DEPARTMENT OF LABOR AND INDUSTRY

CODE CHANGE PROPOSAL FORM

(Must be submitted electronically)

Author/requestor: John G.Smith, P.E.

Date: August 26, 2023

Rev September 20, 2023

Email address: jgsmith76@gmail.com

Model Code: Residential

Telephone number: 612 867-3145

Code or Rule Section: R302
Design Conditions

Firm/Association affiliation, if any:

Code or rule section to be changed: 1322

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:

   X☐ change language contained the model code book? If so, list section(s).
   Section R302

   ☐ 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.

   Add the following new subsection:

   R302.2 Climatic Data Design Conditions

   Climatic data design conditions to be used for the calculation of heating and cooling loads shall be determined by either of the following methods:
   Method 1: Use weather conditions identified in Table R302.1. Where the building city location is not listed, use the listed city that is the nearest.
   Method 2: Use weather data published as a part of ASHRAE Standard 169 for the nearest city. This data is available at www.ASHRAE-meteo.info. Design temperatures shall be the 2021 data and shall be rounded to the nearest whole number. Winter design conditions shall be 99.6% heating dry bulb value. Summer conditions shall be the 1% annual cooling dry bulb design conditions.

Table R302.1
CLIMATIC DATA DESIGN CONDITIONS

City	Winter Design db ºF ASHRAE 99.6%	Summer db ºF/coinc wb ºF ASHRAE 1%
Aitkin	-20	82/72
Albert Lea	-11	86/72
Alexandria AP	-18	85/70
Bemidji AP	-23	82/67
Brainerd	-19	85/69
Cloquet	-18	82/68
Crookston	-24	84/70
Duluth AP	-17	81/67
Ely	-27	82/67
Eveleth	-23	82/67
Faribault	-14	88/73
Fergus Falls	-20	85/70
Grand Marais	-18	73/62
Grand Rapids	-20	82/67
Hibbing/Chisholm	-24	82/68
International Falls AP	-26	82/67
Litchfield	-15	86/72
Little Falls	-18	86/70
Mankato	-12	86/72
Mpls/St. Paul AP	-11	88/72

Montivedeo	-15	88/73
Mora	-18	86/70
Morris	-17	86/72
New Ulm	-14	88/73
Owatonna	-15	86/72
Pequot Lakes	-23	85/68
Pipestone	-12	86/73
Redwood Falls	-13	88/73
Rochester AP	-13	85/72
Roseau	-24	84/72
St. Cloud AP	-17	86/71
Silver Bay	-19	82/66
Thief River Falls	-22	82/68
Tofte		75/61
Virginia	-22	82/67
Warroad	-24	82/70
Wheaton	-17	86/72
Willmar	-11	86/72
Winona	-9	88/73
Worthington	-11	86/71

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 above table is the very similar to what is currently in the 2024 Commercial Energy Code which will go into effect in January of 2024. The difference is the Residential winter design is the 99.6% ASHRAE valuie, while the Commercial value is the extreme mean condition. It is important to have the outdoor design conditions for uniformity in design and to help assure that HVAC systems will perform as expected. Option 2 clearly identifies which weather data conditions to use for the heating and cooling conditions as the data includes many different statistical data points.

2. Why is the proposed code change a reasonable solution?
   Maintains design conditions which are similar to what have used for many years in Minnesota. Provides a standard method of determining the design conditions.

   The 1% summer conditions track to our current Commercial Energy Code, and that is why I propose using those values for the summer conditions.

   The winter design condition proposal of 99.6% was discussed and felt to be a more appropriate value for Residential design than the Commercial mean extreme condition

I would also note that years ago winter design conditions were based on weather data from December, January and February. The new ASHRAE winter tabulated data is based on the full year – 8,760 hours. This can skew the winter design conditions.

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.
   No cost change

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.

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

4. Are there any enforcement or compliance cost increases or decreases with the proposed code change? Please explain.
   No

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, Engineers, Construction Contractors, Building Officials, Owners and Inspectors.

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?
   There would be no uniformity of how heating and cooling loads are calculated.

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: 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: John G. Smith, P.E. *Date:* October 23, 2023

Email address: *Model Code:*Residential

Telephone number: *Code or Rule Section:* R402.2.3 Eave Baffle

Firm/Association affiliation, if any:

Code or rule section to be changed: 1322

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:

   X☐ change language contained the model code book? If so, list section(s).
   R402.2.3 Eave Baffle

   ☐ 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.

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.

