

1.1 **Department of Labor and Industry**

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

1.22 **ASTM.** "~~American Society for Testing and Materials~~" or "ASTM" means ASTM  
1.23 International, formerly known as the American 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, or sleeping, ~~cooking, or eating purposes~~, or any combination thereof,  
2.2 and 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~~ alteration, and repair of  
3.12 buildings governing matters including design and construction standards regarding  
3.13 heat loss control, illumination, climate control, and radon control methods pursuant to  
3.14 Minnesota Statutes, 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 11,  
3.17 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, are  
3.24 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,  
4.8 Air 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; CAN/CGSB 51.71-2005  
4.15 Depressurization Test, Canadian General Standards Board, Place du Portage 111, 6B1,  
4.16 11 Laurier Street, Gatineau, Quebec, Canada KIA 1G6; and Minnesota Department of  
4.17 Commerce, Minnesota Weatherization Field Guide 2003.

4.18 **1322.1101 IRC SECTION N1101, GENERAL.**

4.19 Subpart 1. **IRC Section N1101.1.** IRC Section N1101.1 is amended to read as  
4.20 follows:

4.21 **N1101.1 Scope.** This chapter regulates energy efficiency for the design and  
4.22 construction of buildings regulated by the International Residential Code (IRC) as  
4.23 adopted and amended by the state of Minnesota. This chapter shall also be used to  
4.24 regulate the energy efficiency for the design and construction of new residential  
4.25 buildings regulated by the International Building Code (IBC) as adopted and amended  
4.26 by the state of Minnesota that are not more than three stories in height and contain no  
4.27 conditioned common space that is shared between dwellings, and each dwelling unit  
5.1 contains a separate means of egress. The intent of these criteria is to provide a means

5.2 for furnishing quality indoor air, assuring building durability, and permitting energy  
5.3 efficient operation. Pursuant to part 1322.2100, Appendix F of the 2006 International  
5.4 Residential Code (IRC) applies to all residential buildings covered by this chapter.  
5.5 Enforcement of this chapter must not abridge safety, health, or environmental  
5.6 requirements under other applicable codes or ordinances.

5.7 **Exceptions:**

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

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

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

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

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

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

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

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

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

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

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

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

6.9 Table N1101.2 Minnesota Climate Zones

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

7.2	Mille Lacs	Lac qui Parle
7.3	Morrison	Le Sueur
7.4	Norman	Lincoln
7.5	Otter Tail	Lyon
7.6	Pennington	Martin
7.7	Pine	McLeod
7.8	Polk	Meeker
7.9	Red Lake	Mower
7.10	Roseau	Murray
7.11	St. Louis	Nicollet
7.12	Todd	Nobles
7.13	Traverse	Olmsted
7.14	Wadena	Pipestone
7.15	Wilkin	Pope
7.16		Ramsey
7.17		Redwood
7.18		Renville
7.19		Rice
7.20		Rock
7.21		Scott
7.22		Sherburne
7.23		Sibley
7.24		Stearns
7.25		Steele
7.26		Stevens
7.27		Swift
7.28		Yellow Medicine
7.29		Wabasha
7.30		Waseca
8.1		Watonwan

8.2 Winona

8.3 Wright

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

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

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

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

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

8.18 **N1101.4 Building thermal envelope insulation.** All thermal insulation must  
8.19 conform to Minnesota Rules, chapter 7640, Minnesota Thermal Insulation Standards,  
8.20 adopted by the Department of Commerce. Insulation shall be manufactured for its  
8.21 intended use, installed according to the manufacturer's specifications, and be no  
8.22 less than the stated performance at winter design conditions. Insulation used on  
8.23 the exterior for the purpose of insulating foundation walls shall be a water-resistant  
8.24 material and comply with ASTM C578; or C612; ~~or other approved standards.~~ If an  
8.25 R-value identification mark shall be has not already been applied by the manufacturer  
8.26 to each piece of building thermal envelope insulation 12 inches (305 mm) or more  
9.1 wide. ~~Alternatively,~~ the insulation installers shall provide a certification listing the



9.2 type, manufacturer, and R-value of insulation installed in each element of the building  
9.3 thermal envelope as described in section N1101.8. For blown or sprayed insulation  
9.4 (fiberglass and cellulose), the initial installed thickness, settled thickness, settled  
9.5 R-value, installed density, coverage area, and number of bags installed shall be listed  
9.6 on the certification. For sprayed polyurethane foam (SPF) insulation, the installed  
9.7 thickness of the area covered and R-value of installed thickness shall be listed on  
9.8 the certificate. When using blown or sprayed insulation (fiberglass, cellulose, or  
9.9 sprayed polyurethane foam) requirements from Sections N1101.4.1, N1101.4.1.1, and  
9.10 N1101.4.1.2 shall be met accordingly.

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

9.14 **N1101.4.1.1 Attic thickness markers.** The thickness of blown in or sprayed  
9.15 roof/ceiling insulation (fiberglass or cellulose) shall be written in inches  
9.16 (mm) on markers that are installed at least one for every 100 ft<sup>2</sup> (9.3 m<sup>2</sup>)  
9.17 throughout the attic space. The markers shall be affixed to the trusses or  
9.18 joists and marked with the minimum initial installed thickness with numbers  
9.19 a minimum of 1 inch (25 mm) high. Each marker shall face the attic access  
9.20 opening. Spray polyurethane foam thickness and installed R-value shall be  
9.21 listed on the certificate provided by the insulation installer.

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

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

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

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

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

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

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

10.25 Table N1101.5(2)

10.26 Default Door U-Factors

Door Type	U-Factor
11.1 Uninsulated Metal	1.2
11.2 Insulated Metal	0.6

11.3 Wood 0.5

11.4 Insulated, Non-metal edge,  
11.5 max 45% glazing, any  
11.6 glazing double pane 0.35

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

11.8 Subp. 13. **IRC Section N1101.6.** IRC Section N1101.6 is amended to read as  
11.9 follows:

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

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

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

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

Table N1101.8	
Component	Certificate requirements
Date certificate is installed	Posted date
Dwelling or dwelling unit location	Mailing address and city
Residential contractor	Name and license number of residential contractor
Insulation installed in or on ceiling/roof, walls, slab-on-grade, and floor	Type and installed R-value
Rim joist and foundation wall insulation	Installed R-value, type, and whether the insulation is exterior, integral, or interior
Fenestration	Average U-factor and SHGC

12.5	Ducts outside conditioned spaces	Installed R-value
12.6	Mechanical ventilation system	Type, location, and design continuous and total ventilation rates
12.7		
12.8	Make-up air and combustion air systems (if installed)	Type, location, and size
12.9		
12.10	Heating system	Type, input rating, AFUE or HSPF, manufacturer, model, and the structure's calculated heat loss
12.11		
12.12		
12.13	Domestic water heater	Type, size, manufacturer, and model
12.14	Cooling system (if installed)	Type, output rating, SEER, manufacturer, model, calculated cooling load, and the structure's calculated heat gain
12.15		
12.16		
12.17	Radon control system	Passive or active

12.18 **1322.1102 IRC SECTION N1102, BUILDING THERMAL ENVELOPE.**

12.19 Subpart 1. **IRC Section N1102.1.** IRC Section N1102.1 is amended to read as  
12.20 follows:

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

12.24 **Exceptions:**

- 12.25 1. When using the R-value computation method in Section N1102.1.1 individual  
12.26 component materials can be substituted for those that meet Section N1102.1.2,  
12.27 U-factor alternative.
- 12.28 2. When the provisions of Section N1102.1.3, Total UA alternative, are met.
- 12.29 3. When the provisions of Section N1102.1.4, REScheck software alternative, are met.
- 13.1 4. When the provisions of Section N1102.1.5, Engineered systems alternative, are  
13.2 met.

