



**AIVC-ASC Technical Conference  
Ventilation, IEQ & Sustainability**

**ASHRAE Singapore Chapter - DL Forum**

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# An overview of ASHRAE Standard 62.1

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STANDARD

**ANSI/ASHRAE Standard 62.1-2022**  
(Supersedes ANSI/ASHRAE Standard 62.1-2019)  
Includes ANSI/ASHRAE addenda listed in Appendix Q


## Ventilation and Acceptable Indoor Air Quality

See Appendix Q for approval dates by ASHRAE and the American National Standards Institute.


This Standard is under continuous maintenance by a Standing Standard Project Committee (SSPC) for which the Standards Committee has established a documented program for regular publication of addenda or revisions, including procedures for timely, documented, consensus action on requests for change to any part of the Standard. Instructions for how to submit a change can be found on the ASHRAE® website ([www.ashrae.org/continuous-maintenance](http://www.ashrae.org/continuous-maintenance)).

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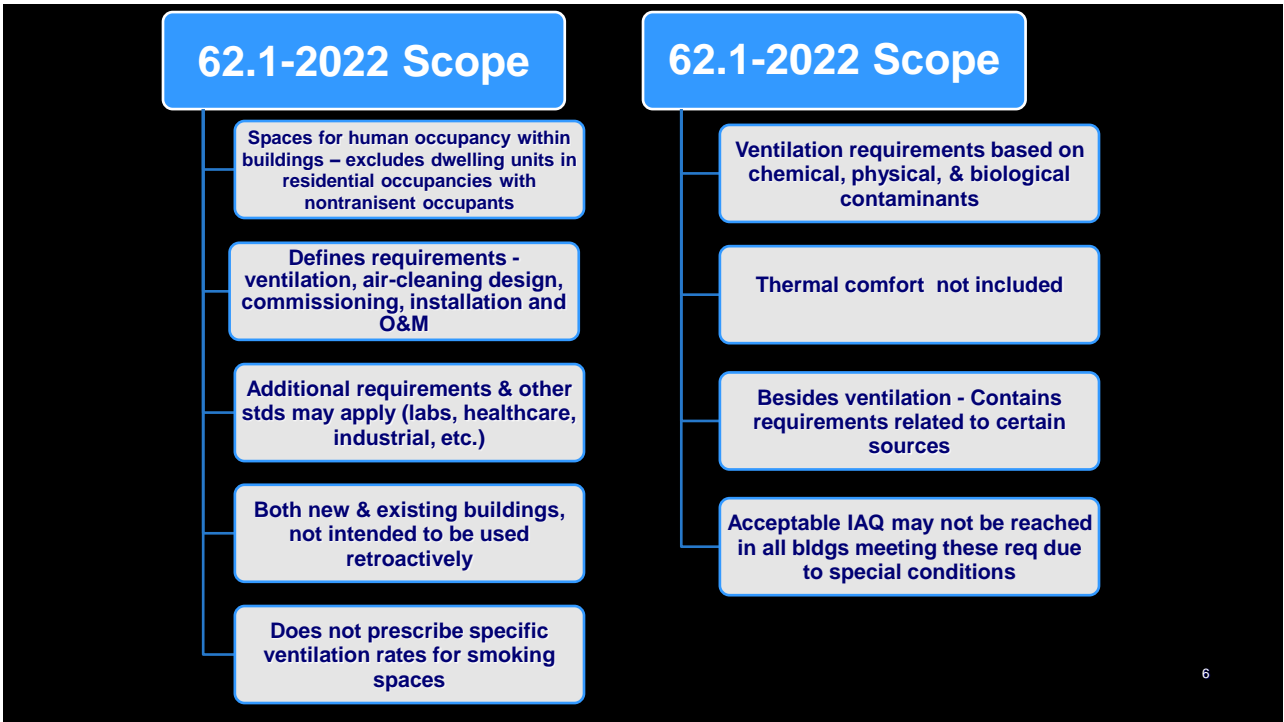
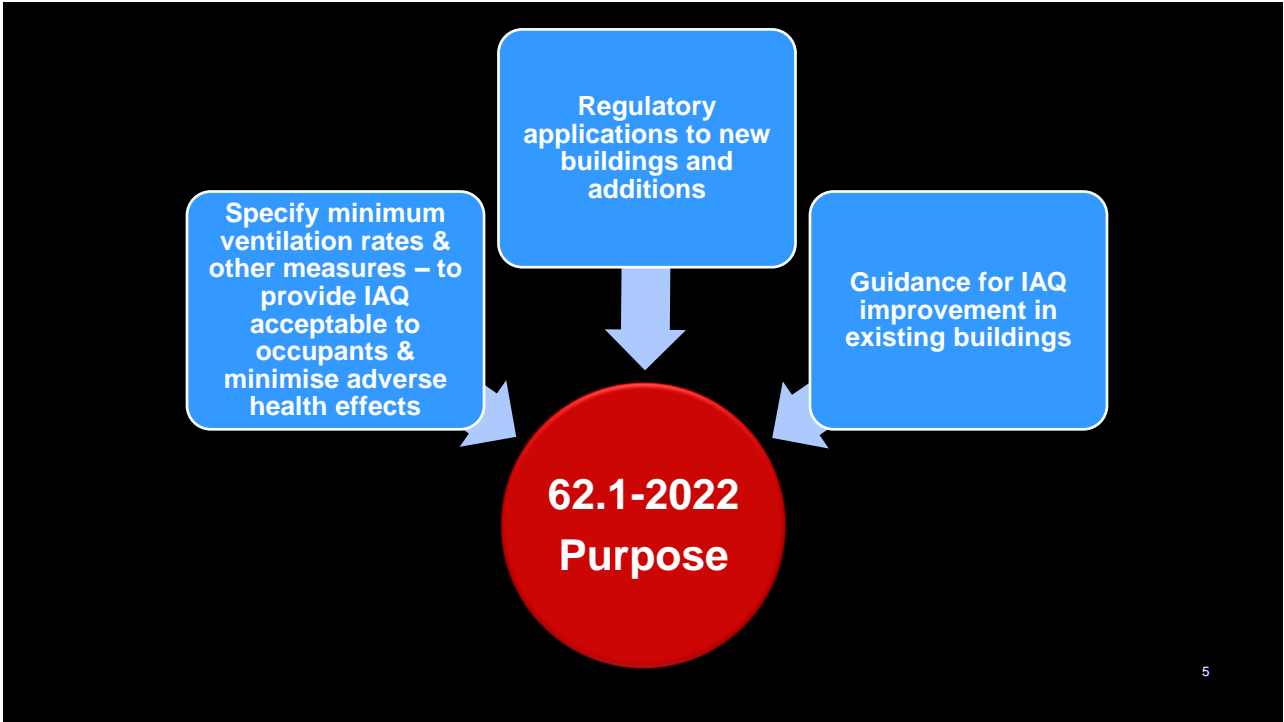
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air in which there are no known contaminants at harmful concentrations as determined by *cognizant authorities* and with which a substantial majority (80% or more) of the people exposed do not express dissatisfaction