   R402.2.3 ~~Eave baffle~~. Wind wash prevention. For air-permeable insulation in vented attics, a baffle shall be installed adjacent to soffit and eave vents. Baffles shall maintain a net free area opening equal to or greater than the size of the vent. The baffle shall extend over the top of the attic insulation. The baffle shall be permitted to be any solid material. The baffle shall be installed to the outer edge of the exterior wall top plate so as to provide maximum space for attic insulation coverage over the topplate. Where soffit venting is not continuous, baffles shall be installed continuously to prevent ventilation air in the eave soffit from bypassing the baffle. A wind wash baffle shall be provided to separate air permeable insulation from the ventilation intake space, extending vertically from the outside edge of the exterior wall top plate to the top of the insulation and sealed on the bottom and sides.

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.)
   Preventing wind wash of the attic insulation along the perimeter wall edges is important to maintain the thermal performance of the insulation. Adding the wind wash baffle accomplishes this.

2. Why is the proposed code change a reasonable solution?
   It is a common solution to the issue.

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.
   The proposed change clarifies a proper installation method which should be included in the project.

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.

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

4. Are there any enforcement or compliance cost increases or decreases with the proposed code change? Please explain.
   No

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?
   General contractor, insulation contractor, building officials.

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?
   Consequences of not adopting are reduction in thermal performance of attic insulation at perimeter.

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: 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: Patrick Murray

Email address: Pmurray@j-berd.com

Telephone number: (320) 656-0847

Firm/Association affiliation, if any: J-Berd Mechanical Contractors Inc.

Date: 9/18/23

Model Code: 2018 IECC

Code or Rule Section: N/A

Code or rule section to be changed: MN R403.5.2, .3, .4

Intended for Technical Advisory Group ("TAG"): Minnesota Residential 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.
~~R403.5.2 Total ventilation rate.~~ ~~The mechanical ventilation system shall provide sufficient outdoor air to equal the total ventilation rate average for each 1-hour period in accordance with Table R403.5.2, or Equation R403.5.2, based on the number of bedrooms and square footage of conditioned space, including the basement and conditioned crawl spaces. For the purposes of Table R403.5.2 and Section R403.5.3, the following applies: a. Equation R403.5.2 Total ventilation rate: Total ventilation rate (cfm) = (0.02 × square feet of conditioned space) + (15 × (number of bedrooms + 1)) b. Equation R403.5.2.1 Continuous ventilation rate: Continuous ventilation rate (cfm) = Total ventilation rate/2~~
~~R403.5.3 Continuous ventilation rate.~~ ~~Continuous ventilation rate (CVR) is a minimum of 50 percent of the total ventilation rate (TVR). The CVR shall not be less than 40 cfm (1133 L/min) and shall provide a continuous average cfm rate according to Table R403.5.2 or according to Equation R403.5.2 for every 1-hour period. The portion of the ventilation system that is intended to be continuous may have automatic cycling controls to provide the average flow rate for each hour.~~
~~R403.5.4 Intermittent ventilation rate.~~ ~~Intermittent ventilation rate means the difference between the total ventilation rate and the continuous ventilation rate.~~

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.)
These sections of MN Residential Energy Code are in conflict with MN Mechanical Code section 403.3.1.1. MREC method for calculating ventilation is complicated and is misunderstood by many in the industry. It also provides inconsistent ventilation to dwelling units where as MMC provides much more consistent ventilation.

2. Why is the proposed code change a reasonable solution?
This would simplify code enforcement and design. It would also provide more consistent ventilation in residential spaces.

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.
Decrease cost. Design and enforcement time would decrease. Equipment and install cost will likely not change.

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.

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

4. Are there any enforcement or compliance cost increases or decreases with the proposed code change? Please explain.
   Enforcement and compliance cost decreases. The complexity of the ventilation calculation results in confusion for enforcement resulting in more time to enforce.

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?
   Tenants, Designers, Air balancers, Building Officials, and Inspectors.

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, there seems to be no reason to have a ventilation requirement outside of the mechanical code.

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?
   Increase costs for building officials and inspectors due to confusion on ventilation requirements.

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: 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: Stephen Wieroniey
Randy NicklAs

Email address: Stephen_wieroniey@huntsman.com
rnicklas@huntsmanbuilds.com

Telephone number: 301-704-5276

Firm/Association affiliation, if any: Huntsman Corporation

Date: June XX, 2023

Model Code: IECC

Code or Rule Section: R402.2.1.1

Code or rule section to be changed:

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).
   R402.2.1.1

   ☐ 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).

   X - 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.

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.

