



THE CAMFIL GROUP

Ventilation Standard for Acceptable Indoor Air Quality
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CLEAN AIR SOLUTIONS



ASHRAE

STANDARD

ANSI/ASHRAE Standard 62.1-2016
(Supersedes ANSI/ASHRAE Standard 62.1-2013)
Includes ANSI/ASHRAE addenda listed in Appendix K

Ventilation for Acceptable Indoor Air Quality

See Appendix K for approval dates by the ASHRAE Standards Committee, the ASHRAE Board of Directors, 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. The change submittal form, instructions, and deadlines may be obtained in electronic form from the ASHRAE website (www.ashrae.org) or in paper form from the Senior Manager of Standards. The latest edition of an ASHRAE Standard may be purchased from the ASHRAE website (www.ashrae.org) or from ASHRAE Customer Service, 1791 Tullie Circle, NE, Atlanta, GA 30329-2305. E-mail: orders@ashrae.org. Fax: 678-539-2129. Telephone: 404-636-8400 (worldwide), or toll free 1-800-527-4723 (for orders in US and Canada). For reprint permission, go to www.ashrae.org/permissions.

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The purpose of this standard is to specify minimum ventilation rates and other measures intended to provide indoor air quality that is acceptable to human occupants and that minimizes adverse health effects.

Acceptable indoor air quality: 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.

ULTIMATE SUCCESSFUL USE OF AIR FILTRATION



Six months under the ocean



One year in space



A daily part of some of our lives

CLEAN AIR SOLUTIONS



AIR QUALITY EVALUATION REQUIREMENTS OF 62.1

- Outdoor air quality shall be investigated in accordance with Sections 4.1 and 4.2 prior to completion of ventilation system design. The results of this investigation shall be documented in accordance with Section 4.3.
- *4.1 - Regional Air Quality.* The status of compliance with national ambient air quality standards shall be determined for the geographic area of the building site.
- *4.1.1 -* In the United States, compliance status shall be either in “attainment” or “nonattainment” with the *National Ambient Air Quality Standards* (NAAQS). In the United States, areas with no U.S. Environmental Protection Agency (USEPA) compliance status designation shall be considered “attainment” areas.
- *4.2 - Local Air Quality.* An observational survey of the building site and its immediate surroundings shall be conducted during hours the building is expected to be normally occupied to identify local contaminants from surrounding facilities that will be of concern if allowed to enter the building.

PRIMARY CONSIDERATIONS FOR AIR FILTRATION - NAAQS

Pollutant [links to historical tables of NAAQS reviews]	Primary/ Secondary	Averaging Time	Level	Form
Carbon Monoxide (CO)	primary	8 hours	9 ppm	Not to be exceeded more than once per year
		1 hour	35 ppm	
Lead (Pb)	primary and secondary	Rolling 3 month average	0.15 µg/m ³ (1)	Not to be exceeded
Nitrogen Dioxide (NO₂)	primary	1 hour	100 ppb	98th percentile of 1-hour daily maximum concentrations, averaged over 3 years
	primary and secondary	1 year	53 ppb (2)	Annual Mean
Ozone (O₃)	primary and secondary	8 hours	0.070 ppm (3)	Annual fourth-highest daily maximum 8-hour concentration, averaged over 3 years
Particle Pollution (PM)	primary	1 year	12.0 µg/m ³	annual mean, averaged over 3 years
		secondary	1 year	15.0 µg/m ³
	primary and secondary	24 hours	35 µg/m ³	98th percentile, averaged over 3 years
		primary and secondary	24 hours	150 µg/m ³
Sulfur Dioxide (SO₂)	primary	1 hour	75 ppb (4)	99th percentile of 1-hour daily maximum concentrations, averaged over 3 years
	secondary	3 hours	0.5 ppm	Not to be exceeded more than once per year

- 6.2.1.1 (PM_{10})** - In areas where the national standard or guideline for PM_{10} is exceeded, particle filters or air-cleaning devices shall be provided to clean the outdoor air at any location prior to its introduction to occupied spaces. Particulate matter filters or air cleaners shall have an efficiency reporting value (MERV) of not less than 8 where rated in accordance with ASHRAE Standard 52.2.
- 6.2.1.1 ($PM_{2.5}$)** - In areas where the national standard or guideline for $PM_{2.5}$ is exceeded, particle filters or air-cleaning devices shall be provided to clean the outdoor air at any location prior to its introduction to occupied spaces. Particulate matter filters or air cleaners shall have an efficiency reporting value (MERV) of not less than 8 where rated in accordance with ASHRAE Standard 52.2.
- 6.2.1.3 Ozone** - Air-cleaning devices for ozone shall be provided when the most recent three-year average annual fourth-highest daily maximum eight-hour average ozone concentration exceeds 0.107 ppm (209 µg/m³).