**Acceptable  
Indoor Air  
Quality**

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## Air Quality Requirements

- Outdoor air quality (Section 4)
- Outdoor air intakes (Section 5.4)
- Air classification and recirculation (Section 5.13)
- Buildings containing ETS areas (Section 5.3)
- Outdoor air treatment (Section 6.1.4)

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# Outdoor Air Quality

- Regional air quality
- Local air quality
- Documentation

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## General Requirements 4.0 Outdoor Air Quality

### Regional Air Quality

- Must determine NAAQS attainment status  
[www.EPA.gov](http://www.EPA.gov)
- If nonattainment, air cleaning is required in some cases

### Local Air Quality

- Conduct observational site survey to identify local sources of air contaminants



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5. SYSTEMS AND EQUIPMENT	
	Ventilation Air Distribution
	Exhaust Duct Location
	Ventilation System Controls
	Airstream Surfaces
	Outdoor Air Intakes
	Local Capture of Contaminants
	Ozone Generating Devices
	Combustion Air
	Particulate Matter Removal
	Maximum Indoor Air Dew Point in Mechanically Cooled Buildings
	Building Exfiltration
	Drain Pans
	Finned-Tube Coils and Heat Exchangers
	Humidifiers and Water Spray Systems
	Access for Inspection, Cleaning and Maintenance
	Building Envelope and Interior Surfaces
	Buildings with Attached Parking Garages
	Air Classification and Recirculation
	Requirements for Buildings Containing ETS Areas and ETS-Free Areas

