

wattsmart Homes Program

Utah

Technical Specifications Manual

Version 3.1.1

Release Date – March 1, 2016

Table of Contents

Foreword	3
IN—Introduction	4-6
IN 1.0—Program Goals and Eligibility	4
IN 1.1—Code Compliance, National and Regional Standards	4
IN 1.2—Materials	5
IN 1.3—Work Quality Verification Process	5
IN 1.4—Equipment Maintenance	5
IN 1.5—Combustion Safety	6
IN 1.6—Requirements for All Mechanical System Installations	6
IN 1.7—Additional Requirements for Heating System Condensation Drains	6
DU—Manufactured Homes Duct Sealing	7-10
DU 1.0—Introduction	7
DU 1.1—Combustion Safety	7
DU 1.2—Measurement	7
DU 1.3—Duct Sealing	8
DU 1.4—Additional Requirements	9-10
CAC and HP—Central Air Conditioner and Heat Pump	11
CAC and HP 1.0—Introduction	11
CAC and HP 1.1—Thermostat	11
CAC and HP 1.2—Line Set Requirements	11
CAC and HP 1.3— Outdoor Unit Installation	11
HP 1.4— Additional Requirements for Ductless Heat Pumps	11
ECM—Gas Furnace with Electrically Commutated Motor	12
ECM 1.0—General Requirements	12
WH—Heat Pump Water Heater	12
WH 1.0—Introduction	12
WH 1.1—Installation	12

WHH—Whole Home HERS	13-20
WHH 1.0—Introduction	13
WHH 1.1—General Modeling Guidance	13
WHH 1.2—Site Information	13
WHH 1.3—General Building Information.....	13
WHH 1.4—Building Surfaces	14-15
WHH 1.5—Space Conditioning	17
WHH 1.6—Water Heating.....	17
WHH 1.7—Duct Systems	18
WHH 1.8—Whole House Infiltration.....	18
WHH 1.9—Mechanical Ventilation.....	18
WHH 1.10—Lights and Appliances.....	19
WHH 1.11—Solar.....	19-20
Appendix C: Glossary.....	21-23
Appendix D: Best Practice Guidelines.....	24-25

Foreword from the Home Energy Savings Program

This Technical Specifications Manual articulates the Rocky Mountain Power Home Energy Savings Program requirements for HVAC, plumbing, and weatherization equipment and service measure installations. This manual is intended to ensure the safety, durability and energy efficiency of customers' homes and provide valuable technical resources for installers.

The weatherization and mechanical specifications included in this manual describe the installation requirements for measures that are eligible for cash incentives. **For specific Program requirements, such as eligible measures, please refer to the appropriate Trade Ally Program Manual. The Program will conduct quality assessment reviews in accordance with applicable specifications and Program requirements.**

This manual goes into effect on December 1, 2016. Please familiarize yourself with these updates and make sure you are aware of any changes relevant to your work.

For more information, please email HESTradeAllyRMP@rockymountainpower.net or call the Home Energy Savings Trade Ally Hotline, 1.800.942.0281, option 1.

Sincerely,

The Rocky Mountain Power Home Energy Savings Team

IN—INTRODUCTION

IN 1.0—Program Goals and Eligibility

The Rocky Mountain Power Home Energy Savings Program (Program) offers cash incentives on a variety of HVAC, plumbing, and weatherization equipment and services. The Program promotes installation practices that are designed to maximize system performance and efficiency. By helping customers minimize their energy use, the Program saves customers money on their energy bill and also reduces the growing demand for power in the region.

The main purpose of weatherization installations is to prevent winter heat loss or summer heat gain from conditioned indoor spaces to unconditioned or outdoor spaces. Conditioned space is defined as an enclosed area within a building that is heated or cooled and designed, or modified, to have a complete and effective pressure boundary. Garages, barns, unattached shops, sheds, unfinished attics and crawlspaces are considered unconditioned space for the purposes of incentive qualification. A garage is defined as any space, heated or unheated, that features a large door designed to permit the entry of an automobile. Weatherization measures shall be installed in the thermal envelope—or building shell—of a home. These areas are typically defined by the separation of conditioned and unconditioned spaces, or between a conditioned space and the outside of the house.

Plumbing and HVAC equipment and service measures are intended to improve performance and efficiency of space and water heating and cooling equipment. All measure qualifications shall be met including compliance with qualified fuel type, floor area served by equipment, and existing equipment.

To be considered a complete measure and eligible for incentives, a measure shall meet all specifications and requirements listed in:

1. The relevant sections of this manual
2. The relevant sections of the Trade Ally Program Manual
3. The relevant incentive application form(s)
4. The relevant Trade Ally Participation Agreement(s)

Resources and additional information can be located at: <http://homeenergysavings.net/>

The Technical Specifications Manual may not cover every situation. If you have questions, email the Home Energy Solutions Trade Ally Team at HESTradeAllyRMP@rockymountainpower.net or call 1.800.942.0281, option 1.

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 or 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 Technical Specifications Manual shall apply. Examples of national and regional regulations include, but are not limited to, building permit, asbestos, lead, combustion appliance, vermiculite, knob and tube wiring, and fire safety requirements.

It is the contractor's sole responsibility to conform to all applicable codes and regulations for installing mechanical equipment in existing homes. Where applicable codes exceed these specifications, installation shall comply with code minimums.

