

## Section 7: Mechanical Ventilation

### Mechanical Ventilation Standards

#### ASHRAE 62.2-2016 | General Compliance Expectations by Funding Source

- All weatherization projects shall comply with ASHRAE 62.2-2016 for all DOE funded WAP projects without exception.
- All weatherization projects shall comply with ASHRAE 62.2-2016 for all Non-DOE funded WAP projects unless written OEO approval to omit specific measures on an individual job is attained and then recorded in the HES job file using the "Atypical Project Approval" form.

#### If it moves air - measure it!

All ventilation capacity determinations must use actual measured fan-flow readings.

No ventilation capacity determinations can use fan-flow estimates or capacity ratings from product manufacturers.

Actual fan-flow readings are required before and after the WAP project.



### Local Ventilation Requirements

By the conclusion of every Vermont WAP project, a minimum of one operational exhaust fan equivalent shall be present in the home to provide local ventilation. A one operational exhaust fan equivalent is defined as 30 cfm measured fan-flow. Any exhaust fan inside the home can contribute toward the minimum local ventilation requirement of 30 total cfm. This local ventilation capacity requirement is in effect on Vermont WAP projects even when there is zero determined need for dwelling-unit ventilation based on the ASHRAE 62.2-2016 local ventilation alternative compliance path calculations.

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#### Dwelling-Unit Ventilation Requirements



Dwelling-unit ventilation requirements shall be calculated using the ASHRAE 62.2-2016 version of the RED Tool located at:

<http://www.residentialenergydynamics.com/REDCalcFree/Tools/ASHRAE6222016>

- ✓ The local ventilation alternative compliance path shall be used to determine dwelling-unit ventilation requirements.
- ✓ The nearest weather station shall be used. (*The use of weather stations located outside of Vermont is allowed when an out-of-state weather station is the closest weather station*).
- ✓ The definitions included at the end of this TEC Manual section—titled, “Four Key Factors that Determine Mechanical Ventilation Requirements”—shall be used solely for the purpose of determining the mechanical ventilation requirements of dwelling units. These four definitions shall not be used for any other program purpose.
- ✓ Actual measured fan-flows shall be used.

Dwelling-unit ventilation can be met with continuously operating devices or with intermittently operating devices that are intentionally programmed to operate in compliance with the ASHRAE 62.2-2016 standard.

#### Dwelling-Unit Ventilation | CFM Installation Compliance Expectations by Funding Source

-  On Non-DOE funded projects only, the installation of the dwelling-unit ventilation requirements as specified by the ASHRAE 62.2-2016 RED Tool is *optional* whenever the dwelling-unit ventilation requirement is  $\leq 30$  cfm.
-  On DOE funded projects only, the installation of the dwelling-unit ventilation requirements as specified by the ASHRAE 62.2-2016 RED Tool is *optional* whenever the dwelling-unit ventilation requirement is  $\leq 15$  cfm.

#### Testing & Documentation Requirements - When

There are 2 required versions of the RED Tool File to save/upload to each HES job file.

1. **The Energy Audit Version** | A version documenting all on-site conditions found before the WAP project, including the actual measured existing fan-flows and the initial blower door reading.
2. **The QCI Version** | A version documenting all on-site conditions found after the WAP project, including the actual measured fan-flows and the final blower door reading.

An additional version of the RED Tool File is recommended, but not required, to be saved/uploaded to HES.

**The Best Guess Version** | A version prepared before the project begins that estimates what the final onsite conditions will be after the full scope of WAP work is installed, including the estimated fan-flow measurements and an estimate of the blower door reading that will be achieved at project completion.

#### Testing & Documentation Requirements - Where

All test results must get entered into the ASHRAE 62.2-2016 RED Tool. Each completed version of the RED Tool file shall be labeled clearly in the HES job file so it's obvious to anyone whether the information shown for each file version is from the beginning *or* the ending of the project (*or* if it's the “Best Guess” version of the RED Tool file). All of the completed RED Tool files shall be saved/uploaded to each HES job file.