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# General Requirements

## 5.0 Systems and Equipment

### Particulate Matter Removal



Use a filter with a **MERV 8** (*based on ASHRAE Standard 52.2*) or **ISO ePM10** (*based on ISO 16890*) [or greater] upstream of dehumidifying coils and other wet-surface devices in supply stream

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# General Requirements

## 5.0 Systems and Equipment

Air Classification and Recirculation. Limit recirculation or transfer of “dirty” air to “cleaner” spaces

Classification - Designate air leaving each space using Table 6.1

- Class 1: Low contaminant concentration (office)
- Class 2: Moderate concentration (dining room)
- Class 3: Significant concentration (sick room)
- Class 4: Highly objectionable or potentially harmful concentration

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# General Requirements

## 5.0 Systems and Equipment

**Manage recirculation as follows**

- **Class 1 to anywhere**
- **Class 2 to self, similar Class 2 or Class 3 or Class 4**
- **Class 3 to self**
- **Class 4 to outdoors**

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# Outdoor Air Treatment

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

- Particulate matter
  - PM10 MERV8 (ISO ePM10)
  - PM2.5 MERV11 (ISO ePM2.5)
- Ozone Volumetric Removal Eff of at least 40%  
(When outdoor ozone levels exceed 0.1 ppm (195  $\mu\text{g}/\text{m}^3$ ))
- Other outdoor contaminants

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## 6.0 Procedures



VRP

- Prescribes rates & procedures based on typical space contaminant sources & source strengths

IAQP

- Requires calculation of rates based on analysis of contaminant sources, concentration targets and perceived air quality targets.

NVP

- O/A provided through openings to outdoors
- Can be used for any zone in conjunction with MV systems

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## 6.2 Ventilation Rate Procedure

- Technically, *Ventilation*  $\neq$  *Outdoor Airflow* but for this presentation, we will equate the terms
- $V_{bz}$  – Breathing zone outdoor airflow
  - **breathing zone:** the region within an occupied space between planes 3 and 72 in. (75 and 1800 mm) above the floor and more than 2 ft (600 mm) from the walls or fixed air-conditioning equipment.
- $V_{oz}$  – Zone outdoor airflow
  - Air that must be supplied to a ventilation zone
- $V_{ot}$  – Outdoor air intake flow
  - Air that must be supplied to the system

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## Ventilation Rate Procedure— Breathing Zone Outdoor Airflow

$$V_{bz} = R_p \times P_z + R_a \times A_z \quad (6.1)$$

where

- $A_z$  = **zone floor area:** the net occupiable area of the ventilation zone, ft<sup>2</sup> (m<sup>2</sup>)
- $P_z$  = **zone population:** the number of people in the ventilation zone during typical usage
- $R_p$  = **outdoor airflow rate required per person,** as determined from Table 6.1
- $R_a$  = **outdoor airflow rate required per unit area,** as determined from Table 6.1

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# Table 6-1

- $R_p$ ,  $R_a$
- Default occupant density
- Air class
- This table shall be used in conjunction with the accompanying notes.
- One related requirement: The rates in this table are based on all other applicable requirements of this standard being met.

Table 6-1 Minimum Ventilation Rates in Breathing Zone (Continued)

Occupancy Category	People Outdoor Air Rate $R_p$		Area Outdoor Air Rate $R_a$		Default Values		Air Class	OS (6.2.6.1.4)
	cfm/person	L/s-person	cfm/ft <sup>2</sup>	L/s-m <sup>2</sup>	Occupant Density			
					#/1000 ft <sup>2</sup>	or #/100 m <sup>2</sup>		

$$\begin{aligned}
 V_{bz} &= R_p \times P_z + R_a \times A_z \\
 &= 2.5 \times 1 + 0.3 \times 20 \\
 &= 8.5 \text{ L/s per person}
 \end{aligned}$$

Office Buildings

Breakrooms	5	2.5	0.12	0.6	50	1	
Main entry lobbies	5	2.5	0.06	0.3	10	1	✓
Occupiable storage rooms for dry materials	5	2.5	0.06	0.3	2	1	
Office space	5	2.5	0.06	0.3	5	1	✓
Reception areas	5	2.5	0.06	0.3	30	1	✓
Telephone/data entry	5	2.5	0.06	0.3	60	1	✓