Contractors bear sole responsibility for complying with all relevant state and national guidelines where the presence of regulated materials is known or suspected, in order to ensure technician and occupant safety. Where the presence of regulated materials is known or suspected, contractors are encouraged to consult guidelines from, but not limited to:

Utah Department of Environmental Quality (DEQ) <http://www.deq.utah.gov/>

Occupational Health and Safety Division (OSHA): <https://www.osha.gov/>

Environmental Protection Agency (EPA): <http://www.epa.gov/lawsregs/topics/>

Building Performance Institute (BPI): http://www.bpi.org/tools_downloads.aspx?selectedTypeID=STD

IN 1.2—Materials

Materials used in the Program shall meet or exceed applicable state, federal or local code and regulations. All materials shall be installed to the manufacturer's specifications. The Program does not keep a list of approved products. Material information shall be provided to the Program, upon request. Adherence to applicable codes and regulations is the responsibility of the contractor or building owner. The Program reserves the right to reject the use of materials and supplies it deems unacceptable.

IN 1.3—Work Quality Verification Process

After eligible measures are installed, a Quality Assurance verification may be required to ensure compliance with Program specifications. The Program will conduct Quality Assurance verifications based solely upon incentive-qualifying measures. **If the installed eligible measures do not meet these specifications, the Program will notify the customer and contractor of the deficiencies and follow up with the contractor to perform corrective actions. The Program does not guarantee energy savings or performance of the installations under this Program. The Program does not assume responsibility for enforcing or determining compliance with codes and regulations or their interpretation.** The Quality Assurance 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 work qualifies for incentives, the homeowner is responsible for discussing with the contractor any discrepancies between the work contracted and Program requirements.

IN 1.4—Equipment Maintenance

All equipment used for diagnostics, installation of insulation, safety, or other weatherization purposes shall be used in accordance with the manufacturer's instructions and shall be properly maintained and calibrated.

IN 1.5—Combustion Safety

It is the responsibility of the Trade Ally to ensure that all combustion appliances contained within the confines of the structure are properly and safely vented, operating, and have suitable combustion air before and after duct sealing occurs and to ensure that all applicable state/local laws, codes, and standards are met and the indoor air quality of the dwelling is not compromised. A combustion appliance is any fuel-burning appliance including ovens, dryers, water heaters, and space heating systems that utilizes natural gas, propane, oil, kerosene, or wood.

A functioning and properly installed (in accordance with manufacturer's specifications) UL-listed carbon monoxide alarm is required when a combustion appliance is present within the confines of the structure when duct sealing is performed

See sections DU for more information.

IN 1.6—Requirements for All Mechanical System Installations

Mechanical equipment shall be installed according to the manufacturer's specifications, except in circumstances where prevailing jurisdictional codes or Program standards exceed those specifications, in which case the applicable codes or Program standards shall be followed. Mechanical equipment shall be installed as a permanent fixture on the property, including any connections to the home's electrical wiring or water piping, and including exhaust ventilation ductwork, if applicable. Mechanical equipment shall have a clearly visible, permanent, factory-affixed label identifying the serial number, make, and model number of the unit. Mechanical equipment shall in no way compromise the structural integrity of the area in which the unit is being installed.

IN 1.7—Additional Requirements for Heating System Condensation Drains

Condensation produced by the operation of the HVAC system or heat pump water heater shall be removed from the area of installation via an adequately sloped drainage system, condensate pump or connection to an existing plumbing drain. Condensation shall slope downhill and flow to a suitable termination point. Defrost or condensate cannot run onto walkways or driveways where it may pose a safety hazard.

DU—Manufactured Homes Duct Sealing

DU 1.0—Introduction

To be considered a complete measure and eligible for incentives, duct sealing shall:

1. Comply with complete measure guidelines listed in section IN 1.0
2. Comply with carbon monoxide alarm and combustion safety requirements listed in section DU 1.1
3. Provide homeowner [*Care for Your Air: A Guide to Indoor Air Quality \(EPA\)*](#)
4. Have a duct leakage test performed before and after duct sealing
5. Bring all accessible ductwork in unconditioned space into compliance with the applicable requirements listed in section DU

DU 1.1—Combustion Safety

Duct sealing can alter the performance of combustion appliances by reducing the amount of available combustion air and can create zones of increased negative pressure. A combustion appliance is any fuel-burning appliance including ovens, dryers, water heaters, and space heating systems that utilizes natural gas, propane, oil, kerosene, or wood. Duct sealing can cause increased concentrations of pollutants and humidity within the dwelling due to reduced natural air exchanges.

It is the responsibility of the Trade Ally to ensure that all combustion appliances contained within the confines of the structure are properly and safely vented, operating, and have suitable combustion air before and after duct sealing occurs and to ensure that all applicable state/local laws, codes, and standards are met and the indoor air quality of the dwelling is not compromised.

Homes with unvented combustion heating appliances are not eligible for duct sealing incentives.

A functioning and properly installed (in accordance with manufacturer's specifications) UL-listed carbon monoxide alarm is required when a combustion appliance is present within the confines of the structure when duct sealing is performed. Homeowners shall be made aware of the alarm and instructed how to operate, test, and maintain the alarm.

A combustion appliance zone (CAZ) is an enclosed area containing a combustion appliance for the purpose of space heating or water heating.

