



**BSR/ASHRAE/IES Addendum at
to ANSI/ASHRAE/IES Standard 90.1-2022**

Public Review Draft

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

**First Public Review (September 2024)
(Draft Shows Proposed Changes to Current Standard)**

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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

ASHRAE Standard 140-2023 added software acceptance criteria to Standard 140, allowing codes citing Standard 140, such as 90.1, to require the results from software to provide results within the ranges included in the addendum. This provides the 90.1 with a measure of the acceptability of a building performance simulation software program based on the tests included in Standard 140. Before Standard 140-2023 had test cases with example results to evaluate building performance software. But it did not include any information on when a software's results would be considered acceptable for the test cases. This meant that organizations that cited Standard 140 would only require that software ran the tests and not that their results had to be within a specific range of results. Historically, this caused confusion for jurisdictions adopting IECC when determining if software passed or failed 140 when simply running the tests was all that was required.

All major building energy modeling software developers were invited to participate in the process to determine the acceptance ranges that appear in 140-2023 and many software developers participated. The acceptance ranges were set so that commonly used software programs are within the ranges, and additional software is expected to be within the ranges as software developers address outlying results. Overall, this approach will encourage building performance simulation software to be more accurate and consistent. No comments were provided during the public review of addendum adding this 140, which reflects the consensus reached within the software and modeling community.

This proposal adds the necessary referencing language to utilize ASHRAE Standard 140-2023, including the acceptance ranges to be met, the reporting requirements, and the details necessary for testing to 90.1 in the four sections that referenced it. This proposal also reduces redundancy in 90.1 by collecting the rules for referencing 140 to Appendix G and reference these rules in Section 12, Appendix C, and Appendix L. The use of a simulation engine and a simplified interface for programs that comply with Appendices C and L have traditionally meant that only the simulation engine and not the entire program including user interface were tested according to 140 and this addendum makes that explicit.

This addendum impacts an optional performance path in the standard designed to provide increased flexibility, which was not subjected to a cost-effectiveness analysis.

[Note to Reviewers: This addendum makes proposed changes to the current standard. These changes are indicated in the text by underlining (for additions) and ~~striketrough~~ (for deletions) except where the reviewer instructions specifically describe some other means of showing the changes. Only these changes to the current standard 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 changes.]

Addendum at to 90.1-2022

Section 3.2 Definitions

simulation engine: the component of the *simulation program* that performs the *building performance simulation calculations*.

simulation program: a computer ~~program~~ software application, including the ~~simulation engine~~ *simulation engine* and the corresponding ~~user interface~~ *simulation user interface*, that is capable of simulating the *energy performance of building systems*.

simulation user interface: the component of the *simulation program* for users to specify inputs that are communicated to the *simulation engine* and to display outputs to the user generated by the *simulation engine*.

12.4.1.4 Simulation Program Testing Requirements

The *simulation program* used to model *design energy cost* and *energy cost budget* shall meet the testing requirements in G2.2.4.2.

12.4.1.4.1 — The ~~simulation program shall be tested according to ASHRAE Standard 140, except for Sections 7 and 8 of Standard 140. The required tests shall include building thermal envelope and fabric load tests (Sections 5.2.1, 5.2.2, and 5.2.3), ground coupled slab on grade analytical verification tests (Section 5.2.4), space cooling equipment performance tests (Section 5.3), space heating equipment performance tests (Section 5.4), and air side HVAC equipment analytical verification tests (Section 5.5), along with the associated reporting (Section 6).~~

12.4.1.4.2 — The ~~test results and modeler reports shall be posted on a publicly available website and shall include the test results of the simulation program and input files used for generating results along with the results of the other simulation programs included in ASHRAE Standard 140, Annexes B8 and B16. The modeler report in Standard 140, Annex A2, Attachment A2.7, shall be completed for results exceeding the maximum or falling below the minimum of the reference values and for omitted results.~~

12.4.1.4.3 — The testing shall be performed for the version of the simulation program used to calculate the *design energy cost* and *energy cost budget*.

Informative Notes:

1. — ~~There are no pass/fail criteria established by this requirement.~~
2. — ~~Based on the Section 3.2 definition, simulation program includes the simulation engine and the corresponding user interface. The testing of a simulation program only meets the requirements of Section 12.4.1.4 for that simulation program and cannot should not be used as proxy for documenting compliance of another simulation program that uses the same simulation engine simulation engine.~~

13. Normative References

ANSI/ASHRAE Standard 140-2020 2023 Method of Test for Evaluating Building Performance Simulation Software.

C3.1.4 Simulation Program Engine Testing Requirements

The simulation engine used to model base envelope performance factor and proposed envelope performance factor shall meet the testing requirements in G2.2.4.2.

C3.1.4.1 The simulation program shall be tested according to ASHRAE Standard 140, except for Sections 7 and 8, of Standard 140. The required tests shall include building thermal envelope and fabric load tests (Sections 5.2.1, 5.2.2, and 5.2.3), ground-coupled slab-on-grade analytical verification tests (Section 5.2.4), space-cooling equipment performance tests (Section 5.3), space-heating equipment performance tests (Section 5.4), and air-side HVAC equipment analytical verification tests (Section 5.5), along with the associated reporting (Section 6).

C3.1.4.2 The test results and modeler reports shall be posted on a publicly available website and shall include the test results of the simulation program and input files used for generating the results along with the results of the other simulation programs included in ASHRAE Standard 140, Annexes B8 and B16. The modeler report in Standard 140, Annex A2, Attachment A2.7 shall be completed for results exceeding the maximum or falling below the minimum of the reference values and for omitted results.

C3.1.4.3 The testing shall be performed for the version of the simulation program used to calculate the proposed envelope performance factor and base envelope performance factor.

