continued participation as an Existing Multifamily Trade Ally. Our programs could not exist without your hard work and commitment to providing energy-efficiency services to the community.

Sincerely,  
The Existing Multifamily Trade Ally Team

# ENERGY TRUST OF OREGON EXISTING MULTIFAMILY WEATHERIZATION SPECIFICATIONS MANUAL

June 1, 2013

## INTRODUCTION

### IN 1.0—Goals and Eligibility

The intent of Energy Trust of Oregon’s weatherization offering for Existing Multifamily is to help small and large multifamily properties, dormitories, sororities, fraternities, retirement/assisted living facilities, and condominiums represented by the homeowners association (HOA) or Board save energy and increase comfort through the installation of cost-effective weatherization improvements. Only Oregon dwellings primarily heated with energy from Portland General Electric, Pacific Power, NW Natural or Cascade Natural Gas are eligible for Energy Trust services and incentives. To be considered a complete measure and qualify for an incentive, the installed measure must meet the specifications defined in this manual and meet local code requirements. The introduction of each section of this manual defines the requirements for achieving a complete measure.

The main purpose of weatherization installations is to prevent winter heat loss from conditioned indoor spaces to unconditioned or outdoor spaces. Weatherization also reduces heat gain in the summer. Weatherization measures shall be installed in the thermal envelope—or building shell—of a building or facility. These areas are typically defined by the separation of conditioned and unconditioned spaces, or between a conditioned space and the outside of the building or facility.

To qualify for an Energy Trust insulation incentive, all insulation shall be in contact with a continuous effective air barrier. Sheetrock, plywood, and foamboard are examples of air barrier materials; fiberglass batt-type insulation is not considered an air barrier. As a courtesy to participants, contractors should be responsible for removing all of their scrap materials and trash that result from their work.

Energy Trust’s Existing Multifamily Weatherization Specifications Manual may not cover every situation. If you have questions, contact the Existing Multifamily Trade Ally Coordinator Daniel Wilkinson at [daniel.wilkinson@lmco.com](mailto:daniel.wilkinson@lmco.com) or call 503-729-0562.

### IN 1.1—Code Compliance, National and Regional Standards

In cases where federal, national, regional, state or local code or regulation exceeds the requirements herein, the code regulation shall apply. If the federal, national, regional, state or local code or regulation does not exceed the requirements herein, the requirements contained in this Multifamily Weatherization Specifications Manual shall apply. Examples of national and regional regulations include, but are not limited to, asbestos, lead, combustion appliances and fire safety requirements. Refer to applicable program and participation agreement materials or contact the Existing Multifamily Trade Ally Coordinator Daniel Wilkinson at [daniel.wilkinson@lmco.com](mailto:daniel.wilkinson@lmco.com) or call 503-729-0562 for more information.

### IN 1.2—Materials

Materials used in the Existing Multifamily weatherization offering shall meet or exceed applicable state, federal or local code and regulations. Materials—including manufacturer’s installation instructions—that do not conform to Existing Multifamily guidelines, shall not be eligible for incentives. Existing Multifamily does not keep a list of approved products. Adherence to applicable codes and regulations is the responsibility of the contractor or building owner. Existing Multifamily reserves the right to refuse the use of materials and supplies it deems unacceptable.

### IN 1.3—Quality Control and Project Quality Verification Process

After weatherization measures are installed, project quality verification may be required to ensure compliance with Existing Multifamily specifications. Existing Multifamily will conduct project quality verifications based solely upon incentive-qualifying measures. If the installed weatherization measures do not meet these specifications, Existing Multifamily will notify the customer and contractor of the deficiencies and follow up with the contractor to perform corrections. However, Existing Multifamily neither guarantees energy savings nor performance of the installations under this offering. Existing Multifamily does not assume responsibility for enforcing or determining compliance with codes and regulations or their interpretation. The project quality verification is limited to measures or sections of measures that are reasonably visible from normal access locations. A reasonable effort will be made to see a representative sample of the measure.

To ensure the project qualifies for incentives, it is the responsibility of the owner to discuss with the contractor any discrepancies between the project performed and the Weatherization Specifications Manual.

## IN 1.4—Waivers for Unusual Conditions

When unusual conditions exist, Existing Multifamily may waive certain provisions of the Weatherization Specifications Manual, or may substitute a different standard or method. The purpose of the waiver is to identify unusual conditions before the project begins. Such waivers require preapproval by Existing Multifamily.

To receive a waiver, contact the Existing Multifamily Trade Ally Coordinator Daniel Wilkinson at [daniel.wilkinson@lmco.com](mailto:daniel.wilkinson@lmco.com) or call 503-729-0562.

## IN 1.5—Illustrations

This manual features illustrations for clarity. All illustration details are considered requirements for the weatherization measures installed.

## IN 1.6—Human Contact Areas

To receive an Energy Trust insulation incentive, fibrous insulation in Human Contact Areas shall be covered with a vapor-permeable air barrier—such as 1/2" gypsum board or house wrap—to limit occupant exposure. Human Contact Areas may include attics, basements, garages and/or storage-areas where occupants go for routine maintenance, storage or access. Vertical and overhead surfaces containing fibrous insulation and located in Human Contact Areas shall also be covered. All covering shall meet applicable codes. See glossary for acceptable vapor-permeable air barrier requirements and materials.

## IN 1.7—Project Eligibility

Projects that are considered to be major remodels, displace tenants, or require the involvement of an architect or engineer, should contact the program to confirm eligibility prior to starting any work. Contact the Existing Multifamily Trade Ally Coordinator Daniel Wilkinson at [daniel.wilkinson@lmco.com](mailto:daniel.wilkinson@lmco.com) or call 503-729-0562.

Incentives will not be issued for attic, wall or floor insulation improvements if owners are required to make the upgrades to meet building code requirements when a permit is required. For example, if the wall sheathing is removed during a remodel project to update electrical or plumbing systems, the insulation added to repair the wall—returning it to building code requirements—is not eligible for an incentive. However, the remaining walls that are unaffected by the remodeling are eligible for standard incentives if the work meets Energy Trust requirements.

Contact the Existing Multifamily Trade Ally Coordinator Daniel Wilkinson at [daniel.wilkinson@lmco.com](mailto:daniel.wilkinson@lmco.com) or call 503-729-0562 to request additional assistance in determining the incentive eligibility for a project.

## IN 1.8—Phased Projects

To qualify for a phased incentive, an entire building must be addressed at once. If the entire building is not upgraded or will not be upgraded within a preapproved time frame, no incentive can be dispersed. The standard incentive will apply if the project occurs in phases. A window installation on only part of the building will not qualify for an incentive unless the remaining windows have already been upgraded.

## IN 1.9—Carbon Monoxide Alarm

Existing Multifamily strongly recommends a carbon monoxide alarm be installed whenever a weatherization measure is performed. The Oregon Fire Marshal has rules about the installation of alarms, regardless of the presence of carbon monoxide sources. Existing Multifamily recommends all trade allies and contractors follow these rules, regardless of permit status.

The Oregon Fire Marshal's pamphlet, "Frequently Asked Carbon Monoxide Questions," should be left with the occupant whenever a garage shares a wall with the tenant space or whenever combustion appliances are present in the tenant space, garage or other attached space. To find this pamphlet, visit [www.oregon.gov/OSP/SFM](http://www.oregon.gov/OSP/SFM).

## IN 1.10—Combustion Appliance Safety

In addition to carbon monoxide alarms, Existing Multifamily recommends trade allies and contractors perform air handler effect tests with doors open and closed in all structures where combustion appliances are present. A Combustion Appliance Zone, or CAZ, is any zone in the house or attached space that contains a combustion appliance. Appliances with a properly installed combustion chamber sealed to the exterior of the structure are not considered combustion appliances for the purposes of the CAZ test. Forced-air system operation shall not de-pressurize a combustion appliance zone by more than 3 pascals with reference to outside.

## IN 1.11—Solar Electric and Solar Water Heating

Existing Multifamily encourages the installation of both energy-efficiency and renewable energy systems for a building or facility. Trade allies interested in offering next steps for customers should consider energy-efficiency improvements and renewable energy options. For more information on solar photovoltaic electric systems and solar thermal water heating systems, incentives, resources and installation guides, visit [www.energytrust.org/trade-ally/programs/solar/resources](http://www.energytrust.org/trade-ally/programs/solar/resources) or call 1-866-368-7878.

## IN 1.12—Regulated Materials

Where the presence of regulated materials is known or suspected, all relevant state and national guidelines should be followed to ensure technician and occupant safety. The contractor and owner should exercise caution when regulated materials are in the unit. Where the presence of regulated materials is known or suspected, contractors are encouraged to consult guidelines from, but not limited to, the Oregon Department of Environmental Quality, or DEQ, the Oregon Occupational Health and Safety Division, the Environmental Protection Agency, or EPA, and the Building Performance Institute, or BPI.

# QUALITY CONTROL POLICIES AND PROCEDURES

- I. Quality Control Standards
- II. Definitions
- III. Criteria For Quality Control Verification Selection
- IV. Quality Control Verification Procedures
- V. Procedures For Jobs Requiring Corrective Action

## I. QUALITY CONTROL STANDARDS

Quality Control, or QC, and work quality verification ensures compliance with the Existing Multifamily Weatherization Specifications Manual; identifies opportunities for improvement for trade allies, contractors and property owners; and provides a quantitative metric to measure installation quality. The primary purpose of QC is to ensure building and measure durability, occupant health and safety, and realized energy savings.

QC and work quality verification only assesses the standards and associated components/materials for the energy-saving measures indicated on a specified incentive application. No warranties of any kind are implied by QC verifications and/or quality assurance visits. Energy Trust of Oregon and Existing Multifamily reserve the right to make reasonable adjustments to any and all of the time frames and processes set forth in these Quality Control Policies and Procedures.

If the trade ally or other contractor subcontracts work, it is the responsibility of the primary trade ally or contractor (the signatory licensed by the Construction Contractors Board, or CCB, on the incentive application materials) to ensure compliance with program standards and guidelines. Trade allies and other contractors are encouraged to implement an internal QC process to ensure each project's success.

Existing Multifamily projects selected for QC or work quality verification will be assessed as "Pass," "Needs Minor Corrective Action," or "Needs Major Corrective Action." These assessments are based on specifications defined in the current Existing Multifamily Weatherization Specifications Manual and any relevant regional/national standards.

Trade allies and contractors are required to:

- a. Perform any required corrective actions at no additional cost to the customer.
- b. Contact the customer within five business days of written notice to schedule mitigation for any required corrective actions.
- c. Remedy any required corrective actions within 30 days of written notice.

If, within five business days of receiving written notice, a trade ally or other contractor fails to contact the customer to schedule an appointment and remedy problems with an Existing Multifamily project requiring corrective action, and/or remediation is not completed within 30 business days of receiving written notice, Existing Multifamily may disqualify the incentive and inform the participant directly. Existing Multifamily requires trade allies and other contractors to reimburse contracted incentive amounts to participants upon disqualification. If work is remediated after 30 business days, the trade ally or contractor may resubmit the customer's incentive application.

Existing Multifamily QC staff may select 15 percent of Existing Multifamily incentive applications for QC verification by scheduled selection criteria or at random. Existing Multifamily incentive applications selected for verification may not be released for payment to the owner and/or trade ally until any required corrective actions are completed and all applicable measures receive a "Pass."

Waivers are available for unusual conditions and situations that prevent complete compliance with specifications. The purpose of the waiver is to identify unusual conditions and obtain preapproval before work begins. Request a waiver prior to starting a weatherization project by contacting the Existing Multifamily Trade Ally Coordinator, Daniel Wilkinson, at [daniel.wilkinson@lmco.com](mailto:daniel.wilkinson@lmco.com) or call 503-729-0562.