13.3 Subp. 2. **IRC Section N1102.1.1.** IRC Section N1102.1.1 is amended to read  
13.4 as follows:

13.5           **N1102.1.1 R-value computation.** Insulation material used in layers, such  
13.6 as framing cavity insulation and insulating sheathing, shall be summed to  
13.7 compute the component R-value. The manufacturer's settled R-value shall be  
13.8 used for blown insulation. Computed R-values shall not include an R-value for  
13.9 other building materials or air films. The thermal performance of a foundation  
13.10 insulation system that is not continuous or a concrete masonry block wall  
13.11 assembly with integral insulation must be determined by paragraph 1 or 2, and  
13.12 must exclude air film coefficients and the R-value of the surrounding soil.

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

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

13.19           Subp. 3. **IRC Section N1102.1.2.** IRC Section N1102.1.2 is amended to read  
13.20 as follows:

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

13.24           Subp. 4. **IRC Section N1102.1.3.** IRC Section N1102.1.3 is amended to read  
13.25 as follows:

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

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

14.9 Table N1102.1

14.10 Insulation and Fenestration Requirements by Component<sup>(a)</sup>

14.11				Wood		
14.12		Fenestra-		Frame		
14.13	Climate	tion <sup>(b)</sup>	Skylight	Ceiling	Wall	
14.14	Zone	U-Factor	U-Factor	R-Value	R-Value	
14.15					19 or	
14.16	Southern	0.35	0.60	38	13 + 5 <sup>(e)</sup>	
14.17	Northern	0.35	0.60	44	19	
14.18				Foundation		Crawl
14.19		Mass		Wall and	Slab <sup>(c)</sup>	Space
14.20	Climate	Wall	Floor	Rim Joist	R-Value	Wall
14.21	Zone	R-Value <sup>(f)</sup>	R-Value	R-Value	& Depth	R-Value
14.22	Southern	15	30 <sup>(d)</sup>	10	10, 3.5 ft	10
14.23	Northern	15	30 <sup>(d)</sup>	10	10, 5 ft	10

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

14.26 <sup>(b)</sup> The fenestration U-factor column excludes skylights.

14.27 <sup>(c)</sup> R-5 shall be added to the required slab edge R-values for heated slabs.

14.28 <sup>(d)</sup> Or insulation sufficient to fill the framing cavity, R-19 minimum.

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

15.3 <sup>(f)</sup> When using log type construction for thermal mass walls the following shall apply:

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

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

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

15.8 Table N1102.1.2

15.9 Equivalent U-Factors<sup>(a)</sup>

15.10 Climate	15.10 Fenestration	15.10 Skylight	15.10 Ceiling	15.10 Frame Wall
15.11 Zone	15.11 U-Factor	15.11 U-Factor	15.11 U-Factor	15.11 U-Factor
15.12 South	0.35	0.60	0.026	0.060
15.13 North	0.35	0.60	0.023	0.060
15.14 Climate	15.14 Mass Wall	15.14 Floor	15.14 Basement	15.14 Crawl Space
15.15 Zone	15.15 U-Factor	15.15 U-Factor	15.15 Wall U-Factor	15.15 Wall U-Factor
15.16 South	0.077	0.033	0.10	0.10
15.17 North	0.077	0.033	0.10	0.10

15.18 <sup>(a)</sup> Nonfenestration U-factors shall be obtained from measurement, calculation, or an  
 15.19 approved source.

15.20 Subp. 7. **IRC Section N1102.1.4.** IRC Section N1102.1 is amended by adding a  
 15.21 section to read as follows:

15.22 **N1102.1.4 REScheck alternative.** A building shall be deemed to meet the  
 15.23 requirements of Section N1102 if the thermal envelope passes, using the U.S.  
 15.24 Department of Energy's (DOE) REScheck software version with equivalencies  
 15.25 as determined by the state of Minnesota. Alternatives are not permitted to be  
 15.26 below the minimum R-values or above the maximum U-values allowed by Table  
 15.27 N1102.1 or N1102.1.2.

16.1 Subp. 8. **IRC Section N1102.1.5.** IRC Section N1102.1 is amended by adding a  
 16.2 section to read as follows:

16.3 **N1102.1.5 Thermal envelope system alternative (engineered system**  
 16.4 **alternative).** A building shall be deemed to meet the requirements of Section  
 16.5 N1102 if there is a design drawing that has been certified by an architect or  
 16.6 professional engineer licensed in Minnesota, pursuant to Minnesota Statutes,

16.7 sections 326.02 to 326.15, certifying that it is equal to or better than the total  
 16.8 energy efficiency performance of a building, including all of its systems, and that  
 16.9 it is built meeting the requirements of this code.

16.10 Subp. 9. **IRC Section N1102.2, Table N1102.2.4.** IRC Section N1102.2 is amended  
 16.11 to read as follows:

16.12 **N1102.2.1 Ceilings with attic spaces.** IRC Section N1102.2.1 is deleted in its  
 16.13 entirety.

16.14 **N1102.2.2 Ceilings without attic spaces.** Where Section N1102.1 requires  
 16.15 insulation levels above R-30 and the design of the roof/ceiling assembly does  
 16.16 not allow sufficient space for the required insulation, the minimum required  
 16.17 insulation for the roof/ceiling assemblies shall be R-30. This reduction of  
 16.18 insulation from the requirements of Section N1102.1 shall be limited to 500  
 16.19 ft <sup>2</sup> (46 m <sup>2</sup>) of ceiling area.

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

16.25 **N1102.2.4 Steel-frame ceilings, walls, and floors.** Steel-frame ceilings, walls,  
 16.26 and floors shall meet the insulation requirements of Table N1102.2.4 or shall  
 16.27 meet the U-factor requirements in Table N1102.1.2. The calculation of the  
 17.1 U-factor for a steel-frame envelope assembly shall use a series-parallel path  
 17.2 calculation method.