<https://www.epa.gov/criteria-air-pollutants/naaqs-table>

APPLYING AIR FILTRATION PER THE 62.1 IAQP

- Calculations look intimidating
- Concentrations for all contaminants must be estimated
- VOCs must be considered (not required for ventilation rate procedure)
- Building must be validated (not required for ventilation rate procedure)
- Manufacturers can provide software for calculations
- When calculations are completed, most installations require MERV 13, the present standard of care in most offices today anyway, no additional cost to address particulate
- ASHRAE provides a guidance list for contaminants
- Building owner's risk is less when considering what may be in the outside "clean air" used for ventilation
- The risks of changing outside air conditions are limited

TABLE E-1 Required Zone Outdoor Airflow or Space Breathing Zone Contaminant Concentration with Recirculation and Filtration for Single-Zone Systems

Required Recirculation Rate			Required Zone Outdoor Airflow (V_{oz} in Section 6)	Breathing Zone Contaminant Concentration
Filter Location	Flow	Outdoor Airflow		
None	VAV	100%	$V_{oz} = \frac{N}{E_z F_f (C_{bz} - C_o)}$	$C_{bz} = C_o + \frac{N}{E_z F V_{oz}}$
A	Constant	Constant	$V_{oz} = \frac{N - E_z R V_r E_f C_{bz}}{E_z (C_{bz} - C_o)}$	$C_{bz} = \frac{N + E_z V_{oz} C_o}{E_z (V_{oz} + R V_r E_f)}$
A	VAV	Constant	$V_{oz} = \frac{N - E_z F_r R V_r E_f C_{bz}}{E_z (C_{bz} - C_o)}$	$C_{bz} = \frac{N + E_z V_{oz} C_o}{E_z (V_{oz} + F_r R V_r E_f)}$
B	Constant	Constant	$V_{oz} = \frac{N - E_z R V_r E_f C_{bz}}{E_z [C_{bz} - (1 - E_f) C_o]}$	$C_{bz} = \frac{N + E_z V_{oz} (1 - E_f) C_o}{E_z (V_{oz} + R V_r E_f)}$
B	VAV	100%	$V_{oz} = \frac{N}{E_z F_f [C_{bz} - (1 - E_f) C_o]}$	$C_{bz} = \frac{N + E_z F_r V_{oz} (1 - E_f) C_o}{E_z F_r V_{oz}}$
B	VAV	Constant	$V_{oz} = \frac{N - E_z F_r R V_r E_f C_{bz}}{E_z [C_{bz} - (1 - E_f) C_o]}$	$C_{bz} = \frac{N + E_z V_{oz} (1 - E_f) C_o}{E_z (V_{oz} + F_r R V_r E_f)}$

WHAT MOST BUILDING OWNERS CARE ABOUT

200,000 square foot building, 50% glass, green level construction - \$63,000
annual energy savings designing at 5 cfm per person instead of 20 cfm per person

- Ozone protection with MERV 8 pleated panel replaced twice a year at \$30 each - \$8520 annual cost (OSA only does not address other contaminants)
- V-bank MERV 13 filter, replaced every two years at \$340 each \$24, 120 annual cost, addresses particulate and gases
- 90-pounds granular carbon in rechargeable panels, replaced every four years, carbon at \$3 per pound - \$9585 annual cost plus particulate filters

