

1.1 **Department of Labor and Industry**

1.2 **Proposed Permanent Rules Relating to Residential Energy Code**

1.3 **1322.0010 DEFINITIONS.**

1.4 **ACCESSIBLE.** Signifies access that requires the removal of an access panel or similar
1.5 removable obstruction.

1.6 **ACCESSIBLE, READILY.** Signifies access without the necessity for removing a panel
1.7 or similar obstruction.

1.8 **ACCA.** "Air Conditioning Contractors of America" or "ACCA" means the Air
1.9 Conditioning Contractors of America.

1.10 **AIR CIRCULATION, FORCED.** A means of providing space conditioning utilizing
1.11 movement of air through ducts or plenums by mechanical means.

1.12 **AIR, EXHAUST.** Air discharged from any space to the outside by the residential
1.13 ventilation system.

1.14 **AIR, OUTDOOR.** The air that is taken from the external atmosphere, and therefore not
1.15 previously circulated through the HVAC system or the conditioned space.

1.16 **AIR-CONDITIONING SYSTEM.** A system that consists of heat exchangers, blowers,
1.17 filters, supply, exhaust and return-air systems, and shall include any apparatus installed
1.18 in connection therewith.

1.19 **ASHRAE.** "American Society of Heating, Refrigeration, and Air-Conditioning
1.20 Engineers" or "ASHRAE" means the American Society of Heating, Refrigeration, and
1.21 Air-Conditioning Engineers.

1.22 **ASTM.** "American Society for Testing and Materials" or "ASTM" means the American
1.23 Society for Testing and Materials.

1.24 **BALANCED VENTILATION SYSTEM.** A residential ventilation system where the
1.25 design fan powered exhaust air is equal to the fan powered supply air.

1.26 **BUILDING.** Building means only a one- or two-family dwelling or portion thereof,
1.27 including townhouses, that is used, or designed or intended to be used, for human

2.1 habitation, living, sleeping, cooking, or eating purposes, or any combination thereof, and
2.2 shall include accessory structures.

2.3 **CONDITIONED SPACE.** For energy purposes, space within a building that is provided
2.4 with heating or cooling equipment or systems capable of maintaining, through design or
2.5 heat loss or gain, 50 degrees Fahrenheit (10 degrees Celsius) winter design conditions and
2.6 85 degrees Fahrenheit (29 degrees Celsius) at summer design conditions, or communicates
2.7 directly with a conditioned space. For mechanical purposes, an area, room, or space being
2.8 heated or cooled by any equipment or appliance.

2.9 **CUBIC FEET PER MINUTE (CFM).** The quantity of air moved in one minute. A
2.10 measurement typically applied to ventilation equipment.

2.11 **ENERGY RECOVERY VENTILATOR (ERV).** A device or combination of devices
2.12 applied to transfer energy and moisture from the exhaust air stream for use within the
2.13 dwelling.

2.14 **EXHAUST VENTILATION SYSTEM.** A residential ventilation system where a fan
2.15 provides exhaust air and supply air is not fan powered.

2.16 **FORCED-AIR CIRCULATION SYSTEM.** An air heating or cooling system.

2.17 **FURNACE.** A vented heating appliance designed or arranged to discharge heated air into
2.18 a conditioned space or through a duct or ducts.

2.19 **HEAT RECOVERY VENTILATOR (HRV).** A device or combination of devices
2.20 applied to transfer energy from the exhaust air stream for use within the dwelling.

2.21 **HVI.** "Home Ventilating Institute" or "HVI" means the Home Ventilating Institute.

2.22 **INTERNATIONAL BUILDING CODE OR IBC.** "International Building Code" or
2.23 "IBC" means the International Building Code, as promulgated by the International Codes
2.24 Council, Falls Church, VA 22041, and as adopted by reference in part 1305.0011.

2.25 **INTERNATIONAL RESIDENTIAL CODE OR IRC.** "International Residential Code"
2.26 or "IRC" means the International Residential Code, as promulgated by the International
2.27 Codes Council, Falls Church, VA 22041, and as adopted by reference in part 1309.0010.

3.1 **MANUFACTURER'S INSTALLATION INSTRUCTIONS.** Printed instructions
3.2 included with equipment as part of the conditions of listing and labeling.

3.3 **MECHANICAL VENTILATION.** The mechanical process of supplying conditioned or
3.4 unconditioned air to, or removing such air from, any space.

3.5 **NATIONAL FENESTRATION RATING COUNCIL OR NFRC.** "National
3.6 Fenestration Rating Council" or "NFRC" means the National Fenestration Rating Council.

3.7 **1322.0015 ADMINISTRATION AND PURPOSE.**

3.8 Subpart 1. **Administration.** This code shall be administered according to chapter
3.9 1300.

3.10 Subp. 2. **Purpose.** The purpose of this chapter is to establish a minimum code
3.11 of standards for the construction, reconstruction, alternation, and repair of buildings
3.12 governing matters including design and construction standards regarding heat loss control,
3.13 illumination, climate control, and radon control methods pursuant to Minnesota Statutes,
3.14 sections 16B.59, 16B.61, and 16B.64.

3.15 **1322.0020 CODES ADOPTED BY REFERENCE.**

3.16 A. The 2006 edition of the International Residential Code (IRC), chapter
3.17 11, is incorporated by reference and made part of the Minnesota State Building Code,
3.18 except as qualified by the applicable provisions in chapter 1300, and as amended in this
3.19 chapter. Chapter 11 of the 2006 IRC is not subject to frequent change, and a copy, with
3.20 amendments for use in Minnesota, is available in the office of the commissioner of labor
3.21 and industry. Portions of this chapter reproduce text and tables from chapter 11 of the 2006
3.22 IRC. The IRC is copyright 2006 by the International Codes Council. All rights reserved.

3.23 B. The following standards and references are incorporated by reference,
3.24 are not subject to frequent change, and are made part of the Minnesota State Building
3.25 Code as amended in this chapter: ASHRAE, 2005 Handbook of Fundamentals, chapter
4.1 29; ASTM E779-87 (1992), Standard Test Method for Determining Air Leakage

4.2 Rate by Fan Pressurization; ASTM E1677-95, Standard Specification for an Air
4.3 Retarder (AR) Material or System for Low-Rise Framed Building Walls; HVI Standard
4.4 915-2006, Loudness Testing and Rating Procedures; HVI Standard 916-2005, Airflow
4.5 Test Procedure; HVI Standard 920-2005, Product Performance Test Procedure; HVI
4.6 Standard 920-2005, Product Performance Certification Procedure; ACCA Manual J,
4.7 Load Calculation for Residential Winter and Summer Air Conditioning, 8th edition, Air
4.8 Conditioning Contractors of America; REScheck, residential energy code software,
4.9 published by the United States Department of Energy; NFRC 100-2001, Procedure for
4.10 Determining Fenestration Product U-Factors, National Fenestration Rating Council;
4.11 NFRC 400-2001, Procedure for Determining Fenestration Product Air Leakage, National
4.12 Fenestration Rating Council; and 101/1.s.2/A440-05, Specification for Windows, Doors,
4.13 and Skylights, American Architectural Manufacturers Association, Canadian Standards
4.14 Association, and Window and Door Manufacturers Association.

4.15 **1322.1101 IRC SECTION N1101, GENERAL.**

4.16 Subpart 1. **IRC Section N1101.1.** IRC Section N1101.1 is amended to read as
4.17 follows:

4.18 **N1101.1 Scope.** This chapter regulates energy efficiency for the design and
4.19 construction of buildings regulated by the International Residential Code (IRC) as
4.20 adopted and amended by the state of Minnesota. This chapter shall also be used to
4.21 regulate the energy efficiency for the design and construction of new residential
4.22 buildings regulated by the International Building Code (IBC) as adopted and amended
4.23 by the state of Minnesota that are not more than three stories in height and contain no
4.24 conditioned common space that is shared between dwellings, and each dwelling unit
4.25 contains a separate means of egress. The intent of these criteria is to provide a means
4.26 for furnishing quality indoor air, assuring building durability, and permitting energy
4.27 efficient operation. Pursuant to part 1322.2100, Appendix F of the 2006 International
5.1 Residential Code (IRC) applies to all residential buildings covered by this chapter.

5.2 Enforcement of this chapter must not abridge safety, health, or environmental
5.3 requirements under other applicable codes or ordinances.

5.4 **Exceptions:**

5.5 1. Portions of the building that do not enclose conditioned space, including garages.

5.6 2. Insulation R-values, air barrier, and vapor retarder requirements are not required
5.7 for existing foundations, crawl space walls, and basements in existing dwellings or
5.8 existing dwelling units whose alteration or repair require a permit if the original
5.9 dwelling's permit was issued before the effective date of this chapter.

5.10 3. Additions to existing dwellings or dwelling units may be made without making
5.11 the entire dwelling or dwelling unit comply, provided that the addition complies
5.12 with all the requirements of this chapter.

5.13 4. Alteration or repairs to existing dwellings or dwelling units may be made without
5.14 making the entire dwelling or dwelling unit comply, provided the alteration complies
5.15 with as many requirements of this chapter as feasible, as determined by the designated
5.16 building official.

5.17 5. Buildings that have been specifically designated as historically significant by the
5.18 state or local governing body, or listed or determined to be eligible for listing in
5.19 the National Register of Historic Places.

5.20 6. If a building houses more than one occupancy, each portion of the building must
5.21 conform to the requirements for the occupancy housed in that portion.

5.22 7. This chapter does not cover buildings, structures, or portions of buildings or
5.23 structures whose peak design energy rate usage is less than 3.4 Btu per hour per
5.24 square foot or 1.0 Watt per hour per square foot of floor area for all purposes.

5.25 Subp. 2. **IRC Section N1101.2.** IRC Section N1101.2 is amended to read as follows:

6.1 **N1101.2 Compliance.** Compliance shall be demonstrated by meeting the
6.2 requirements of this chapter. Climate zones from Table N1101.2.1 shall be used in
6.3 determining the applicable requirements from this chapter.

6.4 Subp. 3. IRC Section N1101.2.1. IRC Section N1101.2.1 is deleted in its entirety.

6.5 Subp. 4. IRC Figure N1101.2. IRC Figure N1101.2 is deleted in its entirety.

6.6 Subp. 5. IRC Table N1101.2. IRC Table N1101.2 is deleted and replaced with
 6.7 the following:

6.8 Table N1101.2 Minnesota Climate Zones

6.9	<u>Northern Zone</u>	<u>Southern Zone</u>
6.10	<u>Aitkin</u>	<u>Anoka</u>
6.11	<u>Becker</u>	<u>Benton</u>
6.12	<u>Beltrami</u>	<u>Big Stone</u>
6.13	<u>Carlton</u>	<u>Blue Earth</u>
6.14	<u>Cass</u>	<u>Brown</u>
6.15	<u>Clay</u>	<u>Carver</u>
6.16	<u>Clearwater</u>	<u>Chippewa</u>
6.17	<u>Cook</u>	<u>Chisago</u>
6.18	<u>Crow Wing</u>	<u>Cottonwood</u>
6.19	<u>Douglas</u>	<u>Dodge</u>
6.20	<u>Grant</u>	<u>Dakota</u>
6.21	<u>Hubbard</u>	<u>Faribault</u>
6.22	<u>Itasca</u>	<u>Fillmore</u>
6.23	<u>Kanabec</u>	<u>Freeborn</u>
6.24	<u>Kittson</u>	<u>Goodhue</u>
6.25	<u>Koochiching</u>	<u>Hennepin</u>
6.26	<u>Lake</u>	<u>Houston</u>
6.27	<u>Lake of the Woods</u>	<u>Isanti</u>
6.28	<u>Mahnomen</u>	<u>Jackson</u>
6.29	<u>Marshall</u>	<u>Kandiyohi</u>
7.1	<u>Mille Lacs</u>	<u>Lac qui Parle</u>
7.2	<u>Morrison</u>	<u>Le Sueur</u>
7.3	<u>Norman</u>	<u>Lincoln</u>

7.4	<u>Otter Tail</u>	<u>Lyon</u>
7.5	<u>Pennington</u>	<u>Martin</u>
7.6	<u>Pine</u>	<u>McLeod</u>
7.7	<u>Polk</u>	<u>Meeker</u>
7.8	<u>Red Lake</u>	<u>Mower</u>
7.9	<u>Roseau</u>	<u>Murray</u>
7.10	<u>St. Louis</u>	<u>Nicollet</u>
7.11	<u>Todd</u>	<u>Nobles</u>
7.12	<u>Traverse</u>	<u>Olmsted</u>
7.13	<u>Wadena</u>	<u>Pipestone</u>
7.14	<u>Wilkin</u>	<u>Pope</u>
7.15		<u>Ramsey</u>
7.16		<u>Redwood</u>
7.17		<u>Renville</u>
7.18		<u>Rice</u>
7.19		<u>Rock</u>
7.20		<u>Scott</u>
7.21		<u>Sherburne</u>
7.22		<u>Sibley</u>
7.23		<u>Stearns</u>
7.24		<u>Steele</u>
7.25		<u>Stevens</u>
7.26		<u>Swift</u>
7.27		<u>Yellow Medicine</u>
7.28		<u>Wabasha</u>
7.29		<u>Waseca</u>
7.30		<u>Watonwan</u>
8.1		<u>Winona</u>
8.2		<u>Wright</u>

8.3 Subp. 6. IRC Table N1101.2.1. IRC Table N1101.2.1 is deleted in its entirety.

8.4 Subp. 7. **IRC Section 1101.3.** IRC Section N1101.3 is amended to read:

8.5 **N1101.3 Identification.** Materials, systems, and equipment shall be identified in a
8.6 manner that will allow a determination of compliance with the applicable provisions
8.7 of this chapter.