17.3 Table N1102.2.4	
17.4 Steel-Frame Ceiling, Wall, and Floor Insulation (R-Value)	
17.5 Wood Frame	
17.6 R-Value Requirement	
	Cold-Formed Steel Equivalent R-Value <sup>a</sup>



17.7		Steel Truss Ceilings <sup>a</sup>
17.8	R-38	R-49 or R-38+3
17.9	R-44	R-38+5
17.10		Steel Joist Ceilings <sup>b</sup>
17.11	R-30	R-38 in 2x4 or 2x6 or 2x8
17.12		R-49 in any framing
17.13	R-38	R-49 in 2x4 or 2x6 or 2x8 or 2x10
17.14		Steel Framed Wall
17.15	R-19	R-13+9 or R-19+8 or R-25+7
17.16		Steel Joist Floor
17.17		R-21+R-6 in 2x6
17.18	R-30	R-21+R-12 in 2x8 or 2x10

17.19 Notes:

17.20 <sup>a</sup> Cavity insulation R-value is listed first, followed by a "+" and the continuous insulation  
17.21 R-value, if applicable.

17.22 <sup>b</sup> Insulation exceeding the height of the framing shall cover the framing.

17.23 **N1102.2.5 Floors.** Floor insulation shall be installed to maintain permanent  
17.24 contact with the underside of the subfloor decking.

17.25 **N1102.2.6 Basement walls.** IRC Section N1102.2.6 is deleted in its entirety and  
17.26 replaced with the following:

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

17.28 **N1102.2.6.1 Foundation insulation.** Foundation insulation of basement  
17.29 and crawl space walls and the perimeter of slab-on-grade floors must  
17.30 comply with this section. Insulation materials shall be installed according to  
18.1 manufacturer's installation specifications and any additional requirements  
18.2 of Sections N1102.2.6.1 to N1102.2.6.11. Adding additional insulation to  
18.3 increase R-values or adding an additional vapor retarder to foundation wall  
18.4 assemblies, other than those required in this section, is prohibited.

18.5 **Exceptions:**

- 18.6 1. Foundation walls enclosing unconditioned spaces shall meet this requirement  
18.7 unless the floor overhead is insulated in accordance with Section N1102.1.  
18.8 2. Permanent wood foundations shall meet the requirements of Section R401.1.  
18.9 3. Frost-protected shallow foundations shall meet the requirements of Section R403.3.  
18.10 4. Insulating concrete form materials shall meet the requirements of Section R611.

18.11 **N1102.2.6.2 Basement foundation and crawl space walls.** Basement  
18.12 foundation and crawl space walls shall be insulated from the top of the  
18.13 foundation wall down to the top of the footing or from the top edge of the  
18.14 interior wall to the top of the slab if insulation is on the interior.

18.15 **N1102.2.6.3 Slab-on-grade and basement walkout foundation walls.**

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

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

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

- 19.3 1. The insulation is located on the exterior or is integral to the foundation wall; and  
19.4 2. An additional R-5 insulation is added to the minimum attic R-value level; and  
19.5 3. The heating system meets the minimum efficiency ratings in Table N1102.2.6.4;  
19.6 and

19.7 4. A minimum of a six-inch energy heel is used for the roof framing and/or truss  
 19.8 system.

19.9 **Table N1102.2.6.4**

19.10 **HVAC System Minimum Efficiency Requirement to Qualify for R-5**  
 19.11 **Exterior Insulation in the Southern Zone**

Heating System Type	Minimum Efficiency Rating	
	AFUE	HSPF
Furnace, Gas or Oil Fired	90%	N/A
Boiler, Gas or Oil Fired	85%	N/A
Heat Pump, Split Systems	N/A	8.0
Heat Pump, Single Package or Equipment (including gas/electric package units)	N/A	7.7

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

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

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

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

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

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

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

20.15 4. Comply with Section N1102.2.6.8, N1104.2.2.6.9, N1102.2.6.10, or  
20.16 N1102.2.6.11.

20.17 **N1102.2.6.8 Rigid interior insulation.** Rigid interior insulation shall  
20.18 comply with the following:

20.19 1. Either ASTM C578 or ASTM C1289.

20.20 2. Dampproofing, waterproofing, or a water repellent shall be applied to  
20.21 the exposed above grade foundation walls or a layer of dampproofing or  
20.22 waterproofing shall be installed on the entire inside surface of the foundation  
20.23 wall. Water-repellent materials shall comply with ASTM E514 with 90  
20.24 percent or greater reduction in water permeance when compared to an  
20.25 untreated sample.

20.26 3. Installation requirements:

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

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

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

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

21.6 e. horizontally continuous acoustic sealant exists between the basement  
21.7 floor and the bottom insulation edge.

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

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

21.12 1. Closed cell polyurethane.

21.13 a. ASTM C1029 compliant with a permeance not greater than 1 in  
21.14 accordance with ASTM E96 procedure A.

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

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

21.19 d. Through penetrations shall be sealed.

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

21.21 a. Sprayed directly onto the foundation wall surface. There must be a  
21.22 one-inch minimum gap between the foundation wall surface and any  
21.23 framing.

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

21.25 c. Through penetrations shall be sealed.

21.26 **N1102.2.6.10 Semi-rigid interior insulation.** Semi-rigid interior insulation  
21.27 shall comply with the following:

22.1 1. ASTM C1621 with a maximum permeance of 1.1 per inch.

22.2 2. Must have a minimum density of 1.3 pcf and have a fungal resistance  
22.3 per ASTM C1338.

22.4 3. Installation requirements:

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

- 22.6 b. Vertical edges shall be sealed with acoustic sealant;
- 22.7 c. All interior joints, edges, and penetrations shall be sealed against air
- 22.8 and water vapor penetration;
- 22.9 d. Horizontally continuous acoustic sealant shall be applied between the
- 22.10 foundation wall and the insulation at the top of the foundation wall; and
- 22.11 e. Horizontally continuous acoustic sealant shall be applied between the
- 22.12 basement floor and the bottom insulation edge.

22.13 **N1102.2.6.11 Unfaced fiberglass batt interior insulation.** Unfaced

22.14 fiberglass batt interior insulation shall comply with the following:

- 22.15 1. Waterproofing shall be applied to the entire inside surface of the
- 22.16 foundation wall.
- 22.17 2. The top and bottom plates must be air sealed to the foundation wall
- 22.18 surface and the basement floor.
- 22.19 3. In addition, an air barrier material and vapor retarder material with a
- 22.20 minimum permeance of at least 1, in accordance with ASTM E96 procedure
- 22.21 A, shall be installed on the warm-in-winter side of the foundation insulation
- 22.22 meeting the following:
- 22.23 a. Air sealed to the framing with construction adhesive or equivalent at the
- 22.24 top and bottom plates and where the adjacent wall is insulated;
- 22.25 b. Air sealed utility boxes and other penetrations; and
- 22.26 c. All seams shall be overlapped at least six inches and sealed with
- 22.27 compatible sealing tape or equivalent.
- 23.1 4. Up to R-13 batts are allowed.

