



**BSR/ASHRAE Addendum e to
ANSI/ASHRAE Standard 140-2023**

First Public Review Draft

Proposed Addendum e to Standard 140-2023, Method of Test for Evaluating Building Performance Simulation Software

**First Public Review Draft (October 2026)
(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 objections on informative material are not offered the right to appeal at ASHRAE or ANSI.)

Foreword

This addendum proposes a streamlining of the reporting requirements. The current S140outNotes.txt file has a very specific structure with instructions both in the file itself and in Annex A2 attachment A2.9. To make it easier for vendors to provide that information, the current Annex A2 attachment A2.9 has been written to support a less structured file that can be provided in any commonly used documentation format, including Markdown, text, or Microsoft Word.

A new informative example of a report file called Standard140ModelingReport.md that has no embedded instructions and a simple format has been created to replace the normative S140outNotes.txt file. The requirement for users to provide a complete report file remains normative.

Proposed changes to the standard include:

- Some reporting requirements related to hardware requirements (hard disk space, memory, monitor, other hardware) have been removed.
- A new section on numerical settings has been added to be consistent with the acceptance criteria requirements.
- Editorial cleanup was made to remove 5.2.2.3 and 5.2.2.4 since they are identical to 5.1.2.3 and 5.1.2.4.
- The phrases “modeling report”, “modeling notes”, and “modeling documentation” were used in multiple places and have been unified to use the phrase “modeling report”.
- A new requirement is added that all reporting requirements, including the modeler report, shall be posted on the website if the results for the corresponding test are posted.

Addendum e to Standard 140-2023

5. GENERAL TEST PROCEDURES

5.1 Class I Test Procedures

[...]

5.1.2 General Reporting Requirements

5.1.2.1 Standard Output Reports. The Standard Output Reports included on the accompanying electronic media shall be used. Instructions regarding these reports are included in Normative Annex A2. Information required for this report includes the following:

a. Software name and version number

b. Modeling report documentation in any commonly used documentation format including Markdown, text, or typical word processing format using S140outNotes.TXT on the accompanying electronic media for the following:

1. Software identifying information ~~and operating requirements~~
2. Modeling methods used when alternative methods are available in the software (as specified in Section 5.1.1.4)
3. Equivalent modeling methods used when the software does not allow direct input of specified values (as specified in Section 5.1.1.5)
4. Non-specified inputs (as specified in Section 5.1.1.6)
5. Changes to source code for the purpose of running the tests, where such changes are not available in publicly released versions of the software (as specified in Section 5.1.1.10)
6. Omitted test cases and results (as specified in Section 5.1.2.3)
7. Anomalous results (as specified in Section 5.1.2.4)
8. Numerical settings (as specified in Section 5.1.2.5)

c. Results for simulated cases using the following files on the accompanying electronic media:

1. Std140_WD_Output.xlsx for the weather drivers tests of Section 6
2. Std140_TF_Output.xlsx for the building thermal envelope and fabric load tests of Section 7
3. Std140_GC_Output.xls for the ground-coupled slab-on-grade analytical verification tests of Section 8
4. Std140_CE_a_Output.xls for the space-cooling-equipment performance analytical verification tests of Sections 9.2.1 and 9.2.2

5. Std140_CE_b_Output.xls for the space-cooling-equipment performance comparative tests of Sections 9.2.3 and 9.2.4

6. Std140_HE_Output.xls for the space-heating-equipment performance tests of Section 10

7. Std140_AE_Output.xlsx for the air-side HVAC equipment performance analytical verification tests of Section 11

8. Std140_ET_Output.xlsx for the thermal fabric empirical validation tests of Section 13

For the specific output quantities required in the results report for each case, refer to Sections 6.3, 7.3, 8.3, 9.3, 10.3, 11.3, and 13.3.

