



CODE CHANGE PROPOSAL FORM

(Must be submitted electronically)

Author/requestor: **Jared Johnson, Phius Alliance Minnesota**

Date: **August 29, 2023**

Marcy Conrad Nutt, Passive House Minnesota

Model Code: **2021 IECC**

Email address:

Telephone number:

Code or Rule Section: **R402.4.1.3**

Firm/Association affiliation, if any: **Phius Alliance Minnesota, Passive House Minnesota**

Code or rule section to be changed: **R402.4.1.3 Leakage Rate**

Intended for Technical Advisory Group ("TAG"):

General Information

Yes **No**

- | | | |
|--|-------------------------------------|-------------------------------------|
| A. Is the proposed change unique to the State of Minnesota? | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
| B. Is the proposed change required due to climatic conditions of Minnesota? | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
| C. Will the proposed change encourage more uniform enforcement? | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
| D. Will the proposed change remedy a problem? | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
| E. Does the proposal delete a current Minnesota Rule, chapter amendment? | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| F. Would this proposed change be appropriate through the ICC code development process? | <input type="checkbox"/> | <input checked="" type="checkbox"/> |

Proposed Language

1. The proposed code change is meant to:

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

R402.4.1.3 Leakage Rate

- 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 ~~striketrough~~ words proposed for deletion. Include the entire code (sub) section or rule subpart that contains your proposed changes.

R402.4.1.3 Leakage Rate

“When complying with Section R401.2.1, the building or dwelling unit shall have an air leakage rate not exceeding 5.0 air changes per hour in Climate Zones 0, 1 and 2, and ~~3-0~~ 2.0 air changes per hour in Climate Zones 3 through 8, when tested in accordance with Section R402.4.1.2.”

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.

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.)

Tighter air sealing:

Air leakage in cold climates creates unnecessary costs for property owners, as well as health and durability challenges in our Minnesota climate:

- **In winter, leaks carry warm, moist air through building walls, causing condensation within the wall cavity. This, in turn, creates rot and mold, which lead to unnecessary health risks and maintenance costs. In addition, heating dollars and humidity are lost through the leaks.**
- **In summer, air leakage results in lost cooling dollars. Leaks also let in allergens, increasingly common pollutants such as wildfire smoke, and humidity. Keeping humidity levels at a safe and healthy level is easier and cheaper in buildings that are well air-sealed.**

Lowering the requirement from 3.0 ACH50 to 2.0 would provide better protection against the issues listed above and improve overall energy performance, while still remaining achievable with current construction materials and practices.

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

Air-sealing uses materials and methods already common and affordable within the building industry. We believe the proposed change can be achieved with little more than education and attention to detail. According to RESNET: Of the 6,143 completed HERS-rated projects in Minnesota over the last 12 months, 75% of those projects have achieved an ACH level of 2.0 or lower.

3. What other factors should the TAG consider?

Tighter air sealing has definite benefits, but requires balanced ventilation to maintain a healthy interior environment – the two must be considered together.

Cost/Benefit Analysis

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

As stated above, we anticipate any cost increase would be minimal. Air sealing is already standard practice, and the majority of new builds in Minnesota are already hitting these ACH levels.

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 energy savings alone would quickly make up for the minimal extra cost. Extra insurance against moisture intrusion into walls is also a potential offset.

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

Builders, who will pass it along to individual homeowners.

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

No, there should not be extra compliance costs.

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.

Not that we are aware of.

Regulatory Analysis

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

Trade workers (siders, framers, specialized subcontractors)

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.

People might argue against the idea of making air-tight walls, instead choosing to “let the walls breathe”. There is an argument to be had in letting walls breathe, as it prevents moisture from sticking around for too long in any cavity. The problem with this approach in our Minnesota climate is that it prevents insulation from ever being used effectively. If we are

going to try to cut down energy usage in cold climates, insulation will have to be part of that solution, and protecting these insulated walls with tight air-sealing is a must.

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?

Over the long term, the amount of energy savings that will not be realized will be tremendous. Small incremental gains can create huge progress when multiplied over thousands and thousands of new homes. More homes will have wall moisture issues as well, which are expensive remediations in comparison to a little extra front-end air sealing work.

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.

We are unaware of any federal or state regulation or requirement related to this proposed change.

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



CODE CHANGE PROPOSAL FORM

(Must be submitted electronically)

Author/requestor: **Jared Johnson, Phius Alliance Minnesota**
Marcy Conrad Nutt, Passive House Minnesota

Date: **October 9, 2023**

Email address:

Model Code: **2021 IECC**

Telephone number:

Code or Rule Section: **Table R402.1.3**

Firm/Association affiliation, if any: **Phius Alliance Minnesota, Passive House Minnesota**

Code or rule section to be changed: **Table R402.1.3**

Intended for Technical Advisory Group (“TAG”):

<u>General Information</u>	<u>Yes</u>	<u>No</u>
A. Is the proposed change unique to the State of Minnesota?	<input checked="" type="checkbox"/>	<input type="checkbox"/>
B. Is the proposed change required due to climatic conditions of Minnesota?	<input checked="" type="checkbox"/>	<input type="checkbox"/>
C. Will the proposed change encourage more uniform enforcement?	<input type="checkbox"/>	<input checked="" type="checkbox"/>
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Proposed Language

1. The proposed code change is meant to:

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

Table R402.1.3 Insulation Minimum R-Values and Fenestration Requirements by Component
(Dec. 2020 version)

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.