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#### Mechanical Ventilation Installations in Wet and/or Unfinished Basements



Mechanical, exhaust-only ventilation systems shall not be installed using WAP funding in any wet and/or unfinished basement/crawlspace areas as a remedy to moisture problems or bulk water intrusion issues.

#### Exhaust Fans | Venting Material & Installation Specifications

All exhaust fans must be vented to the exterior of the building shell in the manner outlined below by the conclusion of every WAP project. This includes (a) fans that were already in place before, and (b) fans that were installed during the WAP project.



- ✓ Rigid, smooth wall vent pipe (PVC or metal piping) shall be used whenever possible.
- ✓ Flexible vinyl/flexible plastic ducts shall not exist on any portion of a vent run.
- ✓ Flexible aluminized or semi-rigid metal venting materials are only allowed (a) if the installation of rigid materials is not possible, (b) as a short ( $\leq 2$  lin. ft. ) takeoff connecting the fan to a rigid, smooth-wall, vent pipe, or (c) as a short ( $\leq 2$  lin. ft. ) transition connecting the end of a rigid, smooth-wall vent pipe to an exhaust hood.
- ✓ All seams in the vent run must be sealed together in a durable fashion.
- ✓ Whenever possible a 1/8" to 1/4" pitch down toward the exhaust outlet at the exterior building shell shall be maintained on horizontal runs of vent piping to minimize the potential for condensation to form and drip back toward the exhaust fan.
- ✓ All vent piping sections located outside of the thermal envelope shall be insulated to R-8 or better. FSK-faced fiberglass, or comparable, is the recommended material choice for this installation whenever the venting materials cannot be fully encapsulated with loose-fill insulation materials. Use of foil-faced bubble-wrap materials is not allowable for this purpose. Use of spray foam insulation is allowable for this purpose.



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#### Clothes Dryers | Venting Material & Installation Specifications

All clothes dryers must be vented to the exterior of the building shell in the manner outlined below by the conclusion of every WAP project.

- ✓ Smooth-wall metal vent pipe shall be used whenever possible.
- ✓ PVC piping shall not exist on any portion of a dryer vent run.
- ✓ Flexible vinyl/plastic ducts shall not exist on any portion of a dryer vent run.
- ✓ Flexible aluminized or semi-rigid metal venting materials are only allowed (a) if the installation of smooth-wall metal vent pipe is not possible, (b) as a short ( $\leq 2 \text{ lin. ft.}$ ) takeoff connecting the dryer to a smooth-wall metal vent pipe, or (c) as a short ( $\leq 2 \text{ lin. ft.}$ ) transition connecting the end of a smooth-wall metal vent pipe to an exhaust hood.
- ✓ Dryer vent pipe sections shall not be screwed together.
- ✓ All seams in the vent run shall be foil-taped. This is one of very few WAP measures where use of tape is acceptable and encouraged practice.
- ✓ Whenever possible, a 1/8" to 1/4" pitch down toward the exhaust outlet at the exterior building shell shall be maintained on the final horizontal section of the vent run that connect directly to the exhaust hood. This installation detail helps minimize the potential for condensation to form and collect in the vent piping.
- ✓ All vent piping sections located outside of the thermal envelope shall be insulated to R-8 or better. FSK-faced fiberglass, or comparable, is the recommended material choice for this installation. Use of foil-faced bubble-wrap materials is not allowable for this purpose. Use of spray foam insulation is allowable for this purpose.

### Four Key Factors that Determine Mechanical Ventilation Requirements

#### Key Factor # 1 | Floor Area

Solely for the purpose of determining the mechanical ventilation requirements of dwelling units, Vermont's WAP adopts the ASHRAE 62.2-2019 definition of floor area\* with the following add-on policy language:

**"Unfinished below-grade, occupiable areas inside the pressure boundary"** shall be defined as an area with a 7 ft. or greater ceiling height and where the insulation value of the boxesill/bandjoist and foundation walls—extending down from the outer subflooring to a point 2 feet below grade level—is R-11 or greater.

