

# Michigan Energy Code Compliance Aid: Whole-House Ventilation

This compliance aid provides a summary of the ventilation requirements of the 2015 Michigan Energy Code (MEC) based on 2015 IECC. It compares them to the requirements found in the 2021 IECC on which the next iteration of the MEC is likely to be based. It is intended to help readers understand and meet these essential code requirements; and to help forward-thinking readers identify and achieve deeper energy savings, by adopting these construction project standards in advance of their being required by code. This compliance aid does not explain the MEC in its entirety. Readers are referred to the current MEC and foundational documents for complete details.

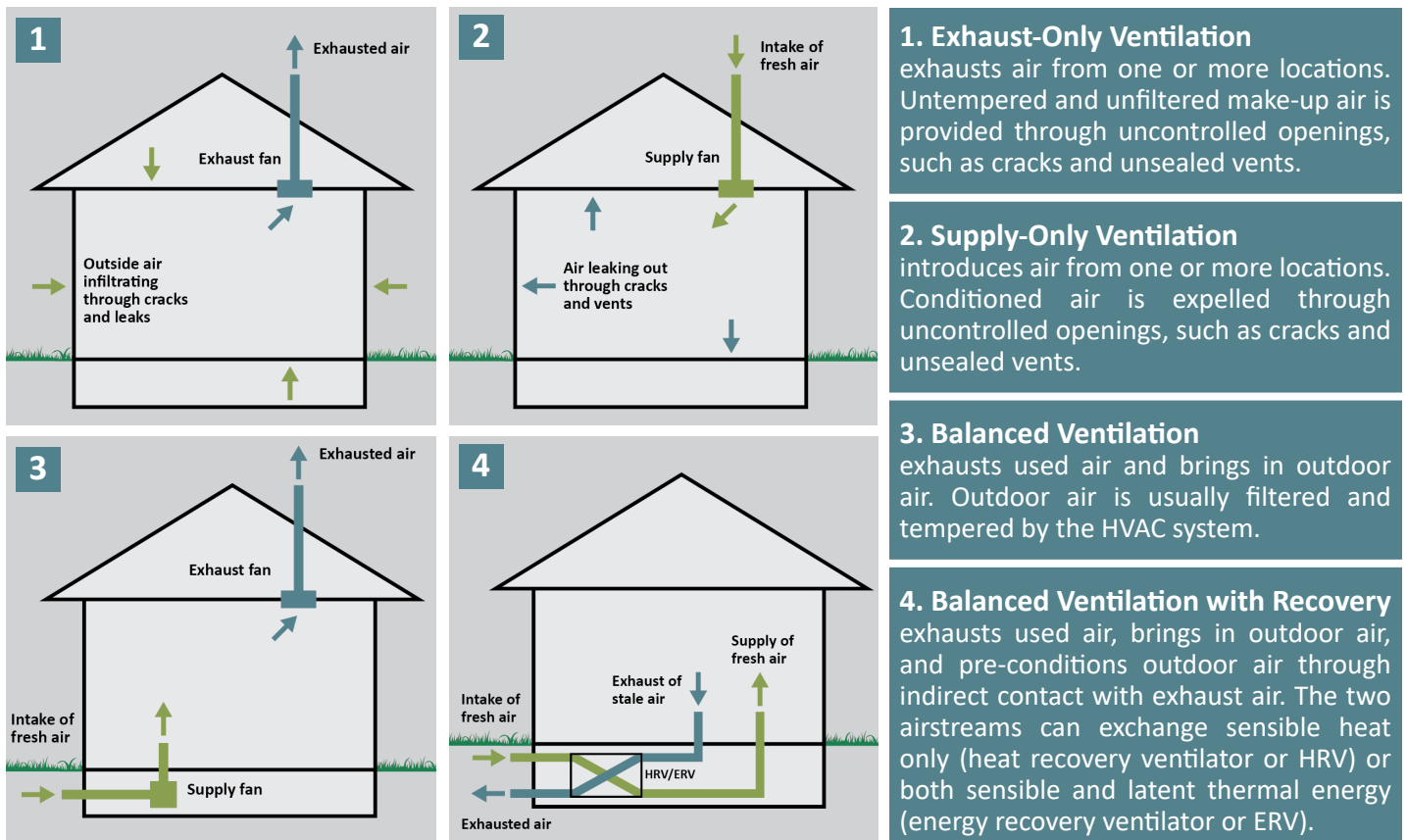
Good indoor air quality (IAQ) is essential to our health, well-being, and comfort. This is especially so in our homes, where we spend nearly one third of our time. When IAQ is less than acceptable, not only might we be uncomfortable, but we also increase our risk of exposure to infectious airborne transmissions and exacerbating chronic respiratory conditions such as allergies and asthma. One of the most effective ways to help ensure acceptable IAQ is through ventilation. According to the ASHRAE *Terminology of HVAC&R*, ventilation is “the process of supplying air to or removing air from a space for the purpose of controlling contaminant levels, humidity, or temperature of the air within the space.”

