BSR/ASHRAE/IES Addendum bx
to ANSI/ASHRAE/IES Standard 90.1-2022

Public Review Draft

Proposed Addendum bx to Standard 90.1-2022, Energy Standard for Sites and Buildings Except Low-Rise Residential Buildings

Second Public Review (October 2025)
(Draft Shows Proposed Independent Substantive Changes to Previous Public Review Draft)

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FOREWORD

This second independent substantive change draft addendum on laboratory ventilation. The following changes are the result of public comments submitted to the first public review.

- "Laboratory exposure control devices" are defined and added to the VAV section based on discussions with commenters who pointed out that hoods are not the only types of devices that must be considered.
- "Corrosive agents" are defined and included in a new exception to the heat recovery requirement based on discussions with commenters who felt that corrosion-resistant coil coatings are not reliable and that a new exception is warranted.
- New clauses 1.ii and 1.iii are added to 6.5.7.3.1.1.c.1 and 6.5.7.3.1.1.c.2 based on discussions with commenters who felt that these additional reasons to increase lab airflow rates should be allowed in order not to affect safety or functionality of some labs.
- New language is added to 6.5.7.3.2.1 based on feedback from a commenter who pointed out that a sensible heat recovery ratio of 0.45 could result in freeze up of the exhaust recovery coil for humidified laboratories where design day ambient is less than 0F
- Exception 6 is added to 6.5.7.3.2 based on discussions with commenters who felt that corrosion resistant coil coatings are not reliable and therefore a new exception is warranted.
- Exception 7 is added to 6.5.7.3.2 based on discussions with a commenter who felt that the added maintenance cost used in the LCCA underrepresented the incremental maintenance for vivaria due to increased filter changes. The LCCA analysis shows very good paybacks of 2-3 years in all climates except 2A, with 10 years in 2A. Many exhaust air heat recovery systems already include a filter upstream of the heat recovery coil. Our analysis is based on such a system. The measure is still cost-effective even if additional exhaust air filtration and maintenance costs are required for a vivarium. The analysis was done assuming 1 cfm/ft2 (6 ACH). At 2 cfm/ft^2, the savings will be roughly double, and the measure is cost-effective in 1A and 2A with added filtration and maintenance costs.
- Exceptions 8.a and 5.b are added to 6.5.7.3.2 based on discussions with commenters who felt that these types of systems were hazardous to personnel maintaining heat recovery systems.
- Section 6.5.7.3.3 Reheat Limitations is removed from this addendum based on feedback from commenters skeptical of the accuracy of the lifecycle cost analysis. The MSC intends to resubmit the Reheat Limitations proposal (with modifications) as a separate addendum.
- The Fume Hood Automatic Sash Closure section is modified to include an option for audible alarms rather than auto closers based on feedback from commenters skeptical of the LCCA for auto closers and concerned about their practicality in some situations. These commenters felt that audible alarms were a less expensive and less onerous/problematic option.

[Note to Reviewers: This public review draft makes proposed independent substantive changes to the previous public review draft. These changes are indicated in the text by underlining (for additions) and ~~strikethrough~~ (for deletions) except where the reviewer instructions specifically describe some other means of showing the changes. Only these changes to the previous draft 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 substantive changes.]

Addendum bx to 90.1-2022

Add new definitions to Section 3.2 (I-P and SI)

laboratory exposure control device: Any equipment or apparatus specifically designed to reduce or eliminate human exposure to hazardous substances in a laboratory setting. Common types of *laboratory exposure control devices* include fume hoods, ventilated enclosures, snorkel exhaust arms, glove boxes, and hazardous gas cabinets.

corrosive agent: a substance that chemically reacts with and degrades metal surfaces, leading to the deterioration of their structural integrity and impairment of their intended function.