\$38,880 and \$53,415 in owners' pocket

EFFECT ON A NEW CONSTRUCTION PROJECT

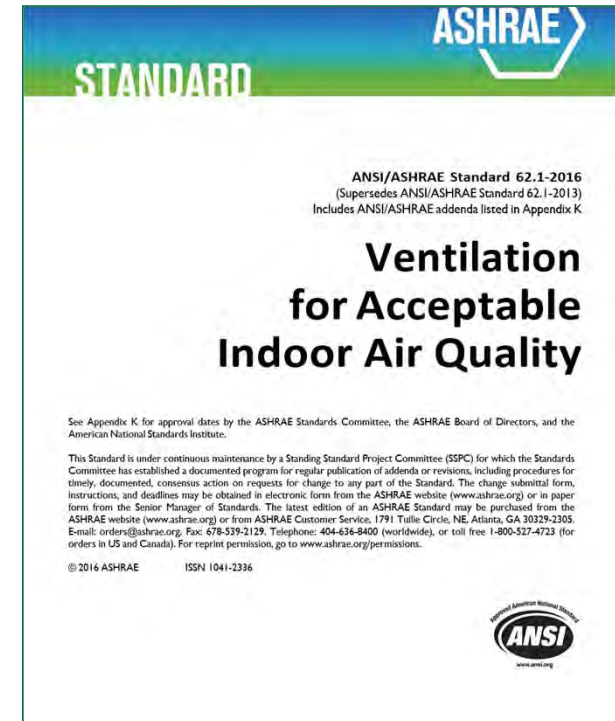
CALCULATIONS REQUIRED MERV 14 AND 50% ADSORBERS

- Reduced OSA 15 CFM to 7-½ cfm per person
- Reduced chiller plant 400 tons
- BTU reduction of 7,138,000 BTU/hr.
- Reduced first cost of \$500,000
- Piping, sheet metal, electrical, etc.

BUILDING IS LESS THAN 2 MILES FROM THIS LOCATION

BENEFITS

- Reduced outdoor air quantity
- Reduced equipment capacity
- Smaller equipment footprint
- Lower operational costs
- Possible savings for demand-billing calculations
- Increased income and margins for the air filter industry
- Air quality guaranteed
- It's the right thing to do!



ROADBLOCKS

- Building code officials
 - Lack of understanding
 - Fear of change
 - Susceptible to propaganda
- There are tens of thousands of gaseous contaminants to consider to protect individuals
 - The same can be said for the “clean air” we introduce for ventilation
 - Historical real building data should rule
- Equipment manufacturers
 - Financial interest
 - Lack of respect for the air filter industry
 - Lack of understanding of filtration technology

We are the biggest impediment.

CITIES EXCEEDING 70 PPM IN 2016

Riverside-San Bernardino-Ontario, CA
Los Angeles-Long Beach-Anaheim, CA
Vernal, UT
Fresno, CA
Sacramento-Roseville-Arden-Arcade, CA
Visalia-Porterville, CA
Bakersfield, CA
Baltimore-Columbia-Towson, MD
Sonora, CA
Bridgeport-Stamford-Norwalk, CT
Red Bluff, CA
Truckee-Grass Valley, CA
Modesto, CA
Sheboygan, WI
Madera, CA
San Diego-Carlsbad, CA
Denver-Aurora-Lakewood, CO
Hanford-Corcoran, CA
Merced, CA
San Francisco-Oakland-Hayward, CA
Chicago-Naperville-Elgin, IL-IN-WI
Hartford-West Hartford-East Hartford, CT
New Haven-Milford, CT
Philadelphia-Camden-Wilmington, PA-NJ-DE-MD
Stockton-Lodi, CA
Yuba City, CA
Houston-The Woodlands-Sugar Land, TX
Las Vegas-Henderson-Paradise, NV
Milwaukee-Waukesha-West Allis, WI
Atlanta-Sandy Springs-Roswell, GA
New York-Newark-Jersey City, NY-NJ-PA
Niles-Benton Harbor, MI
Torrington, CT
Chico, CA
Cleveland-Elyria, OH
Oxnard-Thousand Oaks-Ventura, CA
South Bend-Mishawaka, IN-MI
Cincinnati, OH-KY-IN
Dallas-Fort Worth-Arlington, TX
Fort Collins, CO

Holland, MI
Louisville/Jefferson County, KY-IN
Muskegon, MI
Ogden-Clearfield, UT
Providence-Warwick, RI-MA
Racine, WI
Redding, CA
St. Louis, MO-IL
Salt Lake City, UT
Springfield, MA
Washington-Arlington-Alexandria, DC-VA-MD-WV
Allentown-Bethlehem-Easton, PA-NJ
Detroit-Warren-Dearborn, MI
Grand Rapids-Wyoming, MI
Norwich-New London, CT
Phoenix-Mesa-Scottsdale, AZ
Reading, PA
Ann Arbor, MI
Buffalo-Cheektowaga-Niagara Falls, NY
Cadillac, MI
Charlotte-Concord-Gastonia, NC-SC
El Centro, CA
Kalamazoo-Portage, MI
Ludington, MI
Manitowoc, WI
San Luis Obispo-Paso Robles-Arroyo Grande, CA
Trenton, NJ
Worcester, MA-CT
Birmingham-Hoover, AL
Flint, MI
Gettysburg, PA
Indianapolis-Carmel-Anderson, IN
Knoxville, TN
Lansing-East Lansing, MI
Pittsburgh, PA
Reno, NV
York-Hanover, PA
Ashtabula, OH
Boise City, ID
Canton-Massillon, OH