## II. DEFINITIONS

For weatherization offering purposes, the below terms are defined as follows:

**Quality assurance:** Quality assurance visits are considered to be on-site mentoring/training sessions with QC field staff and the trade ally or contractor occurring before, during, or after installation of measures.

**Courtesy QC:** Existing Multifamily may provide courtesy QC visits when verifications are deemed necessary outside of the normal protocol outlined in these procedures, or when requested by participant.

QC assessment terms (in accordance with any relevant regional/national standards):

**Pass:** Work was satisfactorily installed and completed as submitted on the incentive application and is in compliance with the Existing Multifamily Weatherization Specifications Manual. No corrective actions are necessary.

**Needs Minor Corrective Action:** Work was performed but has minor problems related to installation quality or is not in compliance with the Weatherization Specifications Manual. Problems include specifications which may have been overlooked by the trade ally or contractor and have a minor impact on energy savings or overall installation quality. Examples include, but are not limited to:

- a. Head flashing absent on required exposed windows.
- b. Missing or improperly installed weather-stripping.
- c. Minor voids in insulation or baffling.
- d. Improper support materials or techniques for the installation of insulation.

**Needs Major Corrective Action:** Work was performed with significant or serious problems related to installation quality or is substantially noncompliant with the Weatherization Specifications Manual.

Problems may include:

- a. Poor workmanship, substandard materials, and/or the potential to negatively impact occupant health and safety, intended energy savings, and/or building or measure durability.
- b. Work does not meet criteria for a "complete measure," as defined by the Weatherization Specifications Manual and/or Existing Multifamily incentive guidelines.
- c. Work was performed but does not qualify for the incentive listed on the incentive application and is noted as "does not qualify," commonly referred to as a "DNQ." **A DNQ is considered a serious violation and the trade ally or other contractor shall reimburse participants for any expected incentives that are denied because of a DNQ.**
- d. Three or more minor corrective actions per measure or across multiple measures.

### III. CRITERIA FOR QUALITY CONTROL VERIFICATION SELECTION

The Existing Multifamily QC team may select up to 15 percent of Existing Multifamily incentive applications for QC verifications by scheduled selection criteria or at random. The QC team also tracks specific trade ally, contractor, and measure corrective action rates to inform the scheduled selection criteria. Scheduled selection criteria are dependent upon program resources and may change according to the program's needs and Energy Trust priorities.

The scheduled selection criteria demonstrate installation quality and/or health and safety priorities identified by Existing Multifamily based upon experience, observation of the market as a whole and individual performance. This schedule provides a guide for how projects are selected. In addition, Existing Multifamily makes every reasonable effort to inspect at least one project per trade ally company, per calendar year. Trade allies may request a maximum of three verifications within a consecutive three-month period, subject to availability of program resources. The request can be made on applicable incentive application materials.

Non-random selection criteria contribute to the target rate of other selection designations, both random and non-random. For example: Existing Multifamily has identified a need to select projects from critical-concern contractors at a higher rate to ensure compliance, occupant health and safety, realized energy savings, etc. The projects selected for verification under this selection designation will contribute to the target rate of other selection designations. Contractor A is a critical-concern contractor and installs attic and floor insulation on a project. By selecting this Contractor A project, non-randomly, for verification, Existing Multifamily is able to satisfy other selection designations, including: critical-concern contractors, non-trade ally, weatherization and multi-measure projects.

Existing Multifamily randomly selects projects to ensure the QC process accurately reflects the type(s) of measures installed, previous QC pass/failure rates, and volume of applications submitted for individual trade allies or contractors. Other QC selection criteria may include: incomplete or inconsistent application information, multiple customer complaints, and level of trade ally or contractor involvement with Existing Multifamily. When a "Major Corrective Action" or three or more "Minor Corrective Actions" are required, Existing Multifamily reserves the right to increase the verification rate for other projects completed by the trade ally or contractor (within the same time period).

#### Critical-concern Contractors or Measures

Energy Trust or Existing Multifamily may categorize certain contractors, specific measures and/or designated project types as "Critical Concern" at their discretion and they may be subject to an elevated QC verification rate. If work quality or customer service concerns arise through multiple corrective actions or customer complaints, Energy Trust may issue a cease and desist letter to stop all work until corrective actions are mitigated. Energy Trust and/or Existing Multifamily may request that a contractor's responsible managing individual, or RMI, draft and/or sign a plan of improvement and memorandum of understanding before accepting additional incentive applications. Energy Trust and Existing Multifamily reserve the right to communicate health, safety and customer service concerns to participants and hold incentive payments until all work meets the appropriate specifications.

#### Self-install Projects

Incentive applications for self-installed measures will receive a QC verification. Applications for incentives on participant-installed jobs are not released for payment until all required corrective action is completed and all measures pass QC re-verification.

#### Non-trade Allies

At their discretion, Existing Multifamily may select 25-100 percent of non-trade ally contractors' projects for QC verification. Non-trade allies new to the Existing Multifamily program may be selected at a higher rate than non-trade allies with demonstrated success and understanding of specifications. Incentive applications for jobs installed by non-trade allies are not released for payment until any required corrective action is completed and all applicable measures receive a "Pass."

#### Non-trade Allies: High and/or Sudden Increases in Project Volume

Non-trade ally contractors who demonstrate significant project volume, sudden increases in project and/or measure volume, or potential for large project volume may be subject to an elevated verification rate at the discretion of Existing Multifamily. If work quality concerns arise through three or more corrective actions, Energy Trust may issue a cease and desist letter to stop all work until corrective actions are mitigated. Energy Trust and/or Existing Multifamily may request that the contractor's RMI draft and/or sign a formal Plan of Improvement and Memorandum of Understanding before accepting additional incentive applications.



Energy Trust and Existing Multifamily reserve the right to communicate health, safety and customer service concerns to participants and hold incentive payments until all work meets the appropriate specifications.

### Trade Allies

Existing Multifamily makes every reasonable effort to inspect at least one project per trade ally company, per year. Trade allies may request a maximum of three verifications within a consecutive three-month period, subject to available program resources. The request should be made on applicable incentive application materials.

### New Trade Allies

Existing Multifamily will make every reasonable effort to provide in-field mentoring and technical support to new trade allies. New trade allies may be subject to a selection rate of 100 percent of incentive applications submitted.

### Trade Allies: Sudden High Volume

Trade ally contractors who demonstrate a sudden increase in project and/or measure volume may be subject to an elevated selection rate at the discretion of Existing Multifamily. If work quality concerns arise through three or more corrective actions, Existing Multifamily may place a trade ally on immediate probation with written notice and Energy Trust may issue a cease and desist to stop all work until corrective actions are mitigated. Energy Trust and/or Existing Multifamily may request that a contractor's RMI draft and/or sign a formal plan of improvement and memorandum of understanding before accepting additional incentive applications. Energy Trust and Existing Multifamily reserve the right to communicate health, safety and customer service concerns to participants and hold incentive payments until all work meets the appropriate specifications.

## IV. QUALITY CONTROL VERIFICATION PROCEDURES

When a participant's completed incentive application is selected for QC verification, Existing Multifamily will make every effort to contact them within one week from selection to schedule a verification appointment.

1. The QC specialist visits the participant's building and conducts a verification on measures and related specifications for which the participant is claiming an incentive. The specialist will also complete QC Post Job Verification form.
2. The QC specialist informs the participant whether the work "Passes," or requires "Major Corrective Action" or "Minor Corrective Action."
3. The QC specialist submits the assessment results to the program operations team.
  - a. In the result of a "Pass":
    - i. Existing Multifamily processes the incentive application to release incentive payment to the participant or trade ally.
  - b. In the result of a "Major" or "Minor" corrective action:
    - i. The QC specialist notifies the participant that the project requires corrective action; their incentive payment will not be released until corrective action is taken, and the project may require follow-up work quality verification.
    - ii. The QC specialist immediately informs the trade ally or contractor that the project will require corrective action and may provide further detail. If the measure is self-installed, the QC specialist will educate the participant on proper installation methods to ensure the work passes verification.
    - iii. The program operations team sends a written notice to the trade ally or contractor regarding the corrective action(s) necessary with which to comply: the Existing Multifamily Weatherization Specifications Manual; other relevant program requirements; and/or applicable regional or national standards.
    - iv. Existing Multifamily will not process or release incentive payment for projects requiring corrective action. Existing Multifamily processes incentive payments to the participant and/or trade ally when a project assessment indicates a "Pass."

## V. PROCEDURES FOR JOBS REQUIRING CORRECTIVE ACTION

1. The trade ally or contractor must remediate all corrective actions at **no additional cost to the participant**.
2. The trade ally or contractor must schedule remediation work with the participant within five business days of receiving written notice that the job requires corrective action.
3. The trade ally or contractor must complete remediation within 30 business days of receiving written notice that a job requires corrective action, and notify the QC coordinator of completion.
4. The program will work with the trade ally or contractor to remedy problems, if necessary. Refer to the “Quality Control Standards” section for additional information.
5. The QC specialist may schedule a re-verification for any job requiring major corrective action, once the trade ally or contractor indicates work is completed.
6. The trade ally or contractor will confirm the completion of corrective actions. Re-verification is not required for minor corrective actions, but may be conducted at the discretion of Existing Multifamily. All major corrective actions are subject to re-verification.
7. The project is released for incentive payment when corrective actions are successfully completed and the project receives a “Pass.”

## ATTIC INSULATION

### AT 1.0—Introduction

This section lists work and details that shall be performed before insulation is installed in attics, and specifications for how to install insulation and attic-related ventilation. To qualify for an Existing Multifamily insulation incentive, the pre-existing condition must be R-18 or less, and the attic must be insulated to R-38, or greater, unless otherwise specified herein. Insulation shall be installed to reduce heat loss between conditioned and unconditioned spaces or to the outside of the house.

All accessible attic areas, regardless of eligibility for incentives, must meet the applicable requirements in order to be considered a complete measure, unless a requirement is waived by Existing Multifamily or physical barriers exist (see section IN 1.5). Areas where existing insulation is greater than R-18 are not eligible for incentives. However, all applicable specifications must be met in areas where existing insulation is greater than R-18 for other areas to qualify for the incentive.

### AT 1.1—Attic Air Sealing

To prevent transmission of water vapor and to support the effective R-value of the attic insulation, Existing Multifamily recommends that all accessible attic penetrations are sealed. Attic air sealing opportunities include plumbing, wiring and duct penetrations, top plates, mechanical chases, soffits and similar openings in the air barrier of the attic. If air sealing, appropriate backing materials shall be used to bridge openings that cannot be effectively closed by a sealant. Caulk, foam or other compatible sealants shall be used. Target areas are listed below in Tables AT 1.1a and AT 1.1b.

