ANSI/ASHRAE Addenda l, m, n, o, and s to ANSI/ASHRAE Standard 62.1-2007

ASHRAE STANDARD

Ventilation for Acceptable Indoor Air Quality

This addendum was approved by the ASHRAE Standards Committee on June 20, 2009; by the ASHRAE Board of Directors on June 24, 2009; and by the American National Standards Institute on June 25, 2009.

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FOREWORD

This addendum modifies Informative Appendix D as follows:

• Improve variable-name consistency with body of the standard and Appendix A.
• Delete one figure, replace with two improved figures.
• Delete “proportional” systems from Table D-1, since VAV systems with fixed-position outdoor air dampers are unlikely to meet the requirements of the standard and should be discouraged.

Note: In this addendum, changes to the current standard are indicated in the text by underlining (for additions) and strikethrough (for deletions) unless the instructions specifically mention some other means of indicating the changes.

Addendum I to 62.1-2007


(This appendix is not part of this standard. It is merely informative and does not contain requirements necessary for conformance to the standard. It has not been processed according to the ANSI requirements for a standard and may contain material that has not been subject to public review or a consensus process. Unresolved objectors on informative material are not offered the right to appeal at ASHRAE or ANSI.)

INFORMATIVE APPENDIX D

ACCEPTABLE MASS BALANCE EQUATIONS

FOR USE WITH INDOOR AIR QUALITY PROCEDURE

When applying the Indoor Air Quality Procedure from Section 6.3, mass balance analysis may be employed to determine outdoor air ventilation requirements to control indoor contaminant levels. Table D-1 presents mass balance equations for analysis of single-zone systems.

Figures D-1 and D-2 show representative single-zone systems. A filter may be located in the recirculated airstream (location A) or in the supply (mixed) airstream (location B).

Variable-air-volume (VAV) single-zone systems reduce the circulation rate when the thermal load is lower than the design load. This is accounted for by a design flow reduction fraction $F_r$.

A mass balance equation for the contaminant-of-concern may be written and used to determine the required outdoor airflow or the breathing zone contaminant concentration for the various system arrangements. Six Eight permutations for air-handling and single-zone air distribution systems are described in Table D-1. The mass balance equations for computing the required outdoor airflow and the breathing-zone contaminant concentration at steady-state conditions for each single-zone system are presented in Table D-1.

If the allowable breathing zone contaminant concentration is specified, the equations in Table D-1 may be solved for the zone outdoor airflow rate $V_{oz}$. When the zone outdoor airflow rate is specified, the equations may be solved for the resulting breathing zone contaminant concentration.

While the calculation methods in this appendix are based on single-zone systems and steady-state analysis, calculation methods that account for multiple-zone and transient effects are also available.

REFERENCES

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

<table>
<thead>
<tr>
<th>Required Recirculation Rate</th>
<th>Required Zone Outdoor Airflow ((V_{oz} \text{ in Section 6}))</th>
<th>Breathing Zone Contaminant Concentration</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Filter Location</strong></td>
<td><strong>Flow</strong></td>
<td><strong>Outdoor Airflow</strong></td>
</tr>
<tr>
<td>None</td>
<td>VAV</td>
<td>100%</td>
</tr>
<tr>
<td>A</td>
<td>Constant</td>
<td>Constant</td>
</tr>
<tr>
<td>A</td>
<td>VAV</td>
<td>Constant</td>
</tr>
<tr>
<td>A</td>
<td>VAV</td>
<td>Proportional*</td>
</tr>
<tr>
<td>B</td>
<td>Constant</td>
<td>Constant</td>
</tr>
<tr>
<td>B</td>
<td>VAV</td>
<td>100%</td>
</tr>
<tr>
<td>B</td>
<td>VAV</td>
<td>Constant</td>
</tr>
<tr>
<td>B</td>
<td>VAV</td>
<td>Proportional*</td>
</tr>
</tbody>
</table>

\* Proportional indicates that the outdoor airflow varies with the supply airflow, such that the outdoor airflow is equal to the design value times the flow reduction fraction, \(F_{r}\).
Delete the existing Figure D-1 and insert new Figures D-1 and D-2 as shown.

Figure D-1 Ventilation system schematic.

Figure D-2 Ventilation system schematic—variable air volume system with no infiltration/exfiltration. (*$V_{ol} = V_{oz}$ for single-zone systems.)
(This foreword is not part of this standard. It is merely informative and does not contain requirements necessary for conformance to the standard. It has not been processed according to the ANSI requirements for a standard and may contain material that has not been subject to public review or a consensus process. Unresolved objectors on informative material are not offered the right to appeal at ASHRAE or ANSI.)

FOREWORD

This addendum removes ventilation requirements for healthcare spaces from the Standard since ventilation requirements for these types of spaces are covered in Standard 170-2008, “Ventilation of Health Care Facilities.”

Note: In this addendum, changes to the current standard are indicated in the text by underlining (for additions) and strikethrough (for deletions) unless the instructions specifically mention some other means of indicating the changes.