Add new Section RXXXX (possibly 402.2.1.1) '**Unvented attic and unvented enclosed rafter assemblies** to read as follows:

RXXXX (NXXXX) Unvented attic and unvented enclosed rafter assemblies. Where IECC Table R402.1.2 or IRC Table N1102.1.2 requires R-60 an air impermeable insulation installed to the underside or directly above the roof deck with an R-value of R-30 (U-factor 0.038) shall be deemed equivalent to the provisions in IECC Table R402.1.2 or IRC Table N1102.1.2, with the following requirements:

1. The unvented attic assembly complies with the requirements of IRC R806.5.
2. The house shall attain a blower door test result < 2.5 ACH_{50}.
3. The house shall require a whole house mechanical ventilation system that does not solely rely on a negative pressure strategy (must be positive, balanced or hybrid)
4. Where insulation is installed below the roof deck and the exposed portion of roof rafters are not already covered by the R-30 depth of the air-impermeable insulation, the exposed portion of the roof rafters shall be wrapped (covered) by minimum R-3 unless directly covered by drywall / finished ceiling. Roof rafters are not required to be covered by minimum R-3 if a continuous insulation is installed above the roof deck.
5. Indoor heating, cooling and ventilation equipment (including ductwork) shall be inside the building thermal envelope.

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 IECC model code does not contain a prescriptive R-value for roof deck insulation in unvented attics. When ductwork and mechanical systems are installed in an attic, unvented attic designs provide a unique path to energy savings because they are easier to air seal, and they keep the attic closer to the temperature of the occupied space while trapping any duct leakage, which will passively conditions the space.

2. Why is the proposed code change a reasonable solution?
   The air leakage and duct leakage eliminated by means of an unvented attic constructed with air impermeable insulation represent much larger energy savings versus the need for additional thermal insulation alone.

3. What other factors should the TAG consider?
   The provisions of the proposed section provide builders with a cost-effective energy improvement option without the need for a performance analysis. This allows more funds to be directed at energy improvements.

Cost/Benefit Analysis

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

   The proposed language is an option for builders. It will likely be used where it lowers their construction 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.
   The use of air impermeable insulation helps prevent moisture accumulation at the roof deck which improves durability.

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.
   An air tightness test is required by the 2021 IECC. This code change utilizes that data to require improved performance (2.5 ACH50) versus the requirements in R402.4.1.3.

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?

   The proposed language creates a new option for builders to comply with energy efficiency requirements. This option creates a cheaper pathway toward compliance. It is anticipated that this proposal will be positive for builders and homeowners, without negatively impacting energy efficiency.

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?

   Unvented attics increase the energy efficiency of a home. Minnesota should promote the adoption of a new R-value for roof deck insulation to incentivize builders to construction homes with unvented attics where duct work is kept within conditioned space.

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.

   This proposal has been adopted by Alabama, Georgia, and Utah. It is anticipated to be adopted by North Carolina this year.

   Alabama – R402.2.2.1 (N1102.2.2.1) Semi-conditioned attics (Page 10)
   Georgia – R402.1.2.1 Indirectly Conditioned Attics (Page 4)
   North Carolina - HB 488 (Section 6) (Passed the House; Currently in Senate)
   Utah - HB 532 (page 58)

***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: Mike Moore, Stator LLC, Representing the Home Ventilating Institute

Date: October 31, 2023

Email address: mmoore@statorllc.com

Model Code: Residential Energy

Telephone number: 303.408.7015

Code or Rule Section: 1322.0202, 1322.0403.5

Firm/Association affiliation, if any: Stator LLC

Code or rule section to be changed: 1322.0202, 1322.0403.5

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). *1322.0202, 1322.0403.5*

   ☐ 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.

Adoption of this proposed code change, which is based on requirements in the 2021 IECC, is supported (but not required) by Sec. 29. Minnesota Statutes 2022, section 326B.106, subdivision 1 which states, "(d) Notwithstanding paragraph (c), the commissioner shall act on each new model residential energy code…The commissioner may adopt amendments prior to adoption of the new energy codes, as amended for use in Minnesota, to advance construction methods, technology, or materials, or, where necessary to protect the health, safety, and welfare of the public, or to improve the efficiency or use of a building."

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.
   Please see the text at the end of this code change proposal form for proposed modifications to MN 1322.0202 and 1322.0403.5.

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.
   These proposed changes will only affect other sections of MN Rules where such sections reference MN 1322.0403.5.

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 proposed code changes would update MN's energy code's ventilation provisions to better align with the 2021 IECC-R while improving energy savings versus current requirements.

2. Why is the proposed code change a reasonable solution?
   The proposed code changes have been vetted through the model code process, including the requirement to demonstrate cost effectiveness.