**Table AT 1.1a—Recommended target areas to be air sealed before installing insulation**

Chimney chases and flues	Sheet metal and ASTM E-136-rated caulk shall be used within 3" of masonry chimneys and double-walled flues
Duct chases	If opening is larger than 1/2", bridged with rigid material to attic floor level and sealed
Plumbing, electrical, and HVAC penetrations	Seal with foam or caulk. If opening is larger than 1/2", bridged with rigid material to attic floor level and sealed
Drop soffits	Bridged with rigid material to attic floor level and sealed
Open wall cavities	Bridged with rigid material to attic floor level and sealed

Top plates	Seal with foam or caulk
Knee wall transition	Seal with foam or caulk. If cavity is open, plug with rigid foamboard, sheet metal or other rigid material (see AT 2.7)
Knee walls	Seal penetrations with foam or caulk
Vertical wall transition	Seal with foam or caulk. If cavity is open, plug with rigid foamboard, sheet metal or other rigid material
Exhaust fans	Seal fan housing to ceiling with foam or caulk
ICAT-rated recessed lights	Seal housing to ceiling with foam or caulk
Accesses	Weather-strip access hatch perimeter

**Table AT 1.1b—Recommended Treatments for Recessed Lights**

Rating	Sides of box	Top of box	Insulation
Non-IC	Baffle made of rigid material meeting ASTM E-814 requirements (example: gypsum board), providing 3–4" clearance	Cap made of rigid material meeting ASTM E-814 requirements, and with high vapor permeability (example: gypsum board) with 24" clearance above the top of the fixture	Installed up sides of baffles, but not over top of enclosure
IC	Rigid material providing 3–4" clearance	Cap with high vapor permeability with 24" clearance above the top of the fixture	Installed up to sides and over top of box
ICAT	None	None	May be installed to bury fixture

Metal flue pipes and heat producing fixtures shall comply with the baffling requirements in AT 1.5. Heat producing fixtures may include:

- a. Metal flue vents
- b. Non-IC-rated lights
- c. Non-IC-rated bath fans
- d. Fans with heaters
- e. Transformers

Where the presence of regulated materials is known or suspected, all relevant state and national guidelines should be followed to ensure technician and occupant safety.

## AT 1.2—Knob and Tube Wiring

Before installing insulation in contact with active knob and tube wiring, the electrical system shall be inspected and receive written approval by a licensed electrician. Insulating attics with knob and tube wiring shall be at the discretion of the contractor and owner, and shall adhere to state and local code jurisdictions.

## AT 1.3—Passive Attic Ventilation: Sizing and Distribution

Existing Multifamily requires one square foot of Net Free Area, or NFA, of ventilation for each 150 sq. ft. of attic area if all the vents are on one level. The area may be reduced to a ratio of 1 sq. ft. to 300 sq. ft. if the vent area is divided between upper and lower ventilation. When vent area is divided, the upper vent area shall not exceed 80 percent of the total installed vent area. Gable vents may be considered lower ventilation if the installation allows cross-ventilation of the attic spaces.

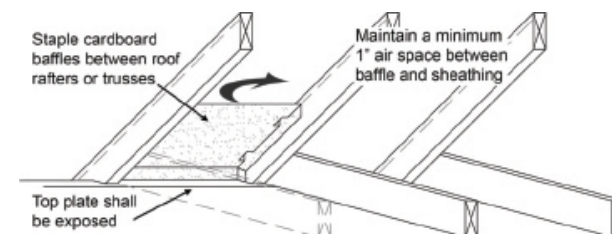
The vent area shall be the NFA, defined as the actual open area of the vent after subtracting any area blocked by screens or louvers. All vents shall be screened. See Existing Multifamily Quick Reference Guide at the back of this manual for NFA calculations.

Any ventilation opening within 6" of the final insulation level shall be baffled with a rigid material, such as moisture-treated cardboard.

## AT 1.4—Baffles for Eave and Soffit Vents

Eave and soffit vents shall be baffled to prevent wind washing through the insulation and blockage of the vent; all insulation types shall comply. Baffles shall be installed before adding more insulation and maintain an opening equal to or greater than the size of the vent. Baffles shall be fastened to roof rafters with at least 9/16" staples or roofing nails. Anchor points shall be spaced no more than 4" apart down each side, in the upper one-half portion of the baffles. Baffles shall be rigid, impervious to wind and resistant to moisture. All baffles shall extend 4" above the final level of insulation.

**Illustration AT 1.4**



A continuous dam shall be installed along continuous soffit or eave vents. Where a continuous soffit vent exists, baffles shall be installed somewhat equally spaced along the length of the soffit and allow enough NFA to satisfy the lower ventilation needs, based on the standard set in section AT 1.3. Unbaffled bays open to a soffit shall be blocked and sealed with a rigid moisture-resistant material so blown product is not able to enter the soffit. **Baffle shall be installed far enough into the bay to reach the exterior side of the top plate.** It is acceptable for compression to occur due to a narrowing roofline.

### AT 1.5–Dams

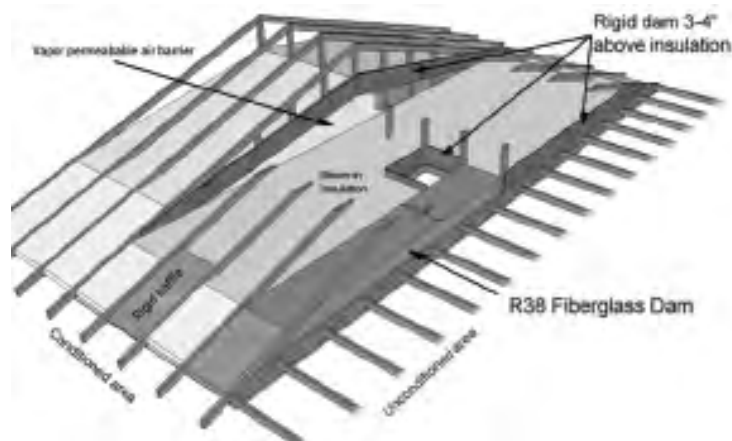
Dams shall be installed where final levels of loose-fill insulation differ. Common areas requiring a dam include raised or dropped ceilings, the sides of vaulted ceilings, and in between insulated and uninsulated areas such as garages. Dams shall be installed to maintain a consistent R-value by one of the following methods:

- a. A durable, rigid material such as plywood, oriented strand board, moisture-treated cardboard or foamboard installed along the full length of required area and extending 4" above the final level of insulation. Rigid dams must be mechanically and securely fastened.
- b. A 14.5" wide (or wider) insulation batt, with an R-value equal to or greater than that specified for the attic, laid flat along the full length of the required area. Insulation batts used as a dam shall be installed so that no gaps or voids exist.

See AT 1.11 for specifications for damming attic accesses.

Sloughing is not permitted.

Illustration AT 1.5



### AT 1.6–Baffles for Chimneys, Flues and Other Heat Sources

Most unfaced fiberglass batt insulation brands meet the ASTM E-136 noncombustible rating. Kraft paper facing does not meet this rating.

Table AT 1.6

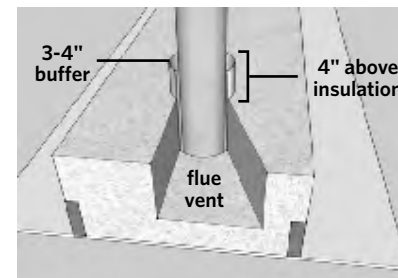
Item	For insulation rated as noncombustible (ASTM E-136)	For insulation not rated as noncombustible
Metal flue	Approved baffle	Approved baffle
Masonry chimney	No baffle required	Approved baffle
Transformers	Approved baffle	Approved baffle
Non-IC rated vented fan/heater combination	Approved baffle	Approved baffle
Miscellaneous electrical	Approved baffle	Approved baffle
Non-IC rated recessed light	Approved baffle*	Approved baffle*
IC-rated recessed light	No baffle required*	No baffle required*
Low-voltage electrical	No baffle required	No baffle required
Vented exhaust fans	No baffle required	No baffle required

\*See table AT 1.1a for air sealing recommendations regarding light fixtures

Baffles shall be made of rigid noncombustible material and constructed using mechanical fasteners. Tape is not a mechanical fastener. Use Table AT 1.6 to determine baffle requirements. Batt-type insulation is not an approved baffle for any heat-producing fixture.

To prevent heat build-up, insulation shall not be in contact with fixtures as described above. When needed, baffles shall keep the insulation at least 3", but not more than 4", from the sides of the heat-producing fixtures. Baffles shall extend at least 4" above the final level of insulation (see Illustration AT 1.6).

Illustration AT 1.6



## AT 1.7—Bath and Exhaust Fans

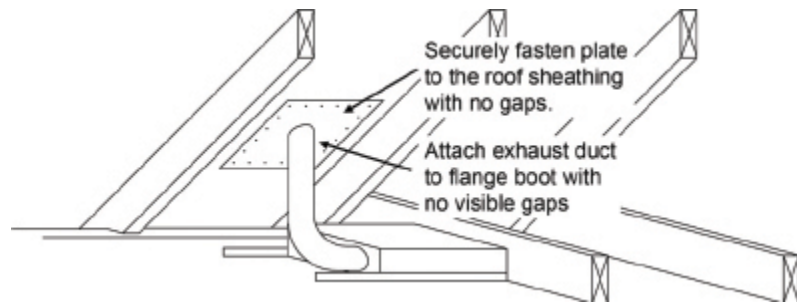
All exhaust fans shall be vented to the exterior of the structure and secured to the exterior sheathing with no gaps to prevent any exhaust air from entering back into the attic (see Illustration AT 1.7). At least one functioning damper shall be present in each system, either at the fan or where vented to the outside. It is highly recommended that exhaust ducts traveling through unconditioned space be insulated to prevent condensation.

Exhaust fans shall be vented to nearest feasible location. Exhaust ducts shall not sag, shall be as straight as possible to maximize effective air flow, and shall have no more than two 90-degree turns, or equivalent. Sags, turns, bends and elbows restrict air movement and the effective flow of air from the exhaust device. If an attic vent is used for fan exhaust, it shall not be included in attic vent area calculations (see section AT 1.2).

Vent ducts shall be securely attached at each joint and to the fan housing using mechanical fasteners, such as screws or mechanically tightened metal clamp-type straps. Sealing materials such as tape, caulk and foam are not acceptable mechanical fasteners. To seal gaps in exhaust ducts, mastic, UL-listed metal HVAC tape or mastic tape may be used.

Existing flexible plastic or metal vent ducts may remain if they are free of holes and kinks, and are in otherwise good condition. Existing plastic or metal ducts shall be vented to the exterior, free of gaps and sealed to prevent exhaust air from entering back into the attic. Exhaust ducting shall be insulated to a minimum R-4 when required for code compliance.

Illustration AT 1.7—Exhaust boot connected to sheathing



## AT 1.8—Kitchen Fans

Kitchen exhaust fans shall be vented to the exterior of the structure and secured to the exterior sheathing with no gaps to prevent any exhaust air from entering back into the attic. Existing rigid metal or flexible metal ducts may remain; however, existing plastic ducts must be replaced. Sealing materials such as tape, caulk and foam are not acceptable mechanical fasteners. To seal gaps in exhaust ducts, mastic, UL-listed metal HVAC tape or mastic tape may be used.

If a new exhaust duct is required for a kitchen stove, it shall be at least 28-gauge galvanized steel, stainless steel, copper or aluminum, and have a smooth interior surface. The exhaust duct shall be airtight and extend directly into a code-approved metal vent cap.

Vent ducts shall be securely attached at each joint and to the fan housing using mechanical fasteners. The exhaust duct shall meet manufacturer's requirements and all local building codes. At least one damper shall be functioning in each system, either at the fan or where it vents to the outside. Exhaust ducting shall be insulated to a minimum R-4 when required for code compliance.

See IUN 1.7 for downdraft exhaust fan venting requirements.

## AT 1.9—Dryer Exhaust Fans

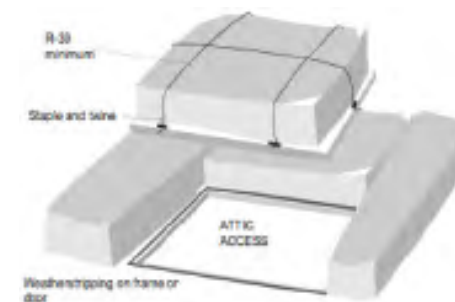
Dryer exhaust venting that travels through the attic shall comply with AT 1.7. See IUN 1.6 for dryer exhaust ventilation specifications.