In addition to promoting health, maintaining good IAQ also helps protect the investments we have made in our homes. Uncontrolled moisture in the indoor air can cause condensation that could damage wood, drywall, and other materials over time. It can also lead to the growth of molds and fungi that damage the home and trigger or cause respiratory illness.

To help maintain acceptable IAQ in the home, the current Michigan Energy Code (2015 MEC) requires that new residential buildings be equipped with fans for mechanical ventilation. If desired, natural ventilation can still be used, but it must be in addition to forced-air ventilation. The residential provisions of the 2021 IECC also require mechanical ventilation, but differ from the 2015 MEC in some significant ways.

## What is Whole-House Ventilation?

Figure 1. Types of Whole-House Ventilation



# Ventilation Rates

2015 MEC §R403.5, 2015 MRC §M1507.3.3, 2021 IECC, and 2021 IRC §M1505.4.3

**Table 1. Single- and Multi-Family Local Ventilation Rates**

Local Area Exhausted	Minimum Air Flowrate (CFM)	
	Continuous	Intermittent
Kitchen	25	100
Bathrooms and Toilet Room	20	50

Whole-house ventilation is not restricted to houses. It applies to structures such as attached condominiums and apartments as well. Both the 2015 MEC and the 2021 IECC agree that for single- and two-family buildings, the ventilation can be either centralized to cover the whole house or local exhaust at the kitchen and bathrooms. In both cases the ventilation may be continuous or

intermittent. Intermittent flowrates must be greater than continuous flowrates so that contaminants can be removed quickly and room air can be promptly restored to an acceptable IAQ level. The same local ventilation rates are required by the 2015 MEC and the 2021 IECC. However, these rates are not found in the energy code, they are located in the mechanical and residential codes. The 2015 Michigan Mechanical Code aligns with the 2015 MEC and 2021 International Mechanical Code aligns with the 2021 IECC.

Whether the system is local or centralized, air exhausted from bathrooms is deemed to be contaminated. Therefore, the 2015 MEC does not permit it to be recirculated to any space within the dwelling unit or to another dwelling unit, especially crawlspaces and attics where any moisture in the air could create a local environment conducive to bacteria and other infectious agents or could damage exposed insulation. Because it is also potentially moisture laden and because it may contain particulates or fumes that one would not want circulated around the home, the 2021 IECC also requires this criterion of kitchen exhaust air from single- and two-family dwelling units.

**Figure 2. Bathroom, Toilet Room, and Kitchen Exhaust**

<b>2015 MEC</b>
Bathroom and toilet room exhaust air are NOT permitted to be recirculated to any space within the building, including attics and crawlspaces. It must be exhausted outdoors.
<b>2021 IECC</b>
Kitchen, bathroom, and toilet room exhaust air are NOT permitted to be recirculated to any space within the building, including attics and crawlspaces. It must be exhausted outdoors.



Ducted thru-the-wall kitchen exhaust fan takes moist air and fumes outside the home.

Data adapted from the 2015 MEC and 2021 IECC. Exceptions may apply. See source documents for complete details.

## Single- and Two-Family Dwelling Units

For single- and two-family houses as well as multi-family buildings with no more than three (3) stories above grade, the minimum mechanical ventilation rates, tabulated in the 2015 MEC, are based on the house conditioned floor area and the number of bedrooms. For example, a 2,500 ft<sup>2</sup>, 3-bedroom, single family house would have a minimum ventilation rate of 60 cfm.

The 2021 IECC offers these same tabulated values. However, it also offers the designer or builder the option of using the formula from which these values were derived. The formula, which originates from ASHRAE 62.2-2010, *Ventilation and Acceptable Indoor Air Quality in Low-Rise Residential Buildings*, is:

$$\text{Minimum Ventilation Rate (cfm)} = 0.01 \text{ cfm/ft}^2 \times \text{Floor Area}_{\text{conditioned}} + 7.5 \text{ cfm/bedroom} \times [\text{Bedroom Qty} + 1]$$

For example, a 2,500 ft<sup>2</sup>, 3-bedroom, single-family house would have a minimum ventilation rate of: 0.01 cfm/ft<sup>2</sup> x 2500 ft<sup>2</sup> + 7.5 cfm/bedroom x [3 bedrooms + 1] = 55 cfm

**Table 2. Excerpt of Single- and Multi-Family Continuous Whole-House Ventilation Rates**

Conditioned Floor Area, ft <sup>2</sup>	Number of Bedrooms		
	0-1	2-3	4-5
< 1500	30	45	60
1501 - 3000	45	60	75
3001 - 4500	60	75	90

Data excerpted from 2015 MEC Table M1507.3.3(1).

is:

## Multi-Family Dwelling Units

It is important to note that multi-family buildings with more than 3 stories above-grade have different ventilation rate requirements. Minimum ventilation rates for these multi-family dwelling units are established by the relevant code for commercial buildings. In this case, the minimum required ventilation rates are based on the space type and are:

**Table 3. Minimum Required Outdoor Ventilation for Multi-Family Dwelling Units**

Living Areas, Including Bedrooms		The greater of either: (a) 0.35 ACH or (b) 15 cfm/person
Kitchen		Either (a) 25 cfm continuous or (b) 100 cfm intermittent
Bathrooms and Toilet Rooms		Either (a) 20 cfm continuous or (b) 50 cfm intermittent
Attached Garage	Common	1.5 cfm/ft <sup>2</sup>
	Private	100 cfm/car

Data excerpted and adapted from the 2015 Michigan Mechanical Code.