23.2 **N1102.2.6.12 Foundation wall insulation performance option.** Insulated

23.3 foundation systems designed and installed under the performance option

23.4 shall meet the requirements of this section.

23.5 **N1102.2.6.12.1 Water separation plane.** The foundation shall be  
23.6 designed and built to have a continuous water separation plane between  
23.7 the interior and exterior. The interior side of the water separation plane  
23.8 must:

23.9 1. have a stable annual wetting/drying cycle whereby foundation wall  
23.10 system water (solid, liquid, and vapor) transport processes produce  
23.11 no net accumulation of ice or water over a full calendar year and the  
23.12 foundation wall system is free of absorbed water for at least four months  
23.13 over a full calendar year;

23.14 2. prevent conditions of moisture and temperature to prevail for a time  
23.15 period favorable to mold growth for the materials used; and

23.16 3. prevent liquid water from the foundation wall system from reaching  
23.17 the foundation floor system at any time during a full calendar year.

23.18 **N1102.2.6.12.2 Documentation.** The foundation insulation system  
23.19 designer shall provide documentation certified by a professional

23.20 engineer ~~registered~~ licensed in Minnesota demonstrating how the  
23.21 requirements of this section are fulfilled. The foundation insulation

23.22 system designer shall also specify the design conditions for the wall  
23.23 and the design conditions for the interior space for which the water

23.24 separation plane will meet the requirements of this section. The  
23.25 foundation insulation system designer shall provide a label disclosing

23.26 these design conditions. The label shall be posted in accordance with  
23.27 Section N1101.8.

24.1 **N1102.2.6.12.3 Installation.** The water separation plane shall be  
24.2 designed and installed to prevent external liquid or capillary water flow  
24.3 across it after the foundation is backfilled.

24.4           **N1102.2.6.12.4 Foundation air barrier.** The foundation insulation  
24.5           system shall be designed and installed to have a foundation air barrier  
24.6           system between the interior and the exterior. The foundation air  
24.7           barrier system must be a material or combination of materials that  
24.8           is continuous with all joints sealed and is durable for the intended  
24.9           application. Material used for the foundation air barrier system must  
24.10          have an air permeability not to exceed  $0.004 \text{ ft}^3 / \text{min} \cdot \text{ft}^2$  under a  
24.11          pressure differential of 0.3 inches water (1.57 psf) ( $0.02 \text{ L/s} \cdot \text{m}^2$  at  
24.12          75Pa) as determined by either commonly accepted engineering tables  
24.13          or by being labeled by the manufacturer as having these values when  
24.14          tested in accordance with ASTM E2178.

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

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

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

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

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

25.3          Subp. 10. **IRC Section N1102.3.** IRC Section N1102.3 is amended to read as  
25.4          follows:



25.5 **N1102.3 Fenestration.**

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

25.8 **N1102.3.2 Glazed fenestration exemption.** Up to 15 square feet (1.4 m<sup>2</sup>)  
25.9 of glazed fenestration per dwelling unit shall be permitted to be exempt from  
25.10 U-factor requirements in Section N1102.1.

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

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

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

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

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

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

26.5 differential expansion and contraction. The following shall be caulked, gasketed,  
26.6 weatherstripped, or otherwise sealed with an air barrier material, suitable film,  
26.7 or solid material:

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

26.22 **Exceptions:**

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

26.26 **N1102.4.2 Fenestration air leakage.** Windows, skylights, and sliding glass  
26.27 doors shall have an air infiltration rate of no more than 0.3 cubic foot per minute  
27.1 per square foot [ $1.5(\text{L/s})/\text{m}^2$ ], and swinging doors no more than 0.5 cubic foot  
27.2 per minute per square foot [ $2.5(\text{L/s})/\text{m}^2$ ], when tested according to NFRC 400 or  
27.3 AAMA/WDMA/CSA 101/I.S.2/A440 by an accredited independent laboratory,  
27.4 and listed and labeled by the manufacturer.

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

27.6 **N1102.4.3 Recessed lighting.** Recessed luminaires installed in the building  
27.7 thermal envelope shall be sealed to limit air leakage between conditioned and  
27.8 unconditioned spaces by being:

27.9 1. IC-rated and labeled with enclosures that are sealed or gasketed to prevent air  
27.10 leakage to the ceiling cavity or unconditioned space;

27.11 2. IC-rated and labeled as meeting ASTM E283 when tested at 1.57 pounds per  
27.12 square foot (75 Pa) pressure differential with no more than 2.0 cubic feet per  
27.13 minute (0.944 L/s) of air movement from the conditioned space to the ceiling  
27.14 cavity; or

27.15 3. located inside an airtight sealed box with clearances of at least 0.5 inch (13  
27.16 mm) from combustible material and 3 inches (76 mm) from insulation.

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

27.24 1. between an attached garage and interior conditioned spaces (tightly fit);

27.25 2. at the exterior edge of the exterior wall top plate extending vertically to the  
27.26 underside of the truss top cord, or for nontruss wood framing to within 3-1/2  
27.27 inches of the roof deck, or to the top of the ceiling insulation (tightly fit);

28.1 3. at all exterior walls and all rim joist areas (tightly fit); and

28.2 4. at all cantilevers, cantilevered rims, and floors over unconditioned spaces  
28.3 (sealed).

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

28.6 **N1102.5 Vapor diffusion management.**

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

28.13 **Exceptions:**

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

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

28.20 **N1102.5.3 Crawl space floor vapor retarder.** The floors of insulated crawl  
28.21 spaces shall be covered with a vapor retarder meeting the provisions of parts  
28.22 1322.2100 to 1322.2103.

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

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

28.26 **N1102.6.1 Reducing air leakage.** ~~If an addition or alteration reduces the~~  
28.27 ~~air leakage characteristics or capacity of a building then a combustion and~~  
28.28 ~~makeup air supply must be provided according to the State Building Code,~~  
29.1 ~~Minnesota Rules, chapter 1346. Alterations that will likely reduce the air leakage~~  
29.2 ~~characteristics or capacity of a building include, but are not limited to, attic~~  
29.3

29.4 ~~insulation, wall insulation, applying siding underlayment, or the replacement of a~~  
29.5 ~~majority of window or door units.~~ A combustion air supply must be provided  
29.6 in accordance with Minnesota Rules, chapter 1346, when an alteration includes  
29.7 installation of attic insulation, wall insulation in more than 50 percent of the  
29.8 area of exterior above grade walls, insulation in at least 50 percent of rim joist  
29.9 spaces, cladding replacement covering more than 50 percent of the total area of  
29.10 exterior walls, or replacement of more than 50 percent of the total number of  
29.11 exterior windows and doors combined.

