MN Department of Labor and Industry, Construction Codes and Licensing Division

2025 Residential Energy Code Technical Advisory Group

Code Change Proposal Compilation for the Review of ASHRAE 90.1-2022

Reducing Air Leakage in Commercial Buildings

MINNESOTA ADVANCED ENERGY CODES
PARTNERSHIP

Proposal overview

Minnesota's proposed energy code amendment lowers the allowable air leakage rate from 0.35 cfm/ft² to 0.30 cfm/ft² at 75 Pa, aligning with national best practices and supporting the state's statutory requirements to improve energy efficiency by 2036.

Why this change matters

- **Low to no cost:** Most Minnesota buildings already comply, proving the code change is feasible and cost-neutral for developers and owners.
- **Significant energy savings:** Reducing air leakage enhances the efficiency of other energy efficiency measures.
- **Industry alignment:** There is national precedence to lower air leakage values.

Energy Savings

PNNL modeling projects a 3.99% reduction in energy consumption over the ASHRAE 90.1-2022 baseline.

Cost Savings

A Pacific Northwest National Laboratory (PNNL) study found savings-to-investment ratios between 2.2 to 7.3, with payback periods of 7.1 to 13.1 years.[1] Due to projected energy savings, there is clear financial benefit, outlined in Table 1.

Type of Building	Estimated Annual Cost Savings
Standalone Retail	**$170**
Mid-rise Apartment	**$299**
Office Medium	**$119**
Hi-Rise Apartment	**$717**
Hospital	**$461**
Hotel Large	**$516**
School Secondary	**$4,236**
Strip Mall	**$280**
Primary School	**$989**

Table 1: Air Leakage Estimated Annual Cost Savings[2]

Regulatory and Compliance Alignment

- Aligns with Washington State Energy Code and U.S. Army Corps of Engineers standards. Supports Minnesota Statute 326B.106, which mandates an 80% reduction in annual net energy consumption by 2036 under ASHRAE 90.1-2004.5.[3]
- Standardized air leakage testing follows ASTM E3158 guidelines.[4]

Supporting Studies:

- Data from 387 U.S. buildings shows an average leakage rate of 0.72 cfm/ft², while modern sealed buildings achieve 0.16–0.25 cfm/ft².
- Center for Energy and Environment testing confirms tighter envelopes are practical and achievable across building types, with Minnesota buildings already performing 85% better than the national average.[5]

[1]https://www.osti.gov/servlets/purl/1489004
[2]The table, based on the ORNL Air Leakage Calculator, highlights the estimated annual cost savings from reducing air leakage to 0.30 cfm/ft² across various building types: https://www.nist.gov/publications/nist-air-leakage-calculation-tools-commercial-buildings
[3]https://www.mncee.org/sites/default/files/report-files/Bohac-Lrg-Bldg-Air-Sealing-Energy-Design-Conf-v2.pdf
[4]https://www.mncee.org/sites/default/files/report-files/Bohac-Lrg-Bldg-Air-Sealing-Energy-Design-Conf-v2.pdf
[5]https://www.mncee.org/sites/default/files/report-files/Bohac-Lrg-Bldg-Air-Sealing-Energy-Design-Conf-v2.pdf

DEPARTMENT OF LABOR AND INDUSTRY

CODE CHANGE PROPOSAL FORM

(Must be submitted electronically)

Author/requestor: Russ Landry, PE

Email address: rlandry@mncee.org

Telephone number: 612-327-1817

Firm/Association affiliation, if any: Center for Energy and Environment (CEE)

Date: 4/4/25

Model Code: ASHRAE 90.1 2022

Code or Rule Section: Chapter 1323

Code or rule section to be changed: 5.4.3

Intended for Technical Advisory Group ("TAG"): Commercial Energy Code

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General Information	**Yes**	**No**
A. Is the proposed change unique to the State of Minnesota?	☒	☐
B. Is the proposed change required due to climatic conditions of Minnesota?	☒	☐
C. Will the proposed change encourage more uniform enforcement?	☐	☒
D. Will the proposed change remedy a problem?	☒	☐
E. Does the proposal delete a current Minnesota Rule, chapter amendment?	☐	☒
F. Would this proposed change be appropriate through the ICC code development process?	☒	☐

Proposed Language

1. The proposed code change is meant to:

☒ change language contained the model code book? If so, list section(s).
Section 3.2, Section 5.4.3.1.1, Section 5.4.3.1.2, Section 5.4.3.1.3, Section 5.4.3.1.4.

☒☐ change language contained in an existing amendment in Minnesota Rule? If so, list Rule part(s).
1323.0543, Subp. 2.

☐ delete language contained in the model code book? If so, list section(s).

☐ delete language contained in an existing amendment in Minnesota Rule? If so, list Rule part(s).

☒ add new language that is not found in the model code book or in Minnesota Rule.
Most of the new language is from 2024 IECC Section C202, Section C402.6.2, Exception 4 and Section C402.6.2.2.

Summary:

This proposal is designed to lower the allowable air leakage rate from 0.35 cfm/sq ft to 0.30 cfm/sq ft under a pressure differential of 75 Pa (0.30 in. of water) and make an equivalent change to the Minnesota amendment for individual dwelling unit testing of multifamily buildings, which will allow air leakage of dwelling unit to not exceed 0.23 cfm/sf of the testing unit enclosure area @ 50 Pa, and provide multifamily buildings the option of choosing either testing approach. This change is being proposed for a variety of reasons, including:

- This is a low to no cost method to achieve significant energy savings, as a reduction in air leakage also increases the efficacy of all other energy savings measures
- The combination of a cold climate and high summer humidities makes tight envelope requirements especially important and cost-effective in Minnesota
- These air leakage rates are well within the range that most commercial buildings in Minnesota are achieving today
- These rates are half-way between the model code and maximum air leakage rates required by the federal General Services Administration and the 2021 Washington State Commercial Energy Code. They are consistent with the rates that the City of Seattle required in their 2015 Commercial Energy Code.
- Benefits of lower air leakage rates include better ability to pressurize buildings to limit air infiltration and the associated space conditioning load, increased airflow available for energy recovery ventilation, better thermal comfort, improved air quality and reduced moisture damage leading to more durable homes

2. Is this proposed code change required by Minnesota Statute? If so, please provide the citation.
While the specific change is not explicitly required by state statute, the code change would contribute to achieving the goal set in Minnesota Statute 326B.106, which states “Beginning in 2024, the commissioner shall act on the new model commercial energy code by adopting each new published edition of ASHRAE 90.1 or a more efficient standard. The commercial energy code in effect in 2036 and thereafter must achieve an 80 percent reduction in annual net energy consumption or greater, using the ASHRAE 90.1-2004 as a baseline. The commissioner shall adopt commercial energy codes from 2024 to 2036 that incrementally move toward achieving the 80 percent reduction in annual net energy consumption.”

3. Provide *specific* language you would like to see changed. Indicate proposed new words with underlining and ~~strikethrough~~ words proposed for deletion. Include the entire code (sub) section or rule subpart that contains your proposed changes.

*Note that single underline blue text is used to indicate text in the previous MN amendment and double underline red text is used to indicate text additions that are first introduced in this current code change proposal.

3. DEFINITIONS, ABBREVIATIONS, AND ACRONYMS
3.2 Definitions
Propose adding new definitions as follows:

testing unit enclosure area: The area sum of all the boundary surfaces that define the dwelling unit, sleeping unit or conditioned enclosed space including top/ceiling, bottom/floor and all sidewalls. This does not include interior partition walls within the dwelling unit, sleeping unit, or conditioned enclosed space. Wall height shall be measured from the finished floor of the conditioned space to the finished floor or roof/ceiling air barrier above.

testing enclosure area: The area sum of all the boundary surfaces that define the conditioned and/semi heated enclosed space including top/ceiling, bottom/floor and all sidewalls. This does not include interior partition walls within conditioned and/semi heated enclosed space. Wall height shall

be measured from the finished floor of the conditioned space to the finished floor or roof/ceiling air barrier above.

5.4.3.1 Whole-Building Air Leakage Verification

5.4.3.1.1 New *buildings* less than 10,000 ft^2 of *gross conditioned floor area* shall comply with one of the following:

a. Measured *air leakage* requirements in Section 5.4.3.1.4.
b. For buildings or portions of buildings enclosing Group R-2 or I-1 occupancies, shall be permitted to be tested by an approved third party in accordance with Section 5.4.3.1.5.

5.4.3.1.2 New buildings not less than 10,000 ft^2 of *gross conditioned floor area* shall comply with one of the following:

a. Measured air leakage requirements in Section 5.4.3.1.4.
b. Buildings or portions of buildings enclosing Group R-2 or I-1 occupancies, shall be permitted to be tested by an approved third party in accordance with Section 5.4.3.1.5
c. A *continuous air barrier design* and installation verification program performed in accordance with Section 5.9.1.2.

5.4.3.1.3 In *alterations* and *additions* to an *existing building* where portions of the *continuous air barrier* are impacted, those portions shall be installed or reinstalled and comply with one of the following:

a. Measured *air leakage* requirements in Section 5.4.3.1.4.
b. Buildings or portions of buildings enclosing Group R-2 or I-1 occupancies, shall be permitted to be tested by an approved third party in accordance with Section 5.4.3.1.5.
c. A *continuous air barrier* design and installation verification program performed in accordance with Section 5.9.1.2.

5.4.3.1.4 Measured Building Envelope Air Leakage.

Where measured *air leakage* is used for compliance, the rate of *air leakage* of the *building envelope* shall not exceed ~~0.35~~ 0.30 cfm/ft^2 under a pressure differential of 75 Pa (0.30 in. of water), with this *air leakage* rate normalized by the sum of the above-*grade* and below-*grade building envelope* areas of the *conditioned space* and *semiheated space* and in accordance with this section.

a. Whole-*building* pressurization testing shall be conducted in accordance with ASTM E3158. For *buildings* less than 10,000 ft^2 of gross conditioned floor area, and that contain no more than one single-zone system, air leakage testing may be conducted in accordance with ASTM E779, ASTM E1827, or ASTM E3158. Testing shall be conducted excluding HVAC related elements and be performed by an independent third-party verification and testing provider in accordance with Section 4.2.5.1.
b. Where a *building* contains both *conditioned space* and *semiheated space*, compliance shall be shown using one of the following as applicable:
    1) Separately for the *conditioned space* and for the *semiheated space*, with the *air leakage* rate for the *conditioned space* normalized by the *exterior building envelope* area of the *conditioned space* and the *air leakage* rate for the *semiheated space* normalized by the *semiexterior building envelope* area of the *semiheated space*.
    2) For the *conditioned space* and for the *semiheated space* together, with the *air leakage* rate for the overall *space* normalized by the sum of the *exterior building envelope* area and the *semiexterior building envelope* area minus the *semiexterior building envelope* area that separates the *conditioned space* from the *semiheated space*.
c. Where the measured *air leakage* rate exceeds ~~0.35~~ 0.30 cfm/ft^2 but does not exceed ~~0.45~~ 0.40 cfm/ft^2, a diagnostic evaluation, such as a smoke tracer or infrared imaging, shall be conducted while the *building* is pressurized, and any leaks noted shall be sealed if such sealing can be made without destruction of *existing building* components. In addition, a visual inspection of the air barrier shall be conducted, and any leaks noted shall be sealed if such sealing can be made without destruction of *existing building* components. An additional

report identifying the corrective actions taken to seal leaks shall be submitted to the *code official* and the *building* owner and shall be deemed to satisfy the requirements of this section.

d. Where the measured *air leakage* rate exceeds ~~0.45~~ 0.40 cfm/ft^2, corrective actions must be made to the *envelope* and an additional test completed where results are ~~0.45~~ 0.40 cfm/ft^2 or less in order to demonstrate compliance.

e. Reporting shall be in compliance with Section 4.2.5.1.2.

