

VT TEC Manual—Appendix M: Mobile Home Policies & Procedures

Non-Energy Saving Measures Including Health & Safety Measures

- A. All protocols regarding safety devices as outlined on Section 4, Pages 6 & 7 of the Technical Policies and Procedures Manual (TEC Manual) shall be met.
- B. By conclusion of a MHPL eligible project there shall be no visible signs of active operational defect or imminently dangerous conditions—including any active signs of spillage or flame rollout—with any combustion appliance, flue pipe or SRJ assembly/roof wedge.
- C. All combustion appliances shall pass all relevant combustion testing procedures and all appropriate spillage and draft tests performed at the worst-case scenario.
- D. All combustion appliances must be equipped with a provision of combustion air from the outdoors. The conduit delivering combustion air from the outdoors must be unobstructed and continue to the exterior of the building shell.
- E. Whenever there is a door located in front of the furnace/furnace closet that can be closed, the air handler must be engaged for an additional pressure imbalance test and any necessary modifications shall be performed to pass this test in accordance with protocols outlined below.

Mobile Home Pressure Imbalance Testing

--This is not a worst-case testing procedure.

--This test is important with furnaces that have no return side distribution system.

Test Set Up & Instruction: The house must be put into winter mode with exterior doors and windows closed during this test. Air conditioners shall be either removed from windows or the air conditioner/window area shall be sealed over with plastic and painters tape or equivalent materials. No other exhaust appliances (fans, dryers, etc.) should be running during this test. With the mobile home in winter mode set up a digital pressure gage to operate in pressure/pressure mode. One of the hoses should be attached to a pressure tap and run into the mobile home furnace closet (CAZ). The other pressure tap on the same channel does not need a hose attached to it as long as the digital gage itself is physically located in the hallway outside of the furnace closet. At this point the setup of the building and the digital gage will enable a measurement of the pressure difference between the furnace closet (CAZ) and the hallway. Turn on the furnace air handler and close the door to the furnace closet. Record the pressure difference indicated on the gage.



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Mobile Home Pressure Imbalance Testing (*continued*)

Action Levels: To avoid excessive pressure imbalances within the home and ensure that adequate return air is getting back to the furnace, the difference in pressure across the closed door cannot exceed 7 PA. If the pressure difference across the door is greater than 7 Pa with the air handler running then corrective actions shall be taken to lower the number before a weatherization project can be closed. If results are within the 5 - 7 Pa range corrective actions are strongly recommended, but are not required.

Corrective Action Strategies: The recommended actions to alleviate the excessive pressure difference between the CAZ and the rest of the home are installing louvered grills into the door (or into a partition wall between the CAZ and rest of the home), undercutting the door or completely removing the door. If opting to completely remove the door in order to pass this test, all hinges and hardware must also be removed from the door opening.

Mechanical Ventilation

The following policies shall be adhered to on all MHPL eligible projects.

Ventilation (*Any purpose*):

- A. Under no circumstances shall any mechanical ventilation device that has a rated capacity from the device manufacturer greater than 80 cfm be installed in a mobile home unless intentional modifications will be performed by the installer to reduce the actual measured fan flow below 80 cfm. This applies to devices installed for either local or whole building ventilation purposes.
- B. All protocols regarding venting materials & installation specifications for exhaust fans shall be met as outlined in Appendix E of the TEC Manual.
- C. All protocols regarding venting material & installation specifications for clothes dryers shall be met as outlined in Appendix E of the TEC Manual.

Local Ventilation: All local ventilation requirements are applicable regardless of whether or not there is a determined need for whole building ventilation in a MHPL eligible project.

By conclusion of a MHPL eligible weatherization project, a minimum of one functional exhaust fan per mobile home shall be present for local ventilation purposes AND the minimum operational local ventilation capacity in each mobile home shall be 30 cfm.

The minimum local ventilation capacity in a mobile home is 30 cfm—total—for the entire home. Any operational exhaust fan inside the mobile home can contribute toward this total. Existing ventilation capacity must be determined with actual measured fan flow readings. Ventilation capacity cannot be determined by estimating fan flow or be based on a fans rated capacity from the manufacturer.



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Mechanical Ventilation (*continued*)

Local Ventilation: It is recommended to have a working exhaust fan in the kitchen whenever a gas oven is present in a mobile home. However, the benefits of installation should be weighed against other factors in the household. In general, when evaluating existing fan flows and planning for enhanced mechanical ventilation solutions in any mobile home, extra care should be taken to avoid installing excessive ventilation capacity and unintentionally creating an environment where the combustion appliances are no longer able to pass worst-case spillage and draft tests.

Whole Building Ventilation: All whole building ventilation requirements as outlined in Appendix E shall be met during each MHPL eligible project.