29.12 **Exceptions:**

29.13 Combustion air is not required if any of the following apply:

- 29.14 1. the building is equipped with carbon monoxide alarms installed in compliance with  
29.15 Minnesota Statutes, sections 299F.50 and 299F.51;
- 29.16 2. the building contains all direct vent or all electric appliances for space and water  
29.17 heating;
- 29.18 3. a worst case draft test is performed according to the Minnesota Department of  
29.19 Commerce's Minnesota Weatherization Field Guide, and documentation is provided  
29.20 that the vented appliances continue to draft within established parameters of the  
29.21 Worst Case Draft Test procedure;
- 29.22 4. a test is performed according to CGSB Standard 51.71 and the depressurization  
29.23 limit does not exceed the maximum amount referenced in Table 3; or
- 29.24 5. the Recommended Procedure for Safety Inspection of an Existing Appliance  
29.25 Installation from Appendix D of the 2006 International Fuel Gas Code is performed  
29.26 for each natural draft water or space heating appliance.

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

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

30.7       **N1102.6.3 Penetrations.** Penetrations resulting as part of an alteration must be  
30.8 sealed. This includes, but is not limited to, penetrations for telecommunication  
30.9 wires and equipment, electrical wires and equipment, electronic wires and  
30.10 equipment, fire sprinklers, plumbing and ducts, and penetrations in exterior walls  
30.11 and ceilings.

30.12       **N1102.6.4 Roofs and ceilings.**

30.13       A. Attic insulation may not be installed unless accessible attic bypasses have  
30.14 been sealed.

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

30.17       **N1102.6.5 Walls.**

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

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

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

30.25       **Exceptions:**

30.26       1. Walls that are back-plastered; and

30.27       2. Walls without framing cavities.

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

31.2       **1322.1103 IRC SECTION N1103, SYSTEMS.**

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

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

31.6 **N1103.2 Ducts.**

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

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

#### 31.11 MINIMUM REQUIRED INSULATION

31.12 (see notes for explanations)

31.13 Duct Location	Requirements
31.14 Attics, garages, and ventilated crawl spaces	R-8 and V
31.15 Exterior of building	R-8, V and W
31.16 Inside of building and in unconditioned spaces 31.17 less than or equal to 15 degrees Fahrenheit	None required
31.18 TD greater than 15 degrees Fahrenheit and less 31.19 than or equal to 40 degrees Fahrenheit	R-3.3 and V
31.20 TD greater than 40 degrees Fahrenheit	R-5 and V
31.21 Within conditioned spaces, in basements 31.22 with insulated walls, and in plenums 31.23 within conditioned spaces	None required
31.24 Intake and exhaust ducts within 31.25 conditioned spaces*	R-3.3 and V
31.26 Within cement slab or within ground 31.27 (also see IMC Section 603.7)	R-3.5

31.28 Notes:

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

32.1 TD = Design temperature differential between the air in the duct and the ambient  
32.2 temperature outside of the duct.

32.3 V = Vapor retarder required in accordance with the IMC Section 604.11. When a vapor  
 32.4 retarder is required, duct insulation required by this section shall be installed without  
 32.5 respect to other building envelope insulation.

32.6 W = Approved weatherproof barrier.

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

32.9	Location	Design Static Pressure	Minimum Required Sealing
32.10	All locations	Greater than 3.0	All transverse joints,
32.11		inches (750Pa) water	longitudinal seams, and
32.12		gauge	duct wall penetrations
32.13			shall be sealed.
32.14			Ductwork shall be equal
32.15			to or less than Leakage
32.16			Class 6 as defined in
32.17			Section 4 of the SMACNA
32.18			HVAC Duct Leakage Test
32.19			Manual*
32.20	Portions of	3.0 inches (750Pa)	All transverse joints,
32.21	return	water gauge and	longitudinal seams, and
32.22	air ducts	less	duct wall penetrations
32.23	completely		shall be sealed
32.24	inside the		
32.25	vapor		
32.26	retarder/ air barrier		
32.27	enclosing		
32.28	conditioned		
32.29	space		
32.30			



33.1	Portions of	3.0 inches (750Pa)	All transverse joints, longitudinal seams, and duct wall penetrations shall be sealed
33.2	return air	water gauge and	
33.3	air ducts in	less	
33.4	the same		
33.5	space as an		
33.6	atmospher-		
33.7	ically vented		
33.8	or fan-		
33.9	assisted		
33.10	appliance		
33.11	All locations	Greater than 0.50	All transverse joints and duct wall penetrations shall be sealed
33.12		to 3.0 inches (125	
33.13		to 750Pa) water	
33.14		gauge	
33.15	All locations	0.50 inches (125Pa)	All transverse joints, longitudinal seams, and duct wall penetrations shall have no visible gaps and shall be sufficiently airtight according to Section 1.7 of the SMACNA HVAC Duct Construction Standards - Metal and Flexible
33.16		water gauge and less	
33.17			
33.18			
33.19			
33.20			
33.21			
33.22			
33.23			
33.24			
33.25			

33.26 **N1103.2.3 Supply ducts.** Supply ducts shall be continuously ducted according  
33.27 to the Minnesota Mechanical Code, chapter 1346, from the point of origin to the  
33.28 point of discharge in the habitable spaces. The building framing cavities and  
33.29 building components shall not be used as supply ducts.

33.30 **N1103.2.4 Domestic water piping insulation.** Pipe insulation shall have a  
33.31 k-value of 0.27. If the K-value of a product is less than 0.27, then the pipe  
33.32 thickness shall be adjusted to have an equivalent R-value.

33.33 A. Cold water piping: no insulation required.

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

34.3 B. Hot water piping: no insulation required.

34.4 **Exceptions:**

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

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

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

34.12 **Exceptions:**

34.13 1. Piping installed within HVAC equipment.

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

34.15 **Table N1103.2.4**

34.16 **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
<b>Piping System Type - Heating</b>						
Above 350	1.5	2.5	2.5	3.0	3.5	3.5
251-350	1.5	2.0	2.5	2.5	3.5	3.5
201-250	1.0	1.5	1.5	2.0	2.0	3.5
141-200	0.5	1.5	1.5	1.5	1.5	1.5
105-140	0.5	1.0	1.0	1.0	1.5	1.5
<b>Piping System Type - Cooling</b>						

34.22

34.23

34.24

34.25

34.26

34.27

34.28

35.1	40.55	0.5	0.5	0.75	1	1	1
35.2	Below 40 (see						
35.3	Item D)	1	1	1.5	1.5	1.5	1.5

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

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

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

35.13 D. For applications with fluid temperatures of 32 degrees Fahrenheit (0 degrees  
 35.14 Celsius) and below, a vapor retarder shall be installed according to IMC Section  
 35.15 604.11.

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

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

35.21 **1322.1104 IRC SECTION N1104, MECHANICAL VENTILATION SYSTEMS.**

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

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

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

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

36.8 **N1104.1.1 Additions or alterations to existing buildings.** Additions or  
 36.9 alterations to existing buildings shall require a dwelling unit mechanical  
 36.10 ventilation system that meets Section N1104.