## AT 1.10—Water Pipes in Attics

If water pipes exist in the attic, they shall be insulated to meet specification IUN 1.3.

## AT 1.11—Interior Attic Access Doors

Illustration AT 1.11—Interior attic and knee wall accesses shall be insulated and weather-stripped.



All operable attic accesses opening to interior spaces shall be insulated, weather-stripped and protected from having loose-fill insulation fall through the opening. Weatherstripping shall be permanently attached to create an effective air seal between the attic access frame and the door. Accesses with air leaks that cannot be weather-stripped shall be repaired or replaced prior to insulating. Ceiling accesses shall be insulated to R-30 with batt-type or rigid insulation. Knee wall accesses shall be insulated to a minimum of R-15.

Batt-type insulation shall be attached to the door with twine stapled to the edges of the door. Stapling the insulation directly to the door is unacceptable. Rigid insulation may be fastened to the door in lieu of batt-type insulation.

Alternatively, R-5 or greater rigid insulation installed between the access cover and a rigid protective material (OSB, plywood or other durable rigid material) attached over the entire insulation area is allowed. Insulation must be sealed around the perimeter to the access cover using caulk, adhesive or spray foam. Access-cover assembly must be tightly sealed using weatherstripping around the entire perimeter.

Attic accesses shall be protected from having loose-fill insulation fall through the opening. The full level of ceiling insulation shall be maintained to the edge of the attic access opening by one of the following methods:

- a. The opening may be framed with wood or plywood boards. The framing shall be permanently attached and extend at least 4" above the final level of insulation. Cardboard or foamboard are not acceptable materials for attic access damming.
- b. A 14.5" wide (or wider) insulation batt laid flat, with an R-value equal to that specified for the attic, may be placed tightly around the perimeter of the access opening. This 14.5" shall be maintained in all outward directions from the access opening, including corners. Insulation batts used as a dam shall be installed so that no gaps or voids exist.

### AT 1.12–Pull-down Stairs

Pull-down stairs in heated areas shall be weather-stripped and insulated to a minimum of R-10. Insulation and weatherstripping shall not prevent easy operation of the stairs. Factory or site-built pull-down stair covers are recommended and shall have a minimum R-10. Multifamily recommends an airtight box made of foamboard and sealed with caulk be constructed to create a snug fit around the opening. New pull-down stair assemblies with a minimum R-5 insulation rating will be permitted provided the insulation is between the conditioned space and the attic stair assembly, and gaskets or weatherstripping prevent air infiltration.

For questions about this specification, email the Existing Multifamily Trade Ally Coordinator Daniel Wilkinson at [daniel.wilkinson@lmco.com](mailto:daniel.wilkinson@lmco.com) or call 503-729-0562.

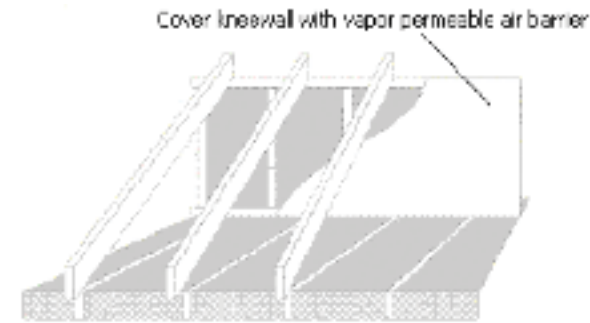
### AT 1.13–Exterior Attic Access Doors

Any outside access shall have a door that is easily opened to permit inspection, and shall be weather- and vermin-proof.

### AT 1.14–Vertical Walls in Attic Spaces

Any vertical wall in an attic that separates conditioned space from unconditioned space shall be sealed for air leaks, and shall be insulated to fill the cavity. Insulation must be secured and covered with a vapor-permeable air barrier. Vertical walls may include knee walls, side walls of vaults, skylights, transitions in ceiling height, or other surfaces. When no wall exists, a rigid air barrier shall be constructed and an effective air and thermal barrier shall be installed. See the Program Information sheet PI320M about knee wall incentives.

Illustration AT 1.14



# INSTALLING ATTIC INSULATION

## IAT 1.0—General Attic Insulation Requirements

In attics with no pre-existing insulation, vapor retarders shall face the heated area of the building. **Do not install new insulation with a vapor retarder on top of pre-existing insulation.** There should only be one vapor retarder in the assembly and it should be in contact with the heated ceiling. If existing attic insulation has a vapor retarder on top surface, slash with razor knife every 6" before adding more insulation.

Attic insulation shall be in contact with the heated area of the unit and shall be installed so there is no air space between the insulation and the heated area.

If the added attic insulation compresses the existing insulation, the final R-value shall be R-38 or greater. After installing the insulation, eave and soffit vents shall remain unblocked.

Kraft facing (commonly attached to batt-type insulation) is a vapor retarder. If kraft facing is attached, it must be in contact with the heated ceiling of the unit.

## IAT 1.1—Installing Loose-fill Insulation

Loose-fill insulation shall be level and smooth, with a uniform R-value. The number of bags used to attain the added R-value shall reasonably match manufacturer's estimated bag count. Baffling and damming requirements—as defined in AT 1.3, 1.4 and 1.5—shall be reviewed prior to installing loose-fill insulation. Toward the eaves, where a sloping roof prevents insulation from being installed to R-38, insulation shall be installed up to the roof decking to maximize R-value if proper ventilation is in place (see Illustration IAT 1.7).

## IAT 1.2—Installing Batt-type Insulation

If batt-type insulation is installed, prepare the attic in the same way as for loose-fill insulation. As stated in section IAT 1.0, do not install vapor retarders over existing insulation. In attic areas where no insulation exists, batts with vapor retarders may be used. The vapor retarder shall be in contact with the ceiling.

Batts shall be cut to fit and placed tightly together with no gaps except those required for clearance around heat-producing fixtures. Where practical, place one row of batts between the joists and another row of batts on top of the first row and at right angles to the joists. When lower ventilation exists, baffling is required to ensure effective R-value and prevent wind washing of insulation. See AT 1.3 for baffling requirements.

## IAT 1.3—Installing Foam Insulation

Spray or rigid foam are acceptable types of insulation, provided they meet the requirements for R-value, are installed in contact with the heated surface, and comply with thermal and ignition barrier requirements for foam plastics as defined by the prevailing jurisdictional building code.

When installing foam-insulation products, the manufacturer's name, product identification and information to determine the end-use shall be left with the owner and presented to an Existing Multifamily representative for review during the QC process. Contact the Existing Multifamily Trade Ally Coordinator Daniel Wilkinson at [daniel.wilkinson@lmco.com](mailto:daniel.wilkinson@lmco.com) or call 503-729-0562 to request support for insulating sloped cavities with foam insulation.

## IAT 1.4—Floored Attics

Cavities below decked storage areas, and above a conditioned space, shall be insulated to the highest practical level. When decked storage areas exceed five percent of the attic area, or 64 sq. ft., whichever is greater, they shall not be included in the square footage calculation of the insulation incentive. When decked storage areas are less than five percent or 64 sq. ft., they may be included in the incentive area calculation. When unusual circumstances allow only for the cavity to be filled, contact Existing Multifamily for incentive information. See AT 1.5 for damming requirements for decked storage areas.

Insulation shall be installed under the boards of floored attics. To fill the cavities, the boards can be lifted or drilled with holes no more than 4 ft. apart. Joist cavities shall be tightly packed with insulation.

## IAT 1.5—Vented Vaulted Ceilings

If insulation is added to a vented vaulted ceiling, a 1" air space shall be maintained above the insulation. Each cavity shall have an upper and lower vent.

## IAT 1.6—Unvented Vaulted Ceilings

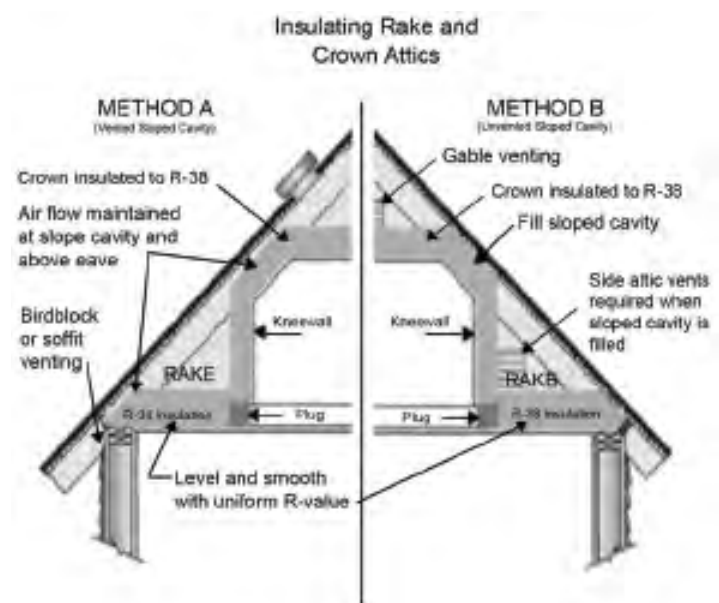
If insulation is added to an unvented vaulted ceiling, it shall be filled with tightly packed insulation. Contact the Existing Multifamily Trade Ally Coordinator Daniel Wilkinson at [daniel.wilkinson@lmco.com](mailto:daniel.wilkinson@lmco.com) or call 503-729-0562 to request support.

## IAT 1.7—Insulating Rake and Crown Attics

When insulating rake and crown attics, a continuous thermal barrier shall be created for it to be a complete measure. Refer to the Program Information sheet PI320M for information about vertical wall incentives.

If rake attics are considered unconditioned space, knee wall accesses shall be insulated to R-15 and weather-stripped to create an effective air seal. If knee wall is used for storage, fibrous knee wall door insulation shall be covered to prevent human contact (see section IN 1.6). Foam-core doors with a minimum R-5 insulation rating (manufactured for exterior use) used in knee wall door installations will be permitted, provided gaskets or weatherstripping prevents air infiltration around the entire door perimeter.

### Illustration IAT 1.7



Use one of the following methods to treat a rake and crown attic. In all cases, the sloped cavity and crown shall be insulated unless physical barriers exist.

### Method A

If the upper and lower passive ventilation calculation requires air to move from rake to crown, a 1" air space shall be maintained between the insulation and the roof deck with continuous baffle or equivalent. Knee walls should be sealed for air leaks, and shall be insulated and covered with a vapor-permeable air barrier. Knee walls shall be treated according to this requirement, regardless of existing insulation levels. Cavities where the knee wall reaches the rake floor shall be plugged with an air barrier and sealed using caulk or foam. Rake insulation shall be in contact with plugs. Refer to Illustration IAT 1.7.

### Method B

If rake and crown attic spaces independently have adequate ventilation, the sloped cavity may be completely filled. Loose-fill insulation may be used as long as the lower opening of each cavity is dammed with a rigid, vapor-permeable material to prevent insulation from falling out of the cavity.

Knee walls should be sealed for air leakage, and shall be insulated and covered with a vapor-permeable air barrier as shown in Illustration IAT 1.7. Knee walls shall be treated according to this requirement, regardless of existing insulation levels. Cavities where the knee wall reaches the rake floor shall be plugged with an air barrier and sealed using caulk or foam. Rake insulation shall be in contact with plugs. Refer to Illustration IAT 1.7.