**\*The Official Definition of Floor Area in the ASHRAE 62.2-2019 standard is below:**

All above- and below-grade finished areas as defined in ANSI Standard Z765, except that **unfinished below-grade, occupiable areas inside the pressure boundary** shall be included as floor area.



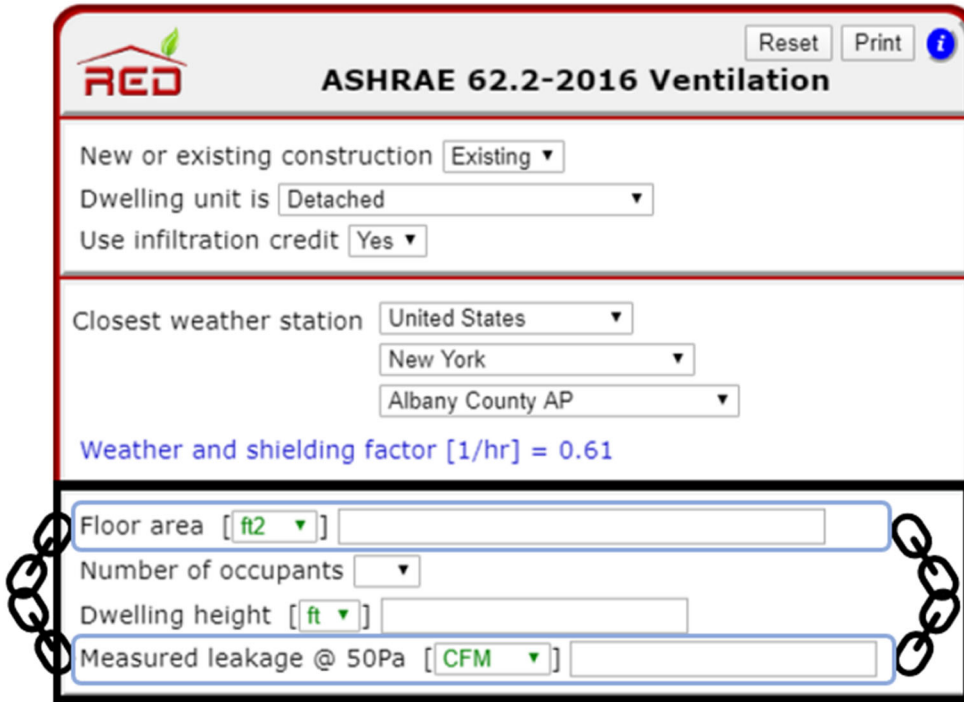
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##### Key Factor # 2 | The Blower Door/CFM50 Result

The Floor Area entry must always link to the blower door testing setup that needs to be used and the Blower Door/CFM50 Result that needs to be entered into the ASHRAE 62.2-2016 RED Tool for purposes of determining the mechanical ventilation requirements of dwelling units



In actual practice, this usually means that when there is a door leading from the main living space down into a basement/crawlspace, two different blower door readings are taken. One test gets taken with the door to the basement opened. Another test gets taken with the door to the basement closed. The blower door reading taken with the basement/crawlspace door in the position that most closely links to the Floor Area entry is the result that must be entered into the ASHRAE 62.2 Red Tool. In other words:

- If the Floor Area entry in the Red Tool **excludes** a basement/crawlspace, then the door separating the living space from that basement/crawlspace must be closed when the blower door reading that gets entered into the Red Tool gets taken.
- If the Floor Area entry in the Red Tool **includes** a basement/crawlspace, then the door separating the living space from that basement/crawlspace must be opened when the blower door reading that gets entered into the Red Tool gets taken.

The visual above is taken from the ASHRAE 62.2-2016 RED Tool. The chains have been added to emphasize the link that we are required to make between the Floor Area entry & the Blower Door/CFM50 entry.