Modify Section 6.5.7.3 as follows (I-P and SI):

6.5.7.3.1 VAV Replacement and Exhaust Air

6.5.7.3.1.1 *Buildings* with laboratory exhaust *systems* having a total laboratory exhaust rate greater than 5000 cfm [2,360 L/s] shall be capable of and configured to reduce exhaust and *replacement air* flow to each laboratory *HVAC zone* to the larger of that required to meet the following:

a) real time cooling or heating loads

b) real time ~~hood~~ *laboratory exposure control device* exhaust and *replacement air* requirements

c) occupied and unoccupied minimum ventilation airflow rates based on occupancy sensors as follows:

1. When occupant sensing controls sense occupants in the laboratory *HVAC zone*, or the *HVAC zone* is scheduled to be occupied, the minimum exhaust and makeup airflow rates shall not exceed the larger of:
   i. the *required minimum outdoor air rate* when spaces are occupied, or
   ii. the minimum circulation rate documented to comply with facility environmental health and safety department requirements, regulatory or governing agencies, or contractual requirements when occupied.
   iii. the minimum circulation rate required to comply with the environmental stability and tolerance requirements to support specific scientific and/or supporting equipment need, or
   iv. 1.0 cfm/ft^2 [5 l/s/m^2]

2. Not more than 20 minutes after no occupancy is detected by all occupant sensors in the *HVAC zone*, and the *HVAC zone* is not scheduled to be occupied, the minimum exhaust and makeup airflow rates shall not exceed the larger of:
   i. the *required minimum outdoor air rate* when spaces are unoccupied, or
   ii. the minimum circulation rate documented to comply with facility environmental health and safety department requirements, regulatory or governing agencies, or contractual requirements when unoccupied.
   iii. the minimum circulation rate required to comply with the environmental stability and tolerance requirements to support specific scientific and/or supporting equipment need, or
   iv. 0.67 cfm/ft^2 [3.4 l/s/m^2]

6.5.7.3.1.2 Exhaust and *replacement air* rates determined by section 6.5.7.3.1.1 shall be permitted to be adjusted as required to meet laboratory pressurization requirements.

Informative Note: ASHRAE Guideline 36 includes detailed sequences of control for laboratory replacement and exhaust air.

6.5.7.3.2 Exhaust Air Heat Recovery

Buildings with laboratory exhaust *systems* having a total laboratory exhaust rate greater than 10,000 cfm [4,725 L/s] shall include an exhaust air heat recovery system that meets all the following:

1. A *sensible energy recovery ratio* of at least 45% at heating design conditions in all climates except Climate Zones 0, 1, and 2. For laboratories with design heating outdoor air temperature below 0°F and with active humidification, the *sensible energy recovery ratio* shall be rated at the coldest outdoor air temperature that does not result in frosting on the exhaust air coil, but no colder than the design heating outdoor air temperature.
2. A *sensible energy recovery ratio* of at least 35% at cooling design conditions in all climates except Climate Zones 3C, 4C, 5B, 5C, 6B, 7, and 8.
3. Heat is recovered from at least 75% of all design occupied lab exhaust airflow.
4. The system includes a means to disable heat recovery when heat recovery results in an increase in energy use.
5. The system includes a bypass damper or other means so that the exhaust air pressure drop through the heat exchanger does not exceed 0.4 in. w.g [100 Pa] when heat recovery is disabled.

Exceptions to 6.5.7.3.2:

1. Additions or alterations to existing laboratory exhaust systems that do not include exhaust air heat recovery.
2. Buildings where the total laboratory exhaust rate exceeds 20 cfm/ft2 [100 l/s/m^2], of roof area.
3. Building located in Climate Zone 3B and within 6 miles [10 km] of an ocean.
4. Buildings with an exhaust air heat recovery system and heat recovery chillers designed to provide at least 40% of the peak heating load from exhaust heat recovery.
5. Exhaust systems requiring wash down systems such as exhaust systems dedicated to perchloric acid fume hoods.
6. Exhaust systems constructed entirely of corrosion-resistant materials and exclusively dedicated to *laboratory exposure control devices* designed to exhaust high concentrations of *corrosive agents*.
7. Systems dedicated to vivarium spaces with design minimum outdoor air rates less than 2.0 cfm/ft^2 [10 l/s/m^2] and located in Climate Zone 0A, 1A or 2A.
8. Exhaust systems exclusively dedicated to:
    a. *laboratory exposure control devices* designed to exhaust radioisotopes, or
    b. Class II Type B2 biological safety cabinets