5.4.3.1.5 Measured *Dwelling* and Sleeping Unit Air Leakage.

The building thermal envelope shall be tested for *air leakage* in accordance with ASTM E779, ANSI/RESNET/ICC 380, ASTM E1827 or an equivalent approved method. ~~t~~The measured *air leakage* shall not exceed ~~0.30~~ 0.23 cfm/ft^2 of the *testing unit enclosure area* at a pressure differential of 0.2 inch water gauge (50 Pa). Where multiple dwellings or sleeping units or other occupiable conditioned spaces are contained within one building thermal envelope, each unit shall be considered as individual testing unit, and the building *air leakage* shall be the weighted average of all testing unit results, weighted by each testing unit's enclosure area. Units shall be tested ~~separately with an unguarded blower door test~~ without simultaneously testing adjacent units and shall be separately tested as follows:

a. Where buildings have fewer than eight testing units, each testing unit shall be tested.

b. For buildings with eight or more testing units, the greater of seven units or 20 percent of the testing units in the building shall be tested, including a top floor unit, a ground floor unit, and a unit with the largest *testing unit enclosure area*. For each tested unit that exceeds the maximum *air leakage* rate, an additional ~~two~~ three units shall be tested, including a mixture of testing unit types and locations.

c. Where the measured *air leakage* rate exceeds 0.23 cfm/ft^2 but does not exceed 0.30 cfm/ft^2, a diagnostic evaluation, such as a smoke tracer or infrared imaging with testing units pressurized, shall be conducted on testing units that exceeded the 0.23 cfm/ft^2, and any leaks noted shall be sealed if such sealing can be made without destruction of *existing building* components. In addition, a visual inspection of the air barrier shall be conducted, and any leaks noted shall be sealed if such sealing can be made without destruction of *existing building* components. An additional report identifying the corrective actions taken to seal leaks shall be submitted to the *code official* and the *building* owner and shall be deemed to satisfy the requirements of this section.

d. Enclosed spaces other than *dwelling units* and sleeping units with not less than one exterior wall in the building thermal envelope shall be tested in accordance with Section 5.4.3.1.4 without simultaneously testing adjacent spaces. The measured *air leakage* rate shall be normalized by *testing enclosure area* of the conditioned space and semiheated space.

Exception: Corridors, stairwells, and enclosed spaces having a conditioned floor area not greater than 1,500 ft (139 m2) shall be permitted to comply with a continuous air barrier design and installation verification program performed in accordance with Section 5.9.1.2.

e. Where the measured weighted average *air leakage* rate for *dwelling units* and sleeping units exceeds 0.30 cfm/ft^2, corrective actions must be made to the *envelope* and additional testing completed where results are 0.30 cfm/ft^2 or less in order to demonstrate compliance.

f. Reporting shall be in compliance with Section 4.2.5.1.2.

4. Will this proposed code change impact other sections of a model code book or an amendment in Minnesota Rule? If so, please list the affected sections or rule parts.

Yes, if approved the Building Performance Factor values in Table 4.2.1.1 should be reduced (based on analysis of this change in combination with other mandatory and prescriptive path amendments) so that the stringency of the Appendix G, Performance Rating Method compliance path stays consistent with the other compliance path options.

Need and Reason

1. Why is the proposed code change needed? Please provide a general explanation as well as a specific explanation for any changes to numerical values (heights, area, etc.)
   In 2023, Minnesota state statute 326B.106 was passed, stating that the Minnesota Commercial Energy Code shall achieve an 80% improvement in efficiency by 2036 over a 2004 baseline. The statute also stipulates that the energy code must incrementally improve each cycle and that each new model code must be reviewed during this time. In order to achieve the 2036 efficiency goals, past trajectory has shown that relying on model code development will not be sufficient. Furthermore, it is best for the market to make incremental improvements towards the goal in each code cycle to smooth the transition to the ultimate goal. Therefore, adopting strengthening amendments to the model code each code cycle is the most effective way to meet these requirements. Based on thorough analysis of market readiness, cost, data analysis and stakeholder engagement, the proposed amendment was selected as an effective step toward meeting these requirements.

   The proposed amendment, to decrease air leakage rates from 0.35 cfm/ft^2 to 0.30 cfm/ft^2 while also decreasing the levels at which corrective actions must be made to the envelope from 0.45 cfm/ft2 to 0.40 cfm/ft^2, is a reasonable and effective step toward achieving these statutory goals.

   The proposed amendment also seeks to maintain provisions for individual dwelling unit testing for air leakage rates from the current Minnesota Commercial Energy Code for consistency and flexibility.

2. Why is the proposed code change a reasonable solution?
   The MN Advanced Energy Codes Partnership is an initiative formed by CEE to achieve Minnesota's statutory requirements around energy code efficiency in new construction. As part of this work, the Partnership has identified key guiding principles for developing new efficiency requirements, to ensure these requirements have the highest impact with least possible burden on the market. These guiding principles include:
   - Ease of market adoption
     - Requirements should be as easy as possible for designers and builders to implement, including products that are currently easily available and implementable by the existing workforce
   - Least cost
     - Requirement should the lowest lifetime cost to implement, accounting for the first cost as well as the energy savings over the lifetime of the measure
   - Collaborative approach
     - Engage stakeholders and listen to feedback
     - Inclusive of all voices and experiences
   - Data-driven decisions
     - Decisions should be guided by data, including the best possible information on cost, market readiness, and energy savings.

   The proposed amendment aligns with these guiding principles:
   - Ease of market adoption: The market is largely meeting these requirements today. Furthermore, this proposal continues the Minnesota amendments for expanding testing options, allowing Minnesotans to continue to take advantage of flexibility that they are accustomed to in this area.
   - Least cost: Modeling done by Pacific Northwest National Laboratory (PNNL) shows this measure alone to account for a 3.99% energy savings over the model code while also increasing the impact of any additional energy savings measures.
   - Market Readiness/Least Cost: Current building practices often resulting in performance levels that meet or exceed the proposed rates, indicating no change will be required to

comply with this measure. Furthermore, if changes are required to meet these levels, there are well-known and widely practiced methods in the market today to achieve these levels at low or no cost.

- Collaborative: Over 30 stakeholders have been consulted from all segments of the commercial market and they have overwhelmingly stated that the proposed levels are reasonable and often achieved today.
- Data focused: Extensive tests of commercial building envelope leakage have been conducted over the past 10+ years that support these rates. [1,2]
    - The 2021 Washington State Energy Code - Commercial requires:
        - The measured air leakage to not exceed 0.25 cfm/ft^2 (1.27 L/s × m2) of the whole building thermal envelope area at a pressure differential of 0.3 inch water gauge (75 Pa).
        - The measured air leakage to not exceed 0.25 cfm/ft^2 (1.27 L/s m2) of the *testing unit enclosure area* at a pressure differential of 0.2 inch water gauge (50 Pa).
    - The U.S. Army Corps of Engineers and General Services Administration require:
        - The measured air leakage to not exceed 0.25 cfm/ft^2 (1.27 L/s × m^2) of the building thermal envelope area at a pressure differential of 0.3 inch water gauge (75 Pa).

3. What other factors should the TAG consider?
    - A CEE study, funded by the State of Minnesota, of large building leakage conducted whole building envelope leakage tests on seven commercial and institutional buildings built from 1936 to 2007 with floor areas that ranged from 27,000 to 246,000 square feet. The air leakages ranged from 0.09 to 0.19 cfm/ft^2 for a pressure difference of 0.30 in. water.
    - In a paper where data was compiled from three different testing agencies from buildings tested for air leakage between 2009 and 2019, 196 military buildings were tested against a maximum air leakage of 0.25 cfm/ft^2 and only six did not pass, indicating widespread capability to achieve the proposed levels[3].
    - Third party envelope leakage tests of three warehouses with floor areas of 242,000, 810,000, and 753,000 square feet resulted in leakages of 0.05, 0.05, and 0.48 cfm/ft^2. The high leakage of 0.48 cfm/ft^2 was due to leakage through code-required operable louvered vents. In addition, recent tests of three new warehouses with floor areas of 35,000, 42,000, and 37,000 square feet resulted in measured envelope leakage of 0.21, 0.21, and 0.24 cfm/ft^2. All these tests suggest that the proposed air leakage rate is attainable for open commercial facilities such as warehouses.[1]

Cost/Benefit Analysis

1. Will the proposed code change increase or decrease costs? Please explain and provide estimates if possible.
    - It is anticipated that the incremental cost associated with meeting lower air leakage rates using whole building leakage test is marginal as the labor and material is already required to meet the testing criteria in the base code. This code change is primarily achieved through improving the quality of the install and additional materials are rarely required to meet the proposed air leakage rates The allowance for compartmentalization tests in multifamily buildings will also ensure the costs are marginal.
    - Third party testing is offered and available in the State. Companies such as WJE, Braun Intertec offer testing services.

[1] David Bohac, et.al, Air sealing tight commercial and institutional buildings, 2016.

[2] M. Marceau and A. Shrode, 2019. *Analysis and Lessons Learned from Whole-Building Air Leakage Testing of 276 Buildings*. Thermal Performance of the Exterior Envelopes of Whole Buildings XIV International Conference. December 9–12, 2019

2. If there is an increased cost, will this cost be offset by a safety or other benefit? Please explain. If the benefit is quantifiable (for example energy savings), provide an estimate if possible.
   - Proposed code change will bring additional energy savings of 3.99% over the 90.1-2022 baseline.
   - Non-quantifiable benefits such as improved thermal comfort, building durability, improved air quality and others will also result from this code change.
   - A previous study by Pacific Northwest National Laboratory found national average savings to investment ratios of 2.2 to 7.3 (varying with building size) and average simple payback periods of 7.1 to 13.1 years (varying with building size). With Minnesota's cold climate, the economics for this measure will be much more favorable than these national averages.[3]

3. If there is a cost increase, who will bear the costs? This can include government units, businesses, and individuals.
   Consumer, Developer, Contractors

4. Are there any enforcement or compliance cost increases or decreases with the proposed code change? Please explain.
   N/A

5. Will the cost of complying with the proposed code change in the first year after the rule takes effect exceed $25,000 for any one small business or small city (Minn. Stat. § 14.127)? A small business is any business that has less than 50 full-time employees. A small city is any statutory or home rule charter city that has less than ten full-time employees. Please explain.
   No, this is not anticipated

Regulatory Analysis

1. What parties or segments of industry are affected by this proposed code change?
   Developers, Builders.

2. Can you think of other means or methods to achieve the purpose of the proposed code change? What might someone opposed to this code change suggest instead? Please explain what the alternatives are and why your proposed change is the preferred method or means to achieve the desired result.
   The purpose of the code change is to achieve energy savings, while also realizing air quality, building durability and thermal comfort benefits. Furthermore, the measure increases the efficiency gains from other measures through interactivity. There are no direct alternatives to these benefits.
   - If this amendment were to be rejected, there does not appear to be any single measure that can fill the energy efficiency gap.