8.8 **N1101.3.1 Plans and specifications.** Plans and specifications shall show in
8.9 sufficient detail pertinent data and features of the building, the equipment, and
8.10 the systems as governed by this chapter, including, but not limited to: design
8.11 criteria, exterior envelope component materials and their locations, U-factors of
8.12 the envelope systems, R-values of insulating materials, size and type of apparatus
8.13 and equipment, equipment and system controls, and other pertinent data to
8.14 indicate conformance with the requirements of this chapter.

8.15 Subp. 8. **IRC Section N1101.4.** IRC Section N1101.4 is deleted in its entirety and
8.16 replaced with the following:

8.17 **N1101.4 Building thermal envelope insulation.** All thermal insulation must conform
8.18 to Minnesota Rules, chapter 7640, Minnesota Thermal Insulation Standards, adopted
8.19 by the Department of Commerce. Insulation shall be manufactured for its intended
8.20 use, installed according to the manufacturer's specifications, and be no less than the
8.21 stated performance at winter design conditions. Insulation used on the exterior for the
8.22 purpose of insulating foundation walls shall be a water-resistant material and comply
8.23 with ASTM C578, C612, or other approved standards. An R-value identification
8.24 mark shall be applied by the manufacturer to each piece of building thermal envelope
8.25 insulation 12 inches (305 mm) or more wide. Alternatively, the insulation installers
8.26 shall provide a certification listing the type, manufacturer, and R-value of insulation
9.1 installed in each element of the building thermal envelope as described in section
9.2 N1101.8. For blown or sprayed insulation (fiberglass and cellulose), the initial
9.3 installed thickness, settled thickness, settled R-value, installed density, coverage
9.4 area, and number of bags installed shall be listed on the certification. For sprayed

9.5 polyurethane foam (SPF) insulation, the installed thickness of the area covered and
9.6 R-value of installed thickness shall be listed on the certificate. When using blown or
9.7 sprayed insulation (fiberglass, cellulose, or sprayed polyurethane foam) requirements
9.8 from Sections N1101.4.1, N1101.4.1.1, and N1101.4.1.2 shall be met accordingly.

9.9 **N1101.4.1 Blown or sprayed roof/ceiling insulation.** Installation of blown
9.10 or sprayed roof/ceiling insulation must comply with sections N1104.1.1 and
9.11 N1104.1.2.

9.12 **N1101.4.1.1 Attic thickness markers.** The thickness of blown in or sprayed
9.13 roof/ceiling insulation (fiberglass or cellulose) shall be written in inches
9.14 (mm) on markers that are installed at least one for every 100 ft² (9.3 m²)
9.15 throughout the attic space. The markers shall be affixed to the trusses or
9.16 joists and marked with the minimum initial installed thickness with numbers
9.17 a minimum of 1 inch (25 mm) high. Each marker shall face the attic access
9.18 opening. Spray polyurethane foam thickness and installed R-value shall be
9.19 listed on the certificate provided by the insulation installer.

9.20 **N1101.4.1.2 Attic insulation card.** A signed and dated insulation receipt
9.21 attic card must be attached to the framing near the access opening, in a
9.22 clearly visible place, and posted with the certificate required by section
9.23 N1101.8. The attic card must identify the type of insulation installed,
9.24 the manufacturer, the installer, the R-value per inch, the designed settled
9.25 thickness, the square footage of attic coverage area, and the number of bags
9.26 installed.

10.1 **N1101.4.2 Insulation mark installation.** Insulating materials shall be installed
10.2 such that the manufacturer's R-value mark is readily observable upon inspection.

10.3 Subp. 9. **IRC Section N1101.5.** IRC Section N1101.5 is deleted in its entirety and
10.4 replaced with the following:

10.5 **N1101.5 Fenestration product rating.** U-factors of fenestration products (windows,
 10.6 doors, and skylights) shall be determined in accordance with NFRC 100-2001, air
 10.7 leakage shall be determined in accordance with Section N1102.4.2. Products lacking
 10.8 such a labeled U-factor shall be assigned a default U-factor from Tables N1101.5(1)
 10.9 and N1101.5(2).

10.10 **Subp. 10. IRC Table N1101.5(1).** IRC Table N1101.5(1) is amended to read as
 10.11 follows:

<u>Table N1101.5(1)</u>				
<u>Default Glazed Fenestration U-Factors</u>				
			<u>Skylight</u>	
<u>Frame Type</u>	<u>Single Pane</u>	<u>Double Pane</u>	<u>Single Pane</u>	<u>Double Pane</u>
<u>Metal</u>	<u>1.20</u>	<u>0.80</u>	<u>1.60</u>	<u>1.05</u>
<u>Metal with Thermal Break</u>	<u>1.1</u>	<u>0.65</u>	<u>1.9</u>	<u>1.1</u>
<u>Non-Metal or Metal Clad</u>	<u>0.95</u>	<u>0.55</u>	<u>1.25</u>	<u>0.80</u>
<u>Glazed Block</u>	<u>0.60</u>			

10.22 **Subp. 11. IRC Table N1101.5(2).**

10.23 Table N1101.5(2)

10.24 Default Door U-Factors

<u>Door Type</u>	<u>U-Factor</u>
<u>Uninsulated Metal</u>	<u>1.2</u>
<u>Insulated Metal</u>	<u>0.6</u>
<u>Wood</u>	<u>0.5</u>
<u>Insulated, Non-metal edge, max 45% glazing, any glazing double pane</u>	<u>0.35</u>

11.5 **Subp. 12. IRC Table N1101.5(3).** IRC Table N1101.5(3) is deleted in its entirety.

11.6 Subp. 13. **IRC Section N1101.6.** IRC Section N1101.6 is amended to read as
 11.7 follows:

11.8 **N1101.6 Installation.** Materials, systems, and equipment shall be installed according
 11.9 to the manufacturer's installation instructions, the conditions of any listing or required
 11.10 certifications, and this code.

11.11 Subp. 14. **IRC Section N1101.7.** IRC Section N1101.7 is deleted in its entirety.

11.12 Subp. 15. **IRC Section N1101.8.** IRC Section N1101.8 is deleted in its entirety
 11.13 and replaced with the following:

11.14 **N1101.8 Building certificate.** A building certificate shall be posted in a permanently
 11.15 visible location inside the building. The certificate shall be completed by the builder
 11.16 and shall list information and values of components listed in Table N1101.8.

11.17 Table N1101.8

<u>Component</u>	<u>Certificate requirements</u>
<u>Date certificate is installed</u>	<u>Posted date</u>
<u>Dwelling or dwelling unit location</u>	<u>Mailing address and city</u>
<u>Residential contractor</u>	<u>Name and license number of residential contractor</u>
<u>Insulation installed in or on ceiling/roof, walls, slab-on-grade, and floor</u>	<u>Type and installed R-value</u>
<u>Rim joist and foundation wall insulation</u>	<u>Installed R-value, type, and whether the insulation is exterior, integral, or interior</u>
<u>Fenestration</u>	<u>Average U-factor and SHGC</u>
<u>Ducts outside conditioned spaces</u>	<u>Installed R-value</u>
<u>Mechanical ventilation system</u>	<u>Type, location, and design continuous and total ventilation rates</u>
<u>Make-up air and combustion air systems (if installed)</u>	<u>Type, location, and size</u>

12.6	<u>Heating system</u>	<u>Type, input rating, AFUE or HSPF,</u>
12.7		<u>manufacturer, model, and the</u>
12.8		<u>structure's calculated heat loss</u>
12.9	<u>Domestic water heater</u>	<u>Type, size, manufacturer, and model</u>
12.10	<u>Cooling system (if installed)</u>	<u>Type, output rating, SEER, manufacturer,</u>
12.11		<u>model, calculated cooling load, and the</u>
12.12		<u>structure's calculated heat gain</u>
12.13	<u>Radon control system</u>	<u>Passive or active</u>

12.14 **1322.1102 IRC SECTION N1102, BUILDING THERMAL ENVELOPE.**

12.15 Subpart 1. **IRC Section N1102.1.** IRC Section N1102.1 is amended to read as
 12.16 follows:

12.17 **N1102.1 Insulation and fenestration criteria.** The building thermal envelope shall
 12.18 meet the requirements of Table N1102.1 and/or Table N1102.1.2 based on the climate
 12.19 zone specified in Table N1101.2.

12.20 **Exceptions:**

12.21 1. When using the R-value computation method in Section N1102.1.1 individual
 12.22 component materials can be substituted for those that meet Section N1102.1.2,
 12.23 U-factor alternative.

12.24 2. When the provisions of Section N1102.1.3, Total UA alternative, are met.

12.25 3. When the provisions of Section N1102.1.4, REScheck software alternative, are met.

12.26 4. When the provisions of Section N1102.1.5, Engineered systems alternative, are
 12.27 met.

13.1 Subp. 2. **IRC Section N1102.1.1.** IRC Section N1102.1.1 is amended to read
 13.2 as follows:

13.3 **N1102.1.1 R-value computation.** Insulation material used in layers, such
 13.4 as framing cavity insulation and insulating sheathing, shall be summed to
 13.5 compute the component R-value. The manufacturer's settled R-value shall be
 13.6 used for blown insulation. Computed R-values shall not include an R-value for

13.7 other building materials or air films. The thermal performance of a foundation
13.8 insulation system that is not continuous or a concrete masonry block wall
13.9 assembly with integral insulation must be determined by paragraph 1 or 2, and
13.10 must exclude air film coefficients and the R-value of the surrounding soil.

13.11 1. The thermal performance must be calculated in accordance with ASHRAE
13.12 Handbook of Fundamentals isotherm planes calculation method certified by a
13.13 professional engineer registered in Minnesota.

13.14 2. The thermal performance must be measured in accordance with the ASTM
13.15 C236 test procedure for thermal transmittance measurement performed by an
13.16 approved laboratory as defined in Minnesota Rules, chapter 7640.

13.17 Subp. 3. **IRC Section N1102.1.2.** IRC Section N1102.1.2 is amended to read
13.18 as follows:

13.19 **N1102.1.2 U-factor alternative.** An assembly with a U-factor equal to or less
13.20 than that specified in Table N1102.1.2 shall be permitted as an alternative to
13.21 the R-value in Table N1102.1.

13.22 Subp. 4. **IRC Section N1102.1.3.** IRC Section N1102.1.3 is amended to read
13.23 as follows:

13.24 **N1102.1.3 Total UA alternative.** If the total building thermal envelope UA (sum
13.25 of U-factor times assembly area) is less than or equal to the total UA resulting
13.26 from using the U-factors in Table N1102.1.2, the building shall be considered
13.27 in compliance with Table N1102.1. The UA calculation shall be done using a
14.1 method consistent with the ASHRAE Handbook of Fundamentals and shall
14.2 include the thermal bridging effects of framing materials.

14.3 Subp. 5. **IRC Table N1102.1.** IRC Table N1102.1 is deleted in its entirety and
14.4 replaced with the following:

Table N1102.1Insulation and Fenestration Requirements by Component^(a)

<u>Climate Zone</u>	<u>Fenestration^(b) U-Factor</u>	<u>Skylight U-Factor</u>	<u>Ceiling R-Value</u>	<u>Wood Frame Wall R-Value</u>	<u>Foundation Wall and Rim Joist R-Value</u>	<u>Slab^(c) R-Value & Depth</u>	<u>Crawl Space Wall R-Value</u>
<u>Southern</u>	<u>0.35</u>	<u>0.60</u>	<u>38</u>	<u>19 or 13 + 5^(e)</u>			
<u>Northern</u>	<u>0.35</u>	<u>0.60</u>	<u>44</u>	<u>19</u>			
<u>Southern</u>	<u>15</u>	<u>30^(d)</u>	<u>10</u>	<u>10, 3.5 ft</u>	<u>10</u>		
<u>Northern</u>	<u>15</u>	<u>30^(d)</u>	<u>10</u>	<u>10, 5 ft</u>	<u>10</u>		

(a) R-values are minimums. U-factors and SHGC are maximums. R-19 shall be permitted to be compressed into a 2x6 cavity.

(b) The fenestration U-factor column excludes skylights.

(c) R-5 shall be added to the required slab edge R-values for heated slabs.

(d) Or insulation sufficient to fill the framing cavity, R-19 minimum.

(e) "13 + 5" means R-13 cavity insulation plus R-5 insulated sheathing. If structural sheathing covers 25 percent or less of the exterior, R-5 sheathing is not required where structural sheathing is used. If structural sheathing covers more than 25 percent of exterior, structural sheathing shall be supplemented with insulated sheathing of at least R-2.

(f) When using log type construction for thermal mass walls the following shall apply:

(1) A minimum of a 7-inch-diameter log shall be used; and

(2) The u-value of fenestration products shall be 0.31 overall on average or better.