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

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

36.21 Equation 11-1:

$$\begin{aligned}
 36.22 \text{ Total ventilation rate (cfm)} &= (0.02 \times \text{square feet of} \\
 36.23 &\quad \text{conditioned space)} + \\
 36.24 &\quad [15 \times (\text{number of bedrooms} + 1)]
 \end{aligned}$$

36.25 **N1104.2.1 Continuous ventilation.** A minimum of 50 percent of the total  
 36.26 ventilation rate, but not less than 40 cfm, shall be provided, on a continuous  
 36.27 rate average for each one-hour period according to Table N1104.2 or Equation  
 36.28 11-2. The portion of the mechanical ventilation system that is intended to be

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

37.3 Equation 11-2:

37.4 Continuous ventilation (cfm) = total ventilation rate/2

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

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

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

37.13 Table N1104.2

37.14 Total and Continuous Ventilation Rates (in cfm)

	Number of Bedrooms					
	1	2	3	4	5	6 <sup>2</sup>
37.17 Conditioned space <sup>1</sup> (in sq. ft.)	Total/Continuous	Total/Continuous	Total/Continuous	Total/Continuous	Total/Continuous	Total/Continuous
37.20 1000-1500	60/40	75/40	90/45	105/53	120/60	135/68
37.21 1501-2000	70/40	85/43	100/50	115/58	130/65	145/73
37.22 2001-2500	80/40	95/48	110/55	125/63	140/70	155/78
37.23 2501-3000	90/45	105/53	120/60	135/68	150/75	165/83
37.24 3001-3500	100/50	115/58	130/65	145/73	160/80	175/88
37.25 3501-4000	110/55	125/63	140/70	155/78	170/85	185/93
37.26 4001-4500	120/60	135/68	150/75	165/83	180/90	195/98
37.27 4501-5000	130/65	145/73	160/80	175/88	190/95	205/103
37.28 5001-5500	140/70	155/78	170/85	185/93	200/100	215/108
37.29 5501-6000 <sup>2</sup>	150/75	165/83	180/90	195/98	210/105	225/113

38.1 <sup>1</sup> Conditioned space includes the basement.

38.2 <sup>2</sup> If conditioned space exceeds 6000 sq. ft. or there are more than 6 bedrooms, use  
38.3 Equation 11-1 from Section N1104.2 to calculate total ventilation rate.

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

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

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

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

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

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

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

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

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

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

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

39.1 An HRV or ERV intended to comply with both the continuous and total ventilation rate  
39.2 requirements shall meet the rated design capacity of the continuous ventilation rate in  
39.3 Section N1104.2.1 under low capacity and meet the total ventilation rate in Section  
39.4 N1104.2.2 under high capacity.

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

39.8 **N1104.3.3 Other methods.** Any mechanical ventilation system consisting of  
39.9 exhaust fans, supply fans, or a combination of both, complying with Section  
39.10 N1104, shall be allowed. A mechanical ventilation system specifically identified  
39.11 in Section N1104.3.1 or N1104.3.2 shall not conflict with Sections N1104.3.1  
39.12 and N1104.3.2. For the purposes of this section, the delivered ventilation rate  
39.13 is the larger of the total air flow of the operating supply fans, or total air flow  
39.14 of the operating exhaust fans.

39.15 **N1104.4 Installation requirements.** All types of mechanical systems shall meet the  
39.16 requirements of this section. The mechanical ventilation system and its components  
39.17 shall also be installed according to the Mechanical Code, Minnesota Rules, chapter  
39.18 1346, and the equipment manufacturer's installation instructions.

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

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

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

40.1 average circulation flow rate each hour, of not less than 0.15 cfm per square  
40.2 foot of the conditioned floor area; or

40.3 (b) when the outdoor air supply is ducted to the forced-air system, it shall be  
40.4 tempered so that the mixed air temperature shall be no less than 60 degrees  
40.5 Fahrenheit or the heating equipment manufacturer's installation instruction,  
40.6 and controls shall be installed to allow the forced air circulation system  
40.7 to provide an average flow rate not less than 0.075 cfm per square foot of  
40.8 conditioned floor area.

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

40.14

40.15

40.16

40.17

40.18

40.19

40.20

40.21

40.22

40.23

40.24

40.25

40.26

40.27

40.28

40.29

Table N1104.4.1.1(1)									
Indirect Circulation Air Flow Rates for Forced-Air Circulation Systems (in cfm)									
		Forced-Air Circulation Systems Flow Rate (cfm)							
		600	800	1000	1200	1400	1600	1800	2000
Conditioned Floor Area	Average Air Flow each Hr (cfm)	Number of Minutes per Hour, if cycled							
		1000-1500	225	23	17	14	12	10	9
1501-2000	300	30	23	18	15	13	12	10	9
2001-2500	375	38	29	23	19	16	14	13	12
2501-3000	450	45	34	27	23	20	17	15	14
3001-3500	525	53	40	32	27	23	20	18	16
3501-4000	600	60	45	36	30	26	23	20	18
4001-4500	675	na <sup>1</sup>	51	41	34	29	26	23	21
4501-5000	750	na <sup>1</sup>	57	45	38	33	29	25	23



41.1	5001-5500	825	na <sup>1</sup>	na <sup>1</sup>	50	42	36	31	28	25
41.2	5501-6000	900	na <sup>1</sup>	na <sup>1</sup>	54	45	39	34	3	27

41.3 <sup>1</sup> Not allowed

Table N1104.4.1.1(2)										
Direct Distribution Air Flow Rates Using Forced-Air Circulation Systems (in cfm)										
		Forced-Air Circulation Systems Flow Rate (cfm)								
		600	800	1000	1200	1400	1600	1800	2000	
Conditioned Floor Area	Average Air Flow each Hr (cfm)	Number of Minutes per Hour, if cycled								
		1000-1500	115	13	9	7	6	5	5	4
1501-2000	150	15	13	9	8	7	6	5	5	
2001-2500	190	19	15	13	10	8	7	7	6	
2501-3000	225	23	17	14	13	10	9	8	7	
3001-3500	265	27	20	15	14	13	10	9	8	
3501-4000	300	30	23	18	15	13	13	10	9	
4001-4500	340	34	26	21	17	15	13	13	11	
4501-5000	375	38	24	23	19	17	15	13	13	
5001-5500	415	42	32	25	21	18	16	14	13	
5501-6000	450	45	34	27	23	20	17	15	14	

41.22 **N1104.4.1.3 Passive openings.** When outdoor air is brought in through a  
 41.23 passive opening, the maximum cfm of the outdoor air requirements shall be  
 41.24 combined with the maximum makeup air requirements of Minnesota Rules,  
 41.25 chapter 1346. The combined air rates shall be brought into the dwelling unit  
 41.26 in accordance with chapter 1346. Controls shall be installed to distribute air  
 41.27 throughout the dwelling unit as required by Section N1104.4.1.1a.