3. What are the probable costs or consequences of not adopting the code change, including those costs or consequences borne by identifiable categories of affected parties, such as separate classes of government units, businesses, or individuals?
   - Less energy efficient commercial construction across all commercial and non-low-rise multifamily building types
   - Construction with a higher potential for moisture damage and reduced thermal comfort
   - Without this measure, the state will not be on the intended path to achieve the statutory requirements stated in 326B.106

4. Are you aware of any federal or state regulation or requirement related to this proposed code change? If so, please list the federal or state regulation or requirement and your assessment of any differences between the proposed code change and the federal regulation or requirement.

[3] R. Hart, C. Nambiar, J. Zhang, Y. Xie. "Envelope Air Tightness for Commercial Buildings: Technical Brief", December 2018

No

***Note: Incomplete forms may be returned to the submitter with instruction to complete the form. Only completed forms can considered by the TAG.

DEPARTMENT OF LABOR AND INDUSTRY

CODE CHANGE PROPOSAL FORM

(Must be submitted electronically)

Author/requestor: Russ Landry

Email address: rlandry@mncee.org

Telephone number: 612-327-1817

Firm/Association affiliation, if any: Center for Energy and Environment (CEE)

Date: 5/6/2025

Model Code: ASHRAE 90.1 2022

Code or Rule Section: Chapter 1323

Code or rule section to be changed: Tables 5.5-6 and 5.5-7

Intended for Technical Advisory Group ("TAG"): Commercial Energy Code

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General Information	**Yes**	**No**
A. Is the proposed change unique to the State of Minnesota?	☒	☐
B. Is the proposed change required due to climatic conditions of Minnesota?	☒	☐
C. Will the proposed change encourage more uniform enforcement?	☒	☐
D. Will the proposed change remedy a problem?	☒	☐
E. Does the proposal delete a current Minnesota Rule, chapter amendment?	☐	☒
F. Would this proposed change be appropriate through the ICC code development process?	☒	☐

Proposed Language

1. The proposed code change is meant to:

   ☒ change language contained the model code book? If so, list section(s).

   ☐ change language contained in an existing amendment in Minnesota Rule? If so, list Rule part(s).

   ☐ delete language contained in the model code book? If so, list section(s).

   ☐ delete language contained in an existing amendment in Minnesota Rule? If so, list Rule part(s).

   ☒ add new language that is not found in the model code book or in Minnesota Rule.

2. Is this proposed code change required by Minnesota Statute? If so, please provide the citation.

Summary:

We propose adopting a slightly modified version of ASHRAE 90.1 2022 Addendum AM, which was published April 30, 2025 and will be incorporated in the ASHRAE 90.1 2025 model code. The modification we propose is to reduce the U-value for dwelling unit windows in line with current market practices to account for the fact that windows typically used in residential applications were not evaluated in the Addendum AM committee process.

These changes are being proposed for a variety of reasons, including:

- Alignment with market readiness: A thorough and vigorous analysis of product availability by the ASHRAE subcommittee has shown that there is a significant variety of products available to meet these levels in all prototype buildings
    - To ensure this also holds true for the proposed dwelling unit values, we reviewed a variety of multifamily projects. In all cases, the same windows being used today could achieve the proposed values with the right glazing options.
- Per the addendum foreword, "The proposed changes were subjected to ASHRAE cost effectiveness analyses to show positive life cycle energy savings"…
- With Minnesota's cold climate and high summer humidities, a robust envelope is especially important and cost-effective in Minnesota
- This measure individually accounts for over a 1% improvement in the code's overall efficiency, while also increasing the efficiency gains from other components due to interactivity
- Additional benefits from energy efficient fenestration include indoor air quality improvements, thermal comfort and resiliency.

2. Is this proposed code change required by Minnesota Statute? If so, please provide the citation.
While the specific change is not explicitly required by state statute, the code change would contribute to achieving the goal set in Minnesota Statute 326B.106, which states "Beginning in 2024, the commissioner shall act on the new model commercial energy code by adopting each new published edition of ASHRAE 90.1 or a more efficient standard. The commercial energy code in effect in 2036 and thereafter must achieve an 80 percent reduction in annual net energy consumption or greater, using the ASHRAE 90.1-2004 as a baseline. The commissioner shall adopt commercial energy codes from 2024 to 2036 that incrementally move toward achieving the 80 percent reduction in annual net energy consumption."

3. Provide *specific* language you would like to see changed. Indicate proposed new words with underlining and ~~strikethrough~~ words proposed for deletion. Include the entire code (sub) section or rule subpart that contains your proposed changes.

Table 5.5-6 Building Envelope requirements for Climate Zone 6 (A,B)*

	Nonresidential			Residential			Semiheated		
Fenestration (0 to 40% of wall)	Assembly Max. U Value	Assembly Max. SHGC	Assembly Min. VT/SHGC	Assembly Max. U Value	Assembly Max. SHGC	Assembly Min. VT/SHGC	Assembly Max. U	Assembly Max. SHGC	Assembly Min. VP/SHGC
Vertical Fenestration, 0% to 40% of Wall									
Fixed	~~0.34~~ 0.31	0.38	1.10 (for all types)	~~0.34~~ 0.27[d]	0.38	1.10	~~0.39~~ 0.35	NR (for all types)	NR (for all types)
Operable[c]	~~0.42~~ 0.38	0.34		~~0.42~~ 0.27[d]	0.34		~~0.48~~ 0.43		
Entrance door[c]	0.63	0.34		0.63	0.34		0.68		
Skylight (0 to 3% of roof)									
All types	~~0.47~~ 0.46	0.40	NR	~~0.50~~ 0.46	0.40	NR	~~0.75~~ 0.65	NR	NR

Table 5.5-7 Building Envelope requirements for Climate Zone 7*

	Nonresidential			Residential			Semiheated		
Fenestration (0 to 40% of wall)	Assembly Max. U Value	Assembly Max. SHGC	Assembly Min. VT/SHGC	Assembly Max. U Value	Assembly Max. SHGC	Assembly Min. VT/SHGC	Assembly Max. U	Assembly Max. SHGC	Assembly Min. VP/SHGC
Vertical Fenestration, 0% to 40% of Wall									
Fixed	~~0.29~~ 0.28	0.40	1.10 (for all types)	~~0.29~~ 0.27 [d]	0.40	1.10	~~0.36~~ 0.32	NR (for all types)	NR (for all types)

Operable[c]	~~0.36~~ 0.35	0.36		~~0.36~~ 0.27[d]	0.36		~~0.44~~ 0.39		
Entrance door[c]	0.63	0.36		0.63	0.36		0.63		
Skylight (0 to 3% of roof)									
All types	0.44	NR	NR	~~0.44~~ 0.46	0.40	NR	~~0.75~~ 0.55	NR	NR

** The following definitions apply: c.i. = continuous insulation (see Section 3.2), FC = filled cavity (see Section A2.3.2.5), NR = no (insulation) requirement.*
a. When using the R-value compliance method for metal building roofs, a thermal spacer block is required (see Section A2.3.2).
b. Exception to Section 5.5.3.2 applies for mass walls above grade.
c. Doors with greater than 50% glazing that are not both equipped with automatic closers and specifically designed to withstand heavy-duty usage shall be considered "Operable" for purposes of determining thermal performance requirements specified in this table.
d The Nonresidential Assembly Maximum U Values specified in this table shall apply to residential spaces other than nontransient dwelling units, as well as to Class AW windows rated in accordance with AAMA/WDMA/CSA 101/I.S.2/A440, vertical curtain walls, storefront windows, window walls, and site-built fenestration products at nontransient dwelling units.

4. Will this proposed code change impact other sections of a model code book or an amendment in Minnesota Rule? If so, please list the affected sections or rule parts.
   Yes, if approved the Building Performance Factor values in Table 4.2.1.1 should be reduced (based on analysis of this change in combination with other mandatory and prescriptive path amendments) so that the stringency of the Appendix G, Performance Rating Method compliance path stays consistent with the other compliance path options.

Need and Reason

1. Why is the proposed code change needed? Please provide a general explanation as well as a specific explanation for any changes to numerical values (heights, area, etc.)
   In 2023, Minnesota state statute 326B.106 was passed, stating that the Minnesota Commercial Energy Code shall achieve an 80% improvement in efficiency by 2036 over a 2004 baseline. The statute also stipulates that the energy code must incrementally improve each cycle and that each new model code must be reviewed during this time. In order to achieve the 2036 efficiency goals, past trajectory has shown that relying on model code development will not be sufficient. Furthermore, it is best for the market to make incremental improvements towards the goal in each code cycle to smooth the transition to the ultimate goal. Therefore, adopting strengthening amendments to the model code each code cycle is the most effective way to meet these requirements. Based on thorough analysis of market readiness, cost, data and stakeholder engagement, the proposed amendment was selected as an effective step toward meeting these requirements.

   The proposed amendment is to adopt addendum AM with modifications to the U factors required for dwelling units, in line with market readiness. This is a reasonable and effective step toward achieving these statutory goals.

2. Why is the proposed code change a reasonable solution?
   The MN Advanced Energy Codes Partnership is an initiative formed by CEE to achieve Minnesota's statutory requirements around energy code efficiency in new construction. As part of this work, the Partnership has identified key guiding principles for developing new efficiency requirements, to ensure these requirements have the highest impact with least possible burden on the market. These guiding principles include:
   - Ease of market adoption
     - Requirements should be as easy as possible for designers and builders to implement, including products that are currently easily available and implementable by the existing workforce
   - Least cost
     - Requirement should have the lowest lifetime cost to implement, accounting for the first cost as well as the energy savings over the lifetime of the measure
   - Collaborative approach
     - Engage stakeholders and listen to feedback

    - Inclusive of all voices and experiences
- Data-driven decisions
    - Decisions should be guided by data, including the best possible information on cost, market readiness, and energy savings.

The proposed amendment aligns with these guiding principles:

- Ease of market adoption:
    - The ASHRAE subcommittee is comprised of industry experts who unanimously voted in support of this amendment. The addendum was also subjected to a public comment period, where all comments were resolved and ultimately the addendum was published on April 30, 2025.
    - A review of current multifamily building projects in Minnesota show products used in dwelling units today can achieve the levels proposed with the right glazing options.
    - The dwelling unit U-values in CZ 6 align with the 2024 IECC U-value requirements for residential homes and low-rise multi-family buildings. Aligning these values will create consistency in the residential market.
- Least cost:
    - Per the addendum am foreword, "The proposed changes were subjected to ASHRAE cost effectiveness analyses to show positive life cycle energy savings using an average heating and cooling scalar of 21.8 as well as engineering judgment to achieve consensus".
    - Minnesota RESNET data for low-rise multifamily buildings shows that 42% of buildings in Minnesota today meet these standards
- Collaborative: With a diverse set of industry experts participating in the ASHRAE subcommittee combined with a public comment process, the addendum has been a collaborative effort through and through.
- Data focused: Comprehensive worksheets were compiled by the subcommittee and put through rigorous review to ensure the proposed values are cost effective and market ready

3. What other factors should the TAG consider?
   N/A

Cost/Benefit Analysis

1. Will the proposed code change increase or decrease costs? Please explain and provide estimates if possible.
    - This addendum is cost effective per ASHRAE 90.1 cost effectiveness analysis, which takes into consideration key factors such as the initial construction costs, energy cost savings, maintenance expenses and the expected lifespan of the improvement.
    - When changes are required to meet the proposed levels, they will most often be achieved through improvements in glass coatings and not require changes in product selection

2. If there is an increased cost, will this cost be offset by a safety or other benefit? Please explain. If the benefit is quantifiable (for example energy savings), provide an estimate if possible.
    - The proposed code change will bring additional energy savings of more than 1% over the 90.1 baseline.
    - Non- quantifiable benefits such as improved thermal comfort, indoor air quality and resiliency

3. If there is a cost increase, who will bear the costs? This can include government units, businesses, and individuals.
    - Consumer

4. Are there any enforcement or compliance cost increases or decreases with the proposed code change? Please explain.

No significant enforcement or compliance cost changes are anticipated, as current inspection protocols will remain consistent with the proposed fenestration standards.

