



**BSR/ASHRAE Addendum L  
to ANSI/ASHRAE Standard 62.1-2016**

**Public Review Draft**

# **Proposed Addendum L to Standard 62.1-2016, Ventilation for Acceptable Indoor Air Quality**

**Second Public Review (August 2018)  
(Draft shows Proposed Changes to Current Standard)**

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## FOREWORD

*The natural ventilation procedure has changed over the years in 62.1. It was relocated from Section 5 to Section 6 and became a ventilation procedure. It was recently modified to require mechanical ventilation with certain exceptions. This proposed addendum provides specific requirements for the exception by providing a clear compliance path. It also recognizes that there are inherent health issues with outdoor air in many locations in the world and updates the prescriptive requirements based on recent studies and airflow evaluations.*

*Outdoor Air requirements specified in 6.2.1 have been applied to naturally ventilated buildings, essentially prohibiting purely naturally ventilated buildings in cities that don't meet national outdoor air standards. Although this is not the best solution, it prioritizes occupant health and follows national guidelines already applied to other 62.1 procedures until new methodology is developed.*

*The prescriptive path has been improved by removing the openable area requirement of 4% of net occupiable floor area and introducing two prescriptive paths for sizing the required openable area that better respond to program in the zone and window type.*

*A four-point definition of a naturally ventilated Engineered System has been developed to require designers to more fully document natural ventilation systems that do not meet prescriptive values.*

*An Informative Appendix that augments the Engineered System definition has also been developed and will be presented as a separate addendum.*

***[Note to Reviewers: This addendum makes proposed changes to the current standard. These changes are indicated in the text by underlining (for additions) and ~~striketrough~~ (for deletions) except where the reviewer instructions specifically describe some other means of showing the changes. Only these changes to the current standard are open for review and comment at this time. Additional material is provided for context only and is not open for comment except as it relates to the proposed changes.]***

## Addendum L to 62.1-2016

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***Add the following new definition in Section 3. The remainder of Section 3 is unchanged.***

***Openable area: “the net free unobstructed area through an opening”***

***Modify Section 6 as shown below. The remainder of Section 6 is unchanged.***

[...]

**6.1.3 Natural Ventilation Procedure.** The prescriptive or engineered system design procedure presented in Section 6.4, in which outdoor air is provided through openings to the outdoors, shall be permitted to be used for any zone or portion of a zone either solely or in conjunction with mechanical ventilation systems in accordance with Section 6.4.

[...]

**Renumber Section 6.2.1 to 6.1.4 so that the section applies to all procedures and modify as shown below. Subsections of 6.2.1 will all be renumbered to 6.1.4.x.**

**6.2.1 6.1.4 Outdoor Air Treatment.** Each ventilation system that provides outdoor air through a supply fan shall comply with the following subsections.

[...]

**6.4 Natural Ventilation Procedure.** ~~Natural ventilation systems shall be designed in accordance with this section and shall include mechanical ventilation systems designed in accordance with Section 6.2, Section 6.3, or both.~~ Natural ventilation systems shall comply with the requirements of either Section 6.4.1 or Section 6.4.2. Designers shall provide effective interior air barriers, insulation, or other means that separate naturally-ventilated spaces from mechanically-cooled spaces, ensuring that high dew point outdoor air does not come into contact with mechanically cooled surfaces.

**Exceptions:**

- ~~1. An engineered natural ventilation system, where approved by the authority having jurisdiction, need not meet the requirements of Section 6.4.~~
- ~~2. The mechanical ventilation systems shall not be required where~~
  - ~~a. natural ventilation openings that comply with the requirements of Section 6.4 are permanently open or have controls that prevent the openings from being closed during periods of expected occupancy or~~
  - ~~b. the zone is not served by heating or cooling equipment.~~

**6.4.1 Prescriptive Compliance Path.** Any zone designed for natural ventilation shall include a mechanical ventilation system designed in accordance with Section 6.2, Section 6.3, or both.

**Exceptions:**

1. Zones in buildings with all of the following characteristics:
  - a. natural ventilation openings that comply with the requirements of Section 6.4.1, and
  - b. controls that prevent the natural ventilation openings from being closed during periods of expected occupancy or natural ventilation openings that are permanently open, and
2. Zones that are not served by heating or cooling equipment.

**6.4.1.4.1 Ceiling Height.** The ceiling height ( $H$ ) to be used in Sections 6.4.1.3 through 6.4.1.5 shall be the minimum ceiling height in the zone space.

**Exception:** For zones wherein ceiling height increases ~~ceilings that are increasing in height~~ as distance from the openings is increased, the ceiling height shall be determined as the average height of the ceiling within 6 m (20 ft) from the ~~operable~~ openings.