## IAT 1.8—Interior Roof Insulation

Open attic spaces may be treated as conditioned space, provided that air-impermeable insulation is installed. Air-impermeable insulation includes spray foam, rigid foam with appropriate sealants, or other materials as defined by the International Residential Code, or IRC. Insulation shall fill the roof rafter cavity. All roof framing shall be insulated to a minimum of R-3. If rigid board is used, all seams shall be sealed using foam or caulk. If insulation is not considered a vapor retarder, then a vapor retarder shall be installed on the heated side of the insulation. If the space is intended to be habitable or there is a combustion appliance in the zone, ignition barrier requirements shall be met. A waiver is required for interior roof insulation. Contact the Existing Multifamily Trade Ally Coordinator Daniel Wilkinson at [daniel.wilkinson@lmco.com](mailto:daniel.wilkinson@lmco.com) or call 503-729-0562 for a waiver.

## IAT 1.9—Low-sloped and Flat Roofs

Insulating low-sloped or flat roofs is technically difficult. Plans for insulating these types of roofs should be reviewed by the local building jurisdiction. Building permits and code compliance are the responsibility of the owner and contractor.



A waiver is required for all low-sloped and flat roofs that cannot be insulated to R-38. Contact the Existing Multifamily Trade Ally Coordinator Daniel Wilkinson at [daniel.wilkinson@lmco.com](mailto:daniel.wilkinson@lmco.com) or call 503-729-0562 for a waiver.

#### Exterior applications

When installing rigid insulation on top of the roof sheathing, all ceiling cavities shall be insulated to the highest possible R-value with tightly packed insulation. The overall insulation assembly shall equal or exceed R-19.

#### Ceiling cavity applications

Ceiling cavity insulation shall achieve a minimum of R-19, or a filled cavity.

#### Preparation

- a. Recessed lights in insulated cavities shall be IC- or ICAT-`rated.
- b. All plumbing vents, kitchen fans, bath fans, wood stoves and other fixtures shall vent to the outside of the new roof and be adequately flashed and sealed.

## UNDERFLOOR INSULATION

### UN 1.0—Introduction

Existing Multifamily underfloor weatherization measures include adding insulation, sealing floor penetrations, adding ventilation, installing a ground cover and adding water pipe insulation. Insulation shall be installed to reduce heat loss between conditioned space and unconditioned space, or to the outside of the building. Basements containing HVAC ducts or that have a direct access to the interior conditioned space of a tenant space shall be considered conditioned space. Insulation installed between a conditioned basement and conditioned space of the unit is not eligible for Energy Trust incentives.

To qualify for an Existing Multifamily incentive, the pre-existing condition must be R-11 or less.

All accessible underfloor areas, regardless of eligibility for incentives, must meet the applicable requirements to be considered a complete measure, unless a requirement is waived by Existing Multifamily or physical barriers exist (see section IN 1.4). Areas where existing insulation is greater than R-11 are not eligible for incentives. However, all applicable specifications must be met in areas where existing insulation is greater than R-11 for other areas to qualify for the incentive.

**Insulation shall be installed so there is no air space between the insulation and the floor. Insulation that is not in continuous contact with the bottom of the subfloor is not acceptable.**

Installing insulation on the exterior walls of a crawlspace is not a qualifying Energy Trust measure.

### UN 1.1—Underfloor Preparation and Debris

Degradable and absorbent scrap materials, especially wood and cardboard, shall be removed from the crawlspace. The underfloor shall be checked for water leaks and wood decay before and after work occurs. The owner shall be notified and corrective measures taken when necessary.

## UN 1.2–Ventilation

Crawlspaces shall be ventilated by openings in exterior foundation walls. Such openings shall have a net area of no less than 1 sq. ft. for each 150 sq. ft. of underfloor area. Where moisture due to climate and groundwater conditions is not considered excessive, Existing Multifamily may allow operable louvers and the required net area of vent opening to be reduced to 1/300 or less (minimum 1/1500), provided the underfloor ground surface area is covered with an approved ground cover.

Openings shall be located as close to corners as practical and shall provide cross-ventilation. The required area of such openings shall be equally distributed along the length of at least two opposite sides. Vents shall be covered with corrosion-resistant wire mesh with mesh openings not to exceed 1/4" in dimension. Existing vent openings covered with wire mesh need not be modified.

Where venting cannot be reasonably added except by breaching a foundation, ventilation requirements shall be waived.

## UN 1.3–Ground Covers

All crawlspaces require a ground cover. All ground covers shall be a minimum of 6-mil black polyethylene. (Non-transparent ground covers may be used, if approved by Existing Multifamily.) If an existing ground cover does not meet Existing Multifamily specifications, it shall be repaired or a new ground cover shall be installed.

All seams shall be lapped at least 12", including going up the sides of the building foundation around the perimeter. The cover shall be continuous with no rips, tears or gaps. Exposed soil or earth in a basement must comply.

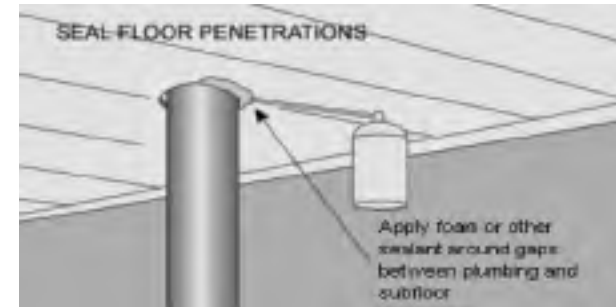
## UN 1.4–Sealing Floor Penetrations

To prevent transmission of water vapor and to support the effective R-value of the underfloor insulation, all floor penetrations are required to be sealed, including plumbing, wiring and duct penetrations, and similar openings in the air barrier of the underfloor. Caulk, foam or other compatible sealants shall be used.

Open chases around chimneys that extend into the crawlspace shall be sealed using fire-rated materials. Spans greater than 1/2" shall be bridged using sheet metal and ASTM E-136-rated caulk within 3" of masonry chimneys and flues.

Bathtub/shower drain accesses shall be sealed. If the drain trap is above the level of the floor, provisions to maintain accessibility for maintenance shall occur.

Illustration UN 1.4



# INSTALLING UNDERFLOOR INSULATION

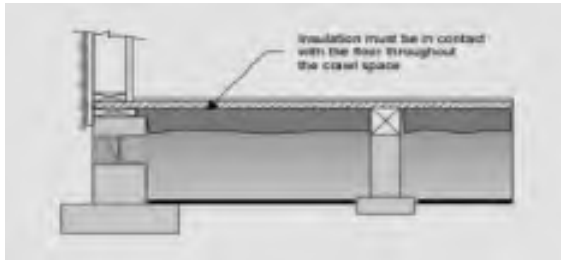
## IUN 1.0–Basic Installation Procedures

Floor insulation shall be in contact with the floor. Compression of fiberglass batt-type insulation is permitted to ensure continuous contact between the insulation and the subfloor. Use of unfaced batt-type insulation is acceptable. There shall only be one vapor retarder in the assembly and it shall be in direct contact with the subfloor and face the conditioned space of the unit.

Kraft facing (commonly attached to batt-type insulation) is a vapor retarder. If kraft facing is attached, it must be in contact with the heated floor of the unit.

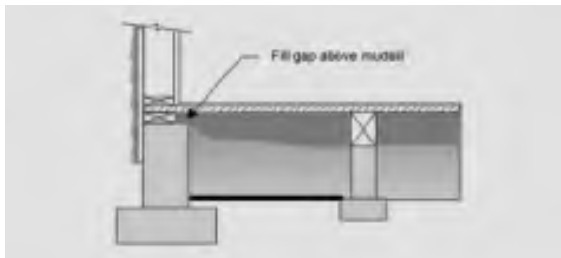
Compression of insulation is acceptable to maintain continuous contact with the bottom of the floor. Insulation levels between R-21 and R-30 are allowed if insulation is in continuous contact with the floor and fills the entire cavity depth, from the bottom of the subfloor to the bottom of the joist or beam.

Illustration IUN 1.0a



Insulation shall be pulled free from any temporary stapling. Insulation shall be cut to fit without gaps or overlaps. There shall be no gaps at the perimeter of the foundation.

Illustration IUN 1.0b



Insulation shall be supported so it does not block or restrict crawlspace ventilation. If necessary, insulation may be compressed to meet this requirement.

## IUN 1.1–Floor Insulation Support Materials

Use one of the following materials to support floor insulation:

- **Wood lath:** Wood lath shall be a minimum of 1/4" x 1".
- **Twine:** Twine shall be non-stretching polypropylene or polyester.
- **Wire:** Wire shall be stainless steel, copper or an equivalent material of similar corrosion resistance, with a minimum diameter of 0.040" (size 18 AWG). Self-supporting wire hangers are not acceptable.

Hand stapling is not a durable fastening technique and will not qualify a project for an Energy Trust incentive.

Fasteners for lath, twine or wire may be either hot-dipped galvanized nails, screws or corrosion-resistant staples that are at least 18-gauge and long enough to penetrate wood at least 5/8".

Illustration IUN 1.1



## IUN 1.2–Spacing Requirements for Support Systems

Staples shall be driven with a power-actuated stapler to achieve at least 5/8" penetration. The maximum spacing for support systems is as follows:

Table IUN 1.2

Spans	Maximum Spacing
24" or less	18" apart
48"	12" apart
60"	8" apart
72"	6" apart

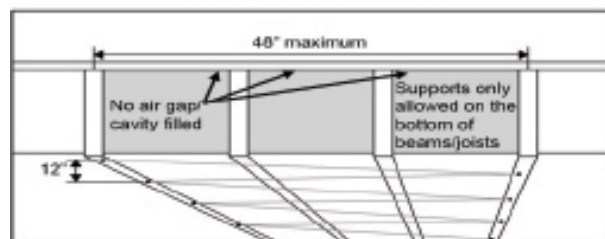
Wood lath shall not be used for spans greater than 48". Splicing is not allowed to meet this requirement. Wood with a thicker dimension may be used for wider spans.

Support systems for spans of over 72", or support systems not secured to the bottom of the joists, require prior approval by Existing Multifamily.

Batt-type insulation shall be supported no more than 3" from the ends. This support shall be parallel to the end of the batt. Small pieces of insulation shall be supported.

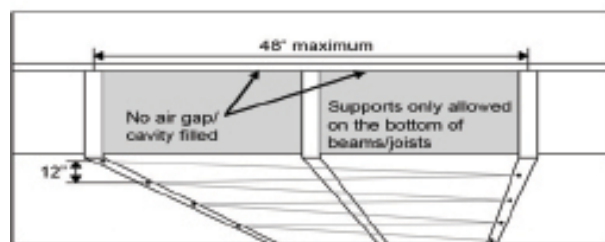
#### Illustration IUN 1.2

##### SKIPPING JOISTS



Up to 16" joist space, staple 12" apart. Skip 1 or 2 joists up to 48" max.

Insulation shall be supported so that it is in direct contact with the bottom of the subfloor sheathing.



Up to 24" joist space, staple 12" apart. Skip one joist up to 48" max.

Support systems shall be fastened to the underside of floor joists. Joists may be skipped; however, the maximum spacing shall not exceed 12". The maximum span of skipped joists shall not exceed 48".

#### IUN 1.3—Water Pipe Insulation

All hot and cold water pipes not enclosed within the floor insulation shall be insulated to a minimum of R-3. Leaking water pipes shall be repaired before insulating them.

All water pipe insulation shall be secured with twine, corrosion-resistant wire or plastic compression ties. Tape is not allowed to secure water pipe insulation. Do not cover the handles and spigots of safety drain valves with insulation.

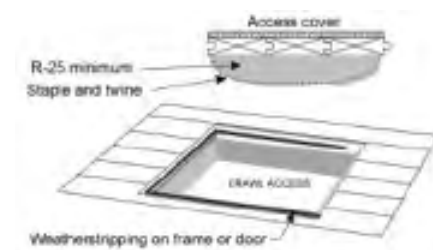
Fiberglass insulation shall have a minimum finished thickness of 1", be in continuous contact with the water pipe and be secured every 12". Insulation shall be secured to the beam at a minimum of every 12" when water pipes run next to a beam or joist.