Mobile Home Duct Evaluation & Improvement Measures

Visual inspection of the mobile home ducts and performance of blower door assisted pressure diagnostic testing is required during every MHPL project.

With the blower door running and the interior of the mobile home at -50 Pa with reference to the outside, a pressure pan test must be completed on every register in the home. By conclusion of a mobile home project the test result at each register shall indicate 1.5 Pa or less or a written statement explaining why this result is not practical to attain is to be documented and maintained in the file.

The requirement to perform the pressure panning at each individual register and to document the results is applicable during the energy audit, by the installation crew (after improvements have been completed) and again at the QCI.

Metal, mesh tape, and mastic are the only allowable materials for performing the repairs to mobile home duct boots and risers. Use of tapes is not allowable with the exception of mesh tape used in tandem with duct mastic. If existing tapes are present (duct tape, foil tape, etc.) the existing tape must be stripped from the ducts before attempting to do any repairing/sealing work.

In addition to evaluating and improving each duct boot and riser, the furnace base to trunk connection shall be accessed, sealed, and verified not to leak air during every mobile home project.



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Mobile Home Duct Evaluation & Improvement Measures (*continued*)

If there are crossover ducts (or air conditioning ducts below the belly material) the following order of operations shall be followed:

1. Evaluate the condition of the cross over ducts during every energy audit
2. Repair is required if there are any damaged sections
3. Replace instead of repairing whenever replacement is likely to be most economical and will enable a more durable and long-lasting installation
4. Whenever a section of ductwork is replaced it must be with rigid duct materials rather than flexible duct materials.

All existing crossover ducts shall be insulated to R - 4 minimum by the conclusion of a mobile home project. All WAP installed sections of crossover ducts shall be insulated to R - 6 minimum.

Installing foam board between the ground and any cross-over/air conditioning ducts in low-to-no ground clearance installation scenarios is strongly encouraged, but is not required practice.

Mobile Home Heating Appliances

Furnaces/Central Heating

Installations & Replacements: Whenever a mobile home furnace/central heating system is being installed during a weatherization project AND the heating system utilizes propane or natural gas the appliance shall be:

- A. A Category IV Appliance
--designed for production of condensate and positive draft pressure
- B. A Sealed Combustion Appliance

Written permission from OEO must be attained prior to the installation of any other category or type of central heating system for MHPL eligible projects when the fuel source is propane or natural gas.

Primary v. Secondary Heating Appliances

Investment Allowances: It is allowable to invest more weatherization funding into the primary heating system than into those deemed secondary heating appliances. With secondary heating appliances in mobile homes, improvement expenses are to be capped at \$350.00 (in direct onsite costs only) unless written permission to exceed this amount is granted by OEO for a particular case.



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Mobile Home Heating Appliances (*Continued*)

Primary v. Secondary Heating Appliances

Determination of Primary System: The energy auditor has discretion in determining the primary fuel source and which appliance is to be deemed the primary heating source for each mobile home project.

Things that should be considered in making these determinations that extend beyond historical consumption records include:

- a) If there is more than one heating appliance do they ever run at the same time or are they only used one at a time
- b) If making a choice between multiple heating options does become necessary which heater does the client prefer to use and why
- c) If a fuel assistance benefit is received what fuel source is the benefit associated with
- d) The working condition of all heating appliances in home
- e) The projected cost to get each appliance operating reliably and safely

Note that if there is no fuel and fuel is needed in order to make informed decisions (specifically with regards to considerations d) and e) as listed above) then fuel can be provided by WAP when it represents the only way to get a heater operational for testing and evaluation purposes. A somewhat common example is when a household is burning wood while the auditor is working through a project on behalf of a client, the fuel tank for the furnace is empty and an informed decision is needed about whether or not to put a significant investment into the wood stove or the mobile home furnace.

Wood Stoves

OEO does not encourage the practice of having weatherization clients remove/disconnect all wood stoves automatically. However, the disconnection of an appliance and the capping of an opening into a chimney or flue is allowable on a case by case basis if the appliance condition and setup are imminently dangerous and weatherization work cannot safely proceed until the safety hazard is removed.

It is allowable to make situational modifications (ex. put non-flammable material underneath and around the stove itself or the flue pipe for heat shielding purposes) and to improve all (or sections of) the venting materials with WAP funding.

Whenever a new/replacement wood stove is installed during a WAP project it must be a mobile home approved stove.



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Mobile Home Water Heaters

If a pre-existing water heater is non-mobile home approved but there are no visible defects, signs of spillage, flame rollout, the flue pipe appears in good condition, there is a provision of combustion air from the outdoors and the results of combustion testing are acceptable:

1. Perform legitimate spillage and draft tests at worst-case and attain passing results

-or-

2. When the layout of the mobile home prevents completion of a true worst-case draft test. *For example there is an exterior access panel to the water heater closet.*

- a) Complete a full combustion test

-and either-

- b) Verify complete separation between the living space and water heater closet with blower door assisted smoke and/or pressure diagnostic testing methods

-or-

- b) Install a spill switch to provide an additional margin for error if the appliance was ever to back draft.