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##### Key Factor # 3 | Number of Occupants

The bigger number out of the two possibilities below **shall** be entered into the ASHRAE 62.2-2016 Red Tool for purposes of determining the mechanical ventilation requirements of dwelling units:

1. The Number of Bedrooms + One  
*or*
2. The Actual Number of Occupants Residing in the Dwelling Unit

The screenshot shows the 'RED' tool interface for ASHRAE 62.2-2016 Ventilation. It includes a header with 'Reset', 'Print', and an information icon. The main form is divided into several sections: 'New or existing construction' (Existing), 'Dwelling unit is' (Detached), 'Use infiltration credit' (Yes), 'Closest weather station' (United States, New York, Albany County AP), and 'Weather and shielding factor [1/hr] = 0.61'. The bottom section contains input fields for 'Floor area [ft2]', 'Number of occupants', 'Dwelling height [ft]', and 'Measured leakage @ 50Pa [CFM]'. The 'Number of occupants' field is highlighted with a blue border.



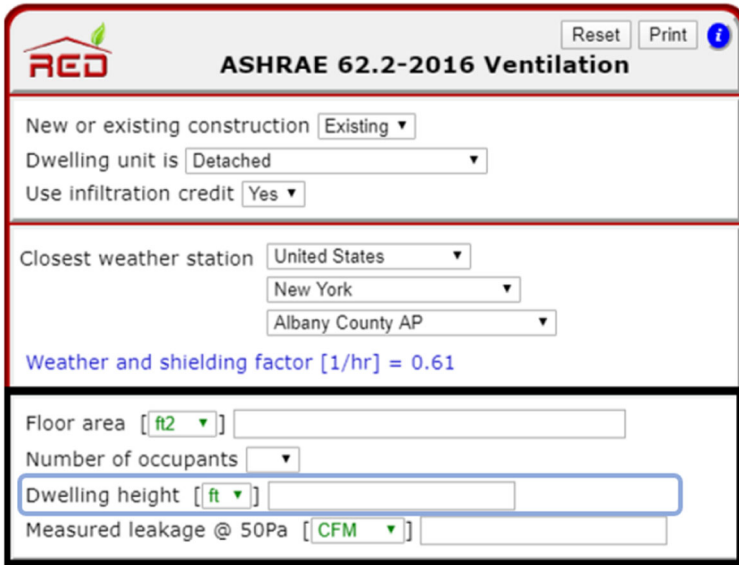
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##### Key Factor # 4 | Dwelling Height

The total vertical distance between the lowest and the highest above grade points of the building—within the pressure boundary—shall be entered into the ASHRAE 62.2-2016 Red Tool as the Dwelling Height for purposes of determining the mechanical ventilation requirements of dwelling units:



The screenshot shows the 'ASHRAE 62.2-2016 Ventilation' tool interface. It includes a 'Reset' and 'Print' button at the top right. The main form contains several dropdown menus and input fields:

- New or existing construction: Existing
- Dwelling unit is: Detached
- Use infiltration credit: Yes
- Closest weather station: United States, New York, Albany County AP
- Weather and shielding factor [1/hr] = 0.61
- Floor area [ft<sup>2</sup>]: [input field]
- Number of occupants: [input field]
- Dwelling height [ft]: [input field]
- Measured leakage @ 50Pa [CFM]: [input field]

Below is a clarifying note about basements related to Dwelling Height entries that we hope will be useful:

Lots of basements in Vermont have uninsulated foundation walls but those basements are still considered to be within the pressure boundary. It is common for approx. two feet of the foundation walls in basements like this to extend above grade-level.

In these basements, you need to **exclude** the basement square footage in your ASHRAE 62.2-2016 Red Tool entry for Floor Area but you need to **include** the two feet of above-grade foundation walls in your ASHRAE 62.2-2016 Red Tool entry for Dwelling Height.