**6.4.1.2 Floor Area to Be Ventilated.** ~~Spaces,~~ The naturally ventilated area in zones or portions of spaces, zones shall extend from the operable wall openings to to be naturally ventilated shall be located within a distance based on the ceiling height, as determined by Sections 6.4.1.1, 6.4.1.2, or 6.4.1.3, 6.4.1.4, or 6.4.1.5, from operable wall Openings shall that meet the requirements of Section 6.4.2 ~~6.4.1.6.~~ For spaces zones where with ceilings that are not parallel to the floor, the ceiling height shall be determined in accordance with Section 6.4.1.51.

**6.4.1.4.3 Single Side Opening.** For spaces zones with operable openings on one side of the space zone, the maximum distance from the operable openings to the extent of naturally ventilated area shall be not more than extend to  $2H$  or less from the openings, where  $H$  is the ceiling height for the zone.

**6.4.1.24 Double Side Opening.** For spaces zones with operable openings on two opposite sides of the zone space, the naturally ventilated area shall extend between the openings, which shall be separated by maximum distance from the operable openings shall be not more than  $5H$  or less, where  $H$  is the ceiling height for the zone.

**6.4.1.35 Corner Openings.** For spaces zones with operable openings on two adjacent sides of a zone space, the naturally ventilated area shall extend to maximum distance from the operable openings shall be not more than  $5H$  or less along a line drawn between the two openings that are farthest apart. Floor area outside that line shall comply with Section 6.4.1.43.

**6.4.26.4.1.6 Location and Size of Openings.** Spaces Zones or portions of spaces zones to be naturally ventilated shall have a permanently open airflow path be permanently open to operable wall openings directly connected to the outdoors. The operable area shall be not less than 4% of the net occupiable floor area. The minimum flowrate to the zone shall be determined in accordance with 6.2.2.1. This flowrate shall be used to determine the required operable area of openings, only accounting for buoyancy-driven flow. Wind-driven flow can only be used when it can be demonstrated that the minimum flowrate is provided for all occupied hours.

**6.4.1.6.1 Sizing Openings – Path A**

Where the zone is ventilated using a single opening or multiple horizontally-spaced single openings, the operable area as a percent of the net occupiable floor area shall be greater than or equal to the value indicated in Table 6.4.1.6.1.1. Where the zone is ventilated using two vertically-spaced openings or multiple horizontally-spaced pairs of openings, the operable area as a percent of the net occupiable floor area shall be greater than or equal to the value indicated in Table 6.4.1.6.1.2.

**Informative Note:** Tables 6.4.1.6.1.1 and 6.4.1.6.1.2 are based solely on buoyancy-driven flow and have not been created to address thermal comfort.

Where openings are covered with louvers, insect screens, or otherwise obstructed, operable area shall be based on the net free unobstructed area through the opening. Where interior zones rooms, or portions of zones rooms, without direct openings to the outdoors are ventilated through adjoining zones rooms, the opening between zones rooms shall be permanently unobstructed and have a free area of more than the greater of not less than 8% of the area of the interior room twice the percent of occupiable floor area used to determine the opening size of adjacent exterior zones, or more less than  $25 \text{ ft}^2$  ( $2.3 \text{ m}^2$ ).

**Table 6.4.1.6.1.1: Minimum openable areas: single openings.**

		Total openable areas in zone as a percentage of $A_z$		
$V_{bz}/A_z \leq$ (L/s per m <sup>2</sup> )	$V_{bz}/A_z \leq$ (cfm per ft <sup>2</sup> )	$H_s/W_s \leq 0.1$	$0.1 < H_s/W_s \leq 1$	$H_s/W_s > 1$
1.0	0.2	4.0	2.9	2.5
2.0	0.4	6.9	5.0	4.4
3.0	0.6	9.5	6.9	6.0
4.0	0.8	12.0	8.7	7.6
5.5	1.1	15.5	11.2	9.8

**GENERAL NOTES**

- Volumetric airflow rates used to estimate required openable area are based on:
  - Dry air density of  $0.075 \text{ lb}_m/\text{ft}^3$  ( $1.2 \text{ kg}_m/\text{m}^3$ ) at a barometric pressure of 1 atm (101.3 kPa) and an air temperature of 70°F (21°C).
  - Temperature difference between indoors and outdoors of 1.8°F (1°C).
  - Gravity constant of  $32.2 \text{ ft/s}^2$  ( $9.81 \text{ m/s}^2$ ).
  - Window discharge coefficient of 0.6.
- The lowest applicable row for the calculated  $V_{bz}/A_z$  shall be used.

where:

$V_{bz}$  = Breathing zone outdoor airflow, per Table 6.2.2.1

$A_z$  = zone floor area, the net occupiable floor area of the ventilation zone

$W_s$  = Aggregated width of all horizontally-spaced single outdoor openings ventilating the space