5.1.2.2 Simulation Input Files. All supporting data required for generating results with the tested software shall be saved, including the following:

- a) Input files
- b) Processed weather data
- c) Intermediate files containing calculations used for developing inputs
- d) A Readme-software-name-yyymmdd.pdf file that briefly describes the contents of the above files according to their file type (i.e., their “.xyz” file extension)

5.1.2.3 Omitted Test Cases. If a program being tested omits a test case, the modeler shall provide an explanation of the omission using the modeler report template provided in Normative Annex A2.

5.1.2.4 Discussion of Anomalous Results. Explanation of anomalous test results using the modeler report template provided in Normative Annex A2 shall be permitted but is not required.

5.1.2.5 Numerical Settings. When the software has multiple numerical settings related to timesteps and tolerances, Section 4.5(e), the numerical settings used during testing shall be described.

5.1.2.6 Posting. When testing parties post any Class I test results on a web site, they shall include all General Reporting requirements (Section 5.1.2).

[...]

5.2 Class II Test Procedures

[...]

5.2.2 General Reporting Requirements

5.2.2.1 Standard Output Reports. The Standard Output Reports included on the accompanying electronic media shall be used. Instructions regarding these reports are included in Normative Annex A2. Information required for this report includes the following:

- a. Software name and version number
- b. Modeling ~~report documentation in any commonly used documentation format, including Markdown, text, or typical word processing format using S140outNotes.TXT in the accompanying electronic media~~ for the following:
 1. Software identifying information ~~and operating requirements~~
 2. Modeling methods used when alternative methods are available in the software (as specified in Section 5.2.1.4)
 3. Equivalent modeling methods used when the software does not allow direct input of specified values (as specified in Section 5.2.1.5)
 4. Changes to source code for the purpose of running the tests, where such changes are not available in publicly released versions of the software (as specified in Section 5.2.1.9)
 5. Omitted test cases and results (as specified in Section ~~5.1.2.3~~ ~~5-2-2-3~~)
 6. Anomalous results (as specified in Section ~~5.1.2.4~~ ~~5-2-2-4~~)
 7. Numerical settings (as specified in Section 5.1.2.5)
- c. Results for simulated cases using the following file on the accompanying electronic media: Std140_TF_Class2_Results.xls, sheet tab “TF_Class2_Output” for the building thermal envelope and fabric load tests of Section 12

For the specific output quantities required in the results report for each case, refer to the appropriate sub-sections of Section 12.3.

5.2.2.2 Simulation Input Files. All supporting data required for generating results with the tested software shall be saved, including the following:

- a) Input files
- b) Processed weather data
- c) Intermediate files containing calculations used for developing inputs

- d) A Readme-software-name-yymmdd.pdf file that briefly describes the contents of the above files according to their file type (i.e., their “.xyz” file extension)

~~5.2.2.3 Omitted Test Cases. If a program being tested omits a test case, the modeler shall provide an explanation using the modeler report template provided in Normative Annex A2.~~

~~5.2.2.4 Discussion of Anomalous Results. Explanation of anomalous test results using the modeler report template provided in Normative Annex A2 shall be permitted but is not required.~~

5.2.2.3 Posting. When testing parties post any Class II test results on a web site, they shall include all General Reporting requirements (Section 5.2.2).

[...]

11.3 Output Requirements. Outputs that are not direct program outputs shall be described in the output spreadsheet and modeler report (see Normative Annex A2). ~~using S140outNotes.txt (under report Block B, Alternative Modeling Methods) provided with the accompanying electronic media.~~

Informative Note: Outputs that are not direct program outputs include spreadsheet and other externally coded postprocessor calculations and other manual calculations not performed directly by the program being tested.

[...]

~~13.2.6.4.2 Reporting. The modeler shall indicate the applied algorithms or values in the modeler report described in Normative Annex A2. Report Block B (alternative modeling methods) of S140outNotes.txt included with the accompanying electronic media.~~

[...]