Pre-formed insulation shall be properly sized. Corners shall be mitered to fit tightly. The inside diameter of the pre-formed insulation shall match the outside diameter of the water pipes. Pre-formed insulation shall be supported every 24", and within 3" of the ends. If connections and corners are larger than piping, exposed joints shall be insulated with fiberglass or pre-formed insulation equal to the outside diameter of the connection and corners.

#### IUN 1.4—Inside Access Doors for Underfloors

All operable accesses between unconditioned and conditioned spaces shall be insulated to R-25 for floor hatches, and R-15 for doors in walls. Insulation shall be securely fastened to access doors using staples and twine or a similar method that ensures the effectiveness and durability of the insulation. Inside access doors shall be weather-stripped.

#### Illustration IUN 1.4



Alternatively, R-5 or greater rigid insulation installed between the access cover and a rigid protective material (OSB, plywood or other durable rigid material) under the entire insulation area is allowed. Insulation must be sealed around the perimeter to the access cover using caulk, adhesive or spray foam. The rigid protective material must be mechanically attached to the access cover to securely hold insulation in place. Access cover assembly must be tightly sealed using weatherstripping around the entire perimeter.

### **IUN 1.5—Outside Access Doors for Underfloors**

Any outside access shall have a door that is easily opened to permit inspection, and shall be weather- and vermin-resistant. Vertical accesses may be screened when it is part of the crawlspace ventilation system. Horizontal hatch covers shall shed water. Wood in contact with soil or concrete shall be pressure-treated.

Existing covers are acceptable if they are in good condition, weather-resistant and vermin-resistant.

### **IUN 1.6—Dryer Exhaust**

Dryer exhaust ducts shall be vented to the exterior of the structure, sealed to prevent exhaust air from entering the building, shall have a damper and shall terminate in a code-approved vent cap. New dryer ducts shall be rigid metal, be securely connected with mechanical fasteners and permanently supported. Exhaust systems shall comply with local code and manufacturer specifications, be as straight as is practical and shall not exceed 25 ft. To prevent blockage with lint, dryer vent ducts shall not be connected with screws. A metal clamp or UL-rated foil tape may be used to secure dryer duct connections.

### **IUN 1.7—Downdraft Exhaust Ducts**

Downdraft exhaust ducts may have a 90-degree turn, shall exit through the foundation or exterior wall, be sealed (with no visible gaps) to prevent exhaust air from entering back into the building and shall end in a code-approved vent cap.

### **IUN 1.8—Installing Foam Insulation**

Spray foam insulation may be used for insulating and air sealing an underfloor area either on its own or in combination with other insulation types (flash and batt). This assembly must meet the requirements for R-value, be in contact with the heated surface, and comply with the thermal and ignition barrier requirements for foam plastics as defined by the prevailing jurisdictional building code. There shall be no gaps or voids in the insulation assembly and all other applicable underfloor specifications shall be met.

Spray foam is exempt from support requirements. When used in combination with other insulation types, spray foam shall be installed in contact with the heated surface of the unit.

Customers should be notified if spray foam insulation will limit access to electrical services, HVAC systems, or plumbing.

### **IUN 1.9—Miscellaneous Underfloor Specifications**

Underfloor areas which allow easy human access must comply with the requirements defined in IN 1.6 Human Contact Areas to protect occupants from encountering fibrous insulation in areas where routine storage or maintenance occurs.

An air barrier or skirting shall protect underfloor insulation exposed to the wind, including unskirted crawlspaces and cantilever floors.

Unconditioned and unvented basements with concrete floors and walls do not require a ground cover, foundation vents or water pipe insulation, except for pipes located on exterior walls. Unconditioned, vented basements with concrete floors and walls do not require a ground cover, but water pipes must be insulated according to IUN 1.3.

Basements with exposed soil or earth shall have a ground cover installed on exposed areas.

If standing water is found in the crawlspace, it shall be drained before the floor can be insulated. A sump pump may be needed for some situations. Draining the water is the responsibility of the owner.

Before installing insulation in contact with active knob and tube wiring, the electrical system shall be inspected and the owner must receive written approval by a licensed electrician. Insulating floors with knob and tube wiring shall be at the discretion of the contractor and owner, and adhere to state and local code.

# WINDOWS AND PATIO DOORS

## WI 1.0—Introduction

Window requirements shall apply to patio doors unless otherwise stated. Windows shall be installed and supported according to the manufacturer's specifications. If window weight cavities exist and are accessible, the weights shall be removed and the cavity shall be filled with insulation. Windows shall be reasonably sealed to prevent air infiltration. All incentive-qualifying windows must meet the applicable requirements—unless a waiver is approved in advance by Existing Multifamily (see section IN 1.4)—to be considered a complete measure. Windows shall be installed to prevent heat loss from a conditioned space to the outside of the unit. Basements containing HVAC ducts or that have a direct access to the interior conditioned space of a unit shall be considered conditioned space.

Overview for all glazing systems:

- a. Safety glazing shall be used where required by current state code. See sections about safety glass for details.
- b. Windows shall operate smoothly and safely.
- c. Screens shall be furnished with all operable windows.
- d. Exterior wood, including frame, sash, trim, stops and sills shall be, at a minimum, caulked and primed.
- e. Hardware and fasteners shall be aluminum, stainless steel or other noncorrosive materials.
- f. Gaps of over 3/8" between the exterior siding and the window shall be covered with solid trim material. Exterior or interior voids over 3/8" in depth or width shall be filled with window-manufacturer-approved materials, such as backer rod, nonexpanding foam or similar product prior to caulking, if caulking will be applied.
- g. Interior window trim shall be replaced if signs of past moisture are present. The surrounding 2 ft. around the exterior of a window shall have no unpainted wood. No louvered windows are allowed in the Existing Multifamily program.

Window incentives shall be paid only for windows of the original dimensions, except when window area must be increased to meet egress requirements.

Windows must be installed to meet these specifications unless federal, state or local jurisdictional codes exceed these specifications.

**Windows must be installed between conditioned and unconditioned space. Windows installed between unconditioned garages and the exterior of the unit will not qualify.**

Qualifying windows shall meet U-value requirements detailed by the current program information document. Existing Multifamily requires documentation of window dimensions and U-value for each qualifying window installed.

## WI 1.1—General Requirements for Glazing

Replacement windows shall be certified and labeled for U-value in accordance with the simulation, testing and certification procedures of the National Fenestration Rating Council Incorporated, or NFRC.

**The following window types are common retrofits. For windows not meeting these descriptions, contact Existing Multifamily for information on qualifying installations.**

## WI 1.2—Block Windows

Block windows do not have nailing flanges. Block windows shall be secured to the rough opening within 4" of each side corner and a minimum 12" on center thereafter. Block windows shall not be smaller than the interior jamb and shall fit tightly within it. Gaps of over 3/8" between the exterior siding and the block window shall be trimmed. Exterior or interior voids over 3/8" in depth or width shall be filled with backer rod prior to caulking. Exposed block windows shall be flashed (see Illustration WI 1.4—Exposed to the Elements).

The flashing shall tuck behind the exterior siding by at least 1". Flashing shall have a downward bending lip of at least 1/4" on the front and ends. Block windows shall be supported at the fin line.

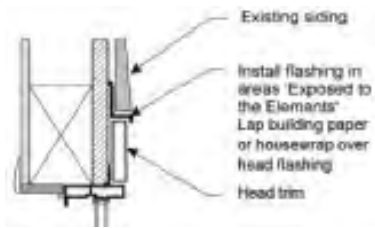
## WI 1.3—Cut-out Windows

Cut-out windows have nailing flanges and are installed on the sheathing or framing. The tops of cut-out windows shall have metal flashing inserted behind the existing siding material and over the head trim piece, unless the tops of the windows are protected by an overhang (see Illustration WI 1.4—Exposed to the Elements).

The sides of cut-out windows shall be flashed with 15 lb. felt or an equivalent building paper. This building paper shall be inserted underneath the existing siding and building paper and over the fins of the windows. The bottoms of cut-out windows shall also be flashed with 15 lb. felt or an equivalent building paper. This building paper shall be inserted underneath the existing siding and over existing building paper and under the bottom fins of the windows.

All filler and trim pieces must be thoroughly caulked. The flashing shall tuck behind the exterior siding at least 1". Flashing shall have a downward bending lip of at least 1/4" on the front and ends.

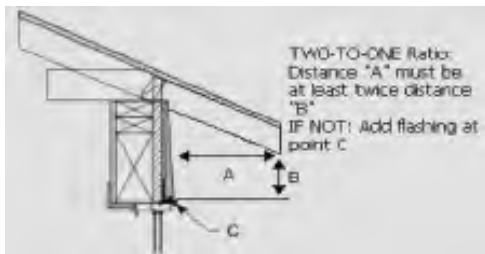
Illustration WI 1.3



### WI 1.4—Exposed to the Elements

To determine if a window is exposed to the elements, use the 2-to-1 ratio system. See the following illustration:

Illustration WI 1.4



### WI 1.5—Stucco-mounted Windows

Stucco-mounted windows are replacement windows which mount directly to the frames of existing windows.

Seal the fin of the new window and the outer flange of the existing window with a sealant designed for this purpose. The sealant must stick to the vinyl fin and the aluminum flange. The lip of the existing aluminum flange shall be at least 3/8" wide. The gap between the frame of the replacement window and the interior trim shall be caulked. If the gap exceeds 1/4", the gap shall be filled with closed-cell backer rod, or chinked and caulked. The gap shall then be covered with a permanently attached trim material and caulked on the top and bottom seams.

The bottom rail of the existing window shall be cleaned to prevent blockage of weep holes. The miter joints on the fin of the replacement window shall be smooth so the corners do not bulge from the aluminum window.

### WI 1.6—Miscellaneous Requirements

The bottom rail of a patio door shall be firmly supported within 1/2" of the exterior edge of the frame. Any wood touching the ground or cement shall be pressure-treated.

### WI 1.7—Health and Safety Requirements

All windows shall meet the following egress and safety-glazing specifications. Installers are required to meet current state or local code if either is more restrictive than Existing Multifamily specifications.

### WI 1.8—General Safety-glazing Requirements

Safety-glazing requirements shall apply to replacement windows and patio doors, multi-glazing inserts and storm windows.

When measuring glazing to determine whether it needs to be safety glazing, measure only the glass itself. Do not measure the sash. All safety glazing shall conform to the Safety Glazing Certification Council, or SGCC, labeling requirements.

Each lite requiring safety glazing shall bear the manufacturer's permanent safety-glazing label. This label of identification shall be etched or ceramic-fired on the glazing and be clearly visible in one of the corners of the lite.

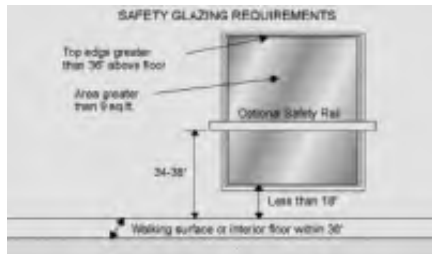
### WI 1.9—Hazardous Locations Requiring Safety Glazing

The following shall be considered specific, hazardous locations for the purpose of glazing:

- a. Glazing in entry doors.
- b. Glazing in patio doors and French doors.
- c. Glazing in storm doors.
- d. Glazing in a fixed or operable panel that meets all of the following conditions:
  - The exposed area of an individual pane is greater than 9 sq. ft.
  - The bottom edge is less than 18" above the floor.
  - The top edge is greater than 36" above the floor.
  - One or more walking surfaces are within 36" horizontally of the glazing.