## Intermittent Ventilation Rates



As with local exhaust systems, when whole-house systems operate intermittently, they must provide higher ventilation rates to compensate for the reduced operating hours. For every 4-hour period, intermittent systems must provide ventilation equivalent to what would be provided under continuous operation. So, for example, if the system were to run only half the time, then the intermittent ventilation rate would have to be twice the continuous rate. The system must operate at least 60 minutes in every 4-hour period. Some increased ventilation rates for intermittent operation are shown in Table 4.

**Table 4. Multipliers for Intermittent Whole-House Ventilation Rates for Single- and Two-Family Dwelling Units**

Run-time	1 in every 4 hours	2 in every 4 hours	3 in every 4 hours	Continuously
Alternate Expression of Run-time	15 minutes in every hour	30 minutes in every hour	45 minutes in every hour	Continuously
Minimum Ventilation Rate	4.0 x Minimum Continuous Rate	2.0 x Minimum Continuous Rate	1.3 x Minimum Continuous Rate	1.0 x Minimum Continuous Rate

Data excerpted and adapted from the 2015 MEC. Interpolation is permitted. Extrapolation is prohibited.

## Fan Efficacy

### 2015 MEC Table R403.5.1 and 2021 IECC Table R403.6.2

Minimum fan efficacy requirements help ensure ventilation systems do not waste energy.

For single- and two-family dwelling units, the requirements are based on fan location.

Fan Location		Air Flowrate (cfm)		Minimum Fan Efficacy (cfm/Watt)	
2015 MEC	2021 IECC	2015 MEC	2021 IECC	2015 MEC	2021 IECC
In-line	In-line	Any	Any	2.8	3.8
Range Hood	Other exhaust	Any	See Note 1	2.8	See Note 1
Bathrooms and Utility Rooms		10 to less than 90	less than 90	1.4	2.8
		Equal to or greater than 90	Equal to or greater than 90	2.8	3.5
No Requirement	HRV, ERV, and integral AHUs	-	Any	-	1.2

Note 1. Range hood falls into the category of Other and criteria depends on the air flowrate. Data adapted from 2015 MEC Table R403.5.1 and 2021 Table R403.6.2.

# Heat Recovery and Energy Recovery Ventilators

## 2021 IECC §R403.6.1

**Table 5: Climate Zones for Upper Peninsula Counties**

County	2015 MEC Climate Zone	2021 IECC Climate Zone
Alger	7	7*
Baraga	7	6A
Chippewa	7	6A
Delta	7	7*
Dickinson	7	7*
Gogebic	7	6A
Houghton	7	6A
Huron	6A	5A
Iron	7	6A
Keweenaw	7	7*
Luce	7	6A
Mackinac	7	6A
Marquette	6A	7*
Menominee	6A	6A
Ontonagon	7	6A

Data adapted from the 2015 MEC and the 2021 IECC.

\*Recovery ventilation required. It may be either heat or energy recovery.

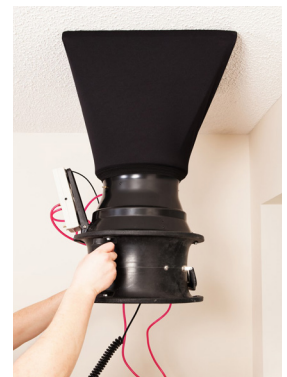
Ventilation air brought into the home adds to the air-conditioning or heating load. In order to reduce this impact, recovery ventilators may be used. These units bring exhaust air and outdoor air into indirect contact, allowing energy to be exchanged between them. The exchanged energy may be sensible only (termed *heat recovery*) or both sensible and latent (termed *energy recovery*). Under the 2015 MEC, recovery is solely at the discretion of the designer or builder for homes built on speculation or the owner for custom homes. Because heat and energy recovery systems help reduce energy costs, the 2021 IECC requires them in Climate Zones 7 and 8, where heating degree days exceed 7200. In Michigan, certain parts of the Upper Peninsula fall into Climate Zone 7. However, climate change has caused some counties that were previously in Climate Zone 7 to shift to the warmer Climate Zone 6A.

## Compliance Testing

### 2021 IECC §R403.6.3

Field testing is the best method for validating that the minimum required ventilation flow rates are achieved. The 2021 IECC requires that ventilation systems be tested for proper airflow with one of the following:

- Flow Hood
- Flow Grid
- Other device to measure airflow rate



Both the ventilation rate and fan efficacy are to be tested and confirmed. Code officials verify compliance at the mechanical rough-in inspection. Air leakage, as well as other HVAC system characteristics, such as equipment size, type, efficiency, and controls, are also verified during this inspection.