$H_s$  = The vertical dimension of the opening (or shortest height of all horizontally-spaced openings)

**Table 6.4.1.6.1.2. Minimum openable areas: two vertically-spaced openings.**

		Total openable areas in zone as a percentage of $A_z$					
$V_{bz}/A_z \leq$ (L/s per m <sup>2</sup> )	$V_{bz}/A_z \leq$ (cfm per ft <sup>2</sup> )	$H_{vs} \leq 8.2 \text{ ft (2.5 m)}$		$8.2 \text{ ft (2.5 m)} < H_{vs} \leq 16.4 \text{ ft (5 m)}$		$16.4 \text{ ft (5 m)} < H_{vs}$	
		$A_s/A_l \leq 0.5$	$A_s/A_l > 0.5$	$A_s/A_l \leq 0.5$	$A_s/A_l > 0.5$	$A_s/A_l \leq 0.5$	$A_s/A_l > 0.5$
1.0	0.2	2.0	1.3	1.3	0.8	0.9	0.6
2.0	0.4	4.0	2.6	2.5	1.6	1.8	1.2
3.0	0.6	6.0	3.9	3.8	2.5	2.7	1.7
4.0	0.8	8.0	5.2	5.0	3.3	3.6	2.3
5.5	1.1	11.0	7.1	6.9	4.5	4.9	3.2

**GENERAL NOTES**

- 1 Volumetric airflow rates used to estimate required operable area are based on:
  - Dry air density of 0.075 lb<sub>air</sub>/ft<sup>3</sup> (1.2 kg<sub>air</sub>/m<sup>3</sup>) at a barometric pressure of 1 atm (101.3 kPa) and an air temperature of 70°F (21°C).
  - Temperature difference between indoors and outdoors of 1.8°F (1°C).
  - Gravity constant of 32.2 ft/s<sup>2</sup> (9.81 m/s<sup>2</sup>).
  - Window discharge coefficient of 0.6.
- 2 The lowest applicable row for the calculated  $V_{bz}/A_z$  shall be used.

where:

$V_{bz}$  = Breathing zone outdoor airflow, per Table 6.2.2.1

$A_z$  = zone floor area, the net occupiable floor area of the ventilation zone

$H_{vs}$  = vertical separation between the center of the top and bottom openings' free operable area. In case of multiple horizontally-spaced pairs of openings, use shortest distance encountered.

$A_s$  = openable area of smallest opening (top or bottom). In case of multiple horizontally-spaced pairs of top-and-bottom openings, use aggregated areas.

$A_l$  = openable area of largest opening (top or bottom). In case of multiple horizontally-spaced pairs of top-and-bottom openings, use aggregated areas.

**6.4.1.6.2 Sizing Openings – Path B**

Calculate the required openable area to a single zone according to AM10-2005 Section 4.3.

**6.4.2 Engineered System Compliance Path**

For an engineered natural ventilation system, the designer shall:

- a. Determine hourly environmental conditions including but not limited to outdoor air dry-bulb temperature, dew-point temperature, outdoor concentration of contaminants including but not limited to PM2.5, PM10 and ozone where data is available, wind speed and direction, and internal heat gains during expected hours of natural ventilation operation.
- b. Determine the effect of pressure losses along natural ventilation airflow paths on the resulting flowrates, including but not limited to inlet vents, air transfer grills, ventilation stacks and outlet vents during representative conditions of expected natural ventilation system use.
- c. Quantify natural ventilation airflow rates of identified airflow paths accounting for wind- and thermally-induced driving pressures during representative conditions of expected natural ventilation system use.
- d. Design to provide outdoor air in quantities sufficient to dilute pollutants and odors of indoor origin to levels that result in acceptable indoor air quality as established under 6.2.2.1 and/or 6.3 during representative conditions of expected natural ventilation system use.

**6.4.3 Control and Accessibility.** The means to open required operable openings shall be readily accessible to building occupants whenever the space is occupied. Controls shall be designed to coordinate operation of the natural and mechanical ventilation systems.

**6.4.4 Documentation.** Where the Natural Ventilation Procedure is used, the designer shall document the values and calculations that show conformance with the compliance path and the controls systems and sequences required for operation of the natural ventilation system including coordination with mechanical ventilation systems. Where the Prescriptive Compliance Path is used for buildings located in an area where the national standard for one or more contaminants is exceeded, any design assumptions and calculations related to the impact on indoor air quality shall be included in the design documents.

[...]

**6.6 Design Documentation Procedures.** Design criteria and assumptions shall be documented and made available for operation of the system after installation. See Sections 4.3, 5.1.3, 5.16.4, 6.2.7.1.3, ~~and~~ 6.3.6, and 6.4.4 regarding assumptions to be detailed in the documentation.