Informative Notes:

1. — There are no pass/fail criteria established by this requirement.
2. — Based on the Section 3 definition, simulation program includes the simulation engine and the corresponding user interface. The testing of a simulation program only meets the requirements of Section C3.1.4 for that simulation program and cannot be used as proxy for documenting compliance of another simulation program that uses the same simulation engine.

G2.2.4 Simulation Program Testing Requirements

G2.2.4.1 Modeling Requirements Related to Testing

The simulation program used to model proposed building performance and baseline building performance shall meet the testing requirements in G2.2.4.2.

Informative note: The testing of a simulation program only meets the requirements of Section G2.2.4 for that simulation program and should not be used as proxy for documenting compliance of another simulation program that uses the same simulation engine.

G2.2.4.2 Required Software Testing

When this section is referenced from Appendices C or L, all use of the term “simulation program” are replaced with “simulation engine.”

The simulation program shall be tested according to ASHRAE Standard 140, except for Sections 7 and 8 of Standard 140. The required tests shall include building thermal envelope and fabric load tests (Sections 5.2.1, 5.2.2, and 5.2.3), ground-coupled slab-on-grade analytical verification tests (Section 5.2.4), space-cooling equipment performance tests (Section 5.3), space-heating equipment performance tests (Section 5.4), and air-side HVAC equipment analytical verification tests (Section 5.5), along with the associated reporting (Section 6).

G2.2.4.2.1 The *simulation program* shall be tested according to ASHRAE Standard 140, except for Sections 12 of Standard 140. The required tests shall include Weather Drivers Tests (Section 6) Building Thermal Envelope and Fabric Load Tests (Section 7), Ground Coupled Slab-On-Grade Tests (Section 8), Space-Cooling Equipment Performance Tests (Section 9), Space-Heating Equipment Performance Tests (Section 10), and Air-Side HVAC Equipment Performance Tests (Section 11), along with the associated reporting.

G2.2.4.2.2 During testing, hidden inputs that are not normally accessible to the user shall be permitted.

Informative note: The hidden inputs are permitted to avoid introducing source code changes strictly used for testing.

G2.2.4.2.3 The software vendor or third party, authorized by either the software vendor or the AHJ, shall publish on a publicly available website, the following ASHRAE Standard 140 test results, input files, and modeler reports for each tested version of a *simulation program*:

1. Test results demonstrating the *simulation program* was tested in accordance with ASHRAE Standard 140 Annex A3 and that meet or exceed the values for “The Minimum Number of Range Cases within the Test Group to Pass” for all test groups in ASHRAE Standard 140, Table A3-14.
2. Test results of the *simulation program* and input files used for generating the ASHRAE Standard 140 test cases along with the results of the other *simulation programs* included in ASHRAE Standard 140, Annexes B8 and B16.
3. The modeler report in ASHRAE Standard 140, Annex A2, Attachment A2.8. Report Blocks A and G shall be completed for results exceeding the maximum or falling below the minimum of the reference values shown in ASHRAE Standard 140 Table A3-1 through Table A3-13, and Report Blocks A and E shall be completed for any omitted results.

A software vendor of the *simulation user interface* or third party, authorized by the software vendor or the AHJ, shall also be permitted to meet the requirements of this section.

G2.2.4.2.4 If a certification program exists for *simulation programs* tested to ASHRAE Standard 140 then the *simulation program* shall be listed in the certification program.

~~**G2.2.4.2** The test results and modeler reports shall be posted on a publicly available website and shall include the test results of the simulation program and input files used for generating the results along with the results of the other simulation programs included in ASHRAE Standard 140, Annexes B8 and B16. The modeler report in Standard 140, Annex A2, Attachment A2.7 shall be completed for results exceeding the maximum or falling below the minimum of the reference values and for omitted results.~~

~~**G2.2.4.3** The testing shall be performed for the version of the simulation program used to calculate the proposed building performance and baseline building performance.~~

Informative notes to G2.2.4:

- ~~1. There are no pass/fail criteria established by this requirement.
See Standard 140, Informative Section 4.5 “Citing Standard 140” for further guidance.~~
- ~~2. Based on the Section 3 definition, *simulation program* includes the simulation engine and the corresponding user interface. The testing of a simulation program only meets the requirements of Section G2.2.4 for that simulation program and cannot be used as proxy for documenting compliance of another simulation program that uses the same simulation engine.~~

L3.2.4 Testing

The simulation engine used to model total system performance ratio of the proposed design and reference design shall meet the testing requirements in G2.2.4.2.

~~L3.2.4.1 The simulation program shall be tested according to ASHRAE Standard 140, except for Sections 7 and 8 of Standard 140. The required tests shall include building thermal envelope and fabric load tests (Sections 5.2.1, 5.2.2, and 5.2.3), ground coupled slab on grade analytical verification tests (Section 5.2.4), space cooling equipment performance tests (Section 5.3), space heating equipment performance tests (Section 5.4), and air side HVAC equipment analytical verification tests (Section 5.5) along with the associated reporting (Section 6).~~

~~L3.2.4.2 The test results and modeler reports shall be posted on a publicly available website and shall include the test results of the simulation program and input files used for generating the results along with the results of the other simulation programs included in ASHRAE Standard 140, Annexes B8 and B16. The modeler report in Standard 140, Annex A2, Attachment A2.7 shall be completed for results exceeding the maximum or falling below the minimum of the reference values and for omitted results.~~

Informative Notes:

- ~~1. — There are no pass/fail criteria established by this testing requirement.~~
- ~~2. — Based on the Section 3.2 definition, simulation program includes the simulation engine and the corresponding user interface. The testing of a simulation program only meets the requirements of Section L1 for that simulation program and cannot be used as proxy for documenting compliance of another simulation program that uses the same simulation engine.~~