The Program recommends following CAZ testing procedures and requirements outlined by industry recognized organizations including, but not limited to, Building Performance Institute, RESNET, or ACCA.

DU 1.2—Measurement

Duct leakage testing using diagnostic equipment shall be performed prior to sealing, and again after sealing is complete, to be eligible for Duct Sealing and Duct Sealing/Duct Insulation incentives. Testing shall be performed only by technicians certified by PTCS, BPI, or NATE.

A duct leakage to outside test shall be run, which involves running a blower door simultaneously, and the ducts shall be pressurized to 50 Pascals. Duct leakage testing shall be conducted according to processes outlined by The Energy Conservatory™ or Retrotec™.

A duct leakage test shall be performed before duct sealing (pre-test) and after duct sealing (post-test). In order to qualify for incentives, duct leakage to outside must be reduced by 50% or more with a 100 CFM₅₀ minimum reduction. Reduction in leakage shall be measured as follows:

$$\text{Total Leakage Reduction CFM}_{50} = \text{Pre-test CFM}_{50} - \text{Post-test CFM}_{50}$$

$$\text{Percent Reduction} = (1 - (\text{Post-test CFM}_{50} \div \text{Pre-test CFM}_{50})) \times 100$$

DU 1.3—Duct Sealing

All new and all accessible existing HVAC supply and return ducts, air handlers, and plenums outside the conditioned space shall be sealed at all joints and corners, including prefabricated joints. It is unnecessary to seal longitudinal seams unless they are damaged.

DU 1.3a—Duct Repair

Inferior sections of duct—such as rusted, crushed or disconnected sections or sections otherwise ineffective—shall be repaired or replaced before duct sealing is performed. When there are large gaps in sheet metal or duct connections, repairs shall be made using sheet metal, sheet metal screws, and/or mastic and mesh-reinforcing tape. Disconnected, loose-fitting or new metal ducts shall be secured using at least three sheet metal screws at each connection.

DU 1.3b—Duct Support

To minimize sagging, ducts shall be supported with durable supports. Flexible ducting supports shall be listed as UL-181 approved, be at least 1½" wide and not restrict airflow. Flexible ducting shall be supported within 3' of each connection to a hard duct. If possible, ducts shall be supported above the ground. When contact with the ground is unavoidable, closed-cell rigid insulation shall be placed under the ducts.

DU 1.3c—Duct-Sealing Materials

Ducts shall be sealed using pliable, water-based mastic labeled as meeting UL-181 standards. Gaps greater than ⅛" shall be reinforced using mesh-reinforcing tape before applying mastic. Boot-to-floor connections shall be sealed with caulking, pliable mastic or expanding foam. Foil or mastic HVAC tape labeled as meeting UL-181 standards may only be used on the air handler.

DU 1.3d—Duct-Sealing Opportunities

All accessible connections of the supply and return plenum and trunkline, and all accessible takeoffs, runs and boots—including the gores on adjustable elbows—shall be sealed with approved materials. The following target areas are listed in order of priority:

1. Plenum
2. Plenum-to-takeoff connections
3. Remove existing loose tape before applying mastic
4. Branch Ts, Ys and Ls
5. Add three screws to each duct connection
6. Duct-to-duct connections
7. Gores on adjustable elbows
8. Finger/dovetail joints
9. Boots
10. Boot-to-floor, boot-to-wall and boot-to-ceiling connections
11. Air-handler cabinet to return and base can

The presence of insulation alone shall not be considered a barrier to accessibility.

Loose tape shall be removed from rigid ducts prior to sealing. Secured tape shall be completely covered with mastic, which shall extend at least ½" beyond the tape edge on either side and be at least ⅛" thick.

DU 1.3e—Flexible Ductwork

All flexible ducts shall be joined to a section of rigid duct of matching diameter, including locations where two separate sections of flex duct meet. Both the inner and outer lining shall be tightly fastened using a compression strap tightened with a tool designed for that purpose. Tape may remain as long as a compression strap is installed to maintain a permanent connection. Flexible ducting shall be supported and comply with UL-181 requirements.

DU 1.4—Additional Requirements

Any portion of an HVAC duct that extends beyond the last register shall be blocked off and sealed.

The crossover ducts shall be installed to prevent compressions or sharp bends, minimize stress at the connections, avoid standing water, and avoid excessive duct lengths. When skirting is not present, the crossover duct shall be protected against rodents, pets, etc. Crossover ducts shall be secured with mechanical fasteners (e.g., stainless steel worm drive clamps, plastic/nylon straps applied with tightening tool, etc.) and sealed with mastic. Existing flexible crossover duct with an insulation value of R-4 or less or which has been damaged shall be replaced with new rigid duct with an insulation value meeting Program requirements.

Where clearances permit, the crossover duct shall be supported above the ground by strapping or blocking. Min R-4, 1" foam board between duct and ground contact is permitted.

If a non-ducted return-air system is in the floor or ceiling cavity, it shall be eliminated. Seal all return-air openings in the floor or ceiling and seal the main return-air opening in the floor or ceiling of the furnace closet. Return air shall be provided through grills in the furnace closet to the conditioned space. These grills shall be adequately sized for the installed heating system. All interior doors shall be undercut, or other means provided, to allow return air to flow back to the furnace closet.

If the rodent barrier has been removed and batt insulation has been installed in the floor, all HVAC ducts, boots and plenums, except flexible crossover ducts, shall be sealed and wrapped with insulation.

