CHAPTER 7672
DEPARTMENT OF COMMERCE
ENERGY CODE

NOTE: This chapter was adopted at 23 SR 145 on July 20, 1998. It became effective on April 15, 2000, as an alternative to chapter 7670. Laws 2000, chapter 407, section 1.

ONE– AND TWO–FAMILY RESIDENTIAL BUILDINGS

7672.0100 