Subp. 6. **IRC Table N1102.1.2.** IRC Table N1102.1.2 is deleted in its entirety and replaced with the following:

15.4 Table N1102.1.2

15.5 Equivalent U-Factors^(a)

15.6 <u>Climate</u>	15.6 <u>Fenestration</u>	15.6 <u>Skylight</u>	15.6 <u>Ceiling</u>	15.6 <u>Frame Wall</u>
15.7 <u>Zone</u>	15.7 <u>U-Factor</u>	15.7 <u>U-Factor</u>	15.7 <u>U-Factor</u>	15.7 <u>U-Factor</u>
15.8 <u>South</u>	15.8 <u>0.35</u>	15.8 <u>0.60</u>	15.8 <u>0.026</u>	15.8 <u>0.060</u>
15.9 <u>North</u>	15.9 <u>0.35</u>	15.9 <u>0.60</u>	15.9 <u>0.023</u>	15.9 <u>0.060</u>
15.10 <u>Climate</u>	15.10 <u>Mass Wall</u>	15.10 <u>Floor</u>	15.10 <u>Basement</u>	15.10 <u>Crawl Space</u>
15.11 <u>Zone</u>	15.11 <u>U-Factor</u>	15.11 <u>U-Factor</u>	15.11 <u>Wall U-Factor</u>	15.11 <u>Wall U-Factor</u>
15.12 <u>South</u>	15.12 <u>0.077</u>	15.12 <u>0.033</u>	15.12 <u>0.10</u>	15.12 <u>0.10</u>
15.13 <u>North</u>	15.13 <u>0.077</u>	15.13 <u>0.033</u>	15.13 <u>0.10</u>	15.13 <u>0.10</u>

15.14 ^(a) Nonfenestration U-factors shall be obtained from measurement, calculation, or an

15.15 approved source.

15.16 Subp. 7. **IRC Section N1102.1.4.** IRC Section N1102.1 is amended by adding a

15.17 section to read as follows:

15.18 **N1102.1.4 REScheck alternative.** A building shall be deemed to meet the

15.19 requirements of Section N1102 if the thermal envelope passes, using the U.S.

15.20 Department of Energy's (DOE) REScheck software version with equivalencies

15.21 as determined by the state of Minnesota. Alternatives are not permitted to be

15.22 below the minimum R-values or above the maximum U-values allowed by Table

15.23 N1102.1 or N1102.1.2.

15.24 Subp. 8. **IRC Section N1102.1.5.** IRC Section N1102.1 is amended by adding a

15.25 section to read as follows:

15.26 **N1102.1.5 Thermal envelope system alternative (engineered system**

15.27 **alternative).** A building shall be deemed to meet the requirements of Section

15.28 N1102 if there is a design drawing that has been certified by an architect or

16.1 professional engineer licensed in Minnesota, pursuant to Minnesota Statutes,

16.2 sections 326.02 to 326.15, certifying that it is equal to or better than the total

16.3 energy efficiency performance of a building, including all of its systems, and that
 16.4 it is built meeting the requirements of this code.

16.5 Subp. 9. IRC Section N1102.2, Table N1102.2.4. IRC Section N1102.2 is amended
 16.6 to read as follows:

16.7 **N1102.2.1 Ceilings with attic spaces.** IRC Section N1102.2.1 is deleted in its
 16.8 entirety.

16.9 **N1102.2.2 Ceilings without attic spaces.** Where Section N1102.1 requires
 16.10 insulation levels above R-30 and the design of the roof/ceiling assembly does
 16.11 not allow sufficient space for the required insulation, the minimum required
 16.12 insulation for the roof/ceiling assemblies shall be R-30. This reduction of
 16.13 insulation from the requirements of Section N1102.1 shall be limited to 500 ft²
 16.14 (46 m²) of ceiling area.

16.15 **N1102.2.3 Mass walls.** Mass walls, for the purposes of this chapter, shall be
 16.16 considered walls of concrete block, concrete, insulated concrete form (ICF),
 16.17 masonry cavity, brick (other than brick veneer), earth (adobe, compressed earth
 16.18 block, rammed earth), and solid timber or logs. The provisions of Section
 16.19 N1102.1 for mass walls shall be applicable.

16.20 **N1102.2.4 Steel-frame ceilings, walls, and floors.** Steel-frame ceilings, walls,
 16.21 and floors shall meet the insulation requirements of Table N1102.2.4 or shall
 16.22 meet the U-factor requirements in Table N1102.1.2. The calculation of the
 16.23 U-factor for a steel-frame envelope assembly shall use a series-parallel path
 16.24 calculation method.

<u>Table N1102.2.4</u>	
<u>Steel-Frame Ceiling, Wall, and Floor Insulation (R-Value)</u>	
<u>Wood Frame</u>	
<u>R-Value Requirement</u>	<u>Cold-Formed Steel Equivalent R-Value^a</u>
	<u>Steel Truss Ceilings^a</u>
<u>R-38</u>	<u>R-49 or R-38+3</u>

17.5	<u>R-44</u>	<u>R-38+5</u>
17.6		<u>Steel Joist Ceilings^b</u>
17.7	<u>R-30</u>	<u>R-38 in 2x4 or 2x6 or 2x8</u>
17.8		<u>R-49 in any framing</u>
17.9	<u>R-38</u>	<u>R-49 in 2x4 or 2x6 or 2x8 or 2x10</u>
17.10		<u>Steel Framed Wall</u>
17.11	<u>R-19</u>	<u>R-13+9 or R-19+8 or R-25+7</u>
17.12		<u>Steel Joist Floor</u>
17.13		<u>R-21+R-6 in 2x6</u>
17.14	<u>R-30</u>	<u>R-21+R-12 in 2x8 or 2x10</u>

17.15 Notes:

17.16 ^{a.} Cavity insulation R-value is listed first, followed by a "+" and the continuous insulation

17.17 R-value, if applicable.

17.18 ^{b.} Insulation exceeding the height of the framing shall cover the framing.

17.19 **N1102.2.5 Floors.** Floor insulation shall be installed to maintain permanent

17.20 contact with the underside of the subfloor decking.

17.21 **N1102.2.6 Basement walls.** IRC Section N1102.2.6 is deleted in its entirety and

17.22 replaced with the following:

17.23 **N1102.2.6 Foundation wall insulation prescriptive option.**

17.24 **N1102.2.6.1 Foundation insulation.** Foundation insulation of basement

17.25 and crawl space walls and the perimeter of slab-on-grade floors must

17.26 comply with this section. Insulation materials shall be installed according to

17.27 manufacturer's installation specifications and any additional requirements

17.28 of Sections N1102.2.6.1 to N1102.2.6.11. Adding additional insulation to

17.29 increase R-values or adding an additional vapor retarder to foundation wall

17.30 assemblies, other than those required in this section, is prohibited.

18.1 **Exceptions:**

18.2 1. Foundation walls enclosing unconditioned spaces shall meet this requirement

18.3 unless the floor overhead is insulated in accordance with Section N1102.1.

- 18.4 2. Permanent wood foundations shall meet the requirements of Section R401.1.
- 18.5 3. Frost-protected shallow foundations shall meet the requirements of Section R403.3.
- 18.6 4. Insulating concrete form materials shall meet the requirements of Section R611.

18.7 **N1102.2.6.2 Basement foundation and crawl space walls.** Basement
18.8 foundation and crawl space walls shall be insulated from the top of the
18.9 foundation wall down to the top of the footing or from the top edge of the
18.10 interior wall to the top of the slab if insulation is on the interior.

18.11 **N1102.2.6.3 Slab-on-grade and basement walkout foundation walls.**
18.12 Slab-on-grade and basement walkout foundation wall insulation shall extend
18.13 to the design frost line or top of footing, whichever is less. The top edge of
18.14 the insulation installed between the exterior wall and the edge of the interior
18.15 slab shall be permitted to be cut at a 45-degree angle away from the exterior
18.16 wall. Slab-edge insulation is not required in jurisdictions designated by the
18.17 code official as having termite infestation.

18.18 **N1102.2.6.4 Foundation wall and rim joist area thermal insulation**
18.19 **requirements.** The foundation wall system and rim joist area shall have
18.20 an insulating layer with minimum thermal properties as required in this
18.21 section. The insulation layer must be a minimum R-10 in accordance with
18.22 Table N1102.1.

18.23 **Exception:** In the Southern Zone, the foundation and rim joist area insulation may
18.24 be reduced to a minimum of an R-5 if:

- 18.25 1. The insulation is located on the exterior or is integral to the foundation wall; and
- 18.26 2. An additional R-5 insulation is added to the minimum attic R-value level; and
- 19.1 3. The heating system meets the minimum efficiency ratings in Table N1102.2.6.4;
19.2 and
- 19.3 4. A minimum of a six-inch energy heel is used for the roof framing and/or truss
19.4 system.

Table N1102.2.6.4

<u>HVAC System Minimum Efficiency Requirement to Qualify for R-5 Exterior Insulation in the Southern Zone</u>		
<u>Heating System Type</u>	<u>Minimum Efficiency Rating</u>	
	<u>AFUE</u>	<u>HSPF</u>
<u>Furnace, Gas or Oil Fired</u>	<u>90%</u>	<u>N/A</u>
<u>Boiler, Gas or Oil Fired</u>	<u>85%</u>	<u>N/A</u>
<u>Heat Pump, Split Systems</u>	<u>N/A</u>	<u>8.0</u>
<u>Heat Pump, Single Package or Equipment (including gas/electric package units)</u>	<u>N/A</u>	<u>7.7</u>

N1102.2.6.5 Integral foundation insulation requirements. An insulation assembly installed integral to the foundation walls shall be manufactured for its intended use and installed according to the manufacturer's specifications.

N1102.2.6.6 Exterior foundation insulation requirements. An insulation assembly installed on the exterior of the foundation walls and the perimeter of slabs-on-grade:

1. shall be of water-resistant materials manufactured for its intended use;
2. shall be installed according to the manufacturer's specifications;
3. shall comply with either ASTM C578, C612, or C1029 as applicable; and
4. shall have a rigid, opaque, and weather-resistant protective covering to prevent the degradation of the insulation's thermal performance. The protective covering shall cover the exposed exterior insulation and extend a minimum of six inches (152 mm) below grade. The insulation and protective covering system shall be flashed in accordance with IRC Section R703.8.

N1102.2.6.7 Interior foundation insulation requirements. An insulation assembly installed on the interior of foundation walls shall meet the following provisions:

20.4 1. Masonry foundation walls shall be drained through the masonry block
20.5 cores to an approved interior drainage system.

20.6 2. If a frame wall is installed, it shall not be in direct contact with the
20.7 foundation wall unless that interior side of the foundation wall has been
20.8 waterproofed.

20.9 3. Comply with the interior air barrier requirements in Section N1102.4.1.

20.10 4. Comply with Section N1102.2.6.8, N1104.2.2.6.9, N1102.2.6.10, or
20.11 N1102.2.6.11.

20.12 **N1102.2.6.8 Rigid interior insulation.** Rigid interior insulation shall
20.13 comply with the following:

20.14 1. Either ASTM C 578 or ASTM C 1289.

20.15 2. Dampproofing, waterproofing, or a water repellent shall be applied to
20.16 the exposed above grade foundation walls or a layer of dampproofing or
20.17 waterproofing shall be installed on the entire inside surface of the foundation
20.18 wall. Water-repellent materials shall comply with ASTM E 514 with 90
20.19 percent or greater reduction in water permeance when compared to an
20.20 untreated sample.

20.21 3. Installation requirements:

20.22 a. must be in contact with the foundation wall surface;

20.23 b. vertical edges shall be sealed with acoustic sealant;

20.24 c. all interior joints, edges, and penetrations shall be sealed against air and
20.25 water vapor penetration;

20.26 d. horizontally continuous acoustic sealant exists between the foundation
20.27 wall and the insulation at the top of the foundation wall; and

21.1 e. horizontally continuous acoustic sealant exists between the basement
21.2 floor and the bottom insulation edge.

21.3 4. The insulation shall not be penetrated by the placement of utilities or by
21.4 fasteners or connectors used to install a frame wall.

21.5 **N1102.2.6.9 Spray-applied interior insulation.** Spray-applied interior
21.6 insulation shall comply with the following as applicable:

21.7 1. Closed cell polyurethane.

21.8 a. ASTM C 1029 compliant with a permeance not greater than 1 in
21.9 accordance with ASTM E 96 procedure A.

21.10 b. Sprayed directly onto the foundation wall surface. There must be a
21.11 one-inch minimum gap between the foundation wall surface and any
21.12 framing.

21.13 c. The insulation shall not be penetrated by the placement of utilities.

21.14 d. Through penetrations shall be sealed.

21.15 2. One-half pound free rise open cell foam.

21.16 a. Sprayed directly onto the foundation wall surface. There must be a
21.17 one-inch minimum gap between the foundation wall surface and any
21.18 framing.

21.19 b. The insulation shall not be penetrated by the placement of utilities.

21.20 c. Through penetrations shall be sealed.

21.21 **N1102.2.6.10 Semi-rigid interior insulation.** Semi-rigid interior insulation
21.22 shall comply with the following:

21.23 1. ASTM C 1621 with a maximum permeance of 1.1 per inch.

21.24 2. Must have a minimum density of 1.3 pcf and have a fungal resistance per
21.25 ASTM C 1338.

21.26 3. Installation requirements:

21.27 a. Must be in contact with the foundation wall surface;

22.1 b. Vertical edges shall be sealed with acoustic sealant;

- 22.2 c. All interior joints, edges, and penetrations shall be sealed against air
22.3 and water vapor penetration;
22.4 d. Horizontally continuous acoustic sealant shall be applied between the
22.5 foundation wall and the insulation at the top of the foundation wall; and
22.6 e. Horizontally continuous acoustic sealant shall be applied between the
22.7 basement floor and the bottom insulation edge.

22.8 **N1102.2.6.11 Unfaced fiberglass batt interior insulation.** Unfaced
22.9 fiberglass batt interior insulation shall comply with the following:

- 22.10 1. Waterproofing shall be applied to the entire inside surface of the
22.11 foundation wall.
22.12 2. The top and bottom plates must be air sealed to the foundation wall
22.13 surface and the basement floor.
22.14 3. In addition, an air barrier material and vapor retarder material with a
22.15 minimum permeance of at least 1, in accordance with ASTM E 96 procedure
22.16 A, shall be installed on the warm-in-winter side of the foundation insulation
22.17 meeting the following:
22.18 a. Air sealed to the framing with construction adhesive or equivalent at the
22.19 top and bottom plates and where the adjacent wall is insulated;
22.20 b. Air sealed utility boxes and other penetrations; and
22.21 c. All seams shall be overlapped at least six inches and sealed with
22.22 compatible sealing tape or equivalent.
22.23 4. Up to R-13 batts are allowed.