CAC and HP—CENTRAL AIR CONDITIONER and HEAT PUMP

CAC and HP 1.0—Introduction

This section governs installation requirements for ducted and ductless heat pump systems and central air conditioners. Refer to IN 1.0, IN 1.1, IN 1.6, and IN 1.7 for additional requirements.

The contractor shall ensure evaporators and condensing units are compatible with one another according to AHRI specifications.

Refer to Appendix B for additional best practices regarding ducted and ductless heat pump systems.

CAC and HP 1.1—Thermostat

A programmable thermostat with the ability to program a temperature setback shall be installed. The temperature setback shall be no more than 3 degrees Fahrenheit to maximize energy-efficient operation.

For heat pumps, the balance point shall be within 5 degrees (plus or minus) of 30°F.

CAC and HP 1.2—Line Set Requirements

Line set penetrations through the building shell shall be sealed.

Outdoor portions of the line set shall be protected with a mechanically secured rigid covering. In situations where installation of a rigid cover is impractical, a securely fastened UV-resistant covering may be used to protect the line set.

The line set shall be insulated over its entire length. For ducted heat pumps and central air conditioners, the liquid line may be uninsulated.

CAC and HP 1.3—Outdoor Unit Installation

The outdoor unit shall rest on a permanent pad on a stable, level surface.

The outdoor unit shall not be covered with debris or have obstacles nearby that restrict or prevent airflow over the unit.

HP 1.4—Additional Requirements for Ductless Heat Pumps

Ductless heat pumps shall be installed in accordance with the requirements listed in HP 1.0, HP 1.2 and HP 1.3.

HP 1.4a—Outdoor Unit Installation

Set outdoor unit on a pad placed on a stable, level surface; secure unit to pad using bolts and/or adhesive. In lieu of pad mounting, the outdoor unit may be wall mounted using hardware designed specifically for this purpose and installed per the manufacturer's instructions and recommendations. If using wall-mount brackets, use vibration mounts to prevent noise concerns.

In cold climates, elevate the unit to maximize clearance under the outdoor unit for easy drainage and reduced snow and ice buildup.

New tubing flares shall be created and connected with the R410A nuts (supplied with your indoor and outdoor unit). Flare nuts provided by the tubing manufacturer shall not be used.

HP 1.4b—Indoor Unit Installation

The indoor unit shall be securely mounted, level and plumb per the manufacturer's specifications to a permanent surface (wall, soffit, partition, etc.). Mounting to movable walls or partitions is not allowed.

Condensate drain should slope downhill and run to a suitable termination point away from crawlspaces and walkways. Condensate pumps shall not be used unless no other reasonable solution for adequate drainage is feasible.

ECM—GAS FURNACE WITH ELECTRICALLY COMMUTATED MOTOR (ECM)

ECM 1.0—General Requirements

Combined supply and return static pressure needs to be between .35-.80 WCI (87-200 Pascal) on the highest heating or cooling fan speed setting upon installation.

All physically accessible ducts should be firmly connected and duct connections at the furnace must be sealed in accordance with section DU.

WH—HEAT PUMP WATER HEATERS

WH 1.0—Introduction

This section governs installation requirements for heat pump water heaters. Refer to IN 1.0, IN 1.2, IN 1.6, and IN 1.7 for additional requirements. See Appendix B for additional best practices regarding heat pump water heaters.

WH 1.1—Installation

The heat pump condensate shall be removed from the area of installation via an adequately sloped drainage system, condensate pump or connection to an existing plumbing drain. If drained to the outdoors, avoid creation of a slip hazard over sidewalks and driveways.

Ensure the unit location meets manufacturer space requirements and that the unit has adequate manufacturer recommended clearances around and above the unit.

WHH—WHOLE HOME HERS: OVERVIEW

WHH 1.0— Introduction

These guidelines provide Home Energy Raters with technical guidance on modeling homes using REM/Rate™ to qualify for Rocky Mountain Power’s Whole Home Energy Rating System (HERS) Index incentive. If using another RESNET accredited rating software tool, e.g. EnergyGauge USA™ or Ekotrope RATER™, please contact a program technical staff for additional details.

The home’s HERS index is used in determining qualification with the incentive and is calculated by running a Home Energy Rating Certificate in REM/Rate. Only versions of REM/Rate accredited by RESNET shall be accepted. These guidelines are tailored for version 15.3 and newer.

If these guidelines conflict with the RESNET Mortgage Industry National Standards, those shall take precedence over these guidelines.

WHH— WHOLE HOME HERS: MODELING GUIDANCE

WHH 1.1— General Modeling Guidance

The following guidance is meant to supplement REM/Rate’s internal guidance and provide additional clarification on specific systems and assemblies that aren’t specifically or clearly addressed. Many of these items can have significant effects on modeling results and are intended to help ensure consistent and accurate estimates. The following sections are organized according to the individual screens within REM/Rate.

WHH 1.2—Site Information

Climate Location

The home shall be modeled in the geographically closest climate location available in REM/Rate.

Utility Rates

The Rater shall use utility rates accurate to the utility territory in which the home will be constructed.