3. What other factors should the TAG consider?
   Minnesota's energy code has long required balanced mechanical ventilation. The latest version of the model energy code (the 2024 IECC) requires heat or energy recovery ventilators (HERVs) in climate zones 6, 7, and 8 based on cost-effectiveness that has been demonstrated versus a reference exhaust-only continuous dwelling unit ventilation system (i.e., the lowest first-cost ventilation system permitted by the model code). Cost effectiveness is even better when comparing an HERV to a reference balanced ventilation system (i.e., the case in MN). Because MN is currently considering updating its energy code to the 2021 edition, HVI's proposal is to align MN's code with the 2021 IECC-R requirement to provide an HERV for dwelling units in climate zones 7 and 8 (note that only climate zone 7 is referenced in the proposal because there are no climate zone 8 locations in MN). If the TAG is willing to consider the 2024 IECC-R as a precedent for MN's energy code, HVI would support MN's alignment with the 2024 IECC to expand the HERV requirement for MN beyond climate zone 7, to also include climate zone 6.

Cost/Benefit Analysis

1. Will the proposed code change increase or decrease costs? Please explain and provide estimates if possible.
   Where an HERV is not already being installed to meet MN's requirements for balanced ventilation, first-costs will increase. A rough estimate for the retail equipment price of a balanced system without heat or energy recovery is $500. A rough estimate for the retail equipment price of an HERV is $1000. Ducting and installation costs are expected to be approximately equal for the balanced system without heat recovery and the HERV.

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 2024 IECC-R is expanding the HERV requirements from climate zones 7 and 8 (as required by the 2021 IECC) to climate zones 6, 7, and 8, based on a cost-effectiveness analysis. The proposal that was submitted to the IECC resulting in expansion of HERV requirements to climate zone 6 showed ~$100 in natural gas savings in the first year of operation, based on building energy simulations for a typical home and a natural gas cost of $1.18/therm. These savings would support a simple payback of approximately 5 years or less in climate zone 6 (based on a $500 difference in first costs between a balanced ventilation system without heat recovery and an HERV). Monetized energy savings in Minnesota's climate zone 7 would be higher due to higher indoor to outdoor temperature differentials versus those in climate zone 6, resulting in an even shorter payback.

3. If there is a cost increase, who will bear the costs? This can include government units, businesses, and individuals.
   Homebuyers would bear the initial cost of the increase. However, financing the $500 incremental cost of the HERV equipment over a 30-year mortgage at 7.5% would result in an annual incremental difference in the mortgage of $41.95. This would be more than offset by the ~$100 in heating energy savings attributed to the HERV, making homebuyers cash-positive in year 1.

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

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.
   The cost of complying is not expected to exceed the $25,000 threshold.

Regulatory Analysis

1. What parties or segments of industry are affected by this proposed code change?
   Homebuilders, contractors, and homebuyers could all be affected by this proposed code change.

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.
   An alternative to requiring HERVs in Minnesota's climate zone 7 (and potentially 6) would be to maintain the current requirement for balanced ventilation. The proposed change is preferable to the alternative because homebuyers should be cash positive in each year of HERV ownership.

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?
   If MN does not adopt this code change proposal, homebuyers may not realize the monetized energy savings associated with specifying an HERV versus a balanced ventilation system, potentially resulting in less available cash that could otherwise be invested or spent by homebuyers in their communities.

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

HVI Proposal
October 31, 2023

Modify MN 1322.0202 as follows:

BALANCED VENTILATION SYSTEM. A ventilation system ~~in which the air intake is within ten percent of the exhaust output~~that simultaneously supplies outdoor air to and exhaust air from a space, where the mechanical supply airflow rate and the mechanical exhaust airflow rate are each within 10 percent of the average of the two airflow rates.

Commented [MM1]: This definition is sourced from the 2024 IRC, IMC, and IECC and is consistent with the latest draft of HVI 920.

Modify MN 1322.0403.5 as follows:

R403.5 Mechanical ventilation (mandatory). The building shall be provided with a balanced ~~mechanical~~ ventilation system that is +/- 10 percent of the system's design capacity and meets the requirements of section R403.5.5, which establishes the continuous and total mechanical ventilation requirements for dwelling unit ventilation. All conditioned finished or unfinished basements, conditioned crawl spaces, and conditioned levels shall be provided with a minimum ventilation rate of 0.02 cfm per square foot or a minimum of 1 supply duct and 1 return duct. The supply and return ducts shall be separated by 1/2 the diagonal dimension of the basement to avoid a short circuit of the air circulation. ~~Outdoor air intakes and exhausts shall have automatic or gravity dampers that close when the ventilation system is not operating.~~

Commented [MM2]: Strike "mechanical" to use the defined term, "balanced ventilation system," which by definition is a mechanical system.

