

# **HVAC Hacks #4: Breathe Easy with Proper Ventilation and Indoor Air Quality**

**An Online Continuing Education Course for Engineers**

**Course Number: HV-6028**

**Credit: 6 Hours / 6 PDH / 6 CPD**

# HVAC Hacks #4: Breathe Easy with Proper Ventilation and Indoor Air Quality

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## BREATHE EASY WITH PROPER VENTILATION AND INDOOR AIR QUALITY (IAQ)




Tired of stuffy buildings and stale air? Unlock the secrets of healthy indoor environments.


In this course, we will delve into the critical role of ventilation in maintaining good indoor air quality (IAQ). You'll learn ventilation strategies to prevent the spread of airborne diseases and create healthy buildings. Industrial ventilation emphasizes the control of heat and contaminants by dilution ventilation and local exhaust ventilation.

The course includes essential metrics, practical tips, and handy rules of thumb to help you make well-informed decisions.


Let's get started with essential metrics and rules of thumb.

## INDOOR AIR QUALITY



	Description	Rules of Thumb
	Indoor Air Quality (IAQ)	<i>Air quality refers to the overall condition of the air, considering factors like pollutants, temperature, humidity, and ventilation.</i>  <i>IAQ refers to the quality of the air within buildings, specifically as it relates to the health and comfort of the people who occupy them.</i>
	Issues with poor IAQ	<i>Health risks. Two common issues are:</i>  <i>a. Sick Building Syndrome (SBS): General indoor discomfort.</i>  <i>b. Building-Related Illness (BRI): Specific illness from a building, e.g., Legionella bacteria in cooling water.</i>  <i>Good IAQ helps to create a comfortable breathing environment for occupants.</i>
	Causes of Poor IAQ	<i>a. Inadequate ventilation or fresh air.</i>


	Description	Rules of Thumb
		<p>b. Poor air distribution - inappropriate intake/exhaust air locations</p> <p>c. Filter problems - inadequate maintenance and more.</p>
	IAQ Improvement Strategies	<p>a. Source Control: Remove pollution source.</p> <p>b. Air filtration: MERV 8 to 13</p> <p>c. Adequate ventilation: Fresh air matters! Aim for 15 – 20 CFM per person.</p> <p>d. Air changes per hour: 2 - 4 air changes per hour.</p> <p>e. Temperature: Typically, around 73-76°F for comfort.</p> <p>f. Moisture: Control humidity between 30% -60%.</p>

#### VENTILATION CODES AND STANDARDS





	Description	Rules of Thumb
	Codes and Standards	<p>ASHRAE Standard 62.</p> <p>a. ASHRAE 62.1: For public and commercial buildings.</p> <p>b. ASHRAE 62.2: For residential buildings.</p> <p>c. ASHRAE 170: Ventilation Requirements for Health Care Facilities.</p>

#### VENTILATION STRATEGIES




	Strategy	Rules of Thumb
	Natural ventilation	<i>Wind-driven and stack effect (temperature/air density difference).</i>
	Mechanical ventilation	a. Utilize fans.

	Strategy	Rules of Thumb
		<ul style="list-style-type: none"> <li>b. May be designed to supply air, exhaust air, and balanced ventilation.</li> <li>c. Dilution ventilation for comfort and local exhaust ventilation (LEV) for contaminant control.</li> </ul>
	<b>Hybrid ventilation</b>	Combining natural and mechanical methods.


## NATURAL VENTILATION

	Natural Ventilation Parameters	Rules of Thumb
	Space Coverage	<ul style="list-style-type: none"> <li>a. Effective up to 25 ft depth from exterior openings.</li> <li>b. Keep openings @ 5% of floor area.</li> </ul>
	Cross-ventilation	<ul style="list-style-type: none"> <li>a. Effective up to 5x room height.</li> <li>b. Windward inlets and leeward outlets optimize airflow.</li> <li>c. Aim for a 1:1 inlet-outlet area ratio.</li> </ul>
	Single-sided Ventilation	<ul style="list-style-type: none"> <li>a. Effective up to 2.5x room height, max 33 ft.</li> <li>b. Provide multiple spaced openings.</li> <li>c. Design windows at 2-3 ft height for unobstructed airflow.</li> </ul>
	Stack Effect	<ul style="list-style-type: none"> <li>a. High elevation aids air movement.</li> <li>b. Position inlets at lower levels and exhaust at higher elevations for heat dissipation.</li> </ul>