WHH 1.3—General Building Information

Conditioned Floor Area

Rater shall include all finished and unfinished spaces that are within the thermal and pressure boundary of the home and receive intentional space conditioning. Rater shall **not** include spaces that receive minimal space conditioning, such as conditioned crawlspaces; or no intentional space conditioning, such as unheated basements or unvented crawlspaces in Conditioned Floor Area calculations. For homes with wall cavity depth of > 7.5”, floor and footprint areas shall be measured from the interior surface of all wall assemblies. All other aspects of dimensioning shall be performed in accordance with ANSI/RESNET/ICC 301-2014.

Infiltration Volume

Rater shall calculate the total volume of all spaces within the thermal and pressure boundary of the home. In other words, the volume of all zones included in the blower door test. Infiltration volume includes but is not limited to:

- All above- and below-grade finished living areas
- Volume from vaults and other ceiling height changes
- All other spaces, whether finished or unfinished, that are within the thermal and pressure boundary of the home and receive intentional conditioning, such as conditioned crawlspaces, conditioned attics, and unfinished basements.

Number of Bedrooms

A bedroom shall be defined as any room 70 ft² or greater in size with a closet and egress, including dens, offices, and similar rooms. Living rooms, dining rooms, and foyers shall not be counted as bedrooms.

Foundation Type

- Slab on Grade: Use for all homes with slab on grade foundation.
- Enclosed Crawlspace: Use for all crawlspaces, whether vented or unvented, which will not receive direct, intentional space conditioning. Set “Thermal Boundary Location” accurate to the home.
- Conditioned Basement or Conditioned Crawlspace: Use for basements, whether finished or unfinished, and crawlspaces that will receive direct, intentional space conditioning.

Note: For REM/Rate to assign the thermal boundary and provide an accurate model, a slab entry must be provided for conditioned crawlspaces, even if a slab is not present in the home. Also, a separate floor entry above the conditioned crawlspace shall be entered that is modeled adjacent to adiabatic space. Subsequent values shall be entered in accordance. If a separate mechanical exhaust ventilation strategy is used for the conditioned crawlspace; this must be added to the whole-house ventilation rate, duration and fan wattage.

- Unconditioned Basement: Use for basements, whether finished or unfinished, which will not receive direct, intentional conditioning. Set “Thermal Boundary Location” accurate to the home.
- More than One Type: Use for all homes constructed with a combination of the types above. For each foundation type included in the home, follow the respective guidance provided above.

WHH 1.4—Building Surfaces

Creating Library Entries

- Create an accurate name and description for the library entry.
- Specify the surface characteristics in REM/Rate’s “Quick Fill” or “Path Layer” entry screens, using appropriate values for insulation R-values, framing factors, etc.

- Overall U-value for the assembly will be reviewed by a program technical staff during file QA. Include any necessary notes on methodology and assumptions in REM/Rate's Notes screen.

Foundation Wall Properties

Follow REM/Rate's internal guidance.

Slab Floor Properties

Slab insulation characteristics shall be entered accurate to the home. "Total Exposed Perimeter" value shall include all slab perimeter that does not abut conditioned space or a separate, below grade buffer space. Rater shall enter all slab characteristics according to the guidance provided in REM/Rate's help file. Where the slab will be used as radiant distribution for a hydronic heat source, the Rater shall designate the home's slab as "Radiant" in the slab library entry.

For all other values, follow REM/Rate's internal guidance.

Note: For REM/Rate to assign the thermal boundary and provide an accurate model, a slab entry must be provided for conditioned crawlspaces, even if a slab is not present. Add this as an uninsulated slab with characteristics accurate to the floor of the crawlspace.

Frame Floor Properties

Follow REM/Rate's internal guidance.

Rim and Band Joist Properties

Follow REM/Rate's internal guidance.

Above-Grade Wall Properties

Follow REM/Rate's internal guidance.

Window and Glass Door Properties

Rater shall enter window and glass door areas, orientations, and physical characteristics accurate to the rated home. Window U-value and SHGC may be calculated as area-weighted averages. Fenestration with similar characteristics (orientation, overhangs, wall association, and thermal characteristics) may be combined to streamline data entry.

Door Properties

Rater shall enter door areas, R-values, and other physical characteristics accurate to the rated home.

Ceiling Properties

Follow REM/Rate's internal guidance.

Skylight Properties

Rater shall enter skylight areas, orientations, and other physical characteristics accurate to the rated home. For skylights with similar characteristics (pitch, orientation, ceiling association, and thermal characteristics), U-value and SHGC may be calculated as area-weighted averages and skylight areas may be combined to streamline data entry.

WHH 1.5—Space Conditioning

Rater shall model all mechanical equipment with capacity, efficiency, location, and electric auxiliary or back up heat values accurate to the unit selected. Rater shall provide heating and cooling equipment model numbers in REM/*Rate's* Notes area.

Load Allocation

Rater shall set the “Capacity Weight % of Load Served” toggles to “on” (checkmarks in boxes) for heating, cooling, and DHW loads, unless stipulated by the modeling guidance for the specific equipment type or combination below.

Air Source Heat Pumps

Rater shall model all conventional central air source heat pumps as “Air Source Heat Pump” type. Rater shall use capacity, efficiency, backup heat capacity, and auxiliary electric use values accurate to the unit selected. Alternatively, Rater may select equipment with similar capacity, efficiency, and auxiliary electric use values from the Air Source Heat Pump library.