Commented [MM3]: Finished needs to be included here, to be consistent with footnote 1 to Table R403.5.2.

Commented [MM4]: Requirements for dampers are located in Section R403.5.10 and do not need to be repeated here.

Exception: Kitchen and bath fans that are not included as part of the mechanical ventilation system are exempt from these requirements.

R403.5.1 Alterations. Alterations to existing buildings are exempt from meeting the requirements of section R403.5.

R403.5.2 Total ventilation rate. The mechanical ventilation system shall provide sufficient outdoor air to equal the total ventilation rate average for each 1-hour period in accordance with Table R403.5.2, or equation R403.5.2, based on the number of bedrooms and square footage of conditioned space, including the basement and conditioned crawl spaces.

For the purposes of Table R403.5.2 and section R403.5.3, the following applies:

a. Equation R403.5.2 Total ventilation rate: Total ventilation rate (cfm) = (0.02 x square feet of conditioned space) + (15 x (number of bedrooms + 1))

b. Equation R403.5.2.1 Continuous ventilation rate: Continuous ventilation rate (cfm) = Total ventilation rate/2

Table R403.5.2

	Number of Bedrooms					
	1	2	3	4	5	6[2]
Conditioned space[1] (in sq. ft.)	Total/ Continuous	Total/ Continuous	Total/ Continuous	Total/ Continuous	Total/ Continuous	Total/ Continuous
1000-1500	60/40	75/40	90/45	105/53	120/60	135/68
1501-2000	70/40	85/43	100/50	115/58	130/65	145/73
2001-2500	80/40	95/48	110/55	125/63	140/70	155/78
2501-3000	90/45	105/53	120/60	135/68	150/75	165/83
3001-3500	100/50	115/58	130/65	145/73	160/80	175/88
3501-4000	110/55	125/63	140/70	155/78	170/85	185/93
4001-4500	120/60	135/68	150/75	165/83	180/90	195/98
4501-5000	130/65	145/73	160/80	175/88	190/95	205/103
5001-5500	140/70	155/78	170/85	185/93	200/100	215/108
5501-6000[2]	150/75	165/83	180/90	195/98	210/105	225/113

1. Conditioned space includes the basement and conditioned crawl spaces.
2. If conditioned space exceeds 6000 sq. ft. or there are more than 6 bedrooms, use equation R403.5.2.

R403.5.3 Continuous ventilation rate. The ~~C~~continuous ventilation rate (CVR) ~~is~~ shall be not less than~~a minimum of~~ 50 percent of the total ventilation rate (TVR). The CVR shall be not ~~be~~ less than 40 cfm and shall provide a continuous average cfm rate according to Table R403.5.2 or according to equation R403.5.2 for every 1-hour period. The portion of the ventilation system that is intended to be continuous may have automatic cycling controls to provide the average flow rate for each hour.

R403.5.4 Intermittent ventilation rate. The ~~I~~intermittent ventilation rate ~~means~~ is the difference between the total ventilation rate and the continuous ventilation rate.

R403.5.5 Balanced ventilation systems and HRV/ERV~~s systems~~. ~~All balanced systems shall be balanced so that the air intake is within 10 percent of the exhaust output.~~ Dwelling units shall be provided with a balanced ventilation system. In climate zone 7, the balanced ventilation system shall be a heat recovery ventilator (HRV) or energy recovery ventilator (ERV) with a sensible recovery efficiency not less than 65 percent at 32°F (0°C) at an airflow greater than or equal to the continuous ventilation rate. The sensible recovery efficiency shall be determined from a listed value or from interpolation of listed values. An ~~heat recovery ventilator (~~HRV~~)~~ or ~~energy recovery ventilator (~~ERV~~)~~ shall ~~meet~~ have either:

1. ~~the requirements of~~A sensible recovery efficiency rating developed in accordance with HVI ~~Standard~~ Publication 920~~, 72 hours minus~~ at -13°F (-~~10~~25°C) ~~cold weather test~~; or
2. ~~certified by a~~ Compliance documentation prepared by a registered professional engineer, stating that the unit is designed to provide outdoor air at an outdoor temperature of -13°F (-25°C) ~~and installed per manufacturer's installation instructions~~.

An HRV or ERV intended to comply with both the continuous and total ventilation rate requirements shall meet the rated design capacity of the continuous ventilation rate specified in section R403.5.3 under low capacity and meet the total ventilation rate specified in section R403.5.2 under high capacity.