~~13.2.7.4.2 Reporting. The modeler shall indicate the applied algorithms or values in the modeler report described in Normative Annex A2. Report Block B (alternative modeling methods) of S140outNotes.txt included with the accompanying electronic media.~~

[...]

13.3.1 General Requirements

a. The values listed by test case below shall be provided and entered into the appropriate Standard Output Report; see Std140_ET_Output.xlsx included with the accompanying electronic media as specified in Normative Annex A2.

b. General reporting requirements of Section 5.1.2 shall apply.

c. Output shall apply the preceding-hour time convention of Section 13.2.1.1.

1. If the program being tested cannot provide output applying preceding-hour time convention, the user shall indicate the tested program output convention in the modeler report described in Normative Annex A2. ~~Report Block B (alternative modeling methods) of Std140-OutputNotes.txt included with the accompanying electronic media.~~

d. Output precision shall be in accordance with that typically available in the model. Do not truncate or round the output. (Informative Note: Std140_ET_Output.xlsx is formatted such that all entered results appear to the nearest hundredth decimal place, however, it maintains the full precision of the entered values.)

e. Do not make changes to the output template. (Informative Note: The template is set up for automated data handling; any changes to it will disrupt that process.)

[...]

(This is a normative annex and is part of this standard.)

NORMATIVE ANNEX A2

STANDARD OUTPUT REPORTS

The Standard Output Reports, consisting of the following forms provided in the electronic media accompanying this standard, shall be used:

- a. Output results for cases of Section 6 (Std140_WD_Output.xlsx, spreadsheet file)
- b. Output results for cases of Section 7 (Std140_TF_Output.xlsx, spreadsheet file)
- c. Output results for cases of Section 8 (Std140_GC_Output.xls, spreadsheet file)
- d. Output results for cases of Sections 9.2.1 and 9.2.2 (Std140_CE_a_Output.xls, spreadsheet file)
- e. Output results for cases of Sections 9.2.3 and 9.2.4 (Std140_CE_b_Output.xls, spreadsheet file)
- f. Output results for cases of Section 10 (Std140_HE_Output.xls, spreadsheet file)
- g. Output results for cases of Section 11 (Std140_AE_Output.xlsx, spreadsheet file)
- h. Output results for cases of Section 12 (sheet "TF_Class2_Output" within Std140_TF_Class2_Results.xls spreadsheet file)

- i. Output results for cases of Section 13 (Std140_ET_Output.xlsx, spreadsheet file)
- j. Modeling report notes (S140outNotes.TXT, ~~text file reprinted as see Attachment A2.9~~)

For entering output results into the above XLS and XLSX template files, the user shall follow the instructions provided at the top of the appropriate electronic spreadsheet file or designated sheet within the spreadsheet file. These instructions are reprinted as Attachments A2.1, A2.2, A2.3, A2.4, A2.5, A2.6, A2.7, and A2.8 respectively, within this section; instructions for sheet "TF_Class2_Output" within Std140_TF_- Class2_Results.xls are not reprinted here.

~~For entering modeling notes into S140outNotes.TXT, the report author shall create one modeling notes text document for each section of tests, for example, as follows:~~

- ~~a. S140outNotes_6.TXT for the Class-I weather drivers tests of Section 6~~
- ~~b. S140outNotes_7.TXT for the Class-I building thermal envelope and fabric load tests of Section 7~~
- ~~c. S140outNotes_8.TXT for the Class-I ground-coupled slab-on-grade tests of Section 8~~
- ~~d. S140outNotes_9A.TXT for the Class-I space-cooling equipment performance analytical verification tests of Sections 9.2.1 and 9.2.2~~
- ~~e. S140outNotes_9B.TXT for the Class-I space-cooling equipment performance comparative tests of Sections 9.2.3 and 9.2.4~~
- ~~f. S140outNotes_10.TXT for the Class-I space-heating equipment performance tests of Section 10~~
- ~~g. S140outNotes_11.TXT for the Class-I air-side HVAC equipment performance analytical verification tests of Section 11~~
- ~~h. S140outNotes_12.TXT for the Class-II test procedures of Section 12~~
- ~~i. S140outNotes_13.TXT for the Class-I thermal fabric empirical validation test procedures of Section 13~~

Informative Note: For entering modeling notes into S140outNotes.TXT, the format of the examples applying S140outNotes_Examples.TXT given in Informative Attachment A2.9 within this section is recommended.