22.24 **N1102.2.6.12 Foundation wall insulation performance option.** Insulated
22.25 foundation systems designed and installed under the performance option
22.26 shall meet the requirements of this section.

23.1 **N1102.2.6.12.1 Water separation plane.** The foundation shall be
23.2 designed and built to have a continuous water separation plane between

- 23.3 the interior and exterior. The interior side of the water separation plane
- 23.4 must:
- 23.5 1. have a stable annual wetting/drying cycle whereby foundation wall
- 23.6 system water (solid, liquid, and vapor) transport processes produce
- 23.7 no net accumulation of ice or water over a full calendar year and the
- 23.8 foundation wall system is free of absorbed water for at least four months
- 23.9 over a full calendar year;
- 23.10 2. prevent conditions of moisture and temperature to prevail for a time
- 23.11 period favorable to mold growth for the materials used; and
- 23.12 3. prevent liquid water from the foundation wall system reaching the
- 23.13 foundation floor system at any time during a full calendar year.
- 23.14 **N1102.2.6.12.2 Documentation.** The foundation insulation system
- 23.15 designer shall provide documentation certified by a professional
- 23.16 engineer registered in Minnesota demonstrating how the requirements
- 23.17 of this section are fulfilled. The foundation insulation system designer
- 23.18 shall also specify the design conditions for the wall and the design
- 23.19 conditions for the interior space for which the water separation plane
- 23.20 will meet the requirements of this section. The foundation insulation
- 23.21 system designer shall provide a label disclosing these design conditions.
- 23.22 The label shall be posted in accordance with Section N1101.8.
- 23.23 **N1102.2.6.12.3 Installation.** The water separation plane shall be
- 23.24 designed and installed to prevent external liquid or capillary water flow
- 23.25 across it after the foundation is backfilled.
- 23.26 **N1102.2.6.12.4 Foundation air barrier.** The foundation insulation
- 23.27 system shall be designed and installed to have a foundation air barrier
- 24.1 system between the interior and the exterior. The foundation air
- 24.2 barrier system must be a material or combination of materials that

24.3 is continuous with all joints sealed and is durable for the intended
24.4 application. Material used for the foundation air barrier system must
24.5 have an air permeability not to exceed 0.004 ft³/min.ft² under a
24.6 pressure differential of 0.3 inches water (1.57 psf) (0.02 L/s.m² at 75Pa)
24.7 as determined by either commonly accepted engineering tables or by
24.8 being labeled by the manufacturer as having these values when tested in
24.9 accordance with ASTM E2178.

24.10 **N1102.2.7 Slab-on-grade floors.** IRC Section N1102.2.7 is deleted in its entirety.

24.11 **N1102.2.8 Crawl space walls.** IRC Section N1102.2.8 is deleted in its entirety.

24.12 **N1102.2.9 Masonry veneer.** Insulation shall not be required on the horizontal
24.13 portion of the foundation that supports a masonry veneer.

24.14 **N1102.2.10 Thermally isolated sunroom insulation.** Sunrooms that are capable
24.15 of maintaining, through design or heat loss, 50 degrees Fahrenheit (10 degrees
24.16 Celsius), during the heating season shall meet the building thermal envelope
24.17 requirements of Table N1102.1 or N1102.1.2. New ceilings and walls separating
24.18 the thermally isolated sunroom from conditioned space shall meet the building
24.19 thermal envelope requirements of Table N1102.1 or N1102.1.2.

24.20 **Exception:** Insulation is not needed in ceilings, walls, and floors that do not separate
24.21 the sunroom from conditioned space and when the sunroom is not capable of
24.22 maintaining, through design or heat gain, 50 degrees Fahrenheit (10 degrees Celsius)
24.23 during the heating season.

24.24 **Subp. 10. IRC Section N1102.3.** IRC Section N1102.3 is amended to read as
24.25 follows:

24.26 **N1102.3 Fenestration.**

25.1 **N1102.3.1 U-factor.** An area-weighted average of fenestration products shall be
25.2 permitted to satisfy the U-factor requirements.

25.3 **N1102.3.2 Glazed fenestration exemption.** Up to 15 square feet (1.4 m²) of
25.4 glazed fenestration per dwelling unit shall be permitted to be exempt from
25.5 U-factor requirements in Section N1102.1.

25.6 **N1102.3.3 Opaque door exemption.** One opaque door assembly is exempted
25.7 from the U-factor requirement in Section N1102.1.

25.8 **N1102.3.4 Thermally isolated sunroom U-factor.** New windows and doors
25.9 separating the sunroom from conditioned space shall meet the building thermal
25.10 envelope requirements.

25.11 **N1102.3.5 Replacement fenestration.** Where some or all of an existing
25.12 fenestration unit is replaced with a new fenestration product, excluding those
25.13 items considered as repair or maintenance, the replacement fenestration unit shall
25.14 meet the applicable requirements for U-factors found in Table N1102.1 unless
25.15 exempt under Section N1102.3.3.

25.16 Subp. 11. **IRC Section N1102.4.** IRC Section N1102.4 is deleted in its entirety
25.17 and replaced with the following:

25.18 **N1102.4 Thermal envelope air leakage.**

25.19 **N1102.4.1 Interior air barrier.** The building thermal envelope shall be
25.20 continuously sealed to limit the leakage of air through the thermal envelope.
25.21 The air barrier shall be installed on the warm-in-winter side of the thermal
25.22 insulation. Areas of potential air leakage in the building thermal envelope shall
25.23 be caulked, gasketed, weatherstripped, or otherwise sealed with an air barrier
25.24 material, suitable film, or solid material to form an effective barrier between
25.25 conditioned and unconditioned spaces. The integrity of all air barriers shall be
25.26 maintained. The sealing methods between dissimilar materials shall allow for
25.27 differential expansion and contraction. The following shall be caulked, gasketed,
26.1 weatherstripped, or otherwise sealed with an air barrier material, suitable film,
26.2 or solid material:

- 26.3 1. walls, floors, ceilings, overhangs, kneewalls, and floor rim joist areas
26.4 separating conditioned from unconditioned spaces;
26.5 2. at all joints, seams, and penetrations of the building thermal envelope;
26.6 3. at all electrical, plumbing, mechanical, and other penetrations of the interior
26.7 air barriers;
26.8 4. at all interconnections in the thermal envelope between concealed vertical
26.9 and horizontal spaces such as soffits, drop ceilings, cove ceilings, and similar
26.10 locations;
26.11 5. in concealed spaces between stairs, fireplace framing, partition walls, chases,
26.12 tubs, and showers directly adjacent to the building thermal envelope;
26.13 6. at the top of interior partition walls and walls separating dwelling units where
26.14 they join insulated ceilings; and
26.15 7. at openings between framing members and window, skylight and door frames,
26.16 and jambs.

26.17 **Exceptions:**

- 26.18 1. Areas that do not separate conditioned from nonconditioned space.
26.19 2. When the insulation material or insulated assembly prevents the leakage of air
26.20 through the thermal envelope.

26.21 **N1102.4.2 Fenestration air leakage.** Windows, skylights, and sliding glass
26.22 doors shall have an air infiltration rate of no more than 0.3 cubic foot per minute
26.23 per square foot [1.5(L/s)/m²], and swinging doors no more than 0.5 cubic foot
26.24 per minute per square foot [2.5(L/s)/m²], when tested according to NFRC 400 or
26.25 AAMA/WDMA/CSA 101/I.S.2/A440 by an accredited independent laboratory,
26.26 and listed and labeled by the manufacturer.

26.27 **Exception:** Site-built windows, skylights, and doors.

- 27.1 **N1102.4.3 Recessed lighting.** Recessed luminaires installed in the building
27.2 thermal envelope shall be sealed to limit air leakage between conditioned and
27.3 unconditioned spaces by being:
- 27.4 1. IC-rated and labeled with enclosures that are sealed or gasketed to prevent air
27.5 leakage to the ceiling cavity or unconditioned space;
 - 27.6 2. IC-rated and labeled as meeting ASTM E 283 when tested at 1.57 pounds per
27.7 square foot (75 Pa) pressure differential with no more than 2.0 cubic feet per
27.8 minute (0.944 L/s) of air movement from the conditioned space to the ceiling
27.9 cavity; or
 - 27.10 3. located inside an airtight sealed box with clearances of at least 0.5 inch (13
27.11 mm) from combustible material and 3 inches (76 mm) from insulation.

27.12 **N1102.4.4 Exterior wind wash barrier.** An exterior wind wash barrier
27.13 must be installed in the following areas when they separate conditioned from
27.14 nonconditioned spaces. Where a sealed wind wash/weather barrier is required it
27.15 must be sealed prior to covering or making it inaccessible. All penetrations in the
27.16 wind wash/weather barrier must be sealed to prevent the intrusion of water and
27.17 airborne moisture. In all other locations the wind wash/weather barrier shall be
27.18 tightly fit to framing members and building components:

- 27.19 1. between an attached garage and interior conditioned spaces (tightly fit);
- 27.20 2. at the exterior edge of the exterior wall top plate extending vertically to the
27.21 underside of the truss top cord, or for nontruss wood framing to within 3-1/2
27.22 inches of the roof deck, or to the top of the ceiling insulation (tightly fit);
- 27.23 3. at all exterior walls and all rim joist areas (tightly fit); and
- 27.24 4. at all cantilevers, cantilevered rims, and floors over unconditioned spaces
27.25 (sealed).

27.26 Subp. 12. **IRC Section N1102.5.** IRC Section N1102.5 is deleted in its entirety
27.27 and replaced with the following:

28.1 **N1102.5 Vapor diffusion management.**

28.2 **N1102.5.1 Exterior wall vapor retarder.** Above grade frame walls, rim joists,
28.3 floors, and ceilings shall be provided with an approved vapor retarder as defined
28.4 in IRC Section R202. The vapor retarder shall be installed on the warm-in-winter
28.5 side of the thermal insulation. Subfloor materials that meet the requirements of a
28.6 vapor retarder are allowed. The vapor retarder does not need to be continuously
28.7 sealed unless it also serves as an air barrier.

28.8 **Exceptions:**

- 28.9 1. In construction where moisture or its freezing will not damage the materials.
28.10 2. Where other approved means to avoid condensation are provided, such as when
28.11 rim joists, crawl space walls, or basement walls are insulated on the exterior or are
28.12 integral to the building assembly and meeting the vapor retarder requirements.

28.13 **N1102.5.2 Under-slab vapor retarders.** Under-slab vapor retarders shall meet
28.14 the provisions of parts 1322.2100 to 1322.2103.

28.15 **N1102.5.3 Crawl space floor vapor retarder.** The floors of insulated crawl
28.16 spaces shall be covered with a vapor retarder meeting the provisions of parts
28.17 1322.2100 to 1322.2103.

28.18 Subp. 13. **IRC Section N1102.6.** IRC Section N1102 is amended by adding a
28.19 section to read as follows:

28.20 **N1102.6 Alterations and repairs to existing residential buildings.**

28.21 **N1102.6.1 Reducing air leakage.** If an addition or alteration reduces the
28.22 air leakage characteristics or capacity of a building then a combustion and
28.23 makeup air supply must be provided according to the State Building Code,
28.24 Minnesota Rules, chapter 1346. Alterations that will likely reduce the air leakage
28.25 characteristics or capacity of a building include, but are not limited to, attic
28.26 insulation, wall insulation, applying siding underlayment, or the replacement of
28.27 a majority of window or door units.

29.1 **N1102.6.2 Conversions.** A change in the occupancy of an existing building
29.2 meeting the scoping provisions of this chapter that would require an increase in
29.3 demand for either fossil fuel or electrical energy supply shall comply with the
29.4 requirements of this chapter.

29.5 **Exception:** Existing HVAC and service water heating equipment within an existing
29.6 building is not required to be replaced.

29.7 **N1102.6.3 Penetrations.** Penetrations resulting as part of an alteration must be
29.8 sealed. This includes, but is not limited to, penetrations for telecommunication
29.9 wires and equipment, electrical wires and equipment, electronic wires and
29.10 equipment, fire sprinklers, plumbing and ducts, and penetrations in exterior walls
29.11 and ceilings.

29.12 **N1102.6.4 Roofs and ceilings.**

29.13 A. Attic insulation may not be installed unless accessible attic bypasses have
29.14 been sealed.

29.15 B. A ceiling vapor retarder may be omitted if the interior ceiling finish is not
29.16 removed.

29.17 **N1102.6.5 Walls.**

29.18 A. Storm windows may be installed over existing glazing without meeting the
29.19 additional requirements of this chapter.

29.20 B. Reglazing and repairs to existing windows are not required to meet the
29.21 additional requirements of this chapter.

29.22 C. Interior wall finish may not be replaced unless wall cavities have been
29.23 insulated to full depth. This item shall apply whenever plaster is removed, even
29.24 though lath may not have been removed.

29.25 **Exceptions:**

29.26 1. Walls that are back-plastered; and

29.27 2. Walls without framing cavities.

30.1 D. A vapor retarder is not required if the interior wall finish is not removed.

30.2 **1322.1103 IRC SECTION N1103, SYSTEMS.**

30.3 IRC Section N1103 is deleted in its entirety and replaced with the following:

30.4 **N1103.1 Controls.** At least one thermostat shall be provided for each separate
30.5 heating and cooling system.