# Zone Air Distribution Effectiveness

## 6.2.1.2

- First enhanced in the 2019 version
- As per Table 6-4 or Normative Appendix C
- Table 6-4  $E_z$  values
  - Well-Mixed Air Distribution
  - Stratified Air Distribution Systems (6.2.1.2.1)
  - Personalised Ventilation Systems (6.2.1.2.2)

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Table 6-4 Zone Air Distribution Effectiveness

Air Distribution Configuration	$E_z$
<b>Well-Mixed Air Distribution Systems</b>	
Ceiling supply of cool air	1.0
Ceiling supply of warm air less than 15°F (8°C) above average space temperature where the supply air-jet velocity is less than 150 fpm (0.8 m/s) within 4.5 ft (1.4 m) of the floor and ceiling return	0.8
<b>Stratified Air Distribution Systems (Section 6.2.1.2.1)</b>	
Floor supply of cool air where the vertical throw is less than or equal to 60 fpm (0.25 m/s) at a height of 4.5 ft (1.4 m) above the floor and ceiling return at a height less than or equal to 18 ft (5.5 m) above the floor	1.2
<b>Personalized Ventilation Systems (Section 6.2.1.2.2)</b>	
Personalized air at a height of 4.5 ft (1.4 m) above the floor combined with ceiling supply of cool air and ceiling return	1.40

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## Ventilation Rate Procedure – Zone Outdoor Airflow 6.2.1.3

$$V_{oz} = V_{bz} / E_z \quad (6.2)$$

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## 6.3 IAQ Procedure

**“The Indoor Air Quality (IAQ) Procedure is a performance-based design approach in which the building and its ventilation system are designed to maintain the concentrations of specific contaminants at or below certain limits identified during the building design and to achieve the design target level of perceived indoor air quality acceptability by building occupants and/or visitors.”**

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# IAQ Procedure

Air-cleaning along with recirculation – effective means for controlling indoor contaminants

O/A – possible to reduce below levels prescribed by VRP

Ventilation system designs based on IAQP need to comply with specified requirements

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## Designing for compliance - IAQP

Performance-based design approach  
Breathing zone outdoor airflow ( $V_{bz}$ ) determined in accordance with Sections 6.3.1 through 6.3.5

6.3.1: Design Compounds and PM2.5 sources and their strengths

6.3.2: Design Compounds and PM2.5 concentration – Concentration limits (Design limits)  
(Referencing Cognizant Authority)

Design Approaches – Must adopt an acceptable design procedure to find required airflow values, based on emission rates, concentration limits and other relevant design parameters

Perceived IAQ – Specify target PAQ (Percent Satisfied)

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# Indoor Air Quality Procedure

Table 6-5 Design Compounds, PM2.5, and Their Design Limits

Compound or PM2.5	Cognizant Authority	Design Limit
Acetaldehyde	Cal EPA CREL (June 2016)	140 $\mu\text{g}/\text{m}^3$
Acetone	A <sub>g</sub> BB LCI	1,200 $\mu\text{g}/\text{m}^3$
Benzene	Cal EPA CREL (June 2016)	3 $\mu\text{g}/\text{m}^3$
Dichloromethane	Cal EPA CREL (June 2016)	400 $\mu\text{g}/\text{m}^3$
Formaldehyde	Cal EPA 8-hour CREL (2004)	33 $\mu\text{g}/\text{m}^3$
Naphthalene	Cal EPA CREL (June 2016)	9 $\mu\text{g}/\text{m}^3$
Phenol	A <sub>g</sub> BB LCI	10 $\mu\text{g}/\text{m}^3$
Tetrachloroethylene	Cal EPA CREL (June 2016)	35 $\mu\text{g}/\text{m}^3$
Toluene	Cal EPA CREL (June 2016)	300 $\mu\text{g}/\text{m}^3$
1,1,1-trichloroethane	Cal EPA CREL (June 2016)	1000 $\mu\text{g}/\text{m}^3$
Xylene, total	A <sub>g</sub> BB LCI	500 $\mu\text{g}/\text{m}^3$
Carbon monoxide	U.S. EPA NAAQS	9 ppm
PM2.5	U.S. EPA NAAQS (annual mean)	12 $\mu\text{g}/\text{m}^3$
Ozone	U.S. EPA NAAQS	70 ppb
Ammonia	Cal EPA CREL (June 2016)	200 $\mu\text{g}/\text{m}^3$

# Combined IAQP & VRP

**6.3.4 Combined IAQ Procedure and Ventilation Rate Procedure.** The IAQP in conjunction with the VRP shall be permitted to be applied to a zone or system. In this case, the VRP shall be used to determine the required zone minimum outdoor airflow, and the IAQP shall be used to determine the additional outdoor air or air cleaning necessary to achieve the concentration limits of the contaminants and contaminant mixtures of concern.