If the conditions outlined above can be satisfied then water heater replacement is not required by VT WAP regardless of whether or not the existing model is non-mobile home approved.

If however, the conditions outlined above are not satisfied then replacing the preexisting water heater with WAP funding is acceptable.

Whenever a water heater is installed during a weatherization project the new appliance shall be mobile home approved.



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Prioritized Airsealing in Mobile Homes

Top of Building

All holes, penetrations and voids in the mobile home ceiling shall be airsealed as needed to enable blown-in roof insulation to be installed without unnecessarily getting into the home.

Bottom of Building

Sealing the Belly Material: All holes, penetrations and voids in mobile home belly materials shall be sealed tightly in a durable manner.

Sealing the Floor, Floor Sheathing & Penetrations Underneath Cabinets: All holes and penetrations through the mobile home floor sheathing—that can be accessed from above—shall be sealed tightly to keep blown insulation from getting into the home during installation.

Note that it is not recommended to cut into/through the belly materials to airseal the floor sheathing from below unless significant deficiencies are identified AND working from underneath the home will be the most effective way to make improvements.

Example scenarios include:

- a) An example of a specific deficiency at the floor sheathing that may be worth accessing and improving from below would be a large opening through the floor underneath a tub or shower in the area around the p-trap assembly and plumbing lines.
- b) An example where cutting into/through mobile home belly materials that are in a good working condition would not be recommended would be in order to gain access for airsealing work around small wire penetrations up through the floor system.

Sides of Building

Water Heater Closets with Exterior Access Panels: A foam-insulated-panel that is protected from the elements and that provides a tight air seal when closed shall be installed whenever there is an exterior access panel to a mobile home water heater closet. This measure is the only prescriptively required measure targeting the sides of mobile homes included within the MHPL.



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Prioritized Airsealing in Mobile Homes (*Continued*)

Water Heater Closets with Exterior Access Panels

Recommended Approach: It is strongly recommended to modify the rough opening (and install weather-stripping as needed) to accommodate the installation of a sandwich-door style access panel.

Minimum Standard: At minimum, this access panel must be assembled similar to an attic hatch. A layer of sheathing must be directly bonded/fastened to at least one side of the foam board in a manner that ensures air cannot freely infiltrate and move through the space between the foam board and the layer of sheathing. The foam board insulation is to be as thick as is possible depending on the available clearance between the panel and the water heater tank.

Non-Compliant Approaches: Please note that the practice of friction fitting foam board insulation into the rough opening of this access point to the water heater closet does not meet this standard and represents a non-allowable installation.

Alternate Approach: Attaching foam board directly to the back side of an existing mobile home access panel does not fully comply with this standard alone but it can be an allowable part of the improvement measure performed in this area. In order to fully meet the acceptable minimum standard for this improvement measure, foam board would need to be bonded/fastened to a preexisting access panel in a manner where no air could freely infiltrate and move through the space between the foam board and the access panel. Then, a layer of sheathing would need to be bonded/fastened to the other side of the foam board in the same manner.

Other Improvement Measures Targeting the Sides of a Mobile Home

All other generalized improvement measures targeted at the sides of mobile homes are to be considered optional measures. These potential improvement measures shall only be pursued and installed by weatherization technicians after all required MHPL improvement measures have been completed in full.



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Prioritized Airsealing in Mobile Homes (*Continued*)

Order of Operations

After all required MHPL measures have been completed in full:

1. Perform Diagnostic Testing
 - a. At this point in the weatherization process/project, performing spillage and draft tests for all combustion appliances is required.
 - b. Performing a blower door test is also required at this point in the weatherization process/project.

2. Take Action Based on Test Results

If all combustion appliances in the mobile home easily pass spillage and draft tests at the worst-case scenarios AND if the building is still above the minimum tightness limit at this point of a MHPL project then additional generalized weatherization measures can be performed and are recommended up to the point where one of the three things outlined below happens.

- a. Reductions of 100 CFM50 per technician hour worked are no longer achievable
- b. The home reaches the minimum tightness limit
- c. The appliances in the home are no longer able to pass spillage and draft tests at the worst-case scenario

Common examples of recommended and optional airsealing points to consider include:

1. The merger point running along the top center of a double wide mobile home
2. Surfaces backing an attic space when there are split level ceilings in a mobile home
3. The joint between the top of a mobile home exterior wall and the mobile home ceiling
4. Window and door weatherstripping/sweeps
5. Installation of tyzalls or interior storms
6. Installation of window clips or fasteners
7. Generalized airsealing around windows and doors
8. Generalized airsealing at window and door rough openings or trim
9. Generalized airsealing at the joint of the floor to bottom of an exterior wall
10. Generalized airsealing of wall paneling/sheathing
11. Generalized airsealing at/around wall outlets



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Mobile Home Belly/Floor Systems

Belly Sealing: Expectations for all belly types and designs

By conclusion of a MHPL project, all holes, tears, voids in the mobile home belly material shall be completely sealed in a durable manner. Use of tape is not allowable for belly sealing purposes.