Commented [MM5]: This language is not needed because it is included in the revised definition of *balanced system* (now called *balanced ventilation system* in the I-codes). The definition of *balanced ventilation system* is sourced from the 2024 IRC, IMC, and IECC.

Commented [MM6]: Section R403.6.1 of the 2021 IECC-R requires an HERV for all dwelling units in climate zones 7 and 8. For MN, only climate zones 6 and 7 are relevant. The latest draft of the 2024 IECC-R expands the requirement to climate zone 6 (Public Comment Draft 2: https://www.iccsafe.org/wp-content/uploads/IECC-RE-PCD2.pdf). HVI's proposed text aligns with the 2021 IECC; however, HVI recommends that HERV requirements be expanded to climate zone 6 to align with the 2024 IECC-R. This would also simplify enforcement across the state.

Commented [MM7]: This sentence is from PCD2 of the 2024 IECC-R. It clarifies how the SRE is to be determined without changing the SRE requirement established in the 2021 IECC-R.

Commented [MM8]: This language clarifies the information that is required from the registered professional engineer, where this option is selected by the builder (i.e., that the system can deliver outdoor air down to -13 F).

Commented [MM9]: The requirement to install equipment in accordance with manufacturer's instructions is located in Section R303.2 of the 2021 IECC and does not need to be repeated here.

Exception: The balanced system and HRV/ERV system may include exhaust fans to meet the intermittent ventilation rate. ~~Surface mounted fans shall have a maximum 1.0 sone per HVI Standard 915.~~

R403.5.6 Installation requirements. All mechanical systems shall meet the requirements of section R403.5.6. The mechanical ventilation system and its components shall also be installed according to the Minnesota Mechanical Code, Minnesota Rules, chapter 1346, and the equipment manufacturer~~'~~'s installation instructions.

R403.5.6.1 Air distribution/circulation. Outdoor air shall be delivered to each habitable space by a forced air circulation system, separate duct system, or individual inlets.

R403.5.6.1.1 Forced air circulation systems. When outdoor air is supplied directly through a forced air circulation system, the requirements of this section shall be met using one of the following methods:

a. when an outdoor air supply is not ducted to the forced air system, controls shall be installed to allow the forced air system to provide an average circulation flow rate each hour of not less than 0.15 cfm per square foot of the conditioned floor area; or

b. when the outdoor air supply is ducted to the forced air system, the mixed air temperature shall not be less than the heating equipment manufacturer's installation instructions. The controls shall be installed to allow the forced air circulation system to provide an average flow rate not less than 0.075 cfm per square foot of conditioned floor area.

R403.5.6.1.2 Directly ducted and individual room inlets. When outdoor air is supplied directly to habitable spaces with an airflow of 20 cfm or greater, the system shall be designed and installed to temper incoming air to not less than 40°F (4°C) measured at the point of distribution into the space.

R403.5.6.1.3 Airflow verification. All mechanical ventilation system airflows greater than 30 cfm at the building exhaust or intake shall be tested and verified. The airflow verification results shall be made available to the building official upon request.

R403.5.7 Fans. When used as part of the mechanical ventilation system, fans shall be capable of delivering the designed air flow at the point of air discharge or intake as determined by section R403.5.2 and according to HVI ~~Standard~~ Publication 916 or HVI Publication 920, as applicable.

R403.5.7.1 Airflow. Fans shall be designed and certified by the equipment manufacturer to be capable of continuous operation at the maximum fan-rated cfm.

R403.5.7.2 Sound performance. Surface mounted fans used to comply with the continuous ventilation requirement of the mechanical ventilation system shall have a maximum 1.0 sone, according to HVI ~~Standard~~ Publication 915. Fans used to comply with the intermittent ventilation requirement of the mechanical ventilation system shall have a maximum 2.5 sones, according to HVI ~~Standard~~ Publication 915. ~~Mechanical ventilation system fans shall meet the efficacy requirements of Table R403.5.1.~~

Exception ~~to sone requirements~~: Sone requirements do not apply to forced air circulation systems and remotely mounted fans~~. If~~ where the remotely mounted fan is not in a habitable space and there are at least 4 feet of ductwork between the fan and grille~~, then the fan sone rating shall be 2.5 sone or less~~. ~~Where mechanical ventilation fans are integral to tested and listed HVAC equipment, the fans shall be powered by an electronically commutated motor.~~

R403.5.7.3 Fan efficacy. Mechanical ventilation system fans shall meet the efficacy requirements of Table R403.5.1 at one or more rating points. Fans shall be tested in accordance with the test procedure referenced by Table R403.5.1 and listed. The airflow shall be reported in the product listing or on the label. Fan efficacy shall be reported in the product listing or shall be derived from the input power and airflow values reported in the product listing or on the label. Fan

Commented [MM12]: HVI 920 is the publication that is applicable to HERV airflow ratings.