5. Will the cost of complying with the proposed code change in the first year after the rule takes effect exceed $25,000 for any one small business or small city (Minn. Stat. § 14.127)? A small business is any business that has less than 50 full-time employees. A small city is any statutory or home rule charter city that has less than ten full-time employees. Please explain.
   It is highly unlikely

Regulatory Analysis

1. What parties or segments of industry are affected by this proposed code change?
   - Developers, window manufacturers.

2. Can you think of other means or methods to achieve the purpose of the proposed code change? What might someone opposed to this code change suggest instead? Please explain what the alternatives are and why your proposed change is the preferred method or means to achieve the desired result.
   The purpose of this code change is to achieve energy savings, while also realizing indoor air quality, thermal comfort and resiliency benefits. Furthermore, this measure increases the efficiency of other building components by strengthening the thermal envelope of the building. There are no direct alternatives to these benefits, though the benefits achieved in air leakage improvements are similar.
   - If this amendment were to be rejected, we would need to look to other changes to fill the efficiency gap
   - It is not anticipated that we could reach our statutory requirements in 2036 without steadily improving our fenestration efficiency levels

3. What are the probable costs or consequences of not adopting the code change, including those costs or consequences borne by identifiable categories of affected parties, such as separate classes of government units, businesses, or individuals?
   - Less energy efficient commercial construction across all commercial and non low-rise multifamily building types
   - Construction with a higher potential for moisture damage and reduced thermal comfort
   - Without this measure, the state will not be on the intended path to achieve the statutory requirements stated in 326B.106

4. Are you aware of any federal or state regulation or requirement related to this proposed code change? If so, please list the federal or state regulation or requirement and your assessment of any differences between the proposed code change and the federal regulation or requirement.
   - 2018 City of Seattle Code[1] and 2021 WSEC[2] requires U factor of 0.26 for fixed windows and U factor of 0.28 for Operable windows with the exception for vertical curtainwalls and site-built fenestration products.
   - 2023 MA Commercial Stretch Energy Code[3] requires U factor 0.30 for fixed and U factor of 0.32 for operable fenestration (applicable to Climate Zone 5 and Marine 4 (IECC Climate zone designations). The stretch code is adopted by 299 communities and went in effect in July, 2023.

[1] 2018 Seattle Energy Code, Commercial Energy Efficiency, Page C-40, available at https://www.seattle.gov/documents/Departments/SDCI/Codes/SeattleEnergyCode/2018SECCommercialChapter4.pdf

[2] https://sbcc.wa.gov/sites/default/files/2024-01/2021_WSEC_C_2ndEd_012824.pdf

[3] 2023 Massachusetts Commercial Stretch Energy Code, Page 10, available at https://www.mass.gov/doc/225-cmr-23-ma-commercial-front-end-amend-redline-december-8-2022/download

- These values align with EnergyStar version 6, for residential windows which will be applicable to residential windows in dwelling units in high rise multifamily buildings.
- 2024 IECC residential code requirement for vertical fenestration in CZ5 and Marine 4 and CZ6 require U factor of 0.28 be met. The code requires U factor of 0.27 in CZ 7 and 8. There are no requirements for SHGC in CZ 5-8. The proposed amendment is less stringent compared to the 2024 IECC requirements in CZ 7.

***Note: Incomplete forms may be returned to the submitter with instruction to complete the form. Only completed forms can considered by the TAG

DEPARTMENT OF LABOR AND INDUSTRY

CODE CHANGE PROPOSAL FORM

(Must be submitted electronically)

Author/requestor: Russ Landry, PE

Email address: rlandry@mncee.org

Telephone number: 612-327-1817

Date: 4/4/25

Model Code: ASHRAE 90.1 2022

Code or Rule Section: Ch. 1323

Firm/Association affiliation, if any: Center for Energy and Environment (CEE)

Topic of proposal: Building Performance Factors for Appendix G Performance Path Projects

Code or rule section to be changed: Table 4.2.1.1 Building Performance Factor (BPF)

Intended for Technical Advisory Group ("TAG"): Energy Code

General Information	**Yes**	**No**
A. Is the proposed change unique to the State of Minnesota?	☒	☐
B. Is the proposed change required due to climatic conditions of Minnesota?	☐	☒
C. Will the proposed change encourage more uniform enforcement?	☒	☐
D. Will the proposed change remedy a problem?	☐	☒
E. Does the proposal delete a current Minnesota Rule, chapter amendment?	☐	☒
F. Would this proposed change be appropriate through the ICC code development process?	☐	☒

Proposed Language

1. The proposed code change is meant to:

☒ change language contained the model code book? If so, list section(s).
Section 4.2.1.1 Compliance Path, Table 4.2.1.1 Building Performance Factor (BPF)

☐ change language contained in an existing amendment in Minnesota Rule? If so, list Rule part(s).

☒ delete language contained in the model code book? If so, list section(s).
Section 4.2.1.1 Compliance Path, Table 4.2.1.1 Building Performance Factor (BPF) [Columns for climate zones that do not exist in Minnesota are to be deleted.]

☐ delete language contained in an existing amendment in Minnesota Rule? If so, list Rule part(s).

☐ add new language that is not found in the model code book or in Minnesota Rule.

Summary

The proposed code change would reduce the Building Performance Factors (BPF) used in conjunction with the Appendix G, "Performance Rating Method" compliance path to match the efficiency levels achieved by the combination of all other Minnesota amendments that strengthen the stringency of the alternative prescriptive path requirements. These BPF values scale the roughly 2004 model code baseline energy model results to match efficiency levels of the current performance path. The final BPF values will be determined through energy modeling of the combined impact of all amendments to the prescriptive path requirements using evaluation methods that are equivalent to those used in official energy code savings determinations. The amended values will be the same or lower than the model code values.

2. Is this proposed code change required by Minnesota Statute? If so, please provide the citation.
   No

3. Provide *specific* language you would like to see changed. Indicate proposed new words with underlining and ~~strikethrough~~ words proposed for deletion. Include the entire code (sub) section or rule subpart that contains your proposed changes.

Table 4.2.1.1 Building Performance Factor (BPF)

Building AreaType	Climate Zone																		
	~~0A~~	~~0B~~	~~1A~~	~~1B~~	~~2A~~	~~2B~~	~~3A~~	~~3B~~	~~3C~~	~~4A~~	~~4B~~	~~4C~~	5A	~~5B~~	~~5C~~	6A	~~6B~~	7	~~8~~
Multifamily	~~0.69~~	~~0.68~~	~~0.71~~	~~0.70~~	~~0.72~~	~~0.72~~	~~0.71~~	~~0.76~~	~~0.63~~	~~0.69~~	~~0.76~~	~~0.71~~	~~0.66~~ TBD*	~~0.72~~	~~0.71~~	~~0.65~~ TBD*	~~0.67~~	~~0.65~~ TBD*	~~0.67~~
Healthcare/hospital	~~0.69~~	~~0.69~~	~~0.70~~	~~0.68~~	~~0.67~~	~~0.65~~	~~0.65~~	~~0.66~~	~~0.64~~	~~0.64~~	~~0.66~~	~~0.63~~	~~0.67~~ TBD*	~~0.65~~	~~0.65~~	~~0.66~~ TBD*	~~0.67~~	~~0.68~~ TBD*	~~0.70~~
Hotel/motel	~~0.66~~	~~0.66~~	~~0.69~~	~~0.65~~	~~0.65~~	~~0.64~~	~~0.64~~	~~0.65~~	~~0.65~~	~~0.63~~	~~0.65~~	~~0.63~~	~~0.62~~ TBD*	~~0.63~~	~~0.62~~	~~0.61~~ TBD*	~~0.62~~	~~0.59~~ TBD*	~~0.58~~
Office	~~0.54~~	~~0.54~~	~~0.53~~	~~0.52~~	~~0.52~~	~~0.52~~	~~0.50~~	~~0.54~~	~~0.48~~	~~0.48~~	~~0.53~~	~~0.48~~	~~0.49~~ TBD*	~~0.52~~	~~0.48~~	~~0.48~~ TBD*	~~0.49~~	~~0.46~~ TBD*	~~0.48~~
Restaurant	~~0.62~~	~~0.59~~	~~0.57~~	~~0.57~~	~~0.57~~	~~0.53~~	~~0.57~~	~~0.53~~	~~0.51~~	~~0.55~~	~~0.54~~	~~0.54~~	~~0.57~~ TBD*	~~0.56~~	~~0.55~~	~~0.59~~ TBD*	~~0.58~~	~~0.61~~ TBD*	~~0.64~~
Retail	~~0.51~~	~~0.49~~	~~0.48~~	~~0.48~~	~~0.44~~	~~0.43~~	~~0.43~~	~~0.43~~	~~0.44~~	~~0.42~~	~~0.43~~	~~0.46~~	~~0.43~~ TBD*	~~0.42~~	~~0.47~~	~~0.43~~ TBD*	~~0.43~~	~~0.41~~ TBD*	~~0.44~~
School	~~0.52~~	~~0.57~~	~~0.57~~	~~0.56~~	~~0.52~~	~~0.53~~	~~0.52~~	~~0.49~~	~~0.50~~	~~0.46~~	~~0.47~~	~~0.47~~	~~0.47~~ TBD*	~~0.46~~	~~0.46~~	~~0.46~~ TBD*	~~0.44~~	~~0.45~~ TBD*	~~0.45~~
Warehouse	~~0.26~~	~~0.26~~	~~0.22~~	~~0.25~~	~~0.21~~	~~0.22~~	~~0.25~~	~~0.21~~	~~0.19~~	~~0.25~~	~~0.22~~	~~0.22~~	~~0.28~~ TBD*	~~0.24~~	~~0.22~~	~~0.31~~ TBD*	~~0.28~~	~~0.29~~ TBD*	~~0.32~~
All others	~~0.62~~	~~0.60~~	~~0.62~~	~~0.59~~	~~0.55~~	~~0.51~~	~~0.53~~	~~0.52~~	~~0.55~~	~~0.53~~	~~0.52~~	~~0.55~~	~~0.53~~ TBD*	~~0.53~~	~~0.56~~	~~0.54~~ TBD*	~~0.54~~	~~0.54~~ TBD*	~~0.54~~

[The columns for climate zones 0A through 4C, 5B, 5C, 6B and 8 are to be removed from the table as they are not applicable to Minnesota and we will not have equivalent updated values.]

[*After amendments to the mandatory requirements and prescriptive path requirements (i.e., Sections 5.4, 5.5, 6.3, 6.4, 6.5, 7.4, 7.5, 8.4, 8.5, 9.3, 9.4, 9.5, 9.6, ,10.4, 10.5, and 11.5.1) are determined, energy analysis of the combined impact of the prescriptive path amendments on building performance will be used to determine the amended values in this table. The amended values will be no higher than the model code values in Table 4.2.1.1, and are generally expected to be lower by a few percent.]

4. Will this proposed code change impact other sections of a model code book or an amendment in Minnesota Rule? If so, please list the affected sections or rule parts.
   No.

