CHAPTER 9: VENTILATION

This chapter discusses ventilation, fans, termination fittings, ducts, and passive vents.

This chapter covers these 4 types of ventilation.

1. Local ventilation
2. Whole-dwelling ventilation
3. Attic and crawl space ventilation
4. Ventilation for cooling

9.1 POLLUTANT CONTROL

Controlling pollutants at the source is the highest priority for good indoor air quality. Mechanical ventilation dilutes pollutants. However, ventilation is ineffective against prolific sources of moisture and pollutants. Ask these questions to evaluate pollution sources.

- Do the occupants have symptoms of dwelling-related illnesses?
- Do sources of moisture like ground water, humidifiers, water leaks, or unvented space heaters cause indoor dampness, high relative humidity, or moisture damage?
- Are there combustion appliances, especially unvented ones, in the living space?
- Do the occupants smoke?
- Are there paints, cleaners, pesticides, gas or other chemicals stored in the home?

9.1.1 Pollution-Control Checklist

Survey the home for pollutants before air-sealing or ventilating the home. Perform the following pollutant-control measures if needed.

- ✓ Repair roof and plumbing leaks.
- ✓ Install a ground-moisture barrier over bare soil in crawl spaces or dirt-floor basements.
- ✓ Verify that dryer ducts and exhaust fans move exhaust air to the outdoors.
- ✓ Verify that combustion-appliance vent systems operate properly.
- ✓ Move paints, cleaning solvents, and other chemicals out of the conditioned space if possible.
- ✓ Air seal between attached garages and a dwelling's conditioned areas.
- ✓ Don't leave un-vented space heaters as a primary heat source.

The dwelling's occupants are often the source of many home pollutants, such as candles, deodorizers, and pesticides. Educate the residents about minimizing such pollutants in their dwellings.

Note: Ventilation specialists now use the term "dwelling" to describe either a single-family home or multifamily living unit, ASHRAE 62.2–2016 now applies to both single-family and multifamily dwellings.

9.2 ASHRAE Standard 62.2–2016 Ventilation

Most dwellings in North America currently rely on air leakage for ventilation. The American Society of Heating, Refrigerating, and Air Conditioning Engineers (ASHRAE) publishes ventilation standards for dwellings.

Their current standard, ASHRAE 62.2–2016, defines the roles and minimum requirements for mechanical and natural ventilation systems and the building envelope. The roles and requirements intend to provide acceptable indoor air quality in residential buildings.

9.2.1 ASHRAE 62.2–2016 Components

If you air seal dwellings during weatherization, you may need to install whole-dwelling mechanical ventilation systems under ASHRAE 62.2–2016, which has 3 components.

1. Whole-dwelling ventilation.
2. Local ventilation.
3. Natural infiltration credit.

This ventilation standard allows for natural infiltration (air leakage) to contribute toward the required whole-dwelling ventilation rate for single-family homes and horizontally attached multifamily buildings (but not vertically attached multifamily buildings.

9.2.2 Whole-Dwelling Ventilation Requirement

To comply with ASHRAE 62.2–2016, use either the formula or the table shown here to determine the whole-dwelling ventilation airflow requirement.

You can provide this mechanical airflow in 4 ways.

1. A dedicated exhaust or supply fan running continuously or cycling by automatic control.
2. A bathroom or kitchen exhaust fan running continuously or cycling by automatic control.
3. A central air handler drawing filtered outdoor air into its return.

4. A balanced ventilation system such as a heat-recovery ventilator (HRV) or energy-recovery-ventilator (ERV).

Room Pressure Imbalances

If any room in the building exceeds ±3 pascals pressure with reference to the common area when all interior doors are closed and while the ventilation system is operating, take action to reduce the pressure. Install transfer grilles or jumper ducts as needed to reduce the room to common area pressure difference to less than ±3 pascals.

Option 1: Finding the Airflow Requirement Using the Formula

If you want to install the minimum ventilation capacity, use these 3 steps to follow the formula option.