Attachment A2.9-Standard 140 Output Form-Modeling Report Notes (~~S140outNotes.TXT~~)

1. MODELING ~~REPORT NOTES~~ FOR ASHRAE STANDARD 140 INTRODUCTION

This document shall include supplemental information about the ASHRAE Standard 140 tests performed. One ~~S140outNotes~~ document shall be provided for each set of tests (e.g., one for the building thermal and fabric load tests of Section 7.2; one for the space-cooling equipment analytical verification tests of Sections 9.2.1 and 9.2.2; etc.) The types of information listed below shall be provided in this document, each in a separate section:

~~a. Software information~~

~~a~~b. Alternative modeling methods

~~b~~c. Equivalent modeling methods

~~c~~d. Non-specified inputs

~~d~~e. Omitted test cases and results

~~e~~f. ~~Changes made to Relevant source code changes for the purpose of running the tests, where such changes are not available in publicly released versions of the software~~

~~f~~g. Anomalous results

~~g~~. Numerical settings

Notes in this document shall be limited to the topics shown above. Notes must be factual and objective and shall only refer to the software being tested. Notes shall not refer to any other software program. Use the word “None” if no content is needed for a section.

Informative Note: A blank template document and an example document are available and are called:

Standard140ModelingReport.md

Standard140ModelingReport-Example.md

~~Text at the start of each section describes the content of the section for the reader and provides instructions for supplying the content. Sample notes are provided in a separate document (S140outNotes_Examples.TXT).~~

[Note to reviewers: Informative “Standard140ModelingReport.md” replaces previous normative Std140outNotes.TXT” throughout the accompanying files set. Informative

“Standard140ModelingReport-Example.md” replaces previous informative Std140outNotes_Examples.TXT” throughout the accompanying files set.]

A. SOFTWARE INFORMATION

~~CONTENT: This section shall include reference information for the software—the vendor, name, and version of the software, plus operating system and computer hardware requirements.~~

~~INSTRUCTIONS: Information for items 1 through 7 below shall be provided. Information for item 8 shall be permitted but is not required.~~

~~1. SOFTWARE VENDOR:~~

~~2. SOFTWARE NAME:~~

~~3. SOFTWARE VERSION (unique software version identifier):~~

~~4. OPERATING SYSTEM REQUIREMENTS:~~

~~5. APPROX HARD DISK SPACE REQUIRED FOR INSTALLATION:~~

~~6. MINIMUM RAM REQUIRED FOR SOFTWARE OPERATION:~~

~~7. MINIMUM DISPLAY MONITOR REQUIREMENTS:~~

~~8. OTHER HARDWARE OR SOFTWARE-RELATED REQUIREMENTS:~~

~~Informative Note: Item 8 can be used to supply additional relevant information.~~

AB. REPORT BLOCK FOR ALTERNATIVE MODELING METHODS

~~CONTENT: If the software being tested provides alternative modeling methods or algorithms for performing the tests, this section shall describe modeling methods used for the tests, as follows:~~

- Provide a separate section for each alternative modeling method, including a list of each setting or capability and its physical meaning, and note the setting or capability used in the tests, see Section 4.5(d) which uses the term alternative algorithm to describe alternative modeling methods.
- When the software has multiple methods to simulate the same building component, the modeling method tested shall be described.
- All tests within a test suite shall use the same modeling method.

- Describe the way the user selects the modeling method used in the test suite and list other options available to the user for simulating the same building component.