## MECHANICAL VENTILATION

	Type of Ventilation	Rules of Thumb
	Supply Air	<i>Blows fresh air in (common for most comfort areas).</i>
	Exhaust Air	<i>Sucks stale air out (ideal for removing heat, pollutants, fumes/contaminants, and odor, found in kitchens, restrooms, and labs).</i>
	Balanced or hybrid	<i>Maintains balanced pressure and uses both supply and exhaust (flexible for specific needs).</i>

## MIXING VENTILATION Vs. DISPLACEMENT VENTILATION

	Ventilation Type	Rules of Thumb
	Mixing Ventilation	<p><i>Fresh air mixes with existing air throughout the room (common but less efficient).</i></p> <ol style="list-style-type: none"> <li><i>a. Air velocity &gt; 400 ft/min.</i></li> <li><i>b. Maintains uniform temperatures.</i></li> <li><i>c. Needs higher air volumes.</i></li> <li><i>d. Works for both cooling and heating environments.</i></li> </ol>
	Displacement Ventilation	<p><i>Fresh air displaces stale air at floor level, creating a clean breathing zone. (This method is more efficient and ideal for high ceilings.)</i></p> <ol style="list-style-type: none"> <li><i>a. Air velocity &lt; 100 ft/min.</i></li> <li><i>b. Best for high ceilings.</i></li> <li><i>c. Creates vertical temperature gradients.</i></li> <li><i>d. Generally quieter due to lower air speed.</i></li> <li><i>e. More suitable for cooling than heating.</i></li> </ol>

## FRESH AIR VENTILATION RATES

	Minimum outdoor air	Rules of Thumb
	General spaces	The average range is 15–20 CFM per person.
	Smoking lounges	50 - 60 CFM per person
	Restaurants	10 - 15 CFM per person
	Retail spaces	5 - 10 CFM per person
	Classrooms	7.5 - 10 CFM per person
	Auditoriums	5 - 10 CFM per person


Refer to Table 6.1, ASHRAE 62.1 for more accurate values. Refer Table below:


### Recommended Fresh Air Ventilation Rates based on ASHRAE Std. 62.1

The current ASHRAE Standard 62.1, 2021 (Table 6.1) sets out minimum ventilation rates based on room size and occupancy. In practical terms:

- a. If the number of occupants in a room doubles, the ventilation rate should also double.
- b. Larger spaces necessitate a greater volume of outside air.

The rightmost column in the table provides the total outside air (OA) rate based on both occupancy and room area.

	People (CFM/person)	Area (CFM/sq. ft)	Occupant density (per 1000 sq. ft)	Combined OA Rate, CFM/person
Classrooms (ages 5-8)	10	0.12	25	15
Restaurants	7.5	0.18	70	10
Hotel Bedroom	5	0.06	10	11
Office space	5	0.06	5	17

	People (CFM/person)	Area (CFM/sq. ft)	Occupant density (per 1000 sq. ft)	Combined OA Rate, CFM/person
Conference/meeting	5	0.06	50	6
Computer rooms	5	0.06	4	20
Warehouses	-	0.06	-	
Auditoriums	5.0	0		5
Religious places				6
Libraries				17
Lobbies				5
Museums/galleries				
Retail mall				
Beauty and nail salons				
Pet shops				
Supermarket				
Disco/dance floors				
Health clubs			40	22
Bowling alley	1	0.12	40	13
Gambling casinos	7.5	0.18	120	9

*To view the remainder of the course material and to take the quiz for PDH credit, you must purchase the course.*

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Refer to ASHRAE Std. 62.1, 2019 (Table 6-1) for detailed list.

**EXHAUST AIR VENTILATION**

ASHRAE Standard 62.1, 2019 (Table 6.2) specifies the extract of exhaust air ventilation rates for various facilities. For a complete list, refer to the Standard.