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NMACM Changes Related to ASHRAE Standards 140, 205, and 209

Additional submitted attachment is included below.

Proposed Changes to Title 24 2025 Nonresidential and Multifamily Alternative Calculation Method Reference Manual

Docket Number 24-BSTD-03

December 18, 2024

Background

I am submitting this comment in my role as a non-voting member of ASHRAE SSPC 140, ASHRAE SSPC 205, and voting member and chair of ASHRAE SSPC 209. I am also a member of ASHRAE SSPC 90.1 and the former chair of the Energy Cost Budget Subcommittee. I also chair a working group of 140 related to acceptance criteria and referencing. My work related to 140 and 205 is supported by a USDOE contract through Argonne National Laboratory, although they are not responsible for any errors or omissions in this document.

ASHRAE Standard 140 Related Changes

In new section 3, “Compliance Software Test Requirements,” please revise the first bullet under the first paragraph to reference the latest version of ASHRAE 140 and its revised title:

“Reference method test cases to verify that the software is evaluating thermal loads and the response of the HVAC systems to these loads in an acceptable manner. These tests reference ASHRAE Standard 140-2023, Method of Test for Evaluating Building Performance Simulation Software.”

Please change the heading of Section 3.3 to read:

“3.3 ASHRAE Standard 140-2023 Tests”

Please update the last paragraph to Section 3.3 to read:

“Compliance software must publish the results of ASHRAE Standard 140-2023 tests, but these tests are not part of the reference method.”

Please add the following paragraphs after the existing paragraphs of Section 3.3:

“The building energy simulation programs 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.

During testing, hidden inputs that are not normally accessible to the user shall be permitted. The hidden inputs are permitted to avoid introducing source code changes that are strictly used for testing.

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 building energy simulation program:

- Test results demonstrating the building energy simulation program were 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.
- Test results of the building energy 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.
- 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 a third party authorized by the software vendor or the AHJ shall also be permitted to meet the requirements of this section.

If a certification program exists for building energy simulation program tested to ASHRAE Standard 140, then the building energy simulation program shall be listed in the certification program.”

ASHRAE Standard 140-2023 added software acceptance criteria to Standard 140, allowing codes citing Standard 140, such as Title 24, to require the results from software to provide results within the ranges included in the standard. This provides Title 24 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, we had test cases with example results to evaluate building performance software. However, it did not include any information on when the 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 may have caused confusion for jurisdictions adopting the code 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 the addendum, which added the updated reference to ASHRAE Standard 140, which reflects the consensus reached within the software and modeling community. This proposal adds the necessary reference language to utilize ASHRAE

Standard 140-2023, including the acceptance ranges to be met, the reporting requirements, and the details necessary for testing.

A proposal with the same intent was submitted and incorporated into IECC 2024, making changes to Sections C407.5.1.2 through C409.5.1. A proposal with the same intent for ASHRAE 90.1 is currently going through the process and is likely to be included in the 2025 version. A proposal with the same intent for Canada's NECB is also being processed. Having many of the major building energy codes in the U.S. and Canada pointing to the same set of acceptance criteria requirements will make it easier and more consistent for building energy modeling software vendors to comply with them.

ASHRAE Standard 205 Related Changes

The draft 2025 Nonresidential and Multifamily Alternative Calculation Method Reference Manual includes the term “curve” 148 times, which, in general, refers to a specific method of describing how to modify nominal equipment performance based on the actual part load or off-nominal conditions. Curves are only one of several approaches that may be used to make this adjustment. Since ASHRAE Standard 205 - Representation of Performance Data for HVAC&R and Other Facility Equipment actually uses tables of data, I recommend that each instance be reviewed and changed to using the term “expanded performance data.” This more generic term will also be used in ASHRAE Standard 90.1-2025 based on the publication of Addendum AS, which is still being processed but is very likely to be published. It would also be good to include the following paragraph to define the new term, which is consistent with 90.1.