In lieu of installing safety glazing in this situation, a protective bar may be installed on the accessible side(s) of the glazing 34" to 38" above the floor. The bar shall be capable of withstanding a horizontal load of 50 lbs. per lineal foot without contacting the glass and be a minimum of 1.5" in height.

Illustration WI 1.9a



Glazing in hot tubs, whirlpools, saunas, steam rooms, bathtubs and showers (where the bottom edge of the glazing is less than 60" above the drain inlet).

Illustration WI 1.9b



Glazing in a fixed or operable panel adjacent to a door where the nearest vertical edge is within a 24" arc of the door in a closed position and that has a bottom edge that is less than 60" above the floor or walking surface.

Illustration WI 1.9c

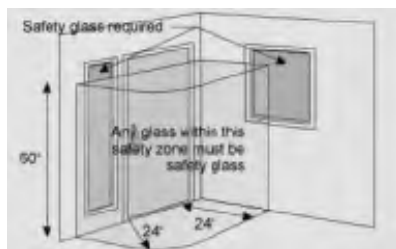
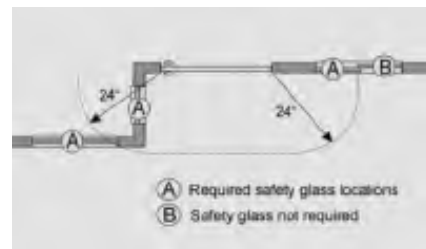


Illustration WI 1.9d



### WI 1.10–Miscellaneous Safety-glazing Requirements

Any glazing panel that can be moved into a hazardous area (e.g. the operable panel of a horizontal sliding window) shall also be made of safety glazing. However, any glazing panel which cannot be moved into a hazardous area (e.g. the upper panel of a single-hung window) does not need to be made of safety glazing.

Fixed glazing panels contained in one window surround, but separated by structural mullions, do not need to be safety glass if they are not located in a hazardous area.

Safety glazing will not be required in the following instances:

- Openings and doors through which a 3" sphere is unable to pass
- Leaded-glass panels
- Faceted and decorative glass

### WI 1.11–Emergency Egress Openings

Every sleeping room shall have at least one operable window or exterior door approved for emergency egress or rescue. The units shall be operable from the inside to a full, clear opening without the use of separate tools. Where windows are provided as a means of egress or rescue, they shall have a sill height of no more than 44" above the floor.

All egress or rescue windows in sleeping rooms shall have a minimum net-clear opening of 5.7 sq. ft. The minimum net-clear opening height dimension shall be 24". The minimum net-clear opening width dimension shall be 20". Windows in which the bottom edge is level with the ground may have a minimum net-clear opening of 5 sq. ft.

An energy-efficient window with the same frame opening dimensions and emergency exit opening as the original may be used as a replacement for windows that are noncompliant with emergency exit provisions. If a replacement window has the same frame opening dimensions but a smaller emergency exit opening than the original, it shall not be replaced unless the smaller exit opening still meets the current emergency exit opening requirements.



# SMALL MULTIFAMILY PROPERTIES

## SM 1.0—Introduction

All qualifying building shell improvements in small multifamily properties shall follow general Existing Multifamily weatherization specifications unless otherwise noted in this section.

## SM 1.1—Definition of Small Multifamily Property

For Energy Trust purposes, a small multifamily property is defined as a property with two to four units per structure and that is the predominant structure on the property. See Program Information sheet PI 320M for a complete list of available incentives.

Small Multifamily may address several duplexes, triplexes or quadplexes on one property, or side-by-side rental townhomes with shared attics. Individually owned condominiums not represented by the HOA or Board are excluded from this and will be addressed through Existing Homes.

## SM 1.2—Wall Insulation

This section applies to exterior walls and buffered walls adjacent to unconditioned areas, such as garages, in Small Multifamily Properties only. Closed walls shall be insulated to R-11 or the highest practical R-value. For verification purposes, the contractor may be required to open and replug selected entry holes at the discretion of Existing Multifamily. Insulation shall be installed to reduce heat loss between conditioned and unconditioned spaces or to reduce heat loss to the outside of the unit.

To qualify for an Existing Multifamily incentive, existing condition of wall insulation must be R-4 or less, and all cavities in all exterior walls must be insulated to R-11, or completely filled, whichever is greater. All accessible exterior wall cavities, regardless of eligibility for incentives, must meet the applicable requirements to be considered a complete measure, unless a requirement is waived by Existing Multifamily or physical barriers exist. Areas in which existing insulation is greater than R-4 are not eligible for incentives. However, all applicable specifications must be met in areas where existing insulation is greater than R-4 for other areas to qualify for the incentive.

### SM 1.2.1—Knob and Tube Wiring

Before installing insulation in cavities with active knob and tube wiring, Existing Multifamily recommends having wiring inspected and approved in

writing by a licensed electrician. Insulating walls with knob and tube wiring shall be at the discretion of the contractor and owner, and must adhere to state and local code.

### SM 1.2.2—Insulating Closed Walls

This section refers to exterior walls and buffered walls adjacent to unconditioned areas, such as garages or knee walls. All cavities in all walls shall be filled, including small cavities above, below and to the side of windows and doors. Use of an infrared camera is strongly encouraged to identify such cavities and due diligence shall be applied to ensure a consistent level of insulation.

Insulation shall not be installed in wall cavities that serve as air ducts for heating or cooling. Cavities containing wall-mounted heaters shall not be insulated unless there is blocking to prevent contact with insulation. Cavities containing fuse or breaker boxes shall not be insulated without owner's consent.

### SM 1.2.3—Plugs and Finish Work

Plugs shall be sealed, weatherproofed and ready to paint. Plugs shall not be vented. Plugs shall be made of material that will not shrink or expand, which would result in damage to the siding or finish. If the surface of the plug is below the surface of the siding, the hole shall be filled with non-shrinking, waterproof filler. If siding is removed and holes are drilled in the sub-siding, the holes shall be plugged.

### SM 1.2.4—Removing and Replacing Siding

If possible, and with owner permission, siding shall be removed to access wall cavities. Before replacing siding, holes shall be filled with fitted plugs or covered with tar paper, counter-flashed and stapled. Shingles or shakes shall be nailed every 4" with a minimum 4D galvanized finish nail and at each corner. Clapboard-type siding shall be nailed at every wall stud or 16" on center. All replaced siding shall use galvanized or corrosion-resistant nails and be re-installed in a professional manner. Any raw wood shall be primed or sealed.

### SM 1.2.5—Open Wall

Open walls that separate conditioned and unconditioned spaces, such as garages adjacent to a conditioned space, shall be sealed for air leakage, insulated to a minimum of R-15 (or the cavity must be filled), and covered with a vapor-permeable air barrier to limit human contact.

### SM 1.2.6—Interior Installations

Walls that are inaccessible from the exterior shall be filled from the interior with the owner's permission.

### SM 1.3—Duct Insulation

To qualify for an Existing Multifamily duct insulation incentive, existing insulation condition must be R-2 or less and ducts must be insulated to R-11 or greater. Flexible ducts shall be R-8 or greater. Basements containing HVAC ducts or that have a direct access to the interior conditioned space of a unit shall be considered conditioned space. Insulation installed on ducts in conditioned space will not be eligible for Energy Trust incentives. This section applies to Small Multifamily Properties only.

All accessible ducts, regardless of eligibility for incentives, must meet the applicable requirements to be considered a complete measure, unless a requirement is waived by Existing Multifamily or physical barriers exist (see section IN 1.4).

#### SM 1.3.1—Insulating Ductwork

All ducts in unconditioned areas shall be insulated. Special attention shall be paid to elbows and termination areas to ensure complete coverage. Do not insulate over flex ducts or pre-formed fiberglass duct board. Insulation shall be secured to ductwork every 12" with twine, noncorrosive wire or vinyl tape.

Duct insulation installed in basements, garages, storage areas or other Human Contact Areas shall be covered to limit occupant exposure to insulation fibers (see section IN 1.6). Covering shall meet applicable fire codes.

### SM 1.4—Rim Joist Insulation

In conditioned basements, insulation installed in direct contact with the wooden perimeter band or rim joist may qualify for the wall insulation incentive. The sill plate and each joist bay shall be sealed for air leaks prior to installation of insulation. Batt-type or foam insulation used in this application shall be tightly installed, securely fastened, be at least R-15 and comply with state and local codes. A human contact barrier shall be installed over batt-type insulation. Incentives will not be paid for rim joist insulation installed in crawlspaces; underfloor insulation shall be installed in units with crawlspaces.

### SM 1.5—Waivers for Unusual Conditions

When unusual conditions exist, Existing Multifamily may waive certain provisions of the weatherization specifications or may substitute a different standard or method. The purpose of the waiver is to identify unusual conditions before work begins. Such waivers require preapproval by Existing Multifamily. Please contact the Existing Multifamily Trade Ally Coordinator Daniel Wilkinson at [daniel.wilkinson@lmco.com](mailto:daniel.wilkinson@lmco.com) or call 503-729-0562.

### SM 1.6—Carbon Monoxide Alarms

A functioning UL-listed carbon monoxide alarm shall be installed in each unit where a weatherization measure is installed, according to manufacturer's specifications, whenever combustion appliances are present in a small-multifamily structure, garage or attached space.

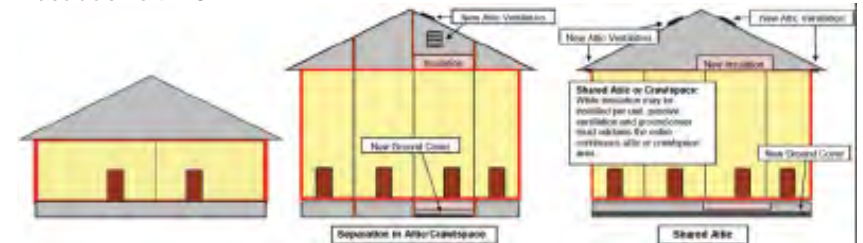
### SM 1.7—Incentive Eligibility of Measures

Not all methods of measure implementation described in this section will qualify for an incentive from Existing Multifamily. For incentive details, refer to Energy Trust's Multifamily web pages at [www.energytrust.org/commercial/multifamily](http://www.energytrust.org/commercial/multifamily).

### SM 1.8—Side-by-side Structures (no horizontally overlapping living spaces)

The units in these structures shall be treated as separate, independent structures for the purposes of weatherization measures with no distinctions being made based on physical separation of attics and crawlspaces/basements or ownership status.

Illustration SM 1.8



#### Insulation

Insulation and window installations for all structures shall treat the entire building shell rather than individual units. Refer to the Attic Insulation and Underfloor Insulation sections for relevant specifications.

## QUICK REFERENCE GUIDE

R-values are typical and intended as guides when specific manufacturer's information is unavailable

Insulation Material	R-value (per inch)	Description (typical)
Loose-fill fiberglass	2.3	Colors: Pink/white/yellow
Fiberglass batts (blanket)	3.1	Pink/yellow; R-value can change depending on condition; see chart
Cellulose fiber	3.7	Light gray/recycled paper products
Rockwool loose fill	3.1	Black/gray similar to fiberglass
Vermiculite	2.1	Silver/brown mica-like
Perlite	3.1	Silver/white

Fiberglass Batt Condition Ratings	R-value (per inch)	Description
Good condition	3	No gaps or other imperfections
Fair condition	2	Gaps over 2.5 percent
Poor condition	0.7	Gaps over 5 percent

Fiberglass Loose Fill	R-values
3.5"	8
5"	11.5
6"	14
7"	16
8"	18.5
9"	21
10"	23
12"	28
15-17"	38

Rockwool Loose Fill	R-values
3.5"	11
5"	16
6"	19
7"	22
8"	25
9"	28
10"	30
12"	37
15"	47

Cellulose Loose Fill	R-values
3.5"	13
5"	19
6"	22
7"	26
8"	30
9"	33
10"	37

Eave Vents
4 holes NFA = 0.09 sq. ft.
3 holes NFA = 0.07 sq. ft.
1 hole NFA = 0.02 sq. ft.
Small rectangle opening NFA = 0.25 sq. ft.
Large rectangle opening NFA = 0.42 sq. ft.

