ADDENDA

ANSI/ASHRAE Addendum a to
ANSI/ASHRAE Standard 160-2021

Criteria for Moisture-Control Design Analysis in Buildings

Approved by the ASHRAE Standards Committee on January 20, 2024 and by the American National Standards Institute on January 31, 2024.

This addendum was approved 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).

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SPECIAL NOTE

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a. interpretation of the contents of this Standard,
b. participation in the next review of the Standard,
c. offering constructive criticism for improving the Standard, or
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(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

ASTM International recently published a standard guide under designation E3054/E3054M-16, entitled "Standard Guide for Characterization and Use of Hygrothermal Models for Moisture Control Design in Building Envelopes." This standard guide is complementary to ASHRAE Standard 160 and provides useful information regarding the characterization and classification of hygrothermal models, the documentation of model characteristics and inputs, and the reporting of results. Addendum a improves the organization and clarity of Section 7, "Reporting," of Standard 160-2021 and adds commentary that references ASTM E3054/E3054M-16.

Informative 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 a to Standard 160-2021

Revise Section 7 as shown.

7. REPORTING

The following reporting requirements shall be met[B-27].

7.1 Provide a description of the building envelope assembly~~.~~ and the following information:

a. ~~Assembly~~
~~b.~~ Type of envelope assembly (wall, roof, etc.)
b. List of constitutive material layers in order from exterior to interior
c. Orientation
d. Surface ~~coefficients~~ radiative properties
e. Air space locations and air space ventilation rates with outdoor air
f. ~~List of materials (include reference source of data)~~ Geographic location of the building

7.2 Provide data on each of the materials in the building envelope assembly and the source of data.

a. Material description
b. Thickness
c. Density
d. Thermal conductivity and its dependency on temperature and moisture content, if ~~applicable~~ available
e. Specific heat capacity
f. Vapor permeance, ~~or~~ vapor permeability, or vapor diffusion resistance factor and its dependency on moisture content or relative humidity
g. Sorption isotherm
h. Liquid diffusivity or liquid conductivity and its dependency on moisture content or relative humidity
i. Suction isotherm
j. ~~Initial moisture content~~
~~k.~~ Other material properties that are relevant ~~required~~ for the analysis ~~analytic model~~, possibly including the following:
    1. Porosity
    2. Capillary saturation
    3. Maximum saturation
    4. Airflow permeability

~~**7.3** Provide general information about the building.~~

~~a. Procedures to protect materials from wetting during construction are specified? (Y/N) (Section 4.1)~~
~~b. Are the operating temperatures for the building specified? (Y/N) (Section 4.2)~~
~~c. Are HVAC equipment and controls included in the design? (Y/N) (Section 4.3)~~
~~d. Which indoor design humidity method is selected?~~
    ~~1. Simplified method (Section 4.3.1)~~

~~2. Intermediate method (Section 7.4)~~
~~3. Full parameter method (Section 4.3.3)~~

~~e. Effects of airflow are considered? (Section 4.4)~~
~~1. No~~
~~2. Yes (Section 4.4.1)~~

~~f. If effects of airflow are considered:~~
~~1. Design air pressures, managed and verified? (Y/N)~~
~~2. Airtightness known? (Y/N)~~

~~g. Weather data (moisture Design Reference Year or 10 years consecutive) (Section 4.5)~~

~~h. Exposure factor (0.7 to 1.5) (Table 4.6.1)~~

~~i. Deposition factor (0.35, 0.5, or 1.0)~~

~~j. Analytic program: Name and description (Section 5):~~

7.3 Provide documentation of the initial temperature and moisture conditions. In addition, provide the following:

a. For new construction, are procedures specified to dry construction materials or to protect materials and assemblies from wetting during construction? (Yes/No) (***Informative Note:*** See Section 4.1 of this standard.)

b. For retrofit applications, are measured moisture content values available? (Yes/No) (***Informative Note:*** See Section 4.1 of this standard.) If "yes," provide documentation of the measured values.

7.4 Provide documentation of the interior conditions, exterior weather conditions, and surface heat and mass transfer coefficients. In addition, provide the following:

a. Are the operating temperatures for the building specified? (Yes/No) (***Informative Note:*** See Section 4.2 of this standard.)

b. Is the indoor humidity explicitly controlled by HVAC equipment and controls included in the design? (Yes/No) If "yes," report the intended design indoor humidity. (***Informative Note:*** See Section 4.3 of this standard.) If "no," report which indoor design humidity method is selected.
   1. Simplified method (***Informative Note:*** See Section 4.3.1 of this standard.)
   2. Intermediate method: Provide further documentation in accordance with Section 7.4.1 of this standard. (***Informative Note:*** See Section 4.3.2 of this standard.)
   3. Full parametric method: Provide further documentation in accordance with Section 7.4.2 of this standard. (***Informative Note:*** See Section 4.3.3 of this standard.)

c. Identify weather data used in the analysis as either the moisture-design reference year or consecutive years of hourly meteorological weather data. (***Informative Note:*** See Section 4.5 of this standard.) Provide the geographic location of the weather data.

d. For exterior wall assemblies, report the method used to analyze wind-driven rain loads: comprehensive analysis or Equation 4-8. (***Informative Note:*** See Section 4.6 of this standard.) If Equation 4-8 is used, provide the following:
   1. Exposure factor (0.7 to 1.5) (***Informative Note:*** See Table 4-4 of this standard.)
   2. Deposition factor (0.35, 0.5, or 1.0) (***Informative Note:*** See Section 4.6 of this standard.)