“Expanded performance data: Detailed performance characteristics, provided by the manufacturer or by a nationally recognized third party, for the equipment accounting for the variation of capacity and energy consumption of that equipment at varying part-load conditions, operating temperatures, and other conditions, expressed as one or more matrices of data, performance curves, or mathematical equations along with the properties needed to describe the expected operating range of the equipment. Example formats for expanded performance data are described in ASHRAE Standard 205-2023 Representation of Performance Data for HVAC&R and Other Facility Equipment.”

Note that this definition is currently undergoing a second public review.

Standard 205-2023 defines the formats for describing detailed performance data for chillers, unitary equipment, fan assemblies, direct expansion systems, motors, motor drives, and mechanical drives. This performance data is expected to be published by equipment manufacturers and primarily used by building energy modeling software. The SSPC 205 committee is continuing to work on expanding this list of data formats for other types of equipment primarily focused on HVAC. To represent performance data as accurately as possible, the formats described in Standard 205 are all in the form of data tables and keyword-value pairs. The tables and keywords vary by the type of equipment. In no case are traditional performance curves used in 205. To make sure that data and software that supports the 205 formats can be used as part of the ACM performance path, this proposal recommends a newly defined term, “expanded performance data,” for most locations in the ACM that use the term “curve.”

ASHRAE Standard 209 Related Changes

Please consider adding an appropriate reference to ASHRAE Standard 209-2024, “Building Performance Simulation Process.” This standard, originally published in 2018, has recently been updated and expanded. ASHRAE Standard 90.1 includes the following informative note in the Energy Cost Budget section and the Performance Rating Method (Appendix G):

“To fully utilize the investment made of creating a building energy model during the design process, the methodology described in ASHRAE Standard 209 should be considered.”

ASHRAE Standard 189.1 includes the following jurisdictional option:

“Energy Simulation Aided Design. For building projects that exceed 25,000 ft² (2300 m²) of gross floor area, the building project shall comply with the requirements of ANSI/ASHRAE Standard 209, Section 4.2.1.”

A recent proposal to the IECC proposed the following language:

“The code official or authority having jurisdiction shall be permitted to require compliance with ASHRAE Standard 209. The intent of this requirement is to standardize the process of applying building performance modeling and fully utilize the investment made by creating a building energy model during the design process.”

I recommend that similar language in Title 24 be added where appropriate.

Building energy modeling serves as a crucial tool for informing the design and operation of energy-efficient buildings. ASHRAE Standard 209 outlines a systematic approach to integrating energy modeling into the design process. The standard aims to establish consistent and reliable procedures, enabling timely assessments of the impact of design decisions during the appropriate design phase. For buildings already following the ACM, the additional value of using the modeling to inform design provides huge benefits compared to the additional effort since the model is being created anyway. Standard 209 provides the approach to using the building model so that it can inform design and help the design team make decisions.

The objective of Standard 209 is to enhance the effectiveness of building energy modeling to achieve significant energy savings and attain building performance targets. ASHRAE Standard 209 outlines both overarching modeling requirements and eleven distinct modeling cycles. Each cycle corresponds to specific goals aligned with different stages of the building design, construction, or operational phases. These modeling cycles build upon the general requirements, providing a comprehensive best-practices framework for leveraging modeling to inform the design process.

The minimum requirements of the standard can be met by completing all the general modeling requirements, a load-reducing modeling cycle early in the design process, and one additional design-phase modeling cycle. The complete set of modeling cycles was designed to offer comprehensive modeling rules and is included for thoroughness. Standard 209 has process requirements, including the review of energy goals, details on input data, input data reporting, output data reporting, quality assurance, and quality control needed for modeling. These additional process requirements will make

modeling more consistent and meet minimal quality requirements. This increase in consistency and requirement for minimum quality in modeling will result in better compliance.

The previous version of the standard, 209-2018, is referenced by AIA in “Architect’s Guide to Building Performance: Integrating Performance Simulation in the Design Process” and in “Contract Documents – Guide for Sustainable Projects - D503-2020.” It is also recognized in USGBC LEED 4.1 in the approach for the Integrative Process Credit, Minimum Energy Performance, and Optimize Energy Performance, and it is used by some architectural firms and universities for RFPs.

Closing

Thank you for your consideration. I and others on each of the referenced ASHRAE committee would be glad to provide additional support or answer questions.

Thank you

Jason Glazer