Table R402.1.3 INSULATION MINIMUM R-VALUES AND FENESTRATION REQUIREMENTS BY COMPONENT (Dec. 2020 version)

CLIMATE ZONE	FENESTRATION U-FACTOR	SKYLIGHT U-FACTOR	GLAZED FENESTRATION SHGC	CEILING R-VALUE	WOOD FRAME WALL R-VALUE	MASS WALL R-VALUE	FLOOR R-VALUE
6	0.30	0.55	NR	60	20+5ci <u>10ci</u> or 0+20ci	15/20	30
7 and 8	0.30	0.55	NR	60	20+5ci <u>14ci</u> or 0+20ci	19/21	38

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.)

Left unaltered, the code presents a significant risk of condensation forming within the wall cavity due to Minnesota’s cold climate. In the Residential Chapter of the 2021 International Energy Conservation Code, the wall insulation requirement in Table R402.1.3 (for both Climate Zone 6 & 7) includes the option to use R20 + 5ci. R20 + 5ci is an insulation assembly that specifies R-20 for cavity insulation along with R-5 for exterior continuous insulation. This will likely pose moisture problems in Minnesota’s climate zones. According to the study by the Building Science Corporation, “BSD-163: Controlling Cold-Weather Condensation Using Insulation” by John Straube: “[condensation] can accumulate as frost in cold weather, and subsequently cause ‘leaks’ when the frost thaws and liquid water drains down, or cause rot if the moisture does not dry quickly upon the return of warmer and sunnier weather.”

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

Again, according to Straube, the exterior insulation R-value should be roughly 50% of the cavity insulation in Climate Zone 6. In the case of R20 + 5ci, the ratio of continuous to exterior insulation is 0.25 (5:20 = 0.25:1). In this case, there would be insufficient exterior insulation to protect against cold-weather condensation in the walls. By utilizing continuous insulation with a minimum R-value of 10, the optimal 50% cavity-to-continuous insulation ratio is achieved (10:20 = 0.5:1).

In Climate Zone 7, the recommended ratio increases - the exterior insulation R-value should be approximately 70% of the cavity insulation due to colder winter temperatures. This results in a recommended continuous insulation R-value of 14 when utilizing R20 insulation within the cavity. ($14/20 = 0.7$)

3. What other factors should the TAG consider?

The additional exterior insulation would also generate benefits to homeowners in added energy savings and thermal comfort.

Cost/Benefit Analysis (PINK = Updates since the previous submission)

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

Adding additional exterior insulation will slightly raise the cost. The difference between 1" of exterior insulation (R-5) and 2" (R-10) is about \$19 per board (which is equivalent to 32 square feet). For a typical home, with roughly 1,800 square feet of wall area and 1,800 square feet of floor area, the additional cost is about \$1,050 per home. With the construction cost of an average mid-level Minnesota home ranging between \$118/SF (Forbes, Houzeo) and \$273/SF (Home Builder Digest) this cost increase totals to about a 0.2 - 0.5 percent increase in overall cost in Climate Zone 6.^{1 2 3}

$(\$118/\text{SF} \times 1800 \text{ SF} = \$212,400; \$1,050/\$213,450 = \underline{0.49\%})$
 $(\$273/\text{SF} \times 1800 \text{ SF} = \$491,400; \$1,050/\$492,450 = \underline{0.21\%})$

The difference between 1" of exterior insulation (R-5) and 3" (R-14) is about \$40 per board. Under the same assumption, the typical cost increase would equal approximately \$2,250 per home. Again, approximating the construction cost of an average home to be about \$120/SF, this cost increase totals to about a 0.5 – 1.1 percent increase in overall cost in Climate Zone 7.

$(\$120/\text{SF} \times 1800 \text{ SF} = \$212,400; \$2,250/\$213,450 = \underline{1.05\%})$
 $(\$273/\text{SF} \times 1800 \text{ SF} = \$491,400; \$2,250/\$492,450 = \underline{0.45\%})$

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 primary value of this code change would be the cost saving due to the avoided maintenance concerns that would be presented by condensation, as well as the subsequent rot and mold, within the wall cavity. Although they would be inherently variable, the repair costs due to moisture problems in walls alone would strongly outweigh the additional up-front cost as described above.

Additionally, incremental cost savings from increased energy efficiency should be taken into account.

¹ Forbes Home. "How Much Does It Cost To Build A House In 2023?" September 2023. (<https://www.forbes.com/home-improvement/contractor/cost-to-build-a-house/>)

² Houzeo. "How Much Does it Cost to Build A House in Minnesota (MN) in 2023?" September 2023. (<https://www.houzeo.com/blog/how-much-does-it-cost-to-build-a-house-minnesota/>)

³ Home Builder Digest. "How Much Does it Cost to Build a House in Minneapolis?" (<https://www.homebuilderdigest.com/cost-guide/minnesota-cost-guides/how-much-does-it-cost-to-build-a-house-in-minneapolis/>)

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

Individuals would bear the cost increase.

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

There is no direct change in enforcement nor compliance costs with this proposal. Aligning the code with current building science recommendations could result in reduced litigation costs.

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.

Not that we are aware of.

Regulatory Analysis

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

Home buyers / renters, builders, trades, owners, manufacturers, architects

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.

Hygrothermal modeling of wall assemblies to determine condensation risk could be an option, but that would come with enforcement/compliance costs.

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?

Homeowners will have to deal with wall insulation condensation issues and the associated costs of remedying those issues. Government entities may have to deal with legal challenges.

The added energy savings of having a higher R-value wall will also bolster the cost-benefit outlook for this change. For the trades that install the CI, this is not a big shift in the practice from the baseline IECC 2021 code- it is simply installing a thicker board.

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.

We are unaware of any federal or state regulation or requirement related to this proposed change.

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