Mini-split Heat Pumps

Model all Ductless and Ducted mini-split heat pumps as follows:

- Enter capacity and HSPF values accurate to the unit selected. Most mini-split heat pumps do not include internal electric resistance back up heat. Unless the manufacturer’s product information indicates internal back up heat, set “Electric Resistance Backup Capacity” value to zero.
- For ductless mini-splits, ductwork shall be assigned to the system. “Sq. Feet Served” shall be entered for the whole home or zone the unit will serve and “Duct Surface Area” shall be estimated using REM/*Rate's* “Estimate Surface Area” option. Set duct location to “Conditioned Space” for 100% of the supply and return ducts. Set “Leakage to Outside” value to zero.
- For ducted mini-splits, “Sq. Feet Served” shall be entered for the whole home or zone the unit will serve and “Duct Surface Area” shall be estimated using REM/*Rate's* “Estimate Surface Area” option. Duct system location shall be entered accurate to the duct system to be installed in the home. Alternatively, if a duct design has been provided, the Rater may calculate duct surface area based on the design. (See “Duct Systems” below)

If no supplemental electric unit heaters, zone heaters, or electric resistance floor heat exist in the home, no further action is required.

If supplemental electric baseboard, unit heaters, or zone heaters will be present in the home and are necessary to meet design loads, the Rater shall enter the supplemental heat as a separate space heating system as follows:

- System type: “Electric baseboard or Radiant”
- Fuel type: “Electric”
- Rated output capacity (kBtuh) = Total capacity of supplemental heat, in kBtuh.
- Seasonal equipment efficiency = 1.0 COP
- Rater shall set the “Capacity Weight % of Load Served” toggles to “off” (no checkmarks in boxes) for heating and adjust the load allocation according to the table below.

Climate Zone	5	6
% of load to be allocated to supplemental heat system	35%	40%

Ground Source Heat Pumps

Follow REM/Rate’s internal guidance.

Radiant Hydronic Heating

Rater shall enter values for fuel type, output capacity, seasonal efficiency, and auxiliary electric use accurate to the equipment installed in the home. Where hydronic systems will use a radiant slab for distribution, the Rater shall designate the home’s slab as “Radiant” in the slab floor library entry.

Integrated Space and Water Heating

Rater shall model integrated space and water heating equipment as separate space and water heat systems. Per the software developers’ guidance, use of the “Integrated Space/Water Heating” Library Type is not recommended.

WHH 1.6—Water Heating

Rater shall enter water heaters with size, location, type, and efficiencies accurate to the equipment installed in the home. Rater shall provide water heater model numbers in REM/Rate’s Notes area.

Heat Pump Water Heaters (HPWH)

- For HPWH having multiple published efficiency factors (EF) depending on the mode the unit is set in, Rater shall model the default or factory set EF for the mode the unit is shipped in.
- A HPWH installed inside conditioned space should be fitted with ducting for both the intake and exhaust air. For HPWH receiving intake air from conditioned space and exhausting to locations outside the thermal envelope, an appropriate volume of airflow shall be added to the mechanical ventilation entry for the home.

Drain Water Heat Recovery Systems

Model the manufacturer's efficiency ratings (CSA 55.1) as found in their technical documentation. This value is expressed in a percentage, only applies to vertical installations, and varies depending on unit diameter and length. Click the appropriate check boxes depending on how the unit is plumbed:

- "DWHR preheats COLD supply for shower" – Click when the DWHR preheats water flowing to the cold water inlet on the shower(s).
- "DWHR preheats HOT supply for shower" – Click when the DWHR preheats water flowing to the hot water heater.

Plumbing Design

Follow REM/Rate's internal guidance.

WHH 1.7—Duct Systems

Rater shall enter "Sq. Feet Served" for the whole home or zone the duct system will serve and "Duct Surface Area" shall be estimated using REM/Rate's "Estimate Surface Area" option. Alternatively, if a duct design has been provided, the Rater may calculate duct surface area based on the design.

Duct system location shall be entered accurate to the duct system to be installed in the home. If the home has more than one ducted heat source, Rater shall create a duct system entry for each heating/cooling source.

Duct "Leakage to Outside" shall be entered accurate to the tested leakage of the system. If only "Total Duct Leakage" was tested, this value may be used as the "Leakage to Outside" value since REM/Rate does not use the "Total Duct Leakage" value for energy simulations. If 100% of the ducts and equipment are located within conditioned space and the system qualifies for RESNETs exemption for duct testing outlined in section 803.2 of the RESNET Mortgage Industry National Standards, Rater may enter a "Leakage to Outside" value of zero. REM/Rate's "Use Default Leakage" option shall not be used.

WHH 1.8—Whole House Infiltration

Rater shall enter infiltration values accurate to the home. Infiltration "Measurement Type" shall be entered as "Blower door test". Heating and cooling season infiltration values shall be the blower door test results, entered with "CFM @ 50 pascals", "CFM @ 25 pascals", or "ACH @ 50 pascals" as the unit type. Rater shall not use "Natural ACH" as the unit type. The "Code Verification" value shall be set to "Tested".

Note: For preliminary model submissions, the infiltration value may be set to 4 ACH50 or another value based on Rater's observations and experience with the particular builder of the modeled home. Raters should use a value that results in conservative savings estimates.