30.6 **N1103.2 Ducts.**

30.7 **N1103.2.1 Insulation.** Ducts shall be insulated in accordance with the Minnesota
30.8 Mechanical Code, chapter 1346.

30.9 **Exception:** Ducts for which heat gain or loss, without insulation, will not increase
30.10 the energy requirements of the building.

30.11 MINIMUM REQUIRED INSULATION

30.12 (see notes for explanations)

30.13 <u>Duct Location</u>	<u>Requirements</u>
30.14 <u>Attics, garages, and ventilated crawl spaces</u>	<u>R-8 and V</u>
30.15 <u>Exterior of building</u>	<u>R-8, V and W</u>
30.16 <u>Inside of building and in unconditioned spaces</u>	
30.17 <u>less than or equal to 15 degrees Fahrenheit</u>	<u>None required</u>
30.18 <u>TD greater than 15 degrees Fahrenheit and less</u>	
30.19 <u>than or equal to 40 degrees Fahrenheit</u>	<u>R-3.3 and V</u>
30.20 <u>TD greater than 40 degrees Fahrenheit</u>	<u>R-5 and V</u>
30.21 <u>Within conditioned spaces, in basements</u>	
30.22 <u>with insulated walls, and in plenums</u>	
30.23 <u>within conditioned spaces</u>	<u>None required</u>
30.24 <u>Intake and exhaust ducts within</u>	
30.25 <u>conditioned spaces*</u>	<u>R-3.3 and V</u>
30.26 <u>Within cement slab or within ground</u>	
30.27 <u>(also see IMC Section 603.7)</u>	<u>R-3.5</u>

30.28 Notes:

30.29 * Insulation required for a distance of 3 feet (914 mm) from the exterior.

31.1 TD = Design temperature differential between the air in the duct and the ambient
 31.2 temperature outside of the duct.
 31.3 V = Vapor retarder required in accordance with the IMC Section 604.11. When a vapor
 31.4 retarder is required, duct insulation required by this section shall be installed without
 31.5 respect to other building envelope insulation.

31.6 W = Approved weatherproof barrier.

31.7 **N1103.2.2 Sealing.** Ducts shall be sealed in accordance with the Minnesota
 31.8 Mechanical Code, chapter 1346.

31.9	<u>Location</u>	<u>Design Static Pressure</u>	<u>Minimum Required Sealing</u>
31.10	<u>All locations</u>	<u>Greater than 3.0</u> <u>inches (750Pa) water</u> <u>gauge</u>	<u>All transverse joints,</u> <u>longitudinal seams, and</u> <u>duct wall penetrations</u> <u>shall be sealed.</u> <u>Ductwork shall be equal</u> <u>to or less than Leakage</u> <u>Class 6 as defined in</u> <u>Section 4 of the SMACNA</u> <u>HVAC Duct Leakage Test</u> <u>Manual*</u>
31.20	<u>Portions of</u> <u>return</u> <u>air ducts</u> <u>completely</u> <u>inside the</u> <u>vapor</u> <u>retarder/</u> <u>air barrier</u> <u>enclosing</u> <u>conditioned</u> <u>space</u>	<u>3.0 inches (750Pa)</u> <u>water gauge and</u> <u>less</u>	<u>All transverse joints,</u> <u>longitudinal seams, and</u> <u>duct wall penetrations</u> <u>shall be sealed</u>

- | | | | |
|-------|---|-----------------------------|----------------------------------|
| 32.1 | <u>Portions of</u> | <u>3.0 inches (750Pa)</u> | <u>All transverse joints,</u> |
| 32.2 | <u>return air</u> | <u>water gauge and</u> | <u>longitudinal seams, and</u> |
| 32.3 | <u>air ducts in</u> | <u>less</u> | <u>duct wall penetrations</u> |
| 32.4 | <u>the same</u> | | <u>shall be sealed</u> |
| 32.5 | <u>space as an</u> | | |
| 32.6 | <u>atmospher-</u> | | |
| 32.7 | <u>ically vented</u> | | |
| 32.8 | <u>or fan-</u> | | |
| 32.9 | <u>assisted</u> | | |
| 32.10 | <u>appliance</u> | | |
| 32.11 | <u>All locations</u> | <u>Greater than 0.50</u> | <u>All transverse joints and</u> |
| 32.12 | | <u>to 3.0 inches (125</u> | <u>duct wall penetrations</u> |
| 32.13 | | <u>to 750Pa) water</u> | <u>shall be sealed</u> |
| 32.14 | | <u>gauge</u> | |
| 32.15 | <u>All locations</u> | <u>0.50 inches (125Pa)</u> | <u>All transverse joints,</u> |
| 32.16 | | <u>water gauge and less</u> | <u>longitudinal seams, and</u> |
| 32.17 | | | <u>duct wall penetrations</u> |
| 32.18 | | | <u>shall have no visible</u> |
| 32.19 | | | <u>gaps and shall be</u> |
| 32.20 | | | <u>sufficiently airtight</u> |
| 32.21 | | | <u>according to Section</u> |
| 32.22 | | | <u>1.7 of the SMACNA HVAC</u> |
| 32.23 | | | <u>Duct Construction</u> |
| 32.24 | | | <u>Standards - Metal and</u> |
| 32.25 | | | <u>Flexible</u> |
| 32.26 | <u>N1103.2.3 Supply ducts. Supply ducts shall be continuously ducted according</u> | | |
| 32.27 | <u>to the Minnesota Mechanical Code, chapter 1346, from the point of origin to the</u> | | |
| 32.28 | <u>point of discharge in the habitable spaces. The building framing cavities and</u> | | |
| 32.29 | <u>building components shall not be used as supply ducts.</u> | | |
| 32.30 | <u>N1103.2.4 Domestic water piping insulation. Pipe insulation shall have a</u> | | |
| 32.31 | <u>k-value of 0.27. If the K-value of a product is less than 0.27, then the pipe</u> | | |
| 32.32 | <u>thickness shall be adjusted to have an equivalent R-value.</u> | | |
| 33.1 | <u>A. Cold water piping: no insulation required.</u> | | |

33.2 **Exception:** All piping located within 6 inches of any heating pipes shall have a
 33.3 minimum of 1 inch insulation with an appropriate vapor jacket.

33.4 B. Hot water piping: no insulation required.

33.5 **Exceptions:**

33.6 1. All recirculating systems shall have a minimum of 0.5 inch insulation on the entire
 33.7 loop with an appropriate vapor jacket.

33.8 2. All underground piping shall have a minimum of 1 inch insulation with an
 33.9 appropriate vapor jacket.

33.10 **N1103.2.5 HVAC Piping.** Hydronic, steam, and condensate piping in all
 33.11 locations shall be insulated in accordance with the Minnesota Mechanical Code,
 33.12 chapter 1346.

33.13 **Exceptions:**

33.14 1. Piping installed within HVAC equipment.

33.15 2. Piping installed in basements, crawl spaces, and cellars.

33.16 Table N1103.2.4

33.17 Insulation Thickness for Nominal Pipe Diameters

Fluid Temperature Range Degrees Fahrenheit	Runouts (see item C)	1 inch (25.4 mm and less)	1.25 to 2 inches (31.7 to 50.8 mm)	2.5 to 4 inches (63.5 to 101.6 mm)	5 to 6 inches (127 to 152 mm)	8 inches (203 mm) and larger
<u>Piping System Type - Heating</u>						
<u>Above 350</u>	<u>1.5</u>	<u>2.5</u>	<u>2.5</u>	<u>3.0</u>	<u>3.5</u>	<u>3.5</u>
<u>251-350</u>	<u>1.5</u>	<u>2.0</u>	<u>2.5</u>	<u>2.5</u>	<u>3.5</u>	<u>3.5</u>
<u>201-250</u>	<u>1.0</u>	<u>1.5</u>	<u>1.5</u>	<u>2.0</u>	<u>2.0</u>	<u>3.5</u>
<u>141-200</u>	<u>0.5</u>	<u>1.5</u>	<u>1.5</u>	<u>1.5</u>	<u>1.5</u>	<u>1.5</u>
<u>105-140</u>	<u>0.5</u>	<u>1.0</u>	<u>1.0</u>	<u>1.0</u>	<u>1.5</u>	<u>1.5</u>
<u>Piping System Type - Cooling</u>						

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34.1	<u>40.55</u>	<u>0.5</u>	<u>0.5</u>	<u>0.75</u>	<u>1</u>	<u>1</u>	<u>1</u>
34.2	<u>Below 40</u>						
34.3	<u>(see Item D)</u>	<u>1</u>	<u>1</u>	<u>1.5</u>	<u>1.5</u>	<u>1.5</u>	<u>1.5</u>

34.4 A. Insulation thickness in this section assumes a k-value of 0.27. If the k-value
 34.5 of a product is less than 0.22, then the thickness must be adjusted to have an
 34.6 equivalent R-value.

34.7 B. For piping exposed to outdoor air, insulation thickness must be 0.5 inch (12.7
 34.8 mm) greater than required in the table.

34.9 C. This column applies only to runouts (branches) 2 inches (50.8 mm) in
 34.10 diameter and less, not exceeding 12 feet (3658 mm) in length, to individual
 34.11 terminal units. All other runouts shall meet the requirements given in other
 34.12 columns in the table, as appropriate.

34.13 D. For applications with fluid temperatures of 32 degrees Fahrenheit (0 degrees
 34.14 Celsius) and below, a vapor retarder shall be installed according to IMC Section
 34.15 604.11.

34.16 **N1103.2.6 Equipment sizing.** Heating and cooling equipment shall be sized per
 34.17 the Minnesota Mechanical Code, chapter 1346, and ACCA Manual J.

34.18 **N1103.4 Domestic circulating hot water systems.** Circulating hot water systems
 34.19 shall include an automatic switch that can turn the hot water circulating pump off
 34.20 when the system is not in use or when the circulating loop temperature is satisfied.

34.21 **1322.1104 IRC SECTION N1104, MECHANICAL VENTILATION SYSTEMS.**

34.22 IRC Chapter 11 is amended by adding a section to read as follows:

34.23 **N1104.1 Mechanical ventilation requirements.** A mechanical ventilation system
 34.24 shall be installed that meets the requirements of this section. This section covers the
 34.25 continuous and total mechanical ventilation requirements for dwelling unit ventilation
 34.26 at summer and winter climatic design conditions according to Section N1104.4.13 and
 34.27 chapter 1346. All unfinished basements, crawlspaces, and levels shall be provided

35.1 with a minimum ventilation rate of 0.02 cfm per square foot, or a minimum of one
 35.2 supply duct and one return duct. The supply and return ducts shall be separated
 35.3 by one-half the diagonal dimension of the basement to avoid a short circuit of the
 35.4 air circulation.

35.5 **Exception:** Kitchen and bath fans that are not included as part of the mechanical
 35.6 ventilation system are exempt from the requirements of Section N1104 but shall
 35.7 comply with the IRC.

35.8 **N1104.1.1 Additions or alterations to existing buildings.** Additions or
 35.9 alterations to existing buildings shall require a dwelling unit mechanical
 35.10 ventilation system that meets Section N1104.

35.11 **Exception:** Buildings whose permit of initial construction was applied for prior to
 35.12 April 15, 2000, and did not require a dwelling unit mechanical ventilation system.

35.13 **N1104.2 Total ventilation rate.** The mechanical ventilation system shall provide
 35.14 sufficient outdoor air to equal the total ventilation rate average, for each one-hour
 35.15 period according to Table N1104.2, or Equation 11-1, based on the number of
 35.16 bedrooms and the square footage of conditioned space, including the basement
 35.17 but excluding conditioned crawl spaces. For heat recovery ventilators and energy
 35.18 recovery ventilators the average hourly ventilation capacity must be determined in
 35.19 consideration of any reduction of exhaust or outdoor air intake, or both, for defrost or
 35.20 other equipment cycling per HVI Standard 920.

35.21 Equation 11-1:

$$\begin{aligned}
 35.22 \text{ Total ventilation rate (CFM)} &= \frac{0.02 \times \text{square feet of}}{35.23 \text{ conditioned space) +} \\
 35.24 &\quad \frac{15 \times (\text{number of bedrooms} + 1)}{35.24}
 \end{aligned}$$

35.25 **N1104.2.1 Continuous ventilation.** A minimum of 50 percent of the total
 35.26 ventilation rate, but not less than 40 cfm, shall be provided, on a continuous
 35.27 rate average for each one-hour period according to Table N1104.2 or Equation
 35.28 11-2. The portion of the mechanical ventilation system that is intended to be

36.1 continuous may have automatic cycling controls providing the average flow rate
 36.2 for each hour meeting the requirements of Section N1104.2.1.

36.3 Equation 11-2:

36.4 Continuous ventilation (CFM) = total ventilation rate/2

36.5 **N1104.2.1.1 Ventilation rate.** The continuous ventilation system shall be
 36.6 balanced in accordance with Section N1104.4.2.

36.7 **Exception:** If the local ventilation requirements according to IRC Section R303.3 are
 36.8 being met by the continuous ventilation system, it shall be capable of operating at a
 36.9 rate not more than 100 percent greater than required by Section N1104.2.1.

36.10 **N1104.2.2 Intermittent ventilation.** The difference between the total ventilation
 36.11 rate and the continuous ventilation rate shall be based on flow rates as designed
 36.12 or as installed.