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

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

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

42.11 **N1104.4.3 Fans.** When used as part of the mechanical ventilation system, fans  
42.12 shall be capable of delivering the designed air flow as determined by Section  
42.13 N1104.2 according to HVI Standard 916. Fans shall be designed and certified by  
42.14 the equipment manufacturer as capable of continuous operation at the rated cfm.  
42.15 Surface mounted fans used to comply with the continuous ventilation part of the  
42.16 mechanical ventilation system shall have a maximum 1.0 sone per HVI Standard  
42.17 915. Fans used to comply with the intermittent ventilation part of the mechanical  
42.18 ventilation system shall have a maximum 2.5 sone per HVI Standard 915.

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

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

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

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

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

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

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

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

43.19 **N1104.4.8 Filtration.** Mechanically supplied outdoor air shall have a filter with  
43.20 a designated minimum efficiency of MERV 4 as defined by ASHRAE Standard  
43.21 52.2. The filter shall be located prior to the air entering the thermal conditioning  
43.22 components, blower, or habitable space and shall be installed to be readily  
43.23 accessible and facilitate regular service.

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

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

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

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

44.10 2. Controls shall be installed to ensure that whenever the mechanical ventilation  
44.11 system is operating, the forced air circulation system provides indirect circulation  
44.12 of 0.15 cfm per square foot of conditioned floor area or direct distribution of  
44.13 0.075 cfm per square foot of conditioned floor area.

44.14 3. If the mechanical ventilation system is not designed to operate whenever the  
44.15 forced air circulation system is operating, the mechanical ventilation system shall  
44.16 incorporate an accessible backflow damper to prevent flow from the outside  
44.17 when the mechanical ventilation system is off.

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

44.19 5. Controls shall be installed to operate the mechanical ventilation system as  
44.20 designed.

44.21 6. Controls shall be readily accessible to occupants and shall be labeled to  
44.22 indicate their function.

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

45.1 **N1104.4.11 Labeling.** The outdoor air intake and exhaust air outlet shall include  
 45.2 a permanent, weather resistant identification label stating "OUTDOOR AIR  
 45.3 INTAKE" or "EXHAUST AIR OUTLET" as appropriate. Controls provided for  
 45.4 continuous and intermittent ventilation shall be provided with a label stating  
 45.5 "VENTILATION SYSTEM" or "VENTILATION FAN" or "INTERMITTENT  
 45.6 FAN" or ventilation symbols, as appropriate.

45.7 **N1104.4.12 Documentation.** Mechanical ventilation systems shall be provided  
 45.8 with documentation that includes proper operation and maintenance instructions  
 45.9 and a warning regarding potential problems if the system is not operated and  
 45.10 maintained. A permanent warning label shall be affixed to a mechanical  
 45.11 ventilation system if it is readily accessible. If the mechanical ventilation system  
 45.12 is not readily accessible, the documentation shall be in a conspicuous readily  
 45.13 accessible location.

45.14 **N1104.4.13 Climatic design conditions.**

45.15 A. HVAC equipment must be sized according to the 2005 ASHRAE Handbook  
 45.16 of Fundamentals, ACCA Manual J, or an equivalent method. Oversizing of  
 45.17 heating equipment must not exceed 43 percent and cooling equipment must  
 45.18 not exceed 21 percent.

45.19 B. Design conditions must be determined from Table N1104.4.13. Design  
 45.20 condition adjustments may be made as determined by the building official to  
 45.21 reflect local climates that differ from the tabulated temperatures or local weather  
 45.22 experience.

45.23 TABLE N1104.4.13

45.24 Outdoor Design Conditions

45.25 City	Summer Db/Wb °F	Winter Db °F
45.26 Aitkin	82/72	-24
45.27 Albert Lea	85/72	-15
46.1 Alexandria	86/70	-21

46.2	Bemidji	84/68	-24
46.3	Cloquet	82/68	-20
46.4	Crookston	84/70	-27
46.5	Duluth	81/67	-20
46.6	Ely	82/68	-29
46.7	Eveleth	82/68	-26
46.8	Faribault	86/73	-16
46.9	Fergus Falls	86/71	-21
46.10	Grand Rapids	81/67	-23
46.11	Hibbing	82/68	-19
46.12	International Falls	83/67	-28
46.13	Litchfield	85/71	-18
46.14	Little Falls	86/71	-20
46.15	Mankato	86/72	-15
46.16	Minneapolis/St. Paul	88/72	-15
46.17	Montevideo	86/72	-17
46.18	Mora	84/70	-21
46.19	Morris	84/72	-21
46.20	New Ulm	87/73	-15
46.21	Owatonna	86/73	-16
46.22	Pequot Lake	84/68	-23
46.23	Pipestone	85/73	-15
46.24	Redwood Falls	89/73	-17
46.25	Rochester	85/72	-17
46.26	Roseau	82/70	-29
46.27	St. Cloud	86/71	-20
46.28	Thief River Falls	82/68	-25
46.29	Tofte	75/61	-14
46.30	Warroad	83/67	-29
47.1	Wheaton	84/71	-20

47.2 Willmar 85/71 -20

47.3 Winona 88/74 -13

47.4 Worthington 84/71 -14

47.5 Db = dry bulb temperature, degrees Fahrenheit

47.6 Wb = wet bulb temperature, degrees Fahrenheit

47.7 **1322.2100 INCORPORATION BY REFERENCE.**

47.8 Appendix F, Radon Control Methods, of the 2006 edition of the International  
 47.9 Residential Code (Appendix F) as promulgated by the International Code Council, Inc.  
 47.10 (ICC), Falls Church, VA 22041, is incorporated by reference and made part of the  
 47.11 Minnesota State Building Code except as qualified by the applicable provisions in chapter  
 47.12 1300, and as amended in parts 1322.2101 to 1322.2103. Appendix F is not subject  
 47.13 to frequent change and a copy of Appendix F, with amendments for use in Minnesota,  
 47.14 is available in the office of the commissioner of labor and industry. Portions of parts  
 47.15 1322.2101 to 1322.2103 reproduce text and tables from Appendix F, which is copyrighted  
 47.16 by the ICC. All rights reserved.

47.17 **1322.2101 SECTION AF101, SCOPE.**

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

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

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

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

47.24 **1322.2102 SECTION AF102, DEFINITIONS.**

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

48.1           **AF102.1 General.** The definitions in this part apply to Minnesota Rules, parts  
48.2           1322.2101 to 1322.2103.

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

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

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

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

48.17          **SOIL-GAS RETARDER.** A continuous membrane of 6-mil (0.15 mm) polyethylene,  
48.18          3-mil (0.075 mm) cross-laminated polyethylene, or other equivalent material used to  
48.19          retard the flow of soil gases into a building.