WHH 1.9—Mechanical Ventilation

Balanced Ventilation Type

Select the Balanced Ventilation system type for systems that are designed to simultaneously supply and exhaust air from the home, including Heat Recovery Ventilators (HRVs) and Energy Recovery Ventilators (ERVs). HRVs must be modeled with Sensible Recovery Efficiency (SRE), Net Airflow, and fan wattage listed in the HVI directory (www.hvi.org). Rater shall specify runtime of 24 hours/day and HVI values for SRE, Net Airflow, and fan wattage for an equipment operating speed that meets minimum ventilation standards (ASHRAE 62.2-2013 or similar) under continuous operation. Alternatively, Rater can model the field-verified flow rate and fan wattage. Rater shall provide HRV/ERV model numbers in REM/Rate's Notes area.

Note: For HRVs/ERVs, even though the REM/Rate Mechanical Ventilation screen asks for "Apparent Sensible Efficiency", the software developer has specified that SRE is the intended value. See REM/Rate's internal help file for additional details.

Exhaust or Supply Only Ventilation Type

Rater shall select this ventilation type if an exhaust or supply fan is used as the primary means of whole-house ventilation. Rater shall enter the field-verified flow rate, schedule, and fan watts for the system installed in the home.

Note: For preliminary model submissions, Rater may specify rate as needed to satisfy minimum ventilation standards (ASHRAE 62.2-2010 or similar) under continuous operation, runtime of 24 hours/day, and default fan watts. Rater shall update these values with field-verified values prior to final submission.

Air Cyclor Ventilation Type

Rater shall select this ventilation type for systems consisting of a fresh air intake duct attached to the return plenum of a central heating system controlled by a smart ventilation controller. Rater shall enter the field-verified flow rate and run time necessary to meet minimum ventilation standards (ASHRAE 62.2-2013 or similar). Fan watts shall be entered as the air handler watts running in the ventilation speed. REM/Rate will automatically deduct periods when the air handler is running during heating/cooling cycles as to not double count runtime.

WHH 1.10—Lights and Appliances

Appliances and Lighting

Rater shall use "RESNET default" values for all appliances, lighting, and ceiling fans. If appliances and light bulbs are installed in the home during final inspection, Rater shall enter values accurate to the equipment installed. If modeling the actual appliance values, Rater shall provide respective model numbers in REM/Rate's Notes area. "Range/Oven" and "Dryer" fuel shall be entered accurate to the home.

WHH 1.11—Solar

Photovoltaic Energy Systems

Solar contributions will not be included in the HERS index used for purposes of qualifying for program incentives.

Interior Mass, Active Solar, Solar Water Heating and Sunspaces

Consult a program technical staff before using.

APPENDIX A: GLOSSARY

ACCA—Air Conditioning Contractors of America

AHRI—Air-Conditioning, Heating and Refrigeration Institute

ANSI—American National Standards Institute

ASTM—American Society for Testing and Materials

Auxiliary heat—Applies only to heat pump systems. Electric resistance coils activated when the outdoor temperature is below the heat pump’s balance point. Also known as strip heat, second-stage heat, supplemental heat and backup heat. Also see emergency heat.

Balance point—The outdoor temperature at which auxiliary heat is needed on a ducted heat pump. Also known as lockout temperature.

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.

CAC – Central Air Conditioner

Combustion appliance—Any fuel-burning appliance, including ovens, dryers, water heaters and heating systems, that utilize natural gas, propane, oil, kerosene or wood.

Combustion Appliance Zone (CAZ)—A conditioned space or enclosed area containing a combustion appliance for the purpose of space heating or water heating. Refer to IN 1.12 for general Program requirements, to MA 3.0 for testing procedures for Existing Manufactured Homes projects, and to Appendix D for additional guidelines.

Complete measure—An installation of an Energy Trust incentive-qualifying measure that meets all requirements in the Specifications Manual and the minimum requirements at all reasonably accessible locations.

Condensate drain—Any drainage system that allows condensation created by condensing gas heating appliances and heat pump equipment to flow into a dedicated drain or outside a building enclosure.

Conditioned basement—Any basement that contains 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—An enclosed area within a building that is heated and designed, or modified, to have a complete and effective pressure boundary. Garages, barns, unattached shops, sheds, unfinished attics and crawlspaces are considered unconditioned space for the purposes of incentive qualification. Garages are defined as any space, whether heated or not, that feature a large door designed to permit the entry of an automobile. Contact the Existing Homes Program for more information.

Cubic feet per minute (CFM)—Rate of flow for air movement between defined areas. CFM₅₀ is the rate of air flow at a constant pressure of 50 pascals.

ECM – Electronically Commutated Motor

Electric Cooling – Permanently installed, electric heat pump or ducted electric central air conditioner serving as the home’s current primary cooling source. Room air conditioners and evaporative cooler do not qualify

Electric heating – Permanently installed, ducted system consisting of an electric furnace, heat pump or electric zonal heating system (baseboard or ceiling/wall heaters) serving as the home’s current primary heat source (space heaters do not qualify)

Emergency heat—For ducted heat pumps, emergency heat is the total amount of auxiliary heat that can be activated if the compressor fails.

Flex duct—Flexible plastic sheeting over a metal wire coil.

HES – Home Energy Savings

HSPF—heating seasonal performance factor. Records the number of BTUs of heat delivered for each watt-hour of electricity used. Factors in both the high-efficiency compressor and the less-efficient electric resistance backups.