Perimeter of Belly/Floor System: Expectations for all belly types and designs

The entire perimeter of the belly/floor system shall be filled to the maximum capacity possible using either chopped fiberglass or cellulose insulation.

Center of Belly/Floor System: Expectations varied by design type

The center sections of the belly/floor system shall be weatherized in accordance with the policies outlined below for the most comparable belly/floor system type and design to that found on each individual project.

--**Belly Type A:** Joists run crossways. Wings/outrigger section of belly is flat. Center belly sags/rounded bottom.

The center belly section must have an average “effective” R-19 minimum by the conclusion of the project. When adding blown insulation to achieve an average “effective” R-19 minimum into a center belly section, the blown insulation shall not be densepacked. This is to be a loose-filled installation only.

--**Belly Type B:** Joists run crossways. Wings/outrigger section of belly is flat. Center belly is flat but dropped down lower making a deeper cavity in the center section than out on the wings.

The center belly section must have an average “effective” R-19 minimum by the conclusion of the project. When adding blown insulation to achieve an average “effective” R-19 minimum into a center belly section, the blown insulation shall not be densepacked. This is to be a loose-filled installation only.

--**Belly Type C:** Joists run longways. Wings/outrigger section of belly is flat. Center belly is flat.

The entire center-belly section shall be blown to full capacity with chopped fiberglass or with cellulose, except for the section directly underneath the ductwork. No insulation shall be intentionally blown into the section directly underneath the ductwork even if space allows. Instead, foam board shall be installed underneath the ductwork/belly material to an R-10 min. effective value in this area.



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Mobile Home Ceilings/Roof Systems

Typical Mobile Home Roof Designs

By conclusion of each mobile home project every ceiling/roof system section shall be insulated to a minimum, average “effective” value of R-40. If an average effective value of R-40 is not possible due to space limitations between the ceiling and the roof then each ceiling/roof system section shall be filled with insulation to the maximum capacity possible.

Mobile Home with Roof-Over

Whenever there is a roof-over that allows for physical access into the attic space between the two roof lines then the original roof cavity shall always be sealed and insulated prior to adding any additional insulation over the top of the original roof.

If there is already batt-insulation over the original roof a perimeter-pull shall be done on all sides. Additional blown insulation must be added to achieve a minimum “effective” R-40 value throughout the roof/attic area everywhere that the roof clearance allows for an “effective” R-40 to be attained.

Mobile Home with Split-Level Ceilings

In mobile homes with split-level ceilings, the interior walls backing up to attic space shall not be insulated with fiberglass batting if the space is physically accessible. The wall sections can be spray foamed with closed cell spray foam, insulated with foam board, densepacked with cellulose or blown to full capacity with chopped fiberglass. Any existing fiberglass batting must be removed prior to installing any of these allowable materials.



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Summary of Recommended v. Required Mobile Home Action Items

Summary Descriptions	Recommended	Required
Boxing-in pressure tanks, well pumps or other mechanicals found between the ground and mobile home belly material is:	X	
Adding pipe insulation to water lines found between ground and mobile home belly material is:	X	
Whenever additional air is provided to the home in order to alleviate excessive CAZ depressurization by cutting through the floor, the ducting is to be continuous from the floor opening to and through the skirting and the ducting must be sealed and insulated. The floor opening cannot be directly open to the crawlspace underneath the mobile home.		X
For an existing heating system in a mobile home, the installation of solid flue pipe, solid offsets or sweeps is:	X	
For an existing heating system in a mobile home where there are adjustable venting materials present instead of solid flue pipe, solid offsets or sweeps then at minimum the application of high-temperature rated sealant to all seams/joints in the venting materials is:		X
For a new heating system installed by WAP the installation of solid flue pipe, solid offsets or sweeps is:		X
Measuring actual exhaust fan flow at an energy audit is:		X
Measuring actual exhaust fan flows at the quality control inspection is:		X
Ensuring that the total measured fan flow in every mobile home meets or exceeds 30 cfm capacity for spot ventilation purposes is:		X
The installation of any exhaust appliance in a mobile home with a rated capacity from the manufacturer exceeding 80 cfm is not allowed unless intentional modifications will be performed by the installer to reduce the actual measured fan flow below 80 cfm:		X