Need and Reason

1. Why is the proposed code change needed? Please provide a general explanation as well as a specific explanation for any changes to numerical values (heights, area, etc.)

This change to the Building Performance Factors is needed to keep a level playing field between the three primary alternative compliance paths.

2. Why is the proposed code change a reasonable solution?

Having the updated Building Performance Factors and condensing the table by eliminating climate zones outside of Minnesota will make it easy for project teams to follow the stringency increase and apply the factors when choosing the Appendix G, Performance Rating Method path.

3. What other factors should the TAG consider?

None

Cost/Benefit Analysis

1. Will the proposed code change increase or decrease costs? Please explain and provide estimates if possible.

This proposed code change will not directly increase costs. It will only indirectly impact costs by eliminating a loophole that might otherwise allow projects to avoid implementing efficiency improvements that are equivalent to separately proposed code changes that may increase costs.

2. If there is an increased cost, will this cost be offset by a safety or other benefit? Please explain. If the benefit is quantifiable (for example energy savings), provide an estimate if possible.

N/A

3. If there is a cost increase, who will bear the costs? This can include government units, businesses, and individuals.

N/A

4. Are there any enforcement or compliance cost increases or decreases with the proposed code change? Please explain.

This will decrease enforcement and compliance costs. Having a performance path less stringent than the prescriptive path would likely lead to more use of that particular performance path. The performance pathway involves numerous steps including modeling, documentation submission and a review of the construction documents against a complex set of modeling requirements, making compliance with this pathway intensive and costly.

5. Will the cost of complying with the proposed code change in the first year after the rule takes effect exceed $25,000 for any one small business or small city (Minn. Stat. § 14.127)? A small business is any business that has less than 50 full-time employees. A small city is any statutory or home rule charter city that has less than ten full-time employees. Please explain.

No.

Regulatory Analysis

1. What parties or segments of industry are affected by this proposed code change?

Businesses seeking permits for new construction for new construction or renovation.

2. Can you think of other means or methods to achieve the purpose of the proposed code change? What might someone opposed to this code change suggest instead? Please explain what the alternatives are and why your proposed change is the preferred method or means to achieve the desired result.

None.

3. What are the probable costs or consequences of not adopting the code change, including those costs or consequences borne by identifiable categories of affected parties, such as separate classes of government units, businesses, or individuals?

Inconsistency amongst the compliance pathways.

4. Are you aware of any federal or state regulation or requirement related to this proposed code change? If so, please list the federal or state regulation or requirement and your assessment of any differences between the proposed code change and the federal regulation or requirement.

None

***Note: The information you provide in this code change proposal form is considered Public Data and used by the TAG to consider your proposed modification to the code. Any code change proposal form submitted to DLI may be reviewed at public TAG meetings and used by department staff and the Office of Administrative Hearings to justify the need and reasonableness of any proposed rule draft subject to administrative review and is available to the public.

****Note: Incomplete forms will be returned to the submitter with instruction to complete the form. Only completed forms will be accepted and considered by the TAG. The submitter may be asked to provide additional information in support of the proposed code change.

DEPARTMENT OF LABOR AND INDUSTRY

CODE CHANGE PROPOSAL FORM

(Must be submitted electronically)

Author/requestor: Russ Landry

Date: 5/8/2025

Email address: rlandry@mncee.org

Model Code: ASHRAE 90.1-2022

Telephone number: 612-335-5863

Code or Rule Section: 1323 Commercial Energy Code

Firm/Association affiliation, if any: CEE

Topic of proposal: Information Required on CDs

Code or rule section to be changed: Section 4.2.2

Intended for Technical Advisory Group ("TAG"): Commercial Energy Code

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General Information	**Yes**	**No**
A. Is the proposed change unique to the State of Minnesota?	☒	☐
B. Is the proposed change required due to climatic conditions of Minnesota?	☐	☒
C. Will the proposed change encourage more uniform enforcement?	☒	☐
D. Will the proposed change remedy a problem?	☒	☐
E. Does the proposal delete a current Minnesota Rule, chapter amendment?	☐	☒
F. Would this proposed change be appropriate through the ICC code development process?	☒	☐

Proposed Language

1. The proposed code change is meant to:

   ☐ change language contained the model code book? If so, list section(s).

   ☒ change language contained in an existing amendment in Minnesota Rule? If so, list Rule part(s).

   ☐ delete language contained in the model code book? If so, list section(s).

   ☐ delete language contained in an existing amendment in Minnesota Rule? If so, list Rule part(s).

   ☒ add new language that is not found in the model code book or in Minnesota Rule.

2. Is this proposed code change required by Minnesota Statute? If so, please provide the citation.

No

3. Provide *specific* language you would like to see changed. Indicate proposed new words with underlining and ~~strikethrough~~ words proposed for deletion. Include the entire code (sub) section or rule subpart that contains your proposed changes.

*Note that single underline is used to indicate text in the previous MN amendment and double underline is used to indicate additions to the amendment.
**Also note that two of the section references in 4.2.2.1(n) below are based on the presumed acceptance of our separate code change proposal regarding air leakage requirements in Section 5.4.3. If that particular code change proposal is not approved, the previous MN amendment to that section will need to be updated (due to a reorganization within that section of the model code), and it is expected that the same Section number references in the proposed 4.2.2.1(n) below would likely still be accurate (but should be verified).

4.2.2 Compliance Documentation

4.2.2.1 Construction Details.

Compliance documents shall show all the pertinent data and features of the building, equipment, ~~and~~ systems, and verification, testing, and commissioning in sufficient detail to permit a determination of compliance by the building official and to indicate compliance with the requirements of this standard. The construction documents shall include the specific items noted in this list, plus any additional design details needed to conclusively demonstrate compliance with all applicable energy code provisions for the energy code path chosen:

a. Insulation materials and their R-values;
b. *Fenestration* assembly *U-factors* and *SHGCs*;
c. Mechanical and *service water heating system* and equipment types, sizes, and efficiencies;
d. *Economizer* description;
e. Mechanical and *service water heating system equipment* and *system* controls strategies and setpoints;
f. *Fan motor brake horsepower for fan motors one horsepower (hp) or larger;*
g. *Fan nameplate electrical input power* or *fan electrical input power* at *fan system design conditions*--whichever is used to calculate *fan system electrical input power* per Section 6.5.3.1.1.2;
h. Fan motor nameplate horsepower and controls;
i. Duct sealing, duct sizing, duct and pipe insulation and location, terminal air or water design flow rates;
j. Electrical distribution diagram(s);
k. Lighting fixture schedule with wattage and control narrative;
l. Locations of daylight zones on plans and provisions for functional testing of lighting controls;
m. Air sealing details clearly delineating the air barrier location and showing continuity between roof, wall foundation, around frames and sleeves, and at other similar openings;
n. A clear indication of the intent to perform whole-building air leakage verification per Section 5.4.3.1 with enough detail on scope, approach, methods, and the provider to make it clear that all of the requirements of the applicable choice between Section 5.4.3.1.4, Section 5.4.3.1.5 or Section 5.9.1.2 will be met;
o. Sufficient design detail to clearly demonstrate that each of the credits chosen to comply with Section 11.5 is met or that each design element which the proposed design simulation assumes to be better than the baseline simulation in the the Energy Cost

Budget Method (per Section 12) or Performance Rating Method (per Appendix G) is included in the design;

p. Additional details as required by the building official to determine whether the work proposed will conform with this standard.

4.2.2.2 Supplemental Information.

Supplemental information necessary to verify compliance with this standard, such as calculations, worksheets, compliance forms, vendor literature, or other data, shall be made available when required by the *building official*. At a minimum, the following supplemental information shall be provided to the *building official* with the permit application:

a. A clear indication of the primary energy code compliance path (Prescriptive, *Energy Cost Budget* Method, or *Performance Rating Method*~~Normative Appendix G~~) chosen within Section 4.2.1, including clear indications of any trade-offs per Section 4.2.1.2.1 or exceptions applied per Section 4.2.1.3 or 4.2.1.4;
b. For prescriptive path projects, a list of the credits used to comply with Section 11.5;
c. For prescriptive path projects, a clear indication of any intent to follow a compliance option within any section other than the prescriptive path denoted by a ".5" section number including:
    a. Section 5.6 Building Envelope Compliance Trade-Off Path;
    b. Section 6.3 Simplified Approach Building Compliance Path for HVAC Systems;
    c. Section 6.6.1 Computer Room Systems Path;
    d. Section 6.6.2 Mechanical System Performance Path;
    e. Section 9.3 Simplified Building Method Compliance Path;
    f. Section 9.6 Alternative Compliance Path: Space-by-Space Method
d. Software reports detailing user inputs and output results when a Section 5.6 or Section 6.6.2 compliance path is chosen;
e. A clear indication of each instance in which an exception is being applied to an otherwise apparently applicable requirement;
f. Area-weighted *U-factor* and *SHGC* calculations when one of the exceptions to Section 5.5.4.1 is applied;
g. Calculations of gross wall area, gross roof area, fenestration area for each orientation, and skylight area for demonstrating compliance with Section 5.5.4.2 and Section 5.5.4.2, or Section 5.6;
h. Lighting power density calculations; and
i. Additional details as required by the building official to determine whether the work proposed will conform with this standard.

4. Will this proposed code change impact other sections of a model code book or an amendment in Minnesota Rule? If so, please list the affected sections or rule parts.
   No

Need and Reason

1. Why is the proposed code change needed? Please provide a general explanation as well as a specific explanation for any changes to numerical values (heights, area, etc.)
   Basic design and energy code path information is commonly omitted from construction documents, making it impossible for plan reviewers to conduct thorough compliance reviews without requesting updates to CDs. As the model code becomes increasingly complex, (i.e. a new Section 11 with credits, a new HVAC total system performance option, and simplified building options for HVAC and lighting) it is more critical that more detailed information about the designers' intended path for energy code compliance be explicitly indicated on the plans. It is also important to move the list of required documentation from the current place within a very topic-specific verification and testing

subsection to the higher-level construction details and supplemental information subsections so that they will be more-readily noticed and their wide scope understood.

2. Why is the proposed code change a reasonable solution?
   It provides a clear summary of the most critical energy code related design and compliance path information in an appropriate place where it addresses all disciplines at once.

3. What other factors should the TAG consider?
   NA

Cost/Benefit Analysis

1. Will the proposed code change increase or decrease costs? Please explain and provide estimates if possible.
   This will not increase costs and is expected to decrease designer costs for many projects by requiring all critical information to be submitted in the initial permit submission, minimizing the need for updates and reissuing of plan sets.

2. If there is an increased cost, will this cost be offset by a safety or other benefit? Please explain. If the benefit is quantifiable (for example energy savings), provide an estimate if possible.
   NA

3. If there is a cost increase, who will bear the costs? This can include government units, businesses, and individuals.
   NA

4. Are there any enforcement or compliance cost increases or decreases with the proposed code change? Please explain.
   This will reduce enforcement and compliance costs by minimizing rework, such as additional information requests and plan rework.

5. Will the cost of complying with the proposed code change in the first year after the rule takes effect exceed $25,000 for any one small business or small city (Minn. Stat. § 14.127)? A small business is any business that has less than 50 full-time employees. A small city is any statutory or home rule charter city that has less than ten full-time employees. Please explain.
   No

Regulatory Analysis

1. What parties or segments of industry are affected by this proposed code change?
   Designers and jurisdictions performing plan review.