Columbus, OH
Dayton, OH
Durango, CO
Elkhart-Goshen, IN
Evansville, IN-KY
Green Bay, WI
Janesville-Beloit, WI
Lebanon, PA
Provo-Orem, UT
San Jose-Sunnyvale-Santa Clara, CA
Traverse City, MI
Whitewater-Elkhorn, WI
Baton Rouge, LA
Berlin, NH-VT
Columbus, IN
Cullowhee, NC
El Paso, TX
Indiana, PA
Lancaster, PA
Memphis, TN-MS-AR
San Antonio-New Braunfels, TX
Scranton-Wilkes-Barre-Hazleton, PA
Springfield, OH
Utica-Rome, NY
Vincennes, IN
Wabash, IN
Watertown-Fort Atkinson, WI
Youngstown-Warren-Boardman, OH-PA
Boston-Cambridge-Newton, MA-NH
Columbia, SC
East Stroudsburg, PA
Hagerstown-Martinsburg, MD-WV
Harrisburg-Carlisle, PA
Huntington-Ashland, WV-KY-OH
Las Cruces, NM
Macon, GA
Madison, WI
Payson, AZ
Rockford, IL
Salisbury, MD-DE
Seymour, IN
Tampa-St. Petersburg-Clearwater, FL
Toledo, OH
Wilmington, OH
Winston-Salem, NC

168,649,604 people
51%

O₃ - Fourth daily maximum 8-hour concentration
(applicable NAAQS is 0.070 ppm)



BSR/ASHRAE Addendum k
to ANSI/ASHRAE Standard 62.1-2016

Public Review Draft

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

**First Public Review (February 2016)
(Draft shows Proposed Changes to Current Standard)**

This draft has been recommended for public review by the responsible project committee. To submit a comment on this proposed standard, go to the ASHRAE website at www.ashrae.org/standards-research-technology/public-review-drafts and access the online comment database. The draft is subject to modification until it is approved for publication by the Board of Directors and ANSI. Until this time, the current edition of the standard (as modified by any published addenda on the ASHRAE website) remains in effect. The current edition of any standard may be purchased from the ASHRAE Online Store at www.ashrae.org/bookstore or by calling 404-636-8400 or 1-800-727-4723 (for orders in the U.S. or Canada).

This standard is under continuous maintenance. To propose a change to the current standard, use the change submittal form available on the ASHRAE website, www.ashrae.org.

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- Proposal to ignore the NAAQS new reference of 0.70 ppm and use the AirNow website reference of 0.100 ppm
- NAAQS have been the standard of care for clean air since 1989
- The EPA reviews the NAAQS values periodically, basing any changes on a process that includes integrated science assessment and risk/exposure assessment.
- 122 metropolitan areas are now areas of non-attainment. Interestingly, there are an additional 220 cities that are in the above 0.60 ppm range, areas that could easily enter the dominion of non-attainment with our affinity for auto usage, etc.
- Air filtration of ozone will be required using the Ventilation Rate Procedure or the IAQ Procedure.
- There are members on the committee that are clearly weighing the financial implications to their buildings owners more heavily than human health.
- Air filtration of ozone will be required using the Ventilation Rate Procedure or the IAQ Procedure.

CHANGE OUR INDUSTRY AND THE WORLD FOR BETTER

- Although ASHRAE avoids the use of the word health and uses the word comfort as a surrogate, they are not fooling anyone, the Standard is published to provide guidance for protecting building occupants from problems that are directly tied to poor indoor air quality. There is a wealth of evidence in independent studies that define ozone as a significant contaminant in terms of human health.
- The designer will now have one source for five contaminants and another source to reference for the sixth contaminants' value, albeit one that is already listed on the first list. This will create confusion and increase the possibility of the designer defining the wrong value.
- By defining the specific level within the Standard of 0.100 ppm, the tie-together with a value as defined by a "cognizant authority" is lost.
- Comments are due by April 22nd.

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THANK YOU