**Informative Note:** The improvement of IAQ through the use of air cleaning or provision of additional outdoor air in conjunction with minimum ventilation rates may be quantified using the IAQP.



ASHRAE Standard 241-2023

## Control of Infectious Aerosols

Approved by the ASHRAE Standards Committee on June 24, 2023.

This Standard is under continuous maintenance by a Standing Standard Project Committee (SSPC) for which the Standards Committee has established a documented program for regular publication of addenda or revisions, including procedures for timely, documented, consensus action on requests for change to any part of the Standard. Instructions for how to submit a change can be found on the ASHRAE® website ([www.ashrae.org/continuous-maintenance](http://www.ashrae.org/continuous-maintenance)).

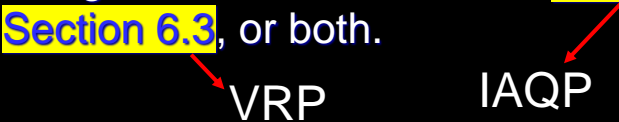
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This standard includes links to online supporting files.

## 6.4 Natural Ventilation Procedure

- **6.4 Natural Ventilation Procedure.** Natural ventilation systems shall be designed in accordance with this section
- **6.4.1 Prescriptive Compliance Path** - shall include mechanical ventilation systems designed in accordance with **Section 6.2**, **Section 6.3**, or both.  


VRP                      IAQP
- **6.4.2 Engineered System Compliance Path** – Engineered NV system – more detailed

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## Natural Ventilation Procedure

- **6.4.1.2 Floor Area To Be Ventilated.** Spaces, or portions of spaces, to be naturally ventilated must be located within a distance based on the ceiling height, as determined by Sections 6.4.1.3, 6.4.1.4, or 6.4.1.5, from operable wall openings which meet the requirements of Section 6.4.1.6.
- **6.4.1.3 Single Side Opening.** For spaces with operable openings on one side of the space, the maximum distance from **the operable openings is  $2H$** , where  **$H$  is the ceiling height**.
- **6.4.1.4 Double Side Opening.** For spaces with operable openings on two opposite sides of the space, the maximum distance from the **operable openings is  $5H$** , where  $H$  is the ceiling height.

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# Natural Ventilation Procedure

- **6.4.1.5 Corner Openings.** For spaces with operable openings on two adjacent sides of a space (i.e., two sides of a corner), the maximum distance from the operable openings is  $5H$  along a line drawn between the outside edges of the two openings which are farthest apart. Floor area outside that line must comply with Section 6.4.1.3 as a zone having openings on only one side of the zone.
- **6.4.1.4 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 space.  
**Exception:** For 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 20 ft (6 m) from the operable openings.

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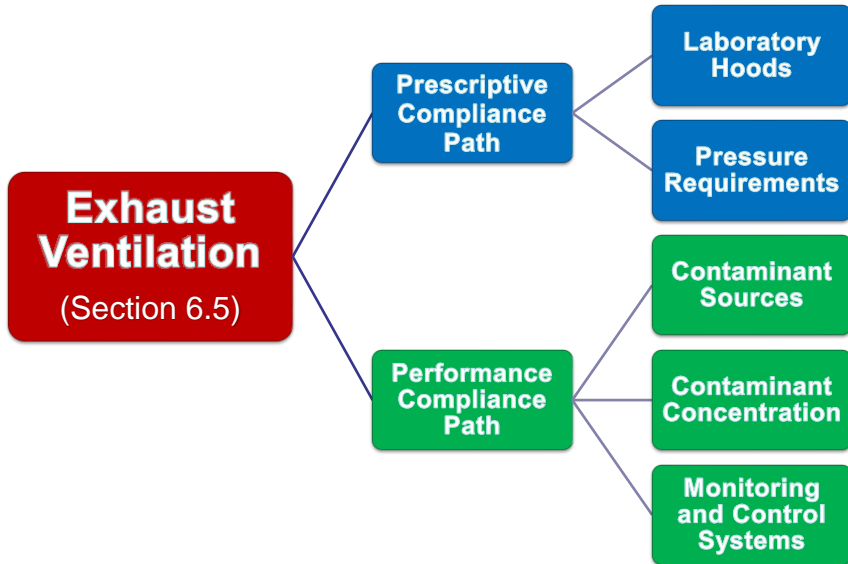
# Natural Ventilation Procedure