Addendum m to 62.1-2007

Delete the following General Note for Table 6-1:

7 Health-care facilities: Rates shall be determined in accordance with Appendix E.

Delete Appendix E in its entirety.

(This is a normative appendix and is part of the standard.)

NORMATIVE APPENDIX E
VENTILATION RATES FOR HEALTH CARE FACILITIES

| Table E-1—Outdoor Air Requirements for Ventilation of Healthcare Facilities (Hospitals, Nursing, and Convalescent Homes)* |
|---|---|---|---|---|
| Application | Estimated Maximum** Occupancy, P/1000 ft²(P/100 m²) | Outdoor Air Requirements, L/s·P | L/s m² | Comments |
| Patient rooms | 10 | 25 | 13 | Special requirements or codes and pressure relationships may determine minimum ventilation rates and filter efficiency. Procedures generating contaminants may require higher rates. |
| Medical procedure | 20 | 15 | 8 |  |
| Operating rooms | 20 | 30 | 15 |  |
| Recovery and ICU | 20 | 45 | 8 |  |
| Autopsy rooms | 20 | 0.50 | 2.50 | Air shall not be recirculated into other spaces. |
| Physical therapy | 20 | 15 | 8 |  |

* Table E-1 prescribes supply rates of acceptable outdoor air required for acceptable indoor air quality. These values have been chosen to dilute human bioeffluents and other contaminants with an adequate margin of safety and to account for health variations among people and varied activity levels.

** Net occupiable space.
6. VENTILATION

Delete this paragraph in its entirety; including any modifications in concurrent public review addenda.

This section is not required for natural ventilation systems; natural ventilation systems shall be designed in accordance with Section 5.1.

6.1 General. Either the Ventilation Rate Procedure, or the IAQ Procedure, and/or the Natural Ventilation Procedure shall be used to design each ventilation system in a building to meet the requirements of this section, subject to the following considerations and restrictions.

Note: Although the intake airflow determined using each of these approaches may differ significantly because of assumptions about the design, any of these approaches is a valid basis for design.

6.1.1 Ventilation Rate Procedure. This is a prescriptive design procedure presented in Section 6.2, in which outdoor air intake rates are determined based on space type, application, occupancy level, and floor area, shall be permitted to be used for any zone or system.

Note: The Ventilation Rate Procedure minimum rates are based on contaminant sources and source strengths that are typical for the listed space type/occupancy categories.

6.1.3 Natural Ventilation Procedure. The prescriptive 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 in conjunction with mechanical ventilation systems as required in Section 6.4.

Delete existing Section 5.1 and insert as new Section 6.4. Renumber remainder of Section 5 and Section 6 accordingly. Revise new Section 6.4 as follows.

Note that Addendum a to 62.1-2007 (included in the 2008 Supplement) made changes to Section 5.1 and the exception in the published standard. The 2008 Supplement is available for free download from the ASHRAE website at http://www.ashrae.org/technology/page/132:

6.4.1. Natural Ventilation Procedure. Natural ventilation systems shall be designed in accordance with this section and shall not subject to the requirements in Section 6. Use of natural ventilation systems shall be permitted in lieu of or in conjunction with mechanical ventilation systems. Such natural ventilation systems shall be designed in accordance with the requirements of 6.3.5 and/or Section 6.3.5.3.

Exceptions:

1. An engineered natural ventilation system when approved by the authority having jurisdiction need not meet the requirements of these Sections 6.4.

2. The mechanical ventilation systems are not required when:
   a. Natural ventilation openings that comply with the requirements of Section 6.4 are permanently open or have controls which prevent the openings from being closed during periods of expected occupancy, or
   b. The zone is not served by heating or cooling equipment.

6.4.1.1 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.

6.4.1.2 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.

6.4.1.3 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 two openings which are farthest apart. Floor area outside that line must comply with sections 6.4.1.1.

6.4.1.4 Ceiling Height. The ceiling height, H, to be used in Sections 6.4.1.1 through 6.4.1.3 shall be the minimum ceiling height in the space.

Exception: For ceilings which 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.

6.4.2 Location and Size of Openings. Naturally ventilated Spaces, or portions of spaces, to be naturally ventilated shall be permanently open to and within 8 m (25 ft) of operable wall or roof openings directly to the outdoors, the openable area of which is a minimum of 4% of the net occupiable floor area. Where openings are covered with louvers or otherwise obstructed, openable area shall be based on the net free unobstructed area through the opening. Where interior rooms, or portions of rooms, without direct openings to the outdoors are ventilated through adjoining rooms, the opening between rooms shall be permanently unobstructed and have a free area of not less than 8% of the area of the interior room nor less than 25 ft² (2.3 m²).

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.

Revise Section 8.3 as follows:

Note that the second sentence in Section 8.3 below was added by Addendum j to 62.1-2007.