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



49.1

Subp. 2. **Figure AF102.**

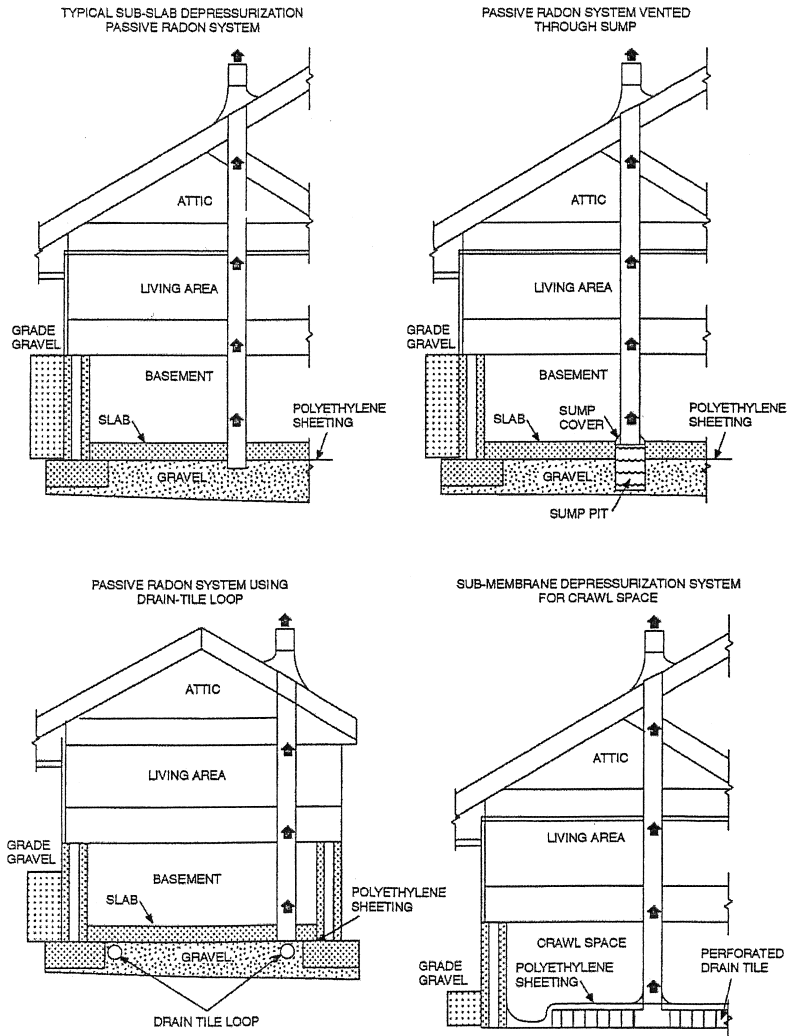


FIGURE AF102  
RADON-RESISTANT CONSTRUCTION DETAILS FOR FOUR FOUNDATION TYPES

50.1 **1322.2103 SECTION AF103, REQUIREMENTS.**

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

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

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

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

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

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

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

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

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

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

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

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

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

51.19 **AF103.4.5 Foundation walls.** Hollow block masonry foundation walls shall be  
51.20 constructed with either a continuous course of solid masonry, one course of  
51.21 masonry grouted solid, or a solid concrete beam at or above finished ground  
51.22 surface to prevent passage of air from the interior of the wall into the living  
51.23 space. Where a brick veneer or other masonry ledge is installed, the course  
51.24 immediately below that ledge shall be sealed. Joints, cracks, or other openings  
51.25 around all penetrations of both exterior and interior surfaces of masonry block or  
51.26 wood foundation walls below the ground surface shall be filled with polyurethane  
51.27 caulk or equivalent sealant. Penetrations of concrete walls shall be filled.

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

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

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

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

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

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

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

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

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

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

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

53.3 **AF103.5.3 Vent pipe.** A plumbing tee or other approved connection shall  
53.4 be inserted horizontally beneath the sheeting with one 10-foot section of a  
53.5 perforated pipe connected to each side of the "T" fitting and then connected to  
53.6 a 3- or 4-inch diameter (76 mm or 102 mm) fitting with a vertical vent pipe  
53.7 installed through the sheeting. The vent pipe shall be of solid piping material and  
53.8 shall be extended up through the building floors, terminated at least 12 inches  
53.9 (305 mm) above the roof in a location at least 10 feet (3,048 mm) away from any  
53.10 window or other opening into the conditioned spaces of the building that is less  
53.11 than 2 feet (610 mm) below the exhaust point, and 10 feet (3,048 mm) from any  
53.12 window or other opening in adjoining or adjacent buildings.

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

53.17 **AF103.6.1 Vent pipe.** A minimum 3-inch diameter (76 mm) ABS, PVC, or  
53.18 equivalent gastight pipe shall be embedded vertically into the sub-slab aggregate  
53.19 or other permeable material before the slab is cast. A "T" fitting with one  
53.20 10-foot section of a perforated pipe connected to each side of the "T" fitting or  
53.21 equivalent method shall be used to ensure that the pipe opening remains within  
53.22 the sub-slab permeable material. Alternatively, the 3-inch (76 mm) pipe shall  
53.23 be inserted directly into an interior perimeter drain tile loop or through a sealed  
53.24 sump cover where the sump is exposed to the sub-slab aggregate or connected to  
53.25 it through a drainage system.

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

54.1 mm) away from any window or other opening into the conditioned spaces of the  
54.2 building that is less than 2 feet (610 mm) below the exhaust point, and 10 feet  
54.3 (3048 mm) from any window or other opening in adjoining or adjacent buildings.

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

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

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

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

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

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

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

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

55.8 **AF103.11 Building depressurization.** Joints in air ducts and plenums in  
55.9 unconditioned spaces shall meet the requirements of Minnesota Rules, chapter  
55.10 1346. Thermal envelope air infiltration requirements shall comply with the energy  
55.11 conservation provisions in chapter 1322. Firestopping shall meet the requirements  
55.12 contained in Section R602.8.

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

55.17 **REPEALER.** Minnesota Rules, parts 7670.0100; 7670.0130; 7670.0260; ~~7670.0350~~  
55.18 ~~7670.0325~~; 7670.0400; 7670.0450; 7670.0460; 7670.0470; 7670.0475; 7670.0490;  
55.19 7670.0495; 7670.0610; 7670.0660; 7670.0710; 7670.0800; 7670.1115; 7672.0100;  
55.20 7672.0200; 7672.0300; 7672.0400; 7672.0500; 7672.0600; 7672.0700; 7672.0800;  
55.21 7672.0900; 7672.1000; 7672.1100; 7672.1200; 7672.1300; 7674.0100; 7674.0200;  
55.22 7674.0300; 7674.0400; 7674.0500; 7674.0600; 7674.0700; 7674.0800; 7674.0900;  
55.23 7674.1000; 7674.1100; and 7674.1200, are repealed.

55.24 **EFFECTIVE DATE.** These amendments are effective ~~five working days after~~  
55.25 ~~publication of the notice of adoption in the State Register~~ June 1, 2009.