Commented [MM13]: This is proposed to be moved to Section R403.5.7.3 for ease of reference. There is no substantive change associated with the move.

Commented [MM14]: This proposed modification is consistent with ASHRAE 62.2 sone exceptions and recognizes that fully ducted HERVs are not rated for sound by HVI (so are not able to meet the 2.5 sone exception).

Commented [MM15]: This last sentence is not related to sone requirements, so it should be moved to the fan efficacy section. Also, note that air handler efficacy is addressed in the fan efficacy table (IECC-R Table R403.6.2, renamed Table R403.5.1 here).

Commented [MM16]: Retained MN's requirement for all mechanical ventilation system fans to meet the fan efficacy requirements of MN Table R403.5.1. The additional language in this section is aligned with the 2021 IECC-R, with the exception that the efficacy of exhaust fans greater than 200 cfm has been increased from 3.5 cfm/W to 4.0 cfm/W to align with ENERGY STAR, consistent with the most recent draft of the 2024 IECC-R. Note that the table structure is aligned with the 2024 IECC-R, which provides better clarification for how the 2021 IECC-R fan efficacy requirements are to be determined.

efficacy for fully ducted HRVs, ERVs, balanced ventilation systems, and in-line supply or exhaust fans shall be determined at a static pressure of not less than 0.2 inch w.c. (50 Pa). Fan efficacy for ducted range hoods, bathroom, and utility room fans shall be determined at a static pressure of not less than 0.1 inch w.c. (25 Pa).

Table R403.5.1 Mechanical Ventilation System Fan Efficacy[a]

FAN TYPE	AIRFLOW RATE (CFM)	MINIMUM EFFICACY (CFM/W)	TEST PROCEDURE
HRV or ERV	Any	1.2[a]	CAN/CSA C439
Balanced ventilation system without heat or energy recovery	Any	1.2[a]	ASHRAE 51 (ANSI/AMCA Standard 210)
Range hood	Any	2.8	
In-line supply or exhaust fan	Any	3.8	
Other exhaust fan	<90	2.8	
	≥ 90 and < 200	3.5	
	> 200	4.0	
Air-handling unit that is integrated to tested and listed HVAC equipment	Any	1.2	Outdoor airflow as specified. Air-handling unit fan power determined in accordance with the applicable US Department of Energy Code of Federal Regulations DOE10 CFR 430, or other approved test method.

For SI: 1 cubic foot per minute = 0.47 L/s.

a. For balanced ventilation systems, HRVs, and ERVs, determine the efficacy as the outdoor airflow divided by the total fan power.

R403.5.8 Multifan systems sharing a common duct. When two or more fans in a dwelling unit share a common duct, each fan shall be equipped with a backdraft damper to prevent recirculation of exhaust air into another room.

R403.5.9 Connection to forced air circulation systems. When air ducts are directly connected to the forced air circulation system, the outdoor air shall be supplied directly to the forced air circulation system, or the exhaust air shall be drawn directly from the forced air circulation system, but not both. To meet the mechanical ventilation system requirements, the air duct shall be installed according to the manufacturer's installation instructions.

> **Exception:** Both outdoor air and exhaust air may be connected to the forced air circulation system only if controls are installed to operate the forced air circulation system when the mechanical ventilation system is operating or other means are provided to prevent short circuiting of ventilation air in accordance with the manufacturer's recommendations.

R403.5.10 Dampers. The mechanical ventilation system supply and exhaust ducts shall be provided with accessible backflow dampers to minimize flow to or from the outdoors when the ventilation system is off. Dampers shall be located within the equipment, ductwork, or ductwork

Commented [MM17]: This table is sourced from the latest draft of the 2024 IECC-R (Public Comment Draft 2: https://www.iccsafe.org/wp-content/uploads/IECC-RE-PCD2.pdf). The values and content are essentially equivalent to the 2021 IECC-R version of the table, with the exception that other exhaust fans exceeding 200 cfm are required to have a minimum fan efficacy of 4.0 cfm/W (i.e., aligned with ENERGY STAR, like the rest of the table). The 2024 IECC-R version also improves the layout of the table.

termination(s), and shall allow access for inspection, service, repair, and replacement without removing permanent construction.

R403.5.11 Intake openings. Exterior air intake openings shall be accessible for inspection and maintenance. Intake openings shall be located according to the Minnesota Mechanical Code, Minnesota Rules, chapter 1346, and shall be covered with a corrosion-resistant screen of not less than 1/4-inch (6.4 mm) mesh. Intake openings shall be located at least 12 inches (305 mm) above adjoining grade level.