~~**6.5.7.3.3 Reheat Limitations**~~

~~Laboratory *HVAC zones* in buildings with greater than 20,000 cfm [9,450 L/s] of laboratory exhaust and with *design minimum outdoor air rates* equal to or greater than the values in Table 6.5.7.3.3 shall include zonal heating and cooling capacity, such as *4-pipe VAV,* to minimize cooling at the air handler and reheating at the zones. Zones shall not simultaneously heat and cool except when necessary to keep zone humidity from exceeding the limits defined in 6.4.3.6.1. Air handlers serving multiple laboratory zones with heating and cooling capacity shall not heat air handler supply air above 50.0°F [10.0°C] and shall not mechanically cool air handler supply air to the zones below the following:~~

~~1. 74.0°F [23.3°C] when outdoor air dewpoint is less than the limit defined in 6.4.3.6.1~~
~~2. The temperature required to maintain the zone humidity limit defined in 6.4.3.6.1 when outdoor air dewpoint is greater than or equal to the limit defined in 6.4.3.6.1.~~

~~Table 6.5.7.3.3 Design Minimum Outdoor Air Rate* Triggering Zonal Heating and Cooling Capacity~~

~~Climate Zones 2B, 3B, 3C~~	~~Climate Zones 0, 1A, 2A, 3A, 5B, 4C~~	~~Climate Zones 4A, 5A, 6A, 6B, 7, 8~~
~~1.0 cfm/ft2 [5 l/s/m^2]~~	~~1.6 cfm/ft2 [8 l/s/m^2]~~	~~2.0 cfm/ft2 [10 l/s/m^2]~~

~~* the sum of the lab zone occupied *design minimum outdoor airflow rates* divided by the sum of the lab zone areas.~~

~~**Exceptions to 6.5.7.3.3:**~~

~~1. Additions or alterations to existing air handling systems serving existing zones without heating and cooling capacity.~~
~~2. Systems where the outdoor dewpoint temperature is greater than or equal to 68.0°F [20°C} at the ASHRAE 2% annual dehumidification design condition and that must maintain space relative humidity ≤ 60% for required certification or accreditation.~~
~~3. Systems dedicated to vivarium spaces or to spaces classified as Biosafety Level 3 or higher.~~
~~4. Laboratory zones served by air handlers also serving zones covered by ASHRAE Standard 170.~~

6.5.7.3.4~~3~~ Fume Hood Automatic Sash Closure or Audible Alarm

~~Variable air volume~~ Laboratory fume hoods with ~~vertical only~~operable sashes located in fume hood intensive laboratories as defined in Table 6.5.7.3.4~~3~~, shall be variable air volume and shall have at least one of the following two options:

Option 1: an automatic sash closure system that complies with the following:

1. The automatic sash closure system shall have a dedicated ~~zone~~ fume hood presence sensor that detects occupants in the area near the fume hood sash and automatically closes the sash within 5 minutes of no detection.
2. The automatic sash closure system shall be equipped with an obstruction sensor that prevents the sash from automatic closing with obstructions in the sash opening. The obstruction sensor shall be capable of sensing transparent materials such as laboratory glassware.
3. The automatic sash closure system shall be capable of being configured in a manual ~~closed~~ open mode where, once the sash is closed, detection of occupants in the area near the fume hood by the ~~zone~~ fume hood presence sensor does not automatically open the fume hood sash.

Option 2: an alarming system that includes a sash position sensor and a dedicated fume hood presence sensor. If the hood is open 5 minutes after no occupants are detected, then the system shall:

1. Trigger an audible alarm near the hood of at least 70 decibels that cannot be disabled by occupants, and
2. Trigger an alarm in the DDC system that is transmitted to building operators and displayed on the DDC graphical display.

Table 6.5.7.3.4~~3~~ Fume Hood Intensive Laboratory Threshold (both must be true)

Occupied Minimum Ventilation ACH	≤ 4	> 4 and ≤ 6	> 6 and ≤ 8	> 8 and ≤ 10	> 10 and ≤ 12	> 12 and ≤ 14
Hood Density (linear feet per 10,000 ft^3 [283 m^3] of laboratory space	≥ 6	≥ 8	≥ 10	≥ 12	≥ 14	≥ 16