Attic Ventilation	
Roof jacks 7" diameter NFA = 0.21 sq. ft.	
Roof jacks 8" diameter NFA = 0.28 sq. ft.	
Roof jacks 9" diameter NFA = 0.35 sq. ft.	
Roof jacks 12" diameter NFA = 0.38 sq. ft.	
Gable vent 12" x 18" NFA = 0.75 sq. ft.	
Gable vent 12" x 24" NFA = 1.50 sq. ft.	
Gable vent 12" x 12" NFA = 0.5 sq. ft.	

To determine the size of the vent in NFA square footage, use the following equation:

1. (Length x Width) / 144 = Gross opening in sq. ft.
2. Gross opening in sq. ft. / screen factor = NFA sq. ft.

### Screen Factor

The screen factor accounts for the loss in ventilation due to screen cloth restricting airflow. Here is a chart of screen factors:

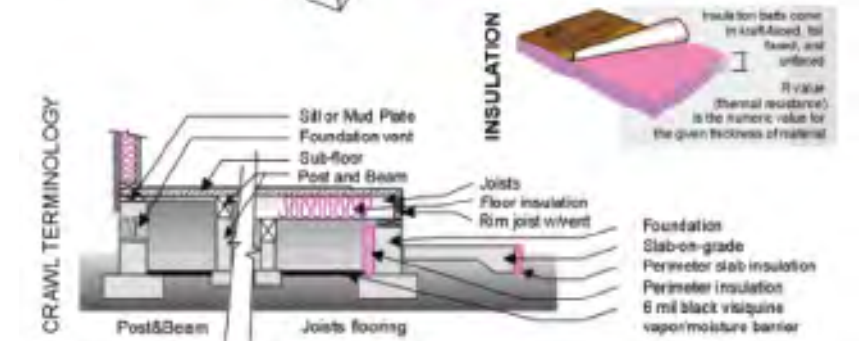
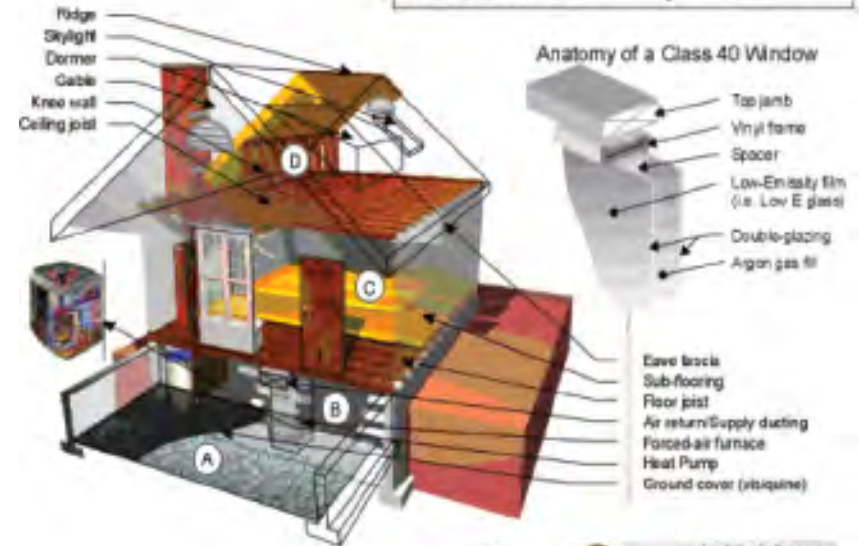
1/4 or 1/2 mesh per inch without louvers = 1.00	1/4 or 1/2 mesh per inch with rain louvers = 2.00
1/8 mesh per inch without rain louvers = 1.25	1/8 mesh per inch with rain louvers = 2.25
1/16 mesh per inch without rain louvers = 2.00	1/16 mesh per inch with rain louvers = 3.00
For example: 14.5" x 3" vent with a 1/8" mesh = 0.24 sq. ft. NFA	

### Rule of thumb: Half of the opening size = NFA

(Most often this will be within acceptable limits for gable vents)

Default Window U-values	U-value	R-value
Single-pane aluminum frame	1.30	0.77
Single-pane w/storm aluminum	1.10	0.91
Double-pane aluminum	0.81	1.23
Vinyl double-pane (no Low-E)	0.48	2.08
Vinyl double-pane Low-E/gas	0.35	2.86
Vinyl double-pane Low-E Super Spacers/gas	0.28	3.57
U.S. Department of Energy standard triple-pane Low-E Super Spacers/gas	0.20	5

## ILLUSTRATED GLOSSARY OF WEATHERIZATION TERMS



## GLOSSARY

**Air barrier:** Interior (conditioned) space to exterior (unconditioned) space should be separated by a continuous and complete barrier to air movement, with any penetrations sealed as well as possible.

**ASTM E-136:** A rating for noncombustible materials. Examples include sheet metal and rated caulks. These materials are appropriate for air sealing around a chimney or flue. Products meeting this rating will have the ASTM E-136 rating on the label. No foam meets this rating.

**ASTM E-814:** A rating for an assembly of materials that inhibits the spread of fire and hot gases through a unit. Examples include gypsum board and ASTM E-814-rated foams and caulks. These materials are appropriate for air sealing, and may be required by code in some locations. Note: some foam products may say “fire-stop” or “fire-block” on the label but are not ASTM E-136-rated and should not be used on a chimney or flue. Foam is combustible.

**Baffles:** Rigid material used to contain loose-fill insulation.

**Building cavity duct:** Any enclosed cavity used for a forced-air duct system. This includes joists where sheet metal forms a pan across the joists.

**Combustion appliance:** Any fuel-burning appliance.

**Combustion Appliance Zone, or CAZ:** A conditioned space or enclosed area containing a combustion appliance for the purpose of space heating or water heating.

**Complete measure:** An installation of an Energy Trust incentive-qualifying measure that meets all requirements in the Weatherization Specifications Manual and the minimum requirements at all reasonably accessible locations. For example, attic insulation must be R-38 over the entire surface adjacent to conditioned space and ducts must be sealed at every joint and seam.

**Conditioned basement:** Any basement containing HVAC ducts and/or is accessible from another conditioned space. Other basements may be considered conditioned if they are largely connected to the conditioned space of the house and separated from the outside.

**Conditioned space:** Enclosed areas that directly receive space conditioning, meaning they contain HVAC vents, electric-resistance heaters or wood stoves. Alternatively, spaces that are not directly conditioned but are largely connected to a conditioned space and have an effective barrier from the outside shall be considered conditioned. Garages are usually considered unconditioned space, unless there is a vent feeding conditioned air to the area.

**Crown attic:** Uppermost attic flat, adjacent to a sloped cavity; commonly seen in 1.5-story properties.

**Cubic Feet per Minute, or CFM:** Rate of flow for air movement between defined areas.

**Denim insulation:** A non-fibrous insulating material that does not require a vapor-permeable air barrier in Human Contact Areas.

**Encapsulated batts:** Fiberglass batts with a perforated vinyl cover (can serve as a vapor-permeable air barrier in human contact/storage areas). These are acceptable for installations.

**Enclosed cavity:** Space bordered on all sides by rigid material.

**Exterior attic access:** Entry into unconditioned attic space directly connected to other unconditioned areas, including garages and outside.

**Exhaust device:** A mechanical unit intended to remove indoor air pollutants, including bathroom exhaust fans, dryers and mechanical ventilation devices.

**Faced batt-type insulation:** Faced batts have an air and/or vapor barrier on one side, usually made of kraft paper. The facing shall always be placed adjacent to the warm surface being insulated and shall not be sandwiched between insulation or installed, which would create a condensing surface on the cold side of the insulation.

**Flex duct:** Flexible plastic sheeting over a metal wire coil.

**Ground cover:** 6-mil or thicker, black polyethylene used to prevent water vapor from emanating from soil in unfinished crawlspaces or basements.

**Human Contact Area:** Location where occupants go for routine maintenance or storage.

**IC- vs. Non-IC-rated light fixtures:** Insulation contact-rated fixtures do not need to be baffled to prevent insulation from contact. Insulation may be piled directly on top of fixture. Non-IC-rated fixtures must be baffled to prevent heat buildup.

**Interior attic access:** Entry into unconditioned attic space directly connected to a conditioned area.

**Knee wall:** A short wall between an attic floor and a sloping roof that separates a conditioned and unconditioned space.

**Net Free Area, or NFA:** The net area of unencumbered venting, meaning the total area of the vent minus the area blocked by screens or louvers.

**Open wall(s):** Any vertical barrier between conditioned and unconditioned space in which the framing is visible from any side.

**Passive ventilation:** Natural ventilation of a space caused by wind or temperature-driven convection. Does not include moving parts such as fans.

**Pony wall:** For the purposes of the Weatherization Specifications Manual, any vertical barrier between conditioned and unconditioned space that is less than full wall height. For example, the wall between a skylight and the open attic space.

**Post and beam:** Floor construction using a support system of beams typically spaced 30"–48" on center. Requires 12" spacing for any support material (see UN 2.2 for spacing/spans).

**Register:** A ventilation grill separating HVAC ducting from conditioned space.

**Rake:** Horizontal section of side attic.

**Return:** Duct that brings conditioned air from the house to air handler.

**Rim or band joist:** Area of a unit where the concrete foundation meets the floor joists.

**Side attics:** Unfinished areas located on the same floor as, and adjacent to, finished spaces. May be considered conditioned or unconditioned, depending on certain criteria.

**Skylight:** Any window unit in an opening in the roof assembly that is installed at a slope of 15 degrees from vertical or greater.

**Sloped ceilings:** Angled ceilings—including vaults—over conditioned spaces that may follow the roof line or intrude into the attic space above and may require special consideration when installing insulation.

**Spray-foam insulation:** A foam-plastic material applied with a foaming agent for use as insulation.

**Supply:** Delivers conditioned air from the air handler into the unit.

**Thermal envelope:** The plane where thermal and air barriers exist to reduce heat transmittance and air leakage. The thermal envelope should be continuous to maximize effectiveness.

**Thermal barrier:** An assembly or material that is installed to prevent heat from conducting between conditioned and unconditioned space.

**Unconditioned space:** Space within a building that is not heated or cooled by an active system or directly linked to conditioned space; outside.

**Unfaced batt-type insulation:** Batt-type insulation with no vapor or air barrier attached.

**Upper attics:** Unfinished areas located above finished spaces. Upper attics are usually considered unconditioned space except in rare cases.

**Vapor-permeable air barrier:** Any material—including house wraps—that substantively blocks air from passing but allows water vapor (which may pass through narrower pores than air) to pass through.

**Vapor barrier:** A material restricting the movement of water vapor from an area of high vapor pressure to one of lower pressure. Material with a perm rating of 1.0 or less is normally considered a vapor barrier.

**Weatherization measure:** Installation of insulation, duct sealing and/or windows.

**Wintertime conditions:** This includes closing overhead garage doors, exterior doors and windows, flues and dampers; opening interior doors and all registers; and shutting off all ventilation fans.