Exception: ~~Combination air intake and exhaust hoods may be approved by the building official when specifically allowed by the equipment manufacturer's installation instructions.~~ Separation is not required between intake air openings and living space exhaust air openings of an individual dwelling unit where a factory-built intake/exhaust combination termination fitting is used to separate the air streams in accordance with the manufacturer's instructions.

R403.5.12 Filtration. All mechanically supplied outdoor air shall have a filter with a designated minimum efficiency ~~of~~ not less than MERV 4 as defined by ASHRAE Standard 52.2. The filter location shall be prior to the air entering the thermal conditioning components, blower, or habitable space. The filter shall be installed so it is readily accessible and facilitates regular service.

R403.5.13 Noise and vibration. Mechanical ventilation system components shall be installed to minimize transmission of noise and vibration. The equipment manufacturer's installation instructions shall be followed and any materials provided by the equipment manufacturer for installation shall be used. In the absence of specific materials or instructions, vibration dampening materials, such as rubber grommets and flexible straps, shall be used when connecting fans and heat exchangers to the building structure. Isolation duct connectors shall be used to mitigate noise transmission.

R403.5.14 Controls. Balanced ~~mechanical~~ ventilation system controls shall comply with all the following:

~~When the mechanical ventilation system is not designed to operate whenever the forced air circulation system is operating, the mechanical ventilation system shall incorporate an accessible backflow damper to prevent flow from the outside when the mechanical ventilation system is off.~~

1. Controls shall be compatible with the ~~mechanical~~ balanced ventilation system, its components, and the manufacturer's installation and operating instructions.

2. Controls shall be installed to operate the ~~mechanical~~ balanced ventilation system as designed.

3. Each control shall be readily accessible to occupants and shall be labeled to indicate the control's function.

R403.5.15 Labeling. All ventilation intake and exhaust outlets shall include permanent, weather-resistant identification labels on the building's exterior.

R403.5.16 Documentation. Documentation, which includes proper operation and maintenance instructions, shall accompany all mechanical ventilation systems. The documentation shall be in a conspicuous and readily accessible location.

R403.5.17 Climatic design conditions.

A. HVAC equipment shall be sized according to the ACCA Manual S or an equivalent method, based on the building's heating and cooling load calculations by using ASHRAE Handbook of Fundamentals or the ACCA Manual J. Oversizing of heating equipment shall not

Commented [MM20]: Revise to align with 2024 IRC and 2021-2024 IMC (Section 401.4.3) approval of factory-built intake/exhaust combination termination fittings.

Commented [MM21]: Revise the language to permit, but not require, installation of filters with a designated minimum efficiency exceeding MERV 4.

Commented [MM22]: This clause on dampers does not belong within the section on controls. Requirements for dampers are located in R403.5.10, which already requires dampers and obviates the need for this superfluous text.

exceed 40 percent of the calculated load requirements and oversizing of cooling equipment shall not exceed 15 percent of the calculated load requirements.

B. Design conditions shall be determined according to Table 403.5.17. Design condition adjustments may be determined by the building official if local climates differ from the tabulated temperatures based on local climate data.

TABLE R403.5.17 Climatic Data Design Conditions

City	Summer Db/Wb °F	Winter Db °F
Aitkin	82/72	-24
Albert Lea	85/72	-15
Alexandria	86/70	-21
Bemidji	84/68	-24
Cloquet	82/68	-20
Crookston	84/70	-27
Duluth	81/67	-20
Ely	82/68	-29
Eveleth	82/68	-26
Faribault	86/73	-16
Fergus Falls	86/71	-21
Grand Rapids	81/67	-23
Hibbing	82/68	-19
International Falls	83/67	-28
Litchfield	85/71	-18
Little Falls	86/71	-20
Mankato	86/72	-15
Minneapolis/St. Paul	88/72	-15
Montevideo	86/72	-17
Mora	84/70	-21
Morris	84/72	-21
New Ulm	87/73	-15
Owatonna	86/73	-16
Pequot Lakes	84/68	-23
Pipestone	85/73	-15
Redwood Falls	89/73	-17
Rochester	85/72	-17
Roseau	82/70	-29

St. Cloud	86/NA	-20
Thief River Falls	82/68	-25
Tofte	75/61	-14
Warroad	83/67	-29
Wheaton	84/71	-20
Willmar	85/71	-20
Winona	88/74	-13
Worthington	84/71	-14

Db = dry bulb temperature, degrees Fahrenheit

Wb = wet bulb temperature, degrees Fahrenheit