~~7.4~~ **7.4.1 Intermediate Method.** If ~~For users of~~ the intermediate method of determining indoor design humidity ~~only~~ is used (***Informative Note:*** See Section 4.3.2 of this standard), provide the following:

a. Residential or nonresidential occupancy?
b. Moisture generation rate (***Informative Note:*** See Sections 4.3.2.1.1 and 4.3.2.1.2 of this standard.)
c. Designed ventilation system? (Yes/No)
d. Number of design air changes per hour (***Informative Note:*** See Sections 4.3.2.1.3 and 4.3.2.1.4 of this standard.)
e. Building volume
f. Resulting ventilation rate
g. For thermostat-controlled air conditioning (***Informative Note:*** See Section 4.3.2.2 of this standard):
   1. Mean coincident outdoor design humidity ratio for cooling
   2. Resulting design indoor humidity
h. For humidistat-controlled air conditioning (***Informative Note:*** See Section 4.3.2.2 of this standard) or dehumidification (***Informative Note:*** See Section 4.3.2.3 of this standard):
   1. Humidity control setting

7.4.2 Full Parametric Method. If the full parametric method of determining indoor design humidity is used, report the parameters in accordance with those listed in Section 4.3.3 of this standard.

7.5 Provide documentation of the building envelope assembly air leakage and rain penetration characteristics. In addition, provide the following:

a. Are effects of airflow considered? (Yes/No) (***Informative Note:*** See Section 4.4 of this standard.) If "yes," provide the following:
   1. Is the air pressure differential between indoors and outdoors explicitly controlled by HVAC equipment and controls included in the design? (Yes/No) If "yes," report the intended air pressure differential. If "no," report which procedure is used for the design air pressure differential (Alternative 1 or Alternative 2). (***Informative Note:*** See Section 4.4.1 of this standard.)
   2. Is the airtightness of the envelope assembly known? (Yes/No) If "yes," report the value and the test method. If "no," report the option used: airtight building or standard construction. (***Informative Note:*** See Section 4.4.1 of this standard.)
   3. Provide a description of the airflow pathways selected and a technical rationale.
b. For exterior wall assemblies, report the amount of rain penetration, deposit site, and technical rationale. (***Informative Note:*** See Section 4.6.1 of this standard.)

7.6 Provide documentation of the software including the following:

a. The name and version of software
b. Report whether the model is deterministic or stochastic
c. Report the dimensionality of the model (1D, 2D, or 3D)
d. Report the numerical grid, time step, and numerical convergence parameters

7.~~5~~7 Provide the moisture performance evaluation criteria used and provide results.

a. If conditions necessary to minimize mold growth are evaluated, provide the following:
   ~~a~~1. Material sensitivity class and rationale for its selection
   ~~b~~2. Mold index decline coefficient and rationale for its selection
   ~~c~~3. Time series of surface temperature and surface relative humidity values
   ~~d~~4. Time series of mold index values
   ~~e~~5. Outcome (pass/fail)
b. If corrosion is evaluated, provide the following:
   ~~a~~1. Criterion used (80% surface rh/other)
   ~~b~~2. Time series of surface temperature and surface relative humidity values
   ~~c~~3. Outcome (pass/fail)

Revise Informative Appendix B as shown.

B-27 Further information that may be useful in describing the hygrothermal analysis is provided in ASTM E3054/E3054M-16, *Standard Guide for Characterization and Use of Hygrothermal Models for Moisture Control Design in Building Envelopes* (ASTM 2016). This ASTM standard guide is complementary to ASHRAE Standard 160. Specifically, the following sections of the ASTM standard guide are relevant:

a. Section 5, "Hygrothermal Model Analysis Inputs," provides a classification of model characteristics, such as the nature of equations, physical phenomena included, dimensionality, and validation, and a classification of model inputs, including material properties, exterior and interior conditions, assembly air leakage, water drainage, and water penetration.
b. Section 6, "Documentation Approach of Modeling Application," provides guidance on documenting the problem, the scope and purpose of the analysis, the classification of the model, and various inputs mentioned above.
c. Section 7, "Reporting of Hygrothermal Model Results," provides guidance on the display, evaluation, and interpretation of the analysis results.

Revise Informative Appendix C as shown.

ASTM. 2016. ASTM E3054/E3054M-16, *Standard Guide for Characterization and Use of Hygrothermal Models for Moisture Control Design in Building Envelopes*. West Conshohocken, PA: ASTM International.

POLICY STATEMENT DEFINING ASHRAE'S CONCERN FOR THE ENVIRONMENTAL IMPACT OF ITS ACTIVITIES

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.

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