Human contact area—Location where occupants go for routine maintenance or storage.

HVAC—heating, ventilation and air conditioning. Refers to components of a home’s mechanical systems that provide space heating and cooling.

Non-electric heating— Heating system with gas, oil, wood, pellet stoves, and propane serving as the home’s current primary heat source

Primary heating system—The main heating equipment that is permanently installed and designed to provide the majority of heat inside a home, regardless of use or condition. Existing Homes cash incentives are available for homes with an electric or natural gas primary heating system with fuel provided by Portland General Electric, Pacific Power, NW Natural Gas or Cascade Natural Gas.

QPL – Qualified Products List

R-Value—Measurement of a material’s thermal resistance, commonly used to describe insulation materials. An increase in R-Value results in an increase in thermal resistance. R-Value is the inverse of U-Value ($R = 1/U$).

Register—A ventilation grill separating HVAC ducting from conditioned space.

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

RMP – Rocky Mountain Power

SEER—seasonal energy efficiency ratio. SEER compares the number of BTUs of heat removed per watt-hour of electricity used on a seasonal basis.

Supply—Delivers conditioned air from the air handler into the home.

Thermal barrier— A material rated to resist heat and flame transmission across its surface, significantly slowing flame spread and limiting the potential fuel source available to an open flame.

Thermal boundary—Any surface or building material that serves to resist the transmission of heat energy between conditioned and unconditioned space.

Thermal envelope— The collection of all surfaces and building materials in a structure that resist air loss and heat transmission between conditioned and unconditioned space. Often referred to as the “building envelope.”

TXV – Thermal Expansion Valve

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

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.

WCI – Water Column Inches

Wintertime conditions— A scenario where all overhead garage doors, exterior doors, windows, flues and dampers are closed, all interior doors and duct registers are open, and all ventilation fans are shut off. Used to perform performance-based air leakage and duct leakage tests.

APPENDIX B: BEST PRACTICE GUIDELINES

This appendix lists best practice guidelines for installing high-quality, long-term energy-efficiency measures, equipment, and services. **Guidelines contained in this appendix are not Program requirements.** They are intended to provide beneficial advice when performing energy efficiency upgrades.

Best Practice: Carbon Monoxide

The Program strongly recommends that a carbon monoxide alarm be installed whenever a weatherization measure is performed.

Carbon monoxide alarms should be installed in each bedroom of a house or at minimum within 15 feet of each sleeping area. Contractors should educate their customers on the use of carbon monoxide alarms and precautions that should be taken if the alarm activates. The intention of the alarm is to warn occupants before they experience the symptoms of carbon monoxide poisoning.

Best Practice: Manufactured Homes

All HVAC ductwork, including plenums, shall be repaired, sealed and properly supported, according to section DU before underfloor insulation is installed. Non-ducted return-air systems in the floor cavity shall be eliminated.

Best Practice: Heating Systems

Existing Homes recommends that heating and cooling systems be sized in accordance with Manual S, Manual D, Manual J, Spec Pro or another industry-accepted HVAC calculation methodology based on building heating loads. The equipment manufacturer's selection procedures and sizing guidelines should be referenced as part of the HVAC planning and sizing process.

Best Practice: Ductless Heat Pumps

Size the unit appropriately to the space to be conditioned; oversized systems negatively impact unit performance.

For optimal performance of the unit, the program recommends using risers between the unit and the permanent pad. Adjustable risers will help prevent debris and snow buildup and allow for better drainage. Riser blocks specifically manufactured/intended for this purpose should be used. The riser blocks should be mechanically or chemically secured to the pad. A pan heater can prevent defrost discharge from freezing inside the compressor and is recommended in extreme climates.

Educate homeowner on filter cleaning and other manufacturer recommended maintenance.

For more information on installation best practices for DHPs, see NW Ductless Heat Pump project's Best Practice Guide: https://goingductless.com/assets/documents/uploads/DHP_BP-Guide_FNL.pdf

For additional information on supplementing electric forced air furnaces with ductless heat pumps, see http://www.bpa.gov/energy/n/emerging_technology/pdf/DHP_FAF_Dec_12.pdf.

Best Practice: Heat Pumps

The Program recommends that the maximum line set length be less than or equal to the manufacturer's specifications, and the line set diameter shall match the manufacturer's recommendations. Line sets should be insulated over their entire length.

The Program recommends that outdoor units be checked for adequate airflow using a TrueFlow Air Handler Flow Meter™.

Strip heat should be set up to not come on in the first stage of operation. Refrigerant charge should be installed in accordance with the manufacturer's specifications. Airflow should be a minimum of 350 CFM per ton.

Best Practice: Heat Pump Water Heaters

If ducting is installed, apply duct insulation and a vapor barrier, or use suitable plastic ducting, to prevent condensation formation on ductwork. If exhaust air only is ducted outside of conditioned space, contractor should ensure combustion appliances are functioning properly and safely and a carbon monoxide alarm should be installed in the home if combustion appliances are present.

Installed ducting should be done to manufacturer's specifications, with manufacturer-approved parts.

Avoid installations near bedrooms or living rooms; if unavoidable, consider using noise dampening features in the space or isolate vibration if noise is a concern. Also consider homeowner comfort impacts of cold air exhaust.

Refer to manufacturer's specifications for efficient mode operation.

Demonstrate filter access and maintenance to homeowner.