8.3 Ventilation System Operation. Mechanical and natural ventilation systems shall be operated in a manner consistent with the O&M Manual. Systems shall be operated such that spaces are ventilated in accordance with Section 6 when they are expected to be occupied.
(This foreword is not part of this standard. It is merely informative and does not contain requirements necessary for conformance to the standard. It has not been processed according to the ANSI requirements for a standard and may contain material that has not been subject to public review or a consensus process. Unresolved objectors on informative material are not offered the right to appeal at ASHRAE or ANSI.)

FOREWORD

This addendum moves the existing Section 6.2.8 “Exhaust Ventilation” and the corresponding Table 6-4 “Minimum Exhaust Rates” to a new Section 6.5 such that exhaust requirements apply to all zones and/or systems regardless of the method used to determine minimum outdoor airflow rates (Ventilation Rate Procedure, IAQ Procedure, or Natural Ventilation Procedure).

Note: In this addendum, changes to the current standard are indicated in the text by underlining (for additions) and strikethrough (for deletions) unless the instructions specifically mention some other means of indicating the changes.

Addendum o to 62.1-2007

Revise Section 6 as follows:

6. PROCEDURES

This section is not required for natural ventilation systems. Natural ventilation systems shall be designed in accordance with Section 5.1. Spaces designed with natural ventilation systems shall comply with Section 6.4.

Relocate Section 6.2.8 to new Section 6.4 as follows:

6.4.2.8 Exhaust Ventilation. The design exhaust airflow shall be determined in accordance with the requirements in Table 6-4. Exhaust makeup air may be any combination of outdoor air, recirculated air, and transfer air.

Renumber existing Section 6.4 as follows:

6.5.4 Design Documentation Procedures. Design criteria and assumptions shall be documented and should be made available for operation of the system within a reasonable time after installation. See Sections 4.3, 5.2.3, 5.17.4, and 6.3.2 regarding assumptions that should be detailed in the documentation.

Revise Section 8.3 as follows:

(Note that the second sentence in Section 8.3 below was added by Addendum j to 62.1-2007 and has yet to be published.)

8.3 Ventilation System Operation. Mechanical and natural ventilation systems shall be operated in a manner consistent with the O&M Manual. Systems shall be operated such that spaces are ventilated in accordance with Section 6 when they are expected to be occupied.
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FOREWORD

Based on committee-member experience, “shipping/receiving” areas and “warehouses” require a minimum outdoor airflow rate per person as well as a minimum per unit area rate, and “coin-operated laundries” need a higher minimum outdoor airflow rate per unit area than previously published.

Note: In this addendum, changes to the current standard are indicated in the text by underlining (for additions) and strikethrough (for deletions) unless the instructions specifically mention some other means of indicating the changes.

Addendum s to 62.1-2007

Revise Table 6-1 as follows (for brevity only modified lines of the table are included):

<table>
<thead>
<tr>
<th>Occupancy Category</th>
<th>People Outdoor Air Rate $R_P$ (cfm/person L/s·person)</th>
<th>Area Outdoor Air Rate $R_A$ (cfm/ft² L/s·m²)</th>
<th>Default Values</th>
</tr>
</thead>
<tbody>
<tr>
<td>Miscellaneous spaces</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Shipping/receiving</td>
<td>10-</td>
<td>5-</td>
<td>0.12</td>
</tr>
<tr>
<td>Warehouses</td>
<td>10-</td>
<td>5-</td>
<td>0.06</td>
</tr>
<tr>
<td>Retail</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Coin-operated laundries</td>
<td>7.5</td>
<td>3.8</td>
<td>0.06</td>
</tr>
<tr>
<td>Sports and Entertainment</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Disco/dance floors</td>
<td>20</td>
<td>10</td>
<td>0.06</td>
</tr>
</tbody>
</table>
ASHRAE is concerned with the impact of its members’ activities on both the indoor and outdoor environment. ASHRAE’s members will strive to minimize any possible deleterious effect on the indoor and outdoor environment of the systems and components in their responsibility while maximizing the beneficial effects these systems provide, consistent with accepted standards and the practical state of the art.

ASHRAE’s short-range goal is to ensure that the systems and components within its scope do not impact the indoor and outdoor environment to a greater extent than specified by the standards and guidelines as established by itself and other responsible bodies.

As an ongoing goal, ASHRAE will, through its Standards Committee and extensive technical committee structure, continue to generate up-to-date standards and guidelines where appropriate and adopt, recommend, and promote those new and revised standards developed by other responsible organizations.

Through its *Handbook*, appropriate chapters will contain up-to-date standards and design considerations as the material is systematically revised.

ASHRAE will take the lead with respect to dissemination of environmental information of its primary interest and will seek out and disseminate information from other responsible organizations that is pertinent, as guides to updating standards and guidelines.

The effects of the design and selection of equipment and systems will be considered within the scope of the system’s intended use and expected misuse. The disposal of hazardous materials, if any, will also be considered.

ASHRAE’s primary concern for environmental impact will be at the site where equipment within ASHRAE’s scope operates. However, energy source selection and the possible environmental impact due to the energy source and energy transportation will be considered where possible. Recommendations concerning energy source selection should be made by its members.