2. Can you think of other means or methods to achieve the purpose of the proposed code change? What might someone opposed to this code change suggest instead? Please explain what the alternatives are and why your proposed change is the preferred method or means to achieve the desired result.
   No

3. What are the probable costs or consequences of not adopting the code change, including those costs or consequences borne by identifiable categories of affected parties, such as separate classes of government units, businesses, or individuals?
   A delay in permit issuance or inconsistent enforcement of compliance, leading to higher energy costs for building owners and/or tenants.

4. Are you aware of any federal or state regulation or requirement related to this proposed code change? If so, please list the federal or state regulation or requirement and your assessment of any differences between the proposed code change and the federal regulation or requirement.
   No

***Note: The information you provide in this code change proposal form is considered Public Data and used by the TAG to consider your proposed modification to the code. Any code change proposal form submitted to DLI may be reviewed at public TAG meetings and used by department staff and the Office of Administrative Hearings to justify the need and reasonableness of any proposed rule draft subject to administrative review and is available to the public.

****Note: Incomplete forms will be returned to the submitter with instruction to complete the form. Only completed forms will be accepted and considered by the TAG. The submitter may be asked to provide additional information in support of the proposed code change.

DEPARTMENT OF LABOR AND INDUSTRY

CODE CHANGE PROPOSAL FORM

(Must be submitted electronically)

Author/requestor: Rachael Spires

Email address: rachael.spires@gmail.com

Telephone number: 612.437.1456

Firm/Association affiliation, if any: AIA Minnesota

Date: 05.06.2025

Model Code: ASHRAE 90.1-2022

Code or Rule Section: 5.1.4 Exception 3

Topic of proposal: Revision of verb tense for clarity

Code or rule section to be changed: 5.1.4 Exception 3

Intended for Technical Advisory Group ("TAG"):

General Information	**Yes**	**No**
A. Is the proposed change unique to the State of Minnesota?	☒	☐
B. Is the proposed change required due to climatic conditions of Minnesota?	☐	☒
C. Will the proposed change encourage more uniform enforcement?	☒	☐
D. Will the proposed change remedy a problem?	☒	☐
E. Does the proposal delete a current Minnesota Rule, chapter amendment?	☐	☒
F. Would this proposed change be appropriate through the ICC code development process?	☒	☐

Proposed Language

1. The proposed code change is meant to:

☐ change language contained the model code book? If so, list section(s).

☒ change language contained in an existing amendment in Minnesota Rule? If so, list Rule part(s). 1323.5.1.3 in ASHRAE 90.1-2019 (for reference) and 1323.5.1.4 in ASHRAE 90.1-2022.

☐ delete language contained in the model code book? If so, list section(s).

☐ delete language contained in an existing amendment in Minnesota Rule? If so, list Rule part(s).

☐ add new language that is not found in the model code book or in Minnesota Rule.

2. Is this proposed code change required by Minnesota Statute? If so, please provide the citation.
   No

3. Provide *specific* language you would like to see changed. Indicate proposed new words with underlining and ~~strikethrough~~ words proposed for deletion. Include the entire code (sub) section or rule subpart that contains your proposed changes.

   Alterations to *roof, wall*, or *floor* cavities that shall be ~~are~~ insulated to full depth with insulation having a minimum nominal value of R-3.0/in. and having either integral vapor retarder qualities or a membrane vapor retarder. The membrane vapor retarder shall prevent moisture from accumulating in the cavities and allow drying to the interior and shall be installed to separate the insulation from the conditioned space in accordance with the *Minnesota Building Code*.

4. Will this proposed code change impact other sections of a model code book or an amendment in Minnesota Rule? If so, please list the affected sections or rule parts.
   No

Need and Reason

1. Why is the proposed code change needed? Please provide a general explanation as well as a specific explanation for any changes to numerical values (heights, area, etc.)
   Clarification of requirement so that it is understood the condition stated is part of the design not an existing condition.

2. Why is the proposed code change a reasonable solution?
   Clarity and consistency of enforcement.

3. What other factors should the TAG consider?
   N/A

Cost/Benefit Analysis

1. Will the proposed code change increase or decrease costs? Please explain and provide estimates if possible.
   No.

2. If there is an increased cost, will this cost be offset by a safety or other benefit? Please explain. If the benefit is quantifiable (for example energy savings), provide an estimate if possible.
   N/A

3. If there is a cost increase, who will bear the costs? This can include government units, businesses, and individuals.
   N/A

4. Are there any enforcement or compliance cost increases or decreases with the proposed code change? Please explain.
   N/A

5. Will the cost of complying with the proposed code change in the first year after the rule takes effect exceed $25,000 for any one small business or small city (Minn. Stat. § 14.127)? A small business is any business that has less than 50 full-time employees. A small city is any statutory or home rule charter city that has less than ten full-time employees. Please explain.
   N/A

Regulatory Analysis

1. What parties or segments of industry are affected by this proposed code change?
   Architectural

2. Can you think of other means or methods to achieve the purpose of the proposed code change? What might someone opposed to this code change suggest instead? Please explain what the alternatives are and why your proposed change is the preferred method or means to achieve the desired result.
   N/A

3. What are the probable costs or consequences of not adopting the code change, including those costs or consequences borne by identifiable categories of affected parties, such as separate classes of government units, businesses, or individuals?
   None.

4. Are you aware of any federal or state regulation or requirement related to this proposed code change? If so, please list the federal or state regulation or requirement and your assessment of any differences between the proposed code change and the federal regulation or requirement.
   No.

***Note: The information you provide in this code change proposal form is considered Public Data and used by the TAG to consider your proposed modification to the code. Any code change proposal form submitted to DLI may be reviewed at public TAG meetings and used by department staff and the Office of Administrative Hearings to justify the need and reasonableness of any proposed rule draft subject to administrative review and is available to the public.

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DEPARTMENT OF LABOR AND INDUSTRY

CODE CHANGE PROPOSAL FORM

(Must be submitted electronically)

Author/requestor: Rachael Spires

Email address: rachael.spires@gmail.com

Telephone number: 612.437.1456

Firm/Association affiliation, if any: AIA Minnesota

Date: 05.06.2025

Model Code: ASHRAE 90.1-2022

Code or Rule Section: 5.1.4 Exception 9

Topic of proposal: Removal of exception to align with overall directive to improve energy efficiency of buildings.

Code or rule section to be changed: 5.1.4 Exception 9

Intended for Technical Advisory Group ("TAG"):

General Information	**Yes**	**No**
A. Is the proposed change unique to the State of Minnesota?	☒	☐
B. Is the proposed change required due to climatic conditions of Minnesota?	☒	☐
C. Will the proposed change encourage more uniform enforcement?	☒	☐
D. Will the proposed change remedy a problem?	☒	☐
E. Does the proposal delete a current Minnesota Rule, chapter amendment?	☐	☒
F. Would this proposed change be appropriate through the ICC code development process?	☒	☐

Proposed Language

1. The proposed code change is meant to:

   ☒ change language contained the model code book? If so, list section(s).
   5.1.4 Exception 9

   ☐ change language contained in an existing amendment in Minnesota Rule? If so, list Rule part(s).

   ☐ delete language contained in the model code book? If so, list section(s).

   ☐ delete language contained in an existing amendment in Minnesota Rule? If so, list Rule part(s).

☐ add new language that is not found in the model code book or in Minnesota Rule.

2. Is this proposed code change required by Minnesota Statute? If so, please provide the citation.
   No

3. Provide *specific* language you would like to see changed. Indicate proposed new words with underlining and ~~strikethrough~~ words proposed for deletion. Include the entire code (sub) section or rule subpart that contains your proposed changes.

   ~~9. Replacement of existing *fenestration*, provided that the area of the replacement *fenestration* does not exceed 25% of the total *fenestration area* of an *existing building* and that the *U-factor* and *SHGC* will be equal to or lower than before the *fenestration* replacement.~~

4. Will this proposed code change impact other sections of a model code book or an amendment in Minnesota Rule? If so, please list the affected sections or rule parts.
   No

Need and Reason

1. Why is the proposed code change needed? Please provide a general explanation as well as a specific explanation for any changes to numerical values (heights, area, etc.)
   The amendment removes an exception that allows windows that do not meet the current energy code. By eliminating this exception, we ensure that all new windows on existing buildings will meet the current MN Energy Code and will help move us towards the goal of reducing the energy use of buildings.

2. Why is the proposed code change a reasonable solution?
   Removing this exception ensures consistency and improvement in the energy performance of buildings. If this exception were to remain, MN's energy efficiency goals would be undermined, and it would also be a missed opportunity for improvement. Additionally, the 25% can be exploited creating a loophole to piecemeal upgrades so that glazing never fully meets the MN Energy Code.

3. What other factors should the TAG consider?
   N/A

Cost/Benefit Analysis

1. Will the proposed code change increase or decrease costs? Please explain and provide estimates if possible.
   Potential to minimally increase costs to provide windows with low-E coatings, thermal breaks, etc.

2. If there is an increased cost, will this cost be offset by a safety or other benefit? Please explain. If the benefit is quantifiable (for example energy savings), provide an estimate if possible.
   Providing energy code compliant windows lowers energy bills by reducing heat loss in the winter and heat gain in the summer.

3. If there is a cost increase, who will bear the costs? This can include government units, businesses, and individuals.
   Building Owner.

4. Are there any enforcement or compliance cost increases or decreases with the proposed code change? Please explain.
   None.

5. Will the cost of complying with the proposed code change in the first year after the rule takes effect exceed $25,000 for any one small business or small city (Minn. Stat. § 14.127)? A small business is any business that has less than 50 full-time employees. A small city is any statutory or home rule charter city that has less than ten full-time employees. Please explain.
   No.

Regulatory Analysis

1. What parties or segments of industry are affected by this proposed code change?
   Architects, Building Owners.

2. Can you think of other means or methods to achieve the purpose of the proposed code change? What might someone opposed to this code change suggest instead? Please explain what the alternatives are and why your proposed change is the preferred method or means to achieve the desired result.
   None.

3. What are the probable costs or consequences of not adopting the code change, including those costs or consequences borne by identifiable categories of affected parties, such as separate classes of government units, businesses, or individuals?
   By not adopting the code change, buildings will be less efficient which will cost building owners more over the life of the building. Additionally, the energy efficiency goal of an 80 percent reduction in annual net energy consumption by 2036 will be harder to meet.

4. Are you aware of any federal or state regulation or requirement related to this proposed code change? If so, please list the federal or state regulation or requirement and your assessment of any differences between the proposed code change and the federal regulation or requirement.
   No.

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of Administrative Hearings to justify the need and reasonableness of any proposed rule draft subject to administrative review and is available to the public.

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DEPARTMENT OF LABOR AND INDUSTRY

CODE CHANGE PROPOSAL FORM

(Must be submitted electronically)

Author/requestor: Staff

Date: 05/08/25

Email address:

Model Code: ASHRAE 90.1-2022

Telephone number:

Code or Rule Section: 5.5.3.1.2

Firm/Association affiliation, if any: DLI

Code or rule section to be changed: 5.5.3.1.2

Intended for Technical Advisory Group ("TAG"): Commercial Energy

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General Information	**Yes**	**No**
A. Is the proposed change unique to the State of Minnesota?	☐	☒
B. Is the proposed change required due to climatic conditions of Minnesota?	☒	☐
C. Will the proposed change encourage more uniform enforcement?	☒	☐
D. Will the proposed change remedy a problem?	☒	☐
E. Does the proposal delete a current Minnesota Rule, chapter amendment?	☐	☒
F. Would this proposed change be appropriate through the ICC code development process?	☒	☐

Proposed Language

1. The proposed code change is meant to:

☐ change language contained the model code book? If so, list section(s).