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<u>Table N1104.2</u>						
<u>Total and Continuous Ventilation Rates (in CFM)</u>						
	<u>Number of Bedrooms</u>					
	<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>	<u>5</u>	<u>6²</u>
<u>Conditioned space¹ (in sq. ft.)</u>	<u>Total/Continuous</u>	<u>Total/Continuous</u>	<u>Total/Continuous</u>	<u>Total/Continuous</u>	<u>Total/Continuous</u>	<u>Total/Continuous</u>
<u>1000-1500</u>	<u>60/40</u>	<u>75/40</u>	<u>90/45</u>	<u>105/53</u>	<u>120/60</u>	<u>135/68</u>
<u>1501-2000</u>	<u>70/40</u>	<u>85/43</u>	<u>100/50</u>	<u>115/58</u>	<u>130/65</u>	<u>145/73</u>
<u>2001-2500</u>	<u>80/40</u>	<u>95/48</u>	<u>110/55</u>	<u>125/63</u>	<u>140/70</u>	<u>155/78</u>
<u>2501-3000</u>	<u>90/45</u>	<u>105/53</u>	<u>120/60</u>	<u>135/68</u>	<u>150/75</u>	<u>165/83</u>
<u>3001-3500</u>	<u>100/50</u>	<u>115/58</u>	<u>130/65</u>	<u>145/73</u>	<u>160/80</u>	<u>175/88</u>
<u>3501-4000</u>	<u>110/55</u>	<u>125/63</u>	<u>140/70</u>	<u>155/78</u>	<u>170/85</u>	<u>185/93</u>
<u>4001-4500</u>	<u>120/60</u>	<u>135/68</u>	<u>150/75</u>	<u>165/83</u>	<u>180/90</u>	<u>195/98</u>
<u>4501-5000</u>	<u>130/65</u>	<u>145/73</u>	<u>160/80</u>	<u>175/88</u>	<u>190/95</u>	<u>205/103</u>
<u>5001-5500</u>	<u>140/70</u>	<u>155/78</u>	<u>170/85</u>	<u>185/93</u>	<u>200/100</u>	<u>215/108</u>
<u>5501-6000²</u>	<u>150/75</u>	<u>165/83</u>	<u>180/90</u>	<u>195/98</u>	<u>210/105</u>	<u>225/113</u>

37.1 ¹ Conditioned space includes the basement.

37.2 ² If conditioned space exceeds 6000 sq. ft. or there are more than 6 bedrooms, use
37.3 Equation 11-1 from Section N1104.2 to calculate total ventilation rate.

37.4 **N1104.3 Ventilation system requirements.** The mechanical ventilation system
37.5 shall be one of three types: exhaust according to Section N1104.3.1; balanced, and
37.6 HRV/ERV according to Section N1104.3.2; or other method according to Section
37.7 N1104.3.3.

37.8 **N1104.3.1 Exhaust systems.** Fans used to comply with the continuous
37.9 ventilation part of the mechanical ventilation system shall:

37.10 1. meet the minimum continuous ventilation rate in Section N1104.2.1 at the
37.11 point of discharge;

37.12 2. be designed and certified by the equipment manufacturer as capable of
37.13 continuous operation at the rated cfm;

37.14 3. have a maximum 1.0 sone per HVI Standard 915 for surface mounted fans;

37.15 4. be permitted to use a required overcurrent protection device as a disconnect
37.16 per the National Electric Code, incorporated by reference in Minnesota Rules,
37.17 chapter 1315; and

37.18 5. comply with the Minnesota Mechanical Code, chapter 1346, which may
37.19 require additional make-up air.

37.20 Fans used to comply with the intermittent ventilation part of the mechanical ventilation
37.21 system shall have a maximum 2.5 sone per HVI Standard 915.

37.22 **N1104.3.2 Balanced, and HRV/ERV systems.** A heat recovery ventilator
37.23 (HRV) or energy recovery ventilator (ERV) shall meet either:

37.24 1. the requirements of HVI Standard 920, 72 hours minus 13 degrees Fahrenheit
37.25 cold weather test; or

37.26 2. certified by a registered professional engineer and installed per manufacturer's
37.27 installation instructions.

38.1 An HRV or ERV intended to comply with both the continuous and total ventilation rate
38.2 requirements shall meet the rated design capacity of the continuous ventilation rate in
38.3 Section N1104.2.1 under low capacity and meet the total ventilation rate in Section
38.4 N1104.2.2 under high capacity.

38.5 **Exception:** The balanced, and HRV/ERV system may include exhaust fans to meet
38.6 the intermittent ventilation rate. Surface mounted fans shall have a maximum 2.5
38.7 sones per HVI Standard 915.

38.8 **N1104.3.3 Other methods.** Any mechanical ventilation system consisting of
38.9 exhaust fans, supply fans, or a combination of both, complying with Section
38.10 N1104, shall be allowed. A mechanical ventilation system specifically identified
38.11 in Section N1104.3.1 or N1104.3.2 shall not conflict with Sections N1104.3.1
38.12 and N1104.3.2. For the purposes of this section, the delivered ventilation rate
38.13 is the larger of the total air flow of the operating supply fans, or total air flow
38.14 of the operating exhaust fans.

38.15 **N1104.4 Installation requirements.** All types of mechanical systems shall meet the
38.16 requirements of this section. The mechanical ventilation system and its components
38.17 shall also be installed according to the Mechanical Code, Minnesota Rules, chapter
38.18 1346, and the equipment manufacturer's installation instructions.

38.19 **N1104.4.1 Air distribution and circulation.** Outdoor air shall be delivered to
38.20 each habitable space by a forced air circulation system, separate duct system,
38.21 individual inlets, or a passive opening.

38.22 **N1104.4.1.1 Forced air circulation systems.** When outdoor air is supplied
38.23 directly through a forced air circulation system, the requirements of this
38.24 section shall be met by either:

38.25 (a) when an outdoor air supply is not ducted to the forced air system,
38.26 controls shall be installed to allow the forced air system to provide an

39.1 average circulation flow rate each hour, of not less than 0.15 cfm per square
 39.2 foot of the conditioned floor area; or
 39.3 (b) when the outdoor air supply is ducted to the forced-air system, it shall be
 39.4 tempered so that the mixed air temperature shall be no less than 60 degrees
 39.5 Fahrenheit or the heating equipment manufacturer's installation instruction,
 39.6 and controls shall be installed to allow the forced air circulation system
 39.7 to provide an average flow rate not less than 0.075 cfm per square foot of
 39.8 conditioned floor area.

39.9 **N1104.4.1.2 Directly ducted and individual room inlets.** When outdoor
 39.10 air is supplied directly to habitable spaces with an airflow of 20 cfm or
 39.11 greater, the system shall be designed and installed to temper incoming air
 39.12 to not less than 40 degrees Fahrenheit measured at the point of distribution
 39.13 into the space.

39.14 Table N1104.4.1.1(1)

39.15 Indirect Circulation Air Flow Rates

39.16 for Forced-Air Circulation Systems (in cfm)

		<u>Forced-Air Circulation Systems Flow Rate (cfm)</u>							
		<u>600</u>	<u>800</u>	<u>1000</u>	<u>1200</u>	<u>1400</u>	<u>1600</u>	<u>1800</u>	<u>2000</u>
<u>Conditioned Floor Area</u>	<u>Average Air Flow each Hr (cfm)</u>	<u>Number of Minutes per Hour, if cycled</u>							
<u>1000-1500</u>	<u>225</u>	<u>23</u>	<u>17</u>	<u>14</u>	<u>12</u>	<u>10</u>	<u>9</u>	<u>8</u>	<u>7</u>
<u>1501-2000</u>	<u>300</u>	<u>30</u>	<u>23</u>	<u>18</u>	<u>15</u>	<u>13</u>	<u>12</u>	<u>10</u>	<u>9</u>
<u>2001-2500</u>	<u>375</u>	<u>38</u>	<u>29</u>	<u>23</u>	<u>19</u>	<u>16</u>	<u>14</u>	<u>13</u>	<u>12</u>
<u>2501-3000</u>	<u>450</u>	<u>45</u>	<u>34</u>	<u>27</u>	<u>23</u>	<u>20</u>	<u>17</u>	<u>15</u>	<u>14</u>
<u>3001-3500</u>	<u>525</u>	<u>53</u>	<u>40</u>	<u>32</u>	<u>27</u>	<u>23</u>	<u>20</u>	<u>18</u>	<u>16</u>
<u>3501-4000</u>	<u>600</u>	<u>60</u>	<u>45</u>	<u>36</u>	<u>30</u>	<u>26</u>	<u>23</u>	<u>20</u>	<u>18</u>
<u>4001-4500</u>	<u>675</u>	<u>na¹</u>	<u>51</u>	<u>41</u>	<u>34</u>	<u>29</u>	<u>26</u>	<u>23</u>	<u>21</u>
<u>4501-5000</u>	<u>750</u>	<u>na¹</u>	<u>57</u>	<u>45</u>	<u>38</u>	<u>33</u>	<u>29</u>	<u>25</u>	<u>23</u>

40.1	<u>5001-5500</u>	<u>825</u>	<u>na¹</u>	<u>na¹</u>	<u>50</u>	<u>42</u>	<u>36</u>	<u>31</u>	<u>28</u>	<u>25</u>
40.2	<u>5501-6000</u>	<u>900</u>	<u>na¹</u>	<u>na¹</u>	<u>54</u>	<u>45</u>	<u>39</u>	<u>34</u>	<u>3</u>	<u>27</u>

40.3 ¹ Not allowed

40.4 <u>Table N1104.4.1.1(2)</u>										
40.5 <u>Direct Distribution Air Flow Rates Using</u>										
40.6 <u>Forced-Air Circulation Systems (in cfm)</u>										
		40.7 <u>Forced-Air Circulation Systems Flow Rate (cfm)</u>								
		<u>600</u>	<u>800</u>	<u>1000</u>	<u>1200</u>	<u>1400</u>	<u>1600</u>	<u>1800</u>	<u>2000</u>	
<u>Conditioned Floor Area</u>	<u>Average Air Flow each Hr (cfm)</u>	40.9 <u>Number of Minutes per Hour, if cycled</u>								
40.12	<u>1000-1500</u>	<u>13</u>	<u>9</u>	<u>7</u>	<u>6</u>	<u>5</u>	<u>5</u>	<u>4</u>	<u>4</u>	
40.13	<u>1501-2000</u>	<u>15</u>	<u>13</u>	<u>9</u>	<u>8</u>	<u>7</u>	<u>6</u>	<u>5</u>	<u>5</u>	
40.14	<u>2001-2500</u>	<u>19</u>	<u>15</u>	<u>13</u>	<u>10</u>	<u>8</u>	<u>7</u>	<u>7</u>	<u>6</u>	
40.15	<u>2501-3000</u>	<u>23</u>	<u>17</u>	<u>14</u>	<u>13</u>	<u>10</u>	<u>9</u>	<u>8</u>	<u>7</u>	
40.16	<u>3001-3500</u>	<u>27</u>	<u>20</u>	<u>15</u>	<u>14</u>	<u>13</u>	<u>10</u>	<u>9</u>	<u>8</u>	
40.17	<u>3501-4000</u>	<u>30</u>	<u>23</u>	<u>18</u>	<u>15</u>	<u>13</u>	<u>13</u>	<u>10</u>	<u>9</u>	
40.18	<u>4001-4500</u>	<u>34</u>	<u>26</u>	<u>21</u>	<u>17</u>	<u>15</u>	<u>13</u>	<u>13</u>	<u>11</u>	
40.19	<u>4501-5000</u>	<u>38</u>	<u>24</u>	<u>23</u>	<u>19</u>	<u>17</u>	<u>15</u>	<u>13</u>	<u>13</u>	
40.20	<u>5001-5500</u>	<u>42</u>	<u>32</u>	<u>25</u>	<u>21</u>	<u>18</u>	<u>16</u>	<u>14</u>	<u>13</u>	
40.21	<u>5501-6000</u>	<u>45</u>	<u>34</u>	<u>27</u>	<u>23</u>	<u>20</u>	<u>17</u>	<u>15</u>	<u>14</u>	

40.22 **N1104.4.1.3 Passive openings.** When outdoor air is brought in through a
 40.23 passive opening, the maximum cfm of the outdoor air requirements shall be
 40.24 combined with the maximum makeup air requirements of Minnesota Rules,
 40.25 chapter 1346. The combined air rates shall be brought into the dwelling unit
 40.26 in accordance with chapter 1346. Controls shall be installed to distribute air
 40.27 throughout the dwelling unit as required by Section N1104.4.1.1a.

40.28 **N1104.4.2 Airflow verification.** Mechanical ventilation system airflows greater
 40.29 than 30 cfm at the building exhaust or intake shall be tested and verified using a

41.1 flow hood, flow grid, pitot tube, or other airflow measuring device. The airflow
41.2 verification results shall be made available to the building official upon request.

41.3 **N1104.4.2.1 Airflow requirements.** When the system is intended to be
41.4 unbalanced, the design supply air flow shall not exceed 0.05 cfm per square
41.5 foot of conditioned space. The operating exhaust air flow shall meet the
41.6 requirements of Section N1104.3.1 and the Minnesota Mechanical Code,
41.7 chapter 1346, which may require additional makeup air. When the system
41.8 is intended to be balanced, the exhaust and supply airflows shall be within
41.9 plus or minus ten percent of each other or the manufacturer's installation
41.10 instructions, whichever is more restrictive.

41.11 **N1104.4.3 Fans.** When used as part of the mechanical ventilation system, fans
41.12 shall be capable of delivering the designed air flow as determined by Section
41.13 N1104.2 according to HVI Standard 916. Fans shall be designed and certified by
41.14 the equipment manufacturer as capable of continuous operation at the rated cfm.
41.15 Surface mounted fans used to comply with the continuous ventilation part of the
41.16 mechanical ventilation system shall have a maximum 1.0 sone per HVI Standard
41.17 915. Fans used to comply with the intermittent ventilation part of the mechanical
41.18 ventilation system shall have a maximum 2.5 sone per HVI Standard 915.