1. Determine the floor area of the conditioned space of the home in square feet (A_{floor}).
2. Determine the number of bedrooms (N_{br}).
3. Insert these numbers in the formula shown next.

$$\textbf{FAN AIRFLOW(CFM)} = 0.03A_{FLOOR} + 7.5(N_{BR} + 1)$$

From ASHRAE Standard 62.2-2016

Option 2: Finding the Airflow Requirement Using the Table

Note: If you know the number of occupants, compare the number of occupants with the number of bedrooms plus 1 and use the higher of those two values.

You can also determine the required continuous fan airflow under ASHRAE 62.2–2016 using the table shown here.

Table 9-1: Continuous CFM Fan Airflow Requirements

Floor Area (ft^2)	Number of Bedrooms				
	1	2-	3	4	5
Less Than 500	30	38	45	53	60
501-1000	45	53	60	68	75
1001-1500	60	68	75	83	90
1501-2000	75	83	90	98	105
2001-2500	90	98	105	113	120
2501-3000	105	113	120	128	135
3001-3500	120	128	135	143	150
3501-4000	135	143	150	158	165
4001-4500	150	158	165	173	180
4501-5000	165	173	180	188	195

From ASHRAE Standard 62.2-2016

Additional Ventilation Guidance

If the ventilation airflow requirement is less than 15 CFM, ASHRAE 62.2–2016 exempts the mechanical-ventilation requirement.

Residential Energy Dynamics provides a free online tool to help calculate ASHRAE 62.2–2016 ventilation rates.

Refer to the *ASHRAE standard* for more details, guidance, and exceptions that are beyond the scope of this field guide.

9.2.3 Local Exhaust Ventilation Requirement

There are two options for complying with the local ventilation requirements for kitchens and bathroom: demand-controlled exhaust or continuous exhaust.

1. For demand-controlled exhaust specify a minimum of 100 CFM for the kitchen, and 50 CFM for each bathroom. An operable window reduces a bathroom's ventilation requirement to 30 CFM.
2. For continuous exhaust specify a minimum of 20 CFM for each bathroom, and 5 ACH for the kitchen (based on volume).

Local Exhaust Deficit

If the existing kitchen or bathroom ventilation doesn't meet the requirements stated here, you may adjust the whole-dwelling ventilation rate to compensate for the local airflow deficits. Follow these steps to calculate the local-ventilation deficit in CFM that must be added to the whole-dwelling ventilation rate.

1. Determine the total local exhaust ventilation requirement for all kitchens and bathrooms.
2. Measure the delivered airflow of existing kitchen or bathroom exhaust fans using flow hood, flow grid, or other airflow measuring device. Subtract this amount from the total local exhaust ventilation requirement.
3. If the local jurisdiction allows for operable windows to provide for local ventilation, subtract 20 CFM for each kitchen or bathroom that has an operable window.

The result of these steps is the local exhaust ventilation deficit in CFM. Add $^1/_4$ of this deficit to the required whole-dwelling ventilation rate.

Measuring fan airflow: Use an exhaust-fan flow meter or a flow hood to verify the airflows through local exhaust fans and whole-building ventilation fans.

9.2.4 Infiltration Credit

ASHRAE 62.2–2016 allows for infiltration to contribute to the dwelling's ventilation airflow. Infiltration can supply the entire whole-dwelling ventilation requirement for very leaky buildings. For moderately leaky buildings, infiltration may supply some of the building's ventilation.

Both single-family and multifamily buildings that are horizontally attached (low rise) are eligible for the infiltration credit.

You can determine the amount of the infiltration credit with a blower-door test and weather data based on the building's location. Calculating the infiltration credit without software is complicated. To simplify the calculations, use the *RED Calc Free* online tool and select "yes" for the *"Use the infiltration credit"* option.

9.3 Fan and Duct Specifications

This section covers fan and duct specifications for both local ventilation and whole-dwelling ventilation. Duct sizing, materials, and installation determine whether airflow meets the design airflow rate (CFM). Most existing exhaust fans and ventilation systems don't achieve their design airflow because of installation flaws.