☒ change language contained in an existing amendment in Minnesota Rule? If so, list Rule part(s). Section 6.1.1.3.6

☐ delete language contained in the model code book? If so, list section(s).

☐ delete language contained in an existing amendment in Minnesota Rule? If so, list Rule part(s).

☐ add new language that is not found in the model code book or in Minnesota Rule.

2. Is this proposed code change required by Minnesota Statute? If so, please provide the citation.
   No

3. Provide *specific* language you would like to see changed. Indicate proposed new words with underlining and ~~strikethrough~~ words proposed for deletion. Include the entire code (sub) section or rule subpart that contains your proposed changes.

   Summary:
   This section intends to consolidate and clarify requirements for rooftop curbs. It includes model code language, as well as new amended language from the previous code cycle. It consolidates requirements from the 2024 MCE 5.5.3.1 & 6.1.1.3.6.

   5.5.3.1.2 Roof Curbs. ~~Skylight and other roof curbs shall be insulated to not less than R-5.0.~~

   5.5.3.1.2.1 New Curbs. Skylight, HVAC and other roof curbs shall be insulated to not less than R-10.0.

   5.5.3.1.2.2 Existing Curbs. Unless technically infeasible, skylight, HVAC and other roof curbs shall be insulated to not less than R-10.0. Curbs shall be raised by replacement or extension to a sufficient height to permit future insulation values complying with Tables 5.5-6 and 5.5-7 when roof replacement occurs.

   5.5.3.1.2.2.1 Skylight and Equipment Relocation and Replacement. Unless technically infeasible, existing curbs serving relocated or replaced skylight, HVAC and other equipment shall be insulated to not less than R-10.0. Curbs shall be of sufficient height to permit future insulation values complying with Tables 5.5-6 and 5.5-7 when roof replacement occurs.

   5.5.3.1.2.2.2 Rooftop curb adaptors. Rooftop curb adaptors shall be insulated in accordance with roof insulation values compliant with Tables 5.5-6 and 5.5-7, or to the greatest extent possible.

4. Will this proposed code change impact other sections of a model code book or an amendment in Minnesota Rule? If so, please list the affected sections or rule parts.

Need and Reason

1. Why is the proposed code change needed? Please provide a general explanation as well as a specific explanation for any changes to numerical values (heights, area, etc.)

   The 2024 Minnesota Commercial Energy Code has similar requirements that need a minor update to fix misinterpretations.

2. Why is the proposed code change a reasonable solution?

   This code change fixes language and adds additional language to address rooftop curb adaptors.

3. What other factors should the TAG consider?

Cost/Benefit Analysis

1. Will the proposed code change increase or decrease costs? Please explain and provide estimates if possible.

   Increase costs. The increase costs are for the curb adaptor insulation.

2. If there is an increased cost, will this cost be offset by a safety or other benefit? Please explain. If the benefit is quantifiable (for example energy savings), provide an estimate if possible.

   This cost should be reduced in energy savings from excess heat loss through an uninsulated curb adaptor

3. If there is a cost increase, who will bear the costs? This can include government units, businesses, and individuals.

   The costs will be incurred by the installer, passed on to the building owner

4. Are there any enforcement or compliance cost increases or decreases with the proposed code change? Please explain.

   None

5. Will the cost of complying with the proposed code change in the first year after the rule takes effect exceed $25,000 for any one small business or small city (Minn. Stat. § 14.127)? A small business is any business that has less than 50 full-time employees. A small city is any statutory or home rule charter city that has less than ten full-time employees. Please explain.

Regulatory Analysis

1. What parties or segments of industry are affected by this proposed code change?

   Contractors, building owners, designers and enforcement individuals

2. Can you think of other means or methods to achieve the purpose of the proposed code change? What might someone opposed to this code change suggest instead? Please explain what the alternatives are and why your proposed change is the preferred method or means to achieve the desired result.

3. What are the probable costs or consequences of not adopting the code change, including those costs or consequences borne by identifiable categories of affected parties, such as separate classes of government units, businesses, or individuals?

4. Are you aware of any federal or state regulation or requirement related to this proposed code change? If so, please list the federal or state regulation or requirement and your assessment of any differences between the proposed code change and the federal regulation or requirement.

***Note: Incomplete forms may be returned to the submitter with instruction to complete the form. Only completed forms can considered by the TAG.

DEPARTMENT OF LABOR AND INDUSTRY
CONSTRUCTION CODES AND LICENSING

Division opinion: Insulation and curb heights at replacement rooftop HVACR

Code Reference: Minnesota Rules, Chapter 1323, Sections 5.5.3.1 and 6.1.1.3.6

Requested by: Gary Thaden

Issued by: Greg Metz, State Building Official

Date received: April 24, 2024

Date issued: April 30, 2024

Division opinions are interpretations provided by the department to facilitate uniformity of code application throughout the state. They are not rulemaking (not code) and non-binding to building officials. Division opinions are intended to provide guidance in areas where interpretations have been inconsistent from one jurisdiction to another.

Interpretation of the 2024 Minnesota Commercial Energy Code

5.5.3.1 Roof insulation. All roofs shall comply with the insulation values specified in Tables 5.5-0 through 5.5-8. Skylight curbs, mechanical curbs, and other roof curbs shall be insulated to the level of roofs with insulation entirely above the deck or R-10, whichever is less.

Exception: Historical buildings with roof slopes two units vertical in 12 units horizontal (2:12) or less.

6.1.1.3.6 Rooftop HVACR. Unless technically infeasible, new and replacement rooftop equipment shall be provided with new insulated curbs in accordance with Section 5.5.3.1. The replacement curbs shall be of sufficient height to permit the installation of insulation that complies with Tables 5.5-6 and 5.5-7 when roof replacement occurs.

Background

Prior to these amendments, there were no insulation requirements at all for roof curbs supporting rooftop HVAC equipment. Contractors have been installing roof curbs with R-5 insulation because there was guidance given for skylight curbs and the application is similar. For roofs with above the deck insulation, changes in the energy code require the installation of more insulation when the roof covering is replaced. Designers have frequently used an exception to the R-value requirement if positive drainage on the roof can't be maintained. Low curb heights for rooftop mechanical equipment have been a limiting factor to achieving greater energy code compliance for the entire roof assembly. Since additional insulation will be required the next time the roof is replaced, it is most

effective to upgrade the roof curb when equipment is added, moved, or replaced in preparation for the additional insulation thickness.

Intent

The intent and purpose of these amendments are to address two aspects: One, Section 5.5.3.1 provides an insulation standard for mechanical curbs installed on roofs because the requirement does not exist in the 2019 ASHRAE 90.1 model standard. Two, Section 6.1.1.3.6 elevates the equipment to provide the physical space for additional insulation that will be required when the roof is next replaced. Minnesota Statute 326B.101 states that amendments to the state building code shall "*…provide basic and uniform performance standards…*". Setting a performance standard with a curb insulation resistance of R-10 and a curb height requirement to support roof covering replacement with code-compliant insulation depth and sufficient freeboard to facilitate positive drainage is that performance criteria.

Division opinion

1. The application of these code sections is limited to curbs on roofs where the insulation is located above the roof deck, because there is no reason to insulate a curb above an unconditioned attic space.
2. Because the building code's charging statement in Minnesota Statutes 326B.101, subpart 1 pertains to establishing performance standards, the requirement for a "new" curb is not necessary if the existing conditions meet or can be modified to achieve the insulation performance requirements without creating other code violations.
3. Technical infeasibility due to structural capacity of the existing roof will need to be demonstrated and certified by a licensed structural engineer for that roof portion which establishes curb height for the rooftop mechanical equipment being replaced.
4. Curb extensions and supplemental insulation are acceptable for modifying existing curbs to comply with the requirements provided that positive drainage can be maintained.

ROOFTOP CURBS and the 2024 MINNESOTA COMMERCIAL ENERGY CODE

Minnesota Department of Labor and Industry

The latest Minnesota Commercial Energy Code became effective Jan. 5, 2024, and includes the following two code provisions that amend the 2019 ASHRAE Standard 90.1 Sections 5.5.3.1 and 6.1.1.3.6 affecting rooftop curbs.

Minnesota Rules 1323.0553, subp. 1 Roof insulation.
(Amends Section 5.5.3.1)

All roofs shall comply with the insulation values specified in Tables 5.5-0 through 5.5-8. Skylight curbs, mechanical curbs, and other roof curbs shall be insulated to the level of roofs with insulation entirely above deck or R-10, whichever is less.

> **Exception:** Historical buildings with roof slopes two units vertical in 12 units horizontal (2:12) or less.

Example of curb elevated for future insulation.

Minn. R. 1323.0611, subp. 1 Rooftop HVACR.
(Amends Section 6.1.1.3)

Unless technically infeasible, new and replacement rooftop equipment shall be provided with new insulated curbs in accordance with Section 5.5.3.1. The replacement curbs shall be of sufficient height to permit the installation of insulation that complies with Tables 5.5-6 and 5.5-7 when roof replacement occurs.

> **Exceptions to 6.1.1.3**:
>
> Compliance shall not be required
> 1. for *equipment* that is being modified or repaired but not replaced, provided that such modifications and/or *repairs* will not result in an increase in the annual *energy* consumption of the *equipment* using the same *energy* type;
> 2. where a replacement or *alteration* of *equipment* requires extensive revisions to other *systems*, *equipment*, or elements of a *building*, and such replaced or altered *equipment* is a like-for-like replacement;
> 3. for a refrigerant change of *existing* equipment;
> 4. for the relocation of *existing equipment*; or
> 5. for ducts and *piping* where there is insufficient *space* or access to meet these requirements.

What does this mean and what is the intent?

These provisions affect rooftop heating, ventilation, air-conditioning and refrigeration (HVACR) mechanical equipment installed on commercial buildings. Each piece of mechanical equipment is typically installed on a curb, elevating it above the roof surface and effects of water, ice and snow. It also provides a method of attaching the equipment to the roof structure. The code provisions listed above are located in separate sections but work together.

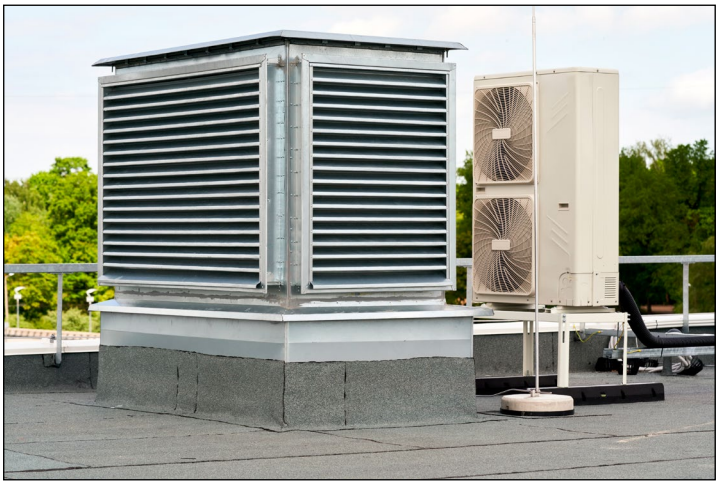
Minn. R. 1323.0553, subp. 1 Roof insulation. (Minnesota Commercial Energy Code Section 5.5.3.1)
The intent of this amendment is to address energy loss through curbs that have either low levels of insulation, or in most cases, no insulation at all. Curbs are made of metal and are highly conductive when not insulated. If the curb does not get insulated, it continues to be a thermal bridge and conduit of energy loss between the interior and exterior of the building.