~~INSTRUCTIONS: If alternative modeling methods are applicable, a separate note for each alternative modeling method or algorithm situation shall be provided. The standard format shown below and a separate number and title for each note shall be applied. If alternative modeling methods are not applicable, specify "NONE" in place of the information below.~~

~~NOTE 1-<Title>~~

~~1.1 Describe the Effect Being Simulated:~~

~~1.2 Optional Settings or Modeling Capabilities~~

~~(list setting or capability and its physical meaning):~~

~~1.2.1 <name>~~

~~Physical Meaning: <explanation>~~

~~1.2.2 <name>~~

~~Physical Meaning: <explanation>~~

~~1.2.n <name>~~

~~Physical Meaning: <explanation>~~

~~1.3 Setting or Capability Used:~~

BC. REPORT BLOCK FOR EQUIVALENT MODELING METHODS

~~CONTENT: This section shall describe equivalent modeling methods used to perform the tests. When the software does not model an effect exactly as stated in the standard or does not permit the input values required, equivalent modeling methods shall be permitted to perform the test. This section shall describe equivalent modeling methods used to perform the tests as follows:~~

- Provide a separate section for each instance of equivalent modeling.
- List the sections of the standard where relevant inputs are specified.
- Provide physical, mathematical, or logical justification of the equivalent modeling method and supporting calculations.

~~INSTRUCTIONS: If equivalent modeling methods are applied, a separate note for each instance of equivalent modeling shall be provided. The standard format shown below and a~~

~~separate number and title for each note shall be applied. If equivalent modeling methods are not applicable, specify "NONE" in place of the information below.~~

~~NOTE 1-<Title>~~

~~1.1 Describe the Effect Being Simulated:~~

~~1.2 Section(s) of the Standard where Relevant Inputs are Specified:~~

~~1.3 Equivalent Input(s) Used:~~

~~1.4 Physical, Mathematical, or Logical Justification of the Equivalent Input(s)-
provide supporting calculations, if relevant:~~

CD. REPORT BLOCK FOR USE OF NON-SPECIFIED INPUTS

~~CONTENT:~~ This section shall describe non-specified inputs used to perform the tests. Use of non-specified inputs shall be permitted only for the following specified sections relating to the following topics:

- Alternative constant exterior surface coefficients in Sections 7.2.1.9.3, 7.2.3.1.4.3, 7.2.3.3.2, and 9.2.1.8
- Alternative constant interior surface coefficients in Sections 7.2.1.10.3, 7.2.3.1.4.4, 7.2.3.2.2, and 9.2.1.9
- Alternative constant interior solar distribution fractions in Sections 7.2.1.12, 7.2.2.1.2.2, 7.2.2.1.6.2, 7.2.2.1.7.2, 7.2.2.2.7.4, 7.2.3.9.3, 7.2.3.10.2, and 7.2.3.12.2
- Air density given at specific altitudes for the space-cooling and space-heating equipment cases in Sections 9.2.1.4.3, 9.2.3.4.3, and 10.2.1.4.3.

Provide a separate section for each use of non-specified inputs as follows:

- List the sections of the standard where relevant inputs are specified.
- Provide physical, mathematical, or logical justification of the use of non-specified inputs and supporting calculations.

~~INSTRUCTIONS: If non-specified inputs are applied, a separate note for each use of nonspecified inputs shall be provided. The standard format shown below and a separate number and title for each note shall be applied. If nonspecified inputs are not applied, specify "NONE" in place of the information below:~~

~~NOTE 1-<Title>~~

~~1.1 Describe the Effect Being Simulated:~~

~~1.2 Section(s) of the Standard where Relevant Inputs are Specified:~~

~~1.3 Nonspecified Input(s) Used:~~

~~1.4 Physical, Mathematical, or Logical Justification for Use of the Nonspecified Input(s)-provide supporting calculations if relevant:~~