- **6.4.2 Engineered System Compliance Path.**
  - a. Determine hourly environmental conditions – Outdoor DBT/DPT, Outdoor concentration of contaminants (PM10, PM2.5, Ozone), wind speed/direction, internal heat gains during expected hours of NV operation
  - b. Determine the effect of pressure losses along NV airflow paths on the resulting flow rates, including inlet openings, air transfer grills, ventilation stacks and outlet openings during representative conditions of expected NV system use
  - c. Quantify NV airflow rates of identified airflow paths accounting for wind induced and thermally induced driving pressures during representative conditions of expected NV system use
  - d. Design to provide OA in quantities sufficient to result in acceptable IAQ as established under Section 6.2.1.1 (Breathing zone outdoor airflow) or 6.3 (IAQP) during representative conditions of expected NV 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 properly coordinate operation of the natural and mechanical ventilation systems.

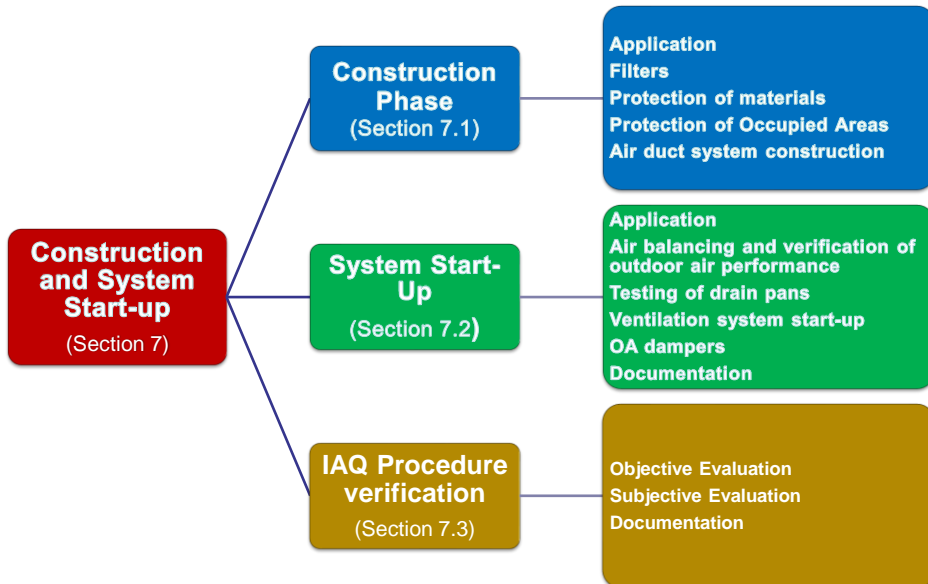
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## **STANDARD 62.1 USER'S MANUAL--BASED ON ANSI/ASHRAE STANDARD 62.1-2019, VENTILATION FOR ACCEPTABLE INDOOR AIR QUALITY**

HANDBOOK / MANUAL / GUIDE by ASHRAE, 2021

[View all product details](#)

- Information on the intent and application of Standard 62.1
- Sample calculations and examples
- Best practices for applying the principles of good indoor air quality (IAQ) and effective ventilation when designing buildings and building systems
- Useful reference material
- Guidance for building operations and maintenance personnel
- Instructions for the user in the application of tools used for compliance with ANSI/ASHRAE Standard 62.1-2019

Also included is an exclusive link to the recently revised Web-based spreadsheets that aid in ventilation rate procedure calculations.

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# **ASHRAE 62.1**

- **Standard is under continuous maintenance process**
- **Changes to the standard can be proposed**
- **Notification of proposed changes are in ASHRAE Standards Action**
- **You can comment on proposed changes**
- **You can request an interpretation**

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