Minn. R. 1323.0611 subp. 1 Rooftop HVACR. (Minnesota Commercial Energy Code Section 6.1.1.3.6)
The intent of this amendment is to raise the equipment higher above the roofing surface to provide the space to add additional insulation for inadequately insulated roofs with an insulated curb. The Minnesota Commercial Energy Code requires minimum levels of insulation when roof coverings are replaced, and this prepares the roof for the additional insulation thickness when required. If curbs are not elevated at the time of equipment replacement, insulation levels may not be able to be increased due to the lack of clearance between the equipment and the roof surface. The equipment cannot sit lower than the adjacent roof surface or it would be sitting in a pool of water, ice or snow. If this was deferred to the time of roof replacement, the outcome would be impractical and costly. Further, the code does not require the equipment to be raised at the time of roof replacement based on Minnesota amendment 1323.0513 subp. 3 to Section 5.1.3:

> 9. Where insulation is provided above the roof deck, and the required R-value for a roof replacement cannot be provided because of existing structural capacity limitations or because of the thickness limitations that occur with the existing rooftop conditions, including heating, ventilation and air conditioning equipment curbs, low door or glazing heights, parapet heights, or proper roof flashing heights, the maximum insulation compatible with the available space and existing rooftop conditions shall be installed, as approved by the building official. New insulation shall have the highest R-value per inch available, and in no case shall the R-value of the roof insulation be reduced or the U-factor of the roof assembly be increased as part of the roof replacement.

What type of equipment does the provision affect?

This applies to rooftop mechanical equipment such as heating or air-conditioning units, supply or exhaust fans, air handling units, Type 1 kitchen exhaust systems, or other items that are part of the HVACR system and utilize a curb as part of the installation.



What does “technically infeasible” include?

Technical infeasibilities are occurrences where what the code requires is not possible or practical. Examples of technical infeasibilities may include but are not limited to the following: adding the weight of additional insulation to an existing roof that is already at its maximum design capacity, and in some cases, ductwork for factory-built Type 1 kitchen exhaust systems may not accommodate modifications due to ductwork availability.

What is the difference between a curb, curb adaptor and a curb extension?

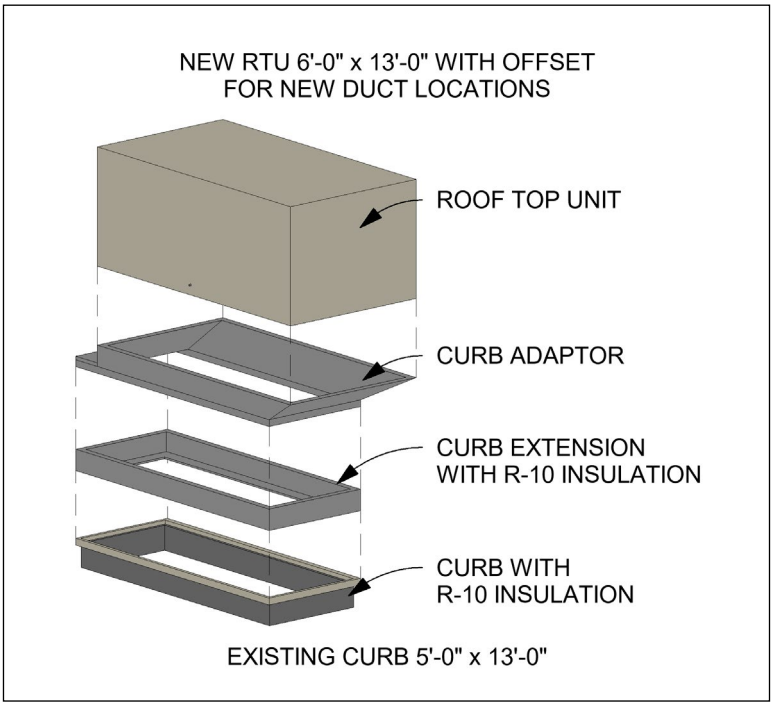
These are technical terms not specifically defined. However, the following explanations help outline how industry typically refers to these components in the context of roofing and mechanical equipment.

Curb: A roof **curb** is a frame, usually constructed from aluminum or galvanized steel, with a wood strip to hold fasteners, and functions as a base and mounting mechanism to secure mechanical equipment to the roof of the building. Typically, mechanical equipment that utilizes a curb includes heating or air-conditioning units, supply or exhaust fans or other items that are part of the HVACR system.

Curb Adapter: A **curb adapter** is a customized component that serves as the interface between the equipment and the curb. New equipment may fit slightly different than what was previously installed, so the curb adaptor will be fit to both the equipment and the curb.

Curb extension: A **curb extension** is essentially a curb that is installed on top of the existing curb. It elevates the equipment without requiring the removal of the existing curb. It is fastened to the existing curb and incorporates a gasket and/or flashing to ensure no water penetrates the connecting seam. Extending a curb avoids roofing alterations that are necessary when a curb is entirely replaced with a new one.

Curb Rail (sleeper): A **curb rail** or sleeper functions just like a curb to support mechanical equipment, but has no opening through the roof surface and sits above the structural roof deck.



Does the existing curb have to be completely replaced when new or replacement equipment is installed?

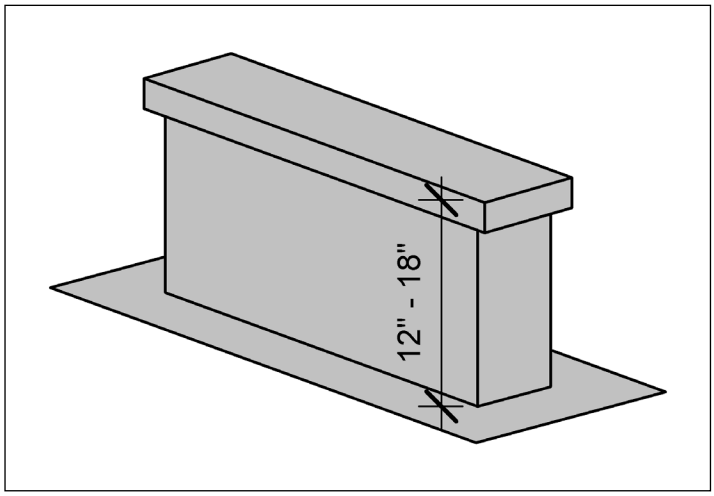
Maybe. Looking at the exceptions to Section 6.1.1.3, exception No. 2 may apply to situations where like-for-like equipment is being replaced, and extensive revisions to the building would be required as a result of replacing the curb. This exception could be used to allow for the installation of a **curb extension** instead of replacing it with a taller curb. The use of this exception is decided on a case-by-case basis at the discretion of the local designated building official.

Does the existing curb need to be insulated when equipment is replaced?

Yes. The existing curb must be insulated to a minimum of R-10 by either adding or replacing insulation within the curb. Even if the curb is extended instead of replacing it, the existing portion must still be insulated. The insulation requirement refers to a total R-value and may include other components of the curb assembly in addition to the insulation to achieve a minimum R-10. The insulation may be any material installed in accordance with the manufacturer's listing and permitted by code.

If the existing curb is tall enough to accommodate the installation of additional roof insulation, does the curb still need to be replaced?

No. If the curb height is tall enough to accommodate the required above-the-deck insulation based on climate zone, the intent to provide room for future additional roof insulation has been met. However, the existing curb must be insulated to a minimum of R-10. If R-10 cannot be accomplished, then it will need to be replaced with a curb meeting the minimum insulation value.



Curb rail

If the existing curb already has some insulation, is that good enough?

Probably not, as most curbs will not be adequately insulated. The total R-value of the curb must be at least R-10 including existing insulation and any new insulation if needed.

Does this provision affect all roof types?

It depends. Curb insulation requirements in Section 5.5.3.1 apply to all roof types with insulation entirely above the deck. The requirement in Section 6.1.1.3.6 to raise the mechanical equipment with a taller curb only applies to situations where achieving the minimum roof R-value would require additional above-the-deck insulation, and doing so would result in a curb height that does not meet design requirements because it is too short.

Does the code specify a minimum or maximum curb height?

No. The code does not provide specific height requirements. The equipment manufacturer, designer, or other requirements may specify a required height above the roof surface. In most cases, a 12-18 inch curb height (above the roof surface) would leave room to add future roof insulation and will be a sufficient height for mechanical equipment.

Can the curb simply be tall enough that verifying the existing roof insulation is not necessary?

Yes. The contractor might elect to elevate the equipment high enough to ensure that the required above-the-deck roof insulation can be achieved, regardless of the current R-value of the roof.

Continuous roof insulation typically has an R-value of 4-5 per inch. The roof could be considered as though it had no insulation and depending on climate zone, 6-8 inches of insulation would meet the minimum above-the-deck insulation requirement, plus the height the manufacturer or designer requires the equipment to sit above the roof surface.

Do curbs need to be insulated or raised if the scope of work is roof replacement?

Curbs must be insulated to a minimum of R-10. However, roof replacement does not require alterations to curb heights.

Do curbs need to be insulated or raised if the scope of work is roof recovering?

No. ASHRAE 90.1 defines *roof recovering* as "the process of installing an additional *roof covering* over an existing *roof covering* without removing the existing *roof covering*." Section 5.1.3 exempts roof recovering from the requirements of Section 5 under exception No. 5.

Do these provisions affect other types of roof curbs?

Maybe. All curbs must be insulated, but not all curbs must be raised. Section 5.5.3.1 states "*All roofs shall comply with the insulation values specified in Tables 5.5-0 through 5.5-8. Skylight curbs, mechanical curbs, and other roof curbs shall be insulated to the level of roofs with insulation entirely above deck or R-10, whichever is less.*" An exception to Section 5.5.3.1 exempts historical buildings with roof slopes 2:12 or less. However, Section 6.1.1.3.6 requiring new curbs only applies to rooftop mechanical equipment.

Do these provisions apply to equipment installed on curb rail supports?

Maybe. Unless the curb rails are replaced, no additional insulation is required, even if they are extended to accommodate longer equipment. However, if the curb rails are replaced, they should be insulated to a minimum R-10 to limit the effects of thermal bridging. Just like other curbs requirements, curb rails will need to be taller to accommodate additional future roof insulation.

When does an architect or engineer need to be involved?

All state projects require the involvement of a licensed design professional. These may include schools, hospitals, jails, assisted care and medical facilities or others as defined by Minnesota Statutes 326B.103. A design professional must be consulted when additional load is imposed to the roof. Lastly, there may be other situations where the local building official may require it based on special circumstances. [Minn. Stat. 326B.103, Subd. 11 and 13]

Does the insulation require an additional inspection?

The local building official will determine methods of verification.

How is the insulation verified after installation?

The local building official will determine methods of verification.

What building types and occupancy classifications do these code provisions affect?

These provisions affect all buildings scoped to the Minnesota Commercial Energy Code.

If the curb is raised and insulated for one piece of new or replaced equipment, do other curbs have to be raised to match at the same time?

No. The curb height does not have to change unless the equipment is replaced.

If the equipment is serviced or repaired, does the curb have to be raised or replaced?

No. Only if the equipment is replaced.

Code fact sheets are written by Construction Codes and Licensing staff and are intended to provide insight about particular sections of Minnesota State Building Code and are only intended to be used as a guide. The building official has the authority to render interpretations of the code. [Minn. R. 1300.0110, subp. 1]