~~DE. REPORT BLOCK FOR OMITTED TEST CASES AND RESULTS~~

~~CONTENT:~~ This section shall describe test cases that were omitted and/or individual results of test cases that were omitted along with the reason for the omission-, as follows:

- ~~• Provide a separate section to describe each type of omission.~~
- ~~• Provide a list of cases where results were omitted and an explanation for each.~~

~~INSTRUCTIONS:~~ If test cases were omitted, a separate note to describe each type of omission shall be provided. The standard format shown below and a separate number and title for each note shall be applied. If there are no omitted test cases, specify "NONE" in place of the information below:

~~NOTE 1-<Title>~~

~~1.1 List Case(s) where Results were Omitted, and which Results were Omitted for the Case(s):~~

~~1.2 Explanation for Omitting the Test Case(s) Results:~~

~~EF. REPORT BLOCK FOR CHANGES TO RELEVANT SOURCE CODE FOR THE PURPOSE OF~~ ~~RUNNING THE TESTS, WHERE SUCH CHANGES ARE NOT AVAILABLE IN A PUBLICLY~~ ~~RELEASED VERSIONS OF THE SOFTWARE~~

~~CONTENT:~~ This section shall describe changes to software source code made to allow the software to run a test, where such changes are not available in a publicly released version of the software. (**Informative Note:** This section addresses special situations where a change to source code is necessary to activate a feature or to permit inputs needed for a test when these features are not available in the publicly released version of the software.)

If changes to source code for the purpose of running a test are applied, separate notes to describe each source code modification shall be provided as follows:

- Provide a list of cases relevant to the changes in the source code.

- Provide an explanation of why the changes to the source code are not included in the publicly released version of the software. See Section 4.5(g) for further information.

~~INSTRUCTIONS: If changes to source code for the purpose of running a test are applied, separate notes to describe each source code modification shall be provided. The standard format shown below and a separate number and title for each note shall be applied. If changes to source code are not applied, specify "NONE" in place of the information below.~~

~~NOTE 1-<Title>~~

~~1.1 List the Change(s) to the Source Code:~~

~~1.2 List the Test Case(s) Relevant to the Change(s) in the Source Code:~~

~~1.3. Explanation of Why the Change Is not Included in the Publicly Released Version of the Software:~~

~~FG. REPORT BLOCK FOR ANOMALOUS RESULTS~~

~~CONTENT: Describing anomalous results shall be permitted but is not required. If anomalous test results are described, this section shall be used.~~

~~INSTRUCTIONS: If anomalous test results are described, each type of anomalous result shall be described in a separate note section. For each type of anomalous result, list the test cases and specific results from the cases that are anomalous and include an explanation of the reason for the anomalous results. The standard format shown below and a separate number and title for each note item shall be applied. If anomalous results are not discussed, it shall be permitted to specify "NONE" in place of the information below.~~

~~NOTE 1-<Title>~~

~~1.1 Test Case(s) and Specific Results from the Case(s) that are Anomalous:~~

~~1.2 Explanation of Reason for the Anomalous Results:~~

~~<END OF DOCUMENT>~~

G. NUMERICAL SETTINGS

Describe the numerical settings used if options are provided to the user. When the software has multiple numerical settings related to timesteps and tolerances, Section 4.5(e), the numerical settings used during testing, shall be described. If different numerical settings are used for different test cases, describe why that was necessary.

Informative Attachment A2.10—Examples of Modeling Report Notes
(~~S140outNotes_Examples.TXT~~)

Informative Note: Attachment A2.10 is all informative material and is not part of the Standard.

MODELING REPORT NOTES FOR ASHRAE STANDARD 140-EXAMPLES

See ~~Standard140ModelingReport_Example.md~~ ~~S140outNotes_Examples.TXT~~ provided with the accompanying electronic media within the "Informative Materials" subfolder included within any of the "Std140_...Files" subfolders.
