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IECC: C407.5, C407.5.1, C407.5.1.1 (New), C407.5.2, C407.5.3, ASHRAE Chapter 06, C407.5.1.2 (New), C407.5.2 (New)

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2024 International Energy Conservation Code [CE Project]

Revise as follows:

C407.5 Calculation software tools. Calculation procedures used to comply with ~~this section~~ Section C407 shall ~~be~~ apply an approved version of a performance analysis software tools capable of calculating the annual energy consumption of all building elements that differ between the *standard reference design* and the *proposed design*. The same approved version of the performance analysis tool shall be used to calculate the proposed design and standard reference design. ~~and shall include the following capabilities~~.

1. ~~Building operation for a full calendar year (8,760 hours).~~
2. ~~Climate data for a full calendar year (8,760 hours) and shall reflect *approved* coincident hourly data for temperature, solar radiation, humidity and wind speed for the building location.~~
3. ~~Ten or more thermal zones.~~
4. ~~Thermal mass effects.~~
5. ~~Hourly variations in occupancy, illumination, receptacle loads, thermostat settings, mechanical ventilation, HVAC equipment availability, service hot water usage and any process loads.~~
6. ~~Part-load performance curves for mechanical equipment.~~
7. ~~Capacity and efficiency correction curves for mechanical heating and cooling equipment.~~
8. ~~Printed *code official* inspection checklist listing each of the *proposed design* component characteristics from Table C407.4.1(1) determined by the analysis to provide compliance, along with their respective performance ratings, including but not limited to *R*-value, *U*-factor, SHGC, HSPF, AFUE, SEER and EF.~~

C407.5.1 ~~Specific~~ Software tool approval. Any version of a performance ~~Performance~~ analysis ~~tools complying with the applicable subsections~~ tool meeting the requirements of Section ~~C407~~ C407.5.1.1 and C407.5.1.2 ~~tested according to ASHRAE Standard 140~~ shall be permitted to be *approved*. Tools are permitted to be *approved* based on meeting a specified threshold for a jurisdiction. The *code official* shall be permitted to approve tools for a specified application or limited scope.

Add new text as follows:

C407.5.1.1 Software tool capabilities. Approved software tools shall include the following capabilities:

1. Building operation for a full calendar year (8,760 hours).
2. Climate data for a full calendar year (8,760 hours) and shall reflect approved coincident hourly data for temperature, solar radiation, humidity, and wind speed for the building location.
3. Ten or more thermal zones.
4. Thermal mass effects.
5. Hourly variations in occupancy, illumination, receptacle loads, thermostat settings, mechanical ventilation, HVAC equipment availability, service hot water usage and any process loads.
6. Part-load performance curves for mechanical equipment.
7. Capacity and efficiency correction curves for mechanical heating and cooling equipment.
8. Printed code official inspection checklist listing each of the proposed design component characteristics from Table C407.4.1(1) determined by the analysis to provide compliance, along with their respective performance ratings, including but not limited to R-value, U-factor, SHGC, HSPF, AFUE, SEER and EF.

Revise as follows:

C407.5.~~2~~ 3 Input values. Where calculations require input values not specified by Sections C402, C403, C404 and C405, those input values shall be taken from an *approved* source.

C407.5.~~3~~ 4 Exceptional calculation methods. Where the simulation program does not model a design, material or device of the *proposed design*, an exceptional calculation method shall be used where approved by the *code official*. Where there are multiple designs, materials or devices that the simulation program does not model, each shall be calculated separately and exceptional savings determined for each. The total exceptional savings

shall not constitute more than half of the difference between the baseline simulated building performance and the proposed simulated building performance. Applications for approval of an exceptional method shall include all of the following:

1. Step-by-step documentation of the exceptional calculation method performed, detailed enough to reproduce the results.
2. Copies of all spreadsheets used to perform the calculations.
3. A sensitivity analysis of energy consumption where each of the input parameters is varied from half to double the value assumed.
4. The calculations shall be performed on a time step basis consistent with the simulation program used.
5. The performance rating calculated with and without the exceptional calculation method.

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140—~~2014~~ 2020: Standard Method of Test for ~~the Evaluation of~~ Evaluating Building ~~Energy Analysis Computer Programs~~ Performance Simulation Software (with Addenda A and B)

Add new text as follows:

C407.5.1.2 Testing required by software vendors. Prior to approval, software tools shall be tested by the software vendor in accordance with ASHRAE Standard 140, except Sections 7 and 8. During testing, hidden inputs that are not normally accessible to the user shall be permitted to avoid introducing source code changes strictly used for testing. Software vendors 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 software tool:

1. Test results demonstrating the software tool was tested in accordance with ASHRAE Standard 140 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 performance analysis tool and input files used for generating the ASHRAE Standard 140 test cases along with the results of the other performance analysis tools included in ASHRAE Standard 140, Annexes B8 and B16.
3. The modeler report in ASHRAE Standard 140, Annex A2, Attachment A2.7. 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.

C407.5.2 Algorithms not tested. Algorithms not tested in accordance with C407.5.1.2, including algorithms that are alternatives to those that were tested, and numerical settings not tested, such as timesteps and tolerances, shall be permitted to be used when modeling the proposed design and *standard reference design*.

Reason: Addendum b for ASHRAE Standard 140-2020 adds software acceptance criteria to Standard 140, allowing codes citing Standard 140, such as IECC, to require the results from software to provide results within the ranges included in the addendum. This provides the IECC with a measure of the acceptability of a building performance simulation software program based on the tests included in Standard 140. Before Addendum b, Standard 140 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 140-2020, Addendum b and many software developers participated. The acceptance ranges were set so that most 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 b, which reflects the consensus reached within the software and modeling community.

This proposal adds the necessary referencing language to utilize Addendum b for ASHRAE Standard 140, including the acceptance ranges to be met, the reporting requirements, and the details necessary for testing to section C407 Simulated Building Performance.

Cost Impact: The code change proposal will neither increase nor decrease the cost of construction.
The code change proposal will neither increase nor decrease the cost of construction. It impacts only an alternative path to compliance C407. The modeler needs to select to use software that complies, which is no different than previously. The additional burden of testing software using Standard 140 rests with the building performance software vendor, where for many software vendors much of this cost has already been borne when they submitted results during development of the acceptance criteria.