41.19 **Exception:** Sone requirements do not apply to forced air circulation systems and
41.20 remotely mounted fans, provided the remotely mounted fan is not in a habitable space
41.21 and there is at least 4 feet of ductwork between the fan and the grille.

41.22 **N1104.4.4 Multifan systems.** When two or more exhaust fans in a dwelling
41.23 unit share a common exhaust duct, each fan shall be equipped with a backdraft
41.24 damper to prevent recirculation of exhaust air into another room.

41.25 **N1104.4.5 Connection to forced air circulation systems.** Air ducts connected
41.26 directly to the forced air circulation system can be used to meet the mechanical
41.27 ventilation system requirements. Either the tempered outdoor air may be

42.1 supplied to, or exhaust air may be drawn from, the forced air circulation system,
42.2 but not both.

42.3 **Exception:** Both outdoor air and exhaust air may be connected to the forced air
42.4 circulation system, provided that controls are installed to ensure that the forced
42.5 air circulation system is operating whenever the mechanical ventilation system
42.6 is operating or other means are provided to prevent short circuiting of fresh air
42.7 according to the manufacturer's recommendations.

42.8 **N1104.4.6 Dampers.** Mechanical ventilation system supply and exhaust ducts
42.9 shall be provided with accessible backflow dampers to minimize flow to or from
42.10 the outdoors when the ventilation system is off.

42.11 **N1104.4.7 Intake openings.** Exterior air intake openings shall be accessible for
42.12 inspection and maintenance. Intake openings shall be located in accordance
42.13 with the Minnesota Mechanical Code, chapter 1346, and shall be covered with
42.14 corrosion resistant screen of not less than one-fourth inch (6.4 mm) mesh. Intake
42.15 openings shall be located at least 12 inches (305 mm) above adjoining grade level.

42.16 **Exception:** Combination air intake and exhaust hoods may be approved by the
42.17 building official when specifically allowed by the equipment manufacturer's
42.18 installation instructions.

42.19 **N1104.4.8 Filtration.** Mechanically supplied outdoor air shall have a filter with
42.20 a designated minimum efficiency of MERV 4 as defined by ASHRAE Standard
42.21 52.2. The filter shall be located prior to the air entering the thermal conditioning
42.22 components, blower, or habitable space and shall be installed to be readily
42.23 accessible and facilitate regular service.

42.24 **N1104.4.9 Noise and vibration.** Mechanical ventilation system components
42.25 shall be installed to minimize noise and vibration transmission. The equipment
42.26 manufacturer's installation instructions shall be followed, and materials provided
42.27 by the equipment manufacturer shall be used for this purpose. In the absence

43.1 of specific materials or instructions, vibration dampening materials such as
43.2 rubber grommets and flexible straps shall be used when connecting fans and
43.3 heat exchangers to the building structure, and isolation duct connectors shall be
43.4 used to mitigate noise transmission.

43.5 **N1104.4.10 Controls.** Mechanical ventilation system controls shall be provided
43.6 according to the following.

43.7 1. Controls shall be installed to ensure that the forced air circulation system is
43.8 operating whenever the mechanical ventilation system is operating if required by
43.9 the equipment manufacturer's installation instructions.

43.10 2. Controls shall be installed to ensure that whenever the mechanical ventilation
43.11 system is operating, the forced air circulation system provides indirect circulation
43.12 of 0.15 cfm per square foot of conditioned floor area or direct distribution of
43.13 0.075 cfm per square foot of conditioned floor area.

43.14 3. If the mechanical ventilation system is not designed to operate whenever the
43.15 forced air circulation system is operating, the mechanical ventilation system shall
43.16 incorporate an accessible backflow damper to prevent flow from the outside
43.17 when the mechanical ventilation system is off.

43.18 4. Controls shall be compatible with the mechanical ventilation system.

43.19 5. Controls shall be installed to operate the mechanical ventilation system as
43.20 designed.

43.21 6. Controls shall be readily accessible to occupants and shall be labeled to
43.22 indicate their function.

43.23 7. If a switch is used for continuous ventilation, it can be located centrally or
43.24 remotely, but shall not be located in a bath or toilet room. If centrally located, it
43.25 shall be properly labeled and lighted when the system is on. If remotely located,
43.26 there shall be a lighted status indicator in a central location that will be lighted
43.27 when the system is on.

44.1 **N1104.4.11 Labeling.** The outdoor air intake and exhaust air outlet shall include
 44.2 a permanent, weather resistant identification label stating "OUTDOOR AIR
 44.3 INTAKE" or "EXHAUST AIR OUTLET" as appropriate. Controls provided for
 44.4 continuous and intermittent ventilation shall be provided with a label stating
 44.5 "VENTILATION SYSTEM" or "VENTILATION FAN" or "INTERMITTENT
 44.6 FAN" or ventilation symbols, as appropriate.

44.7 **N1104.4.12 Documentation.** Mechanical ventilation systems shall be provided
 44.8 with documentation that includes proper operation and maintenance instructions
 44.9 and a warning regarding potential problems if the system is not operated and
 44.10 maintained. A permanent warning label shall be affixed to a mechanical
 44.11 ventilation system if it is readily accessible. If the mechanical ventilation system
 44.12 is not readily accessible, the documentation shall be in a conspicuous readily
 44.13 accessible location.

44.14 **N1104.4.13 Climatic design conditions.**
 44.15 A. HVAC equipment must be sized according to the 2005 ASHRAE Handbook
 44.16 of Fundamentals, ACCA Manual J, or an equivalent method. Oversizing of
 44.17 heating equipment must not exceed 43 percent and cooling equipment must
 44.18 not exceed 21 percent.
 44.19 B. Design conditions must be determined from Table N1104.4.13. Design
 44.20 condition adjustments may be made as determined by the building official to
 44.21 reflect local climates that differ from the tabulated temperatures or local weather
 44.22 experience.

44.23 TABLE N1104.4.13
 44.24 Outdoor Design Conditions

44.25 <u>City</u>	<u>Summer Db/Wb °F</u>	<u>Winter Db °F</u>
44.26 <u>Aitkin</u>	<u>82/72</u>	<u>-24</u>
44.27 <u>Albert Lea</u>	<u>85/72</u>	<u>-15</u>
45.1 <u>Alexandria</u>	<u>86/70</u>	<u>-21</u>

45.2	<u>Bemidji</u>	<u>84/68</u>	<u>-24</u>
45.3	<u>Cloquet</u>	<u>82/68</u>	<u>-20</u>
45.4	<u>Crookston</u>	<u>84/70</u>	<u>-27</u>
45.5	<u>Duluth</u>	<u>81/67</u>	<u>-20</u>
45.6	<u>Ely</u>	<u>82/68</u>	<u>-29</u>
45.7	<u>Eveleth</u>	<u>82/68</u>	<u>-26</u>
45.8	<u>Faribault</u>	<u>86/73</u>	<u>-16</u>
45.9	<u>Fergus Falls</u>	<u>86/71</u>	<u>-21</u>
45.10	<u>Grand Rapids</u>	<u>81/67</u>	<u>-23</u>
45.11	<u>Hibbing</u>	<u>82/68</u>	<u>-19</u>
45.12	<u>International Falls</u>	<u>83/67</u>	<u>-28</u>
45.13	<u>Litchfield</u>	<u>85/71</u>	<u>-18</u>
45.14	<u>Little Falls</u>	<u>86/71</u>	<u>-20</u>
45.15	<u>Mankato</u>	<u>86/72</u>	<u>-15</u>
45.16	<u>Minneapolis/St. Paul</u>	<u>88/72</u>	<u>-15</u>
45.17	<u>Montevideo</u>	<u>86/72</u>	<u>-17</u>
45.18	<u>Mora</u>	<u>84/70</u>	<u>-21</u>
45.19	<u>Morris</u>	<u>84/72</u>	<u>-21</u>
45.20	<u>New Ulm</u>	<u>87/73</u>	<u>-15</u>
45.21	<u>Owatonna</u>	<u>86/73</u>	<u>-16</u>
45.22	<u>Pequot Lake</u>	<u>84/68</u>	<u>-23</u>
45.23	<u>Pipestone</u>	<u>85/73</u>	<u>-15</u>
45.24	<u>Redwood Falls</u>	<u>89/73</u>	<u>-17</u>
45.25	<u>Rochester</u>	<u>85/72</u>	<u>-17</u>
45.26	<u>Roseau</u>	<u>82/70</u>	<u>-29</u>
45.27	<u>St. Cloud</u>	<u>86/71</u>	<u>-20</u>
45.28	<u>Thief River Falls</u>	<u>82/68</u>	<u>-25</u>
45.29	<u>Tofte</u>	<u>75/61</u>	<u>-14</u>
45.30	<u>Warroad</u>	<u>83/67</u>	<u>-29</u>
46.1	<u>Wheaton</u>	<u>84/71</u>	<u>-20</u>

46.2 Willmar 85/71 -20

46.3 Winona 88/74 -13

46.4 Worthington 84/71 -14

46.5 Db = dry bulb temperature, degrees Fahrenheit

46.6 Wb = wet bulb temperature, degrees Fahrenheit

46.7 **1322.2100 INCORPORATION BY REFERENCE.**

46.8 Appendix F, Radon Control Methods, of the 2006 edition of the International
 46.9 Residential Code (Appendix F) as promulgated by the International Code Council, Inc.
 46.10 (ICC), Falls Church, VA 22041, is incorporated by reference and made part of the
 46.11 Minnesota State Building Code except as qualified by the applicable provisions in chapter
 46.12 1300, and as amended in parts 1322.2101 to 1322.2103. Appendix F is not subject
 46.13 to frequent change and a copy of Appendix F, with amendments for use in Minnesota,
 46.14 is available in the office of the commissioner of labor and industry. Portions of parts
 46.15 1322.2101 to 1322.2103 reproduce text and tables from Appendix F, which is copyrighted
 46.16 by the ICC. All rights reserved.

46.17 **1322.2101 SECTION AF101, SCOPE.**

46.18 Subpart 1. **General.** Appendix F, Section AF101, is amended to read as follows:

46.19 The purpose of parts 1322.2101 to 1322.2103 is to establish requirements for
 46.20 radon-resistant construction in new residential construction built to the requirements of
 46.21 Minnesota Rules, chapter 1305 or 1309.

46.22 Subp. 2. **Figure AF101.** Appendix F, Figure AF101, is deleted in its entirety.

46.23 Subp. 3. **Table AF101(1).** Appendix F, Table AF101(1), is deleted in its entirety.

46.24 **1322.2102 SECTION AF102, DEFINITIONS.**

46.25 Subpart 1. **General.** Appendix F, Section AF102, is amended to read as follows:

47.1 **AF102.1 General.** The definitions in this part apply to Minnesota Rules, parts
47.2 1322.2101 to 1322.2103.

47.3 **SUB-SLAB DEPRESSURIZATION SYSTEM (Passive).** A system designed to
47.4 achieve lower sub-slab air pressure relative to indoor air pressure by use of a vent pipe
47.5 routed through the conditioned space of a building and connecting the sub-slab area with
47.6 outdoor air, thereby relying on the convective flow of air upward in the vent to draw
47.7 air from beneath the slab.

47.8 **SUB-SLAB DEPRESSURIZATION SYSTEM (Active).** A system designed to achieve
47.9 lower sub-slab air pressure relative to indoor air pressure by use of a fan-powered vent
47.10 drawing air from beneath the slab.

47.11 **DRAIN TILE LOOP.** A continuous length of drain tile or perforated pipe extending
47.12 around all of the internal perimeter of a basement or crawl space.

47.13 **RADON GAS.** A naturally occurring, chemically inert, radioactive gas that is not
47.14 detectable by human senses. As a gas, it can move readily through particles of soil and
47.15 rock and can accumulate under the slabs and foundations of homes where it can easily
47.16 enter into the living space through construction cracks and openings.

47.17 **SOIL-GAS RETARDER.** A continuous membrane of 6-mil (0.15 mm) polyethylene,
47.18 3-mil (0.075 mm) cross-laminated polyethylene, or other equivalent material used to
47.19 retard the flow of soil gases into a building.

47.20 **SUB-MEMBRANE DEPRESSURIZATION SYSTEM.** A system designed to achieve
47.21 lower sub-membrane air pressure relative to crawl space air pressure by use of a vent
47.22 drawing air from beneath the soil-gas-retarder membrane.

48.1

Subp. 2. **Figure AF102.**

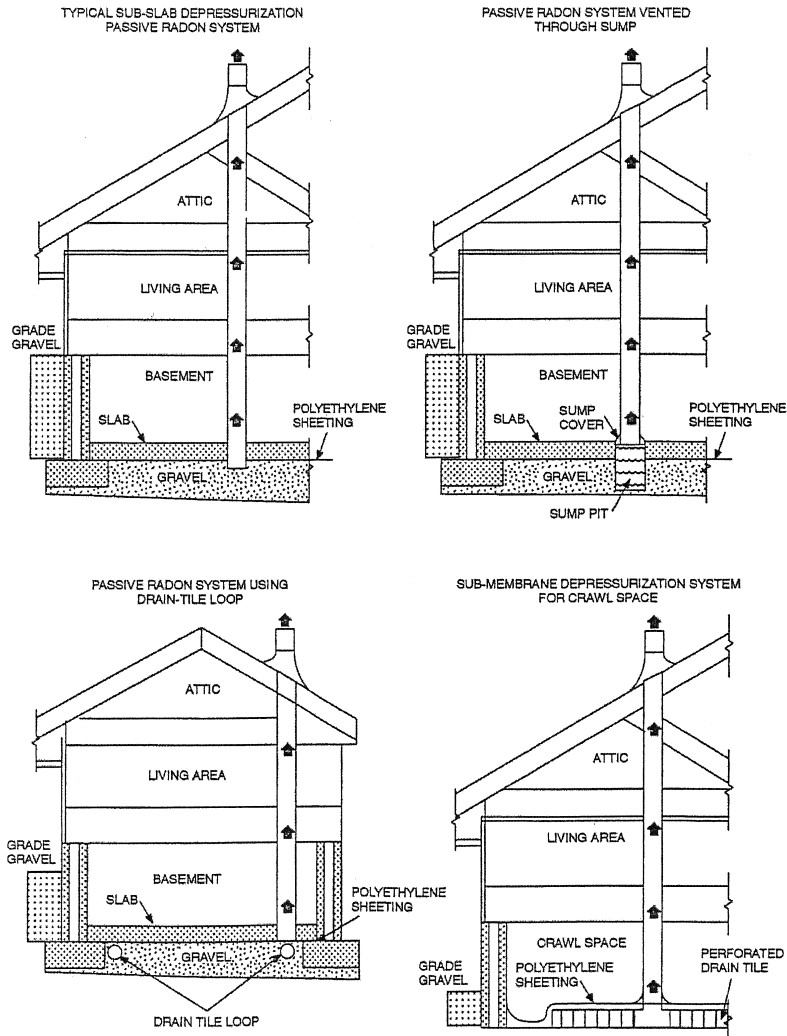


FIGURE AF102
RADON-RESISTANT CONSTRUCTION DETAILS FOR FOUR FOUNDATION TYPES

49.1 **1322.2103 SECTION AF103, REQUIREMENTS.**

49.2 Appendix F, Section AF103, is amended to read as follows:

49.3 **AF103.1 General.** The following passive construction techniques are intended
49.4 to resist radon entry and prepare the building for post construction active radon
49.5 mitigation. (see Figure AF102).

49.6 **AF103.2 Subfloor preparation.** A layer of gas-permeable material shall be placed
49.7 under all concrete slabs and other floor systems that directly contact the ground and
49.8 are within the walls of the living spaces and conditioned crawl spaces of the building,
49.9 to facilitate the installation of an active sub-slab depressurization system if needed.

49.10 The gas-permeable layer shall consist of one of the following:

49.11 1. A uniform layer of clean aggregate, a minimum of 4 inches (102 mm) thick. The
49.12 aggregate shall consist of material that will pass through a 2-inch (51 mm) sieve and
49.13 be retained by a 1/4-inch (6.4 mm) sieve.

49.14 2. A uniform layer of sand (native or fill), a minimum of 4 inches (102 mm) thick,
49.15 overlain by a layer or strips of geotextile drainage matting designed to allow the
49.16 lateral flow of soil gases.

49.17 3. Other materials, systems, or floor designs with demonstrated capability to permit
49.18 depressurization across the entire sub-floor area.

49.19 **AF103.3 Soil-gas-retarder.** A minimum of 6-mil (0.15 mm) [or 3-mil (0.075 mm)
49.20 cross-laminated] polyethylene or equivalent flexible sheeting material shall be placed
49.21 on top of the gas-permeable layer prior to casting the slab or placing the floor
49.22 assembly to serve as a soil-gas-retarder by bridging any cracks that develop in the
49.23 slab or floor assembly and to prevent concrete from entering the void spaces in the
49.24 aggregate base material. The sheeting shall cover the entire floor area with separate
49.25 sections of sheeting lapped at least 12 inches (305 mm). The sheeting shall fit closely
49.26 around any pipe, wire, or other penetrations of the material. All punctures or tears in
49.27 the material shall be sealed or covered with additional sheeting.

50.1 **AF103.4 Entry routes.** Potential radon entry routes shall be closed in accordance
50.2 with Sections AF103.4.1 through AF103.4.10.

50.3 **AF103.4.1 Floor openings.** Openings around bathtubs, showers, water closets,
50.4 pipes, wires, or other objects that penetrate concrete slabs or other floor
50.5 assemblies shall be filled with a polyurethane caulk or equivalent sealant applied
50.6 in accordance with the manufacturer's recommendations.

50.7 **AF103.4.2 Concrete joints.** All control joints, isolation joints, construction
50.8 joints, and any other joints in concrete slabs or between slabs and foundation
50.9 walls shall be sealed with a caulk or sealant. Gaps and joints shall be cleared
50.10 of loose material and filled with polyurethane caulk or other elastomeric sealant
50.11 applied in accordance with the manufacturer's recommendations.

50.12 **AF103.4.3 Condensate drains.** Condensate drains shall be trapped or routed
50.13 through nonperforated pipe to daylight.

50.14 **AF103.4.4 Sumps.** Sump pits open to soil or serving as the termination point for
50.15 sub-slab or interior drain tile loops shall be covered with a gasketed or otherwise
50.16 sealed lid. Sumps used as the suction point in a sub-slab depressurization system
50.17 shall have a lid designed to accommodate the vent pipe. Sumps used as a floor
50.18 drain shall have a lid equipped with a trapped inlet.

50.19 **AF103.4.5 Foundation walls.** Hollow block masonry foundation walls shall be
50.20 constructed with either a continuous course of solid masonry, one course of
50.21 masonry grouted solid, or a solid concrete beam at or above finished ground
50.22 surface to prevent passage of air from the interior of the wall into the living
50.23 space. Where a brick veneer or other masonry ledge is installed, the course
50.24 immediately below that ledge shall be sealed. Joints, cracks, or other openings
50.25 around all penetrations of both exterior and interior surfaces of masonry block or
50.26 wood foundation walls below the ground surface shall be filled with polyurethane
50.27 caulk or equivalent sealant. Penetrations of concrete walls shall be filled.

51.1 **AF103.4.6 Waterproofing/dampproofing.** The exterior surfaces of portions
51.2 of concrete and masonry block walls below the ground surface shall be
51.3 dampproofed or waterproofed in accordance with Section R406 of this code.

51.4 **AF103.4.7 Air-handling units.** Air-handling units in crawl spaces shall be
51.5 sealed to prevent air from being drawn into the unit.

51.6 **Exception:** Units with gasketed seams or units that are otherwise sealed by the
51.7 manufacturer to prevent leakage.

51.8 **AF103.4.8 Ducts.** Ductwork passing through or beneath a slab shall be of
51.9 seamless material unless the air-handling system is designed to maintain
51.10 continuous positive pressure within such ducting. Joints in such ductwork shall
51.11 be sealed to prevent air leakage.

51.12 Ductwork located in crawl spaces shall have all seams and joints sealed by
51.13 closure systems in accordance with Minnesota Rules, chapter 1346.

51.14 **AF103.4.9 Unconditioned crawl space floors.** Openings around all penetrations
51.15 through floors above unconditioned crawl spaces shall be caulked or otherwise
51.16 filled to prevent air leakage.

51.17 **AF103.4.10 Unconditioned crawl space access.** Access doors and other
51.18 openings or penetrations between basements and adjoining unconditioned crawl
51.19 spaces shall be closed, gasketed, or otherwise filled to prevent air leakage.

51.20 **AF103.5 Passive sub-membrane depressurization system.** In buildings with
51.21 crawl space foundations, the following components of a passive sub-membrane
51.22 depressurization system shall be installed during construction.

51.23 **AF103.5.1 Ventilation.** Unconditioned crawl spaces shall be provided with vents
51.24 to the exterior of the building. The minimum net area of ventilation openings
51.25 shall comply with Section R408.1 of this code.

51.26 **AF103.5.2 Soil-gas-retarder.** The soil in crawl spaces shall be covered with a
51.27 continuous layer of minimum 6-mil (0.14 mm) polyethylene soil-gas-retarder.

52.1 The ground cover shall be lapped a minimum of 12 inches (305 mm) at joints
52.2 and shall extend to all foundation walls enclosing the crawl space area.

52.3 **AF103.5.3 Vent pipe.** A plumbing tee or other approved connection shall
52.4 be inserted horizontally beneath the sheeting with one 10-foot section of a
52.5 perforated pipe connected to each side of the "T" fitting and then connected to
52.6 a 3- or 4-inch diameter (76 mm or 102 mm) fitting with a vertical vent pipe
52.7 installed through the sheeting. The vent pipe shall be of solid piping material and
52.8 shall be extended up through the building floors, terminated at least 12 inches
52.9 (305 mm) above the roof in a location at least 10 feet (3,048 mm) away from any
52.10 window or other opening into the conditioned spaces of the building that is less
52.11 than 2 feet (610 mm) below the exhaust point, and 10 feet (3,048 mm) from any
52.12 window or other opening in adjoining or adjacent buildings.

52.13 **AF103.6 Passive sub-slab depressurization system.** In buildings with basements,
52.14 foundations, and/or conditioned crawl spaces, or slab-on-grade buildings, the
52.15 following components of a passive sub-slab depressurization system shall be installed
52.16 during construction.

52.17 **AF103.6.1 Vent pipe.** A minimum 3-inch diameter (76 mm) ABS, PVC, or
52.18 equivalent gastight pipe shall be embedded vertically into the sub-slab aggregate
52.19 or other permeable material before the slab is cast. A "T" fitting with one
52.20 10-foot section of a perforated pipe connected to each side of the "T" fitting or
52.21 equivalent method shall be used to ensure that the pipe opening remains within
52.22 the sub-slab permeable material. Alternatively, the 3-inch (76 mm) pipe shall
52.23 be inserted directly into an interior perimeter drain tile loop or through a sealed
52.24 sump cover where the sump is exposed to the sub-slab aggregate or connected to
52.25 it through a drainage system.

52.26 The pipe shall be extended up through the building floors, terminate at least 12
52.27 inches (305 mm) above the surface of the roof in a location at least 10 feet (3048

53.1 mm) away from any window or other opening into the conditioned spaces of the
53.2 building that is less than 2 feet (610 mm) below the exhaust point, and 10 feet
53.3 (3048 mm) from any window or other opening in adjoining or adjacent buildings.

53.4 **Exception:** If an active sub-slab depressurization system is installed, the vent pipe
53.5 may be routed through unconditioned space within the building or garage, provided
53.6 the vent pipe is insulated to a minimum of R-4. Radon vent pipes shall terminate at
53.7 least 12 inches above the roof or shall be connected to a single vent that terminates at
53.8 least 12 inches above the roof. For active systems, a system monitoring device must
53.9 also be installed. All other requirements of this section apply.

53.10 **AF103.6.2 Multiple vent pipes.** In buildings where interior footings or other
53.11 barriers separate the sub-slab aggregate or other gas-permeable material, each
53.12 area shall be fitted with an individual vent pipe. Radon vent pipes shall connect
53.13 to a single vent that terminates at least 12 inches above the roof or each individual
53.14 vent pipe shall terminate separately at least 12 inches above the roof.

53.15 **AF103.7 Vent pipe drainage.** All components of the radon vent pipe system
53.16 shall be installed to provide positive drainage to the ground beneath the slab or
53.17 soil-gas-retarder.

53.18 **AF103.8 Vent pipe accessibility.** Radon vent pipes shall provide enough space
53.19 around the pipe for future installation of a fan system. The space provided for
53.20 installation of a future fan shall be a minimum of 24 inches in diameter, centered on
53.21 the axis of the vent stack, and shall extend for a minimum vertical distance of 3 feet.

53.22 **Exception:** The radon vent pipe need not be accessible in an attic space where an
53.23 approved rooftop electrical supply is provided for future use.

53.24 **AF103.9 Vent pipe identification.** All radon vent pipes shall be identified with at
53.25 least one label on each floor and in accessible attics. The label shall read: "Radon
53.26 Reduction System."

54.1 **AF103.10 Combination foundations.** Combination basement/crawl space or
54.2 slab-on-grade/crawl space foundations shall have separate radon vent pipes installed
54.3 in each type of foundation area. Each radon vent pipe shall terminate above the roof
54.4 or shall be connected to a single vent that terminates above the roof.

54.5 **Exception:** A single vent pipe is allowed in a building with a combination foundation
54.6 as long as soil gases can flow freely between the areas of the combination foundations
54.7 and it is connected to an approved vent pipe.

54.8 **AF103.11 Building depressurization.** Joints in air ducts and plenums in
54.9 unconditioned spaces shall meet the requirements of Minnesota Rules, chapter
54.10 1346. Thermal envelope air infiltration requirements shall comply with the energy
54.11 conservation provisions in chapter 1322. Firestopping shall meet the requirements
54.12 contained in Section R602.8.

54.13 **AF103.12 Power source.** To provide for future installation of an active
54.14 sub-membrane or sub-slab depressurization system, an electrical circuit terminated in
54.15 an approved box shall be installed during construction in the attic or other anticipated
54.16 location of vent pipe fans.

54.17 **REPEALER.** Minnesota Rules, parts 7670.0100; 7670.0130; 7670.0260; 7670.0350;
54.18 7670.0400; 7670.0450; 7670.0460; 7670.0470; 7670.0475; 7670.0490; 7670.0495;
54.19 7670.0610; 7670.0660; 7670.0710; 7670.0800; 7670.1115; 7672.0100; 7672.0200;
54.20 7672.0300; 7672.0400; 7672.0500; 7672.0600; 7672.0700; 7672.0800; 7672.0900;
54.21 7672.1000; 7672.1100; 7672.1200; 7672.1300; 7674.0100; 7674.0200; 7674.0300;
54.22 7674.0400; 7674.0500; 7674.0600; 7674.0700; 7674.0800; 7674.0900; 7674.1000;
54.23 7674.1100; and 7674.1200, are repealed.

54.24 **EFFECTIVE DATE.** These amendments are effective five working days after
54.25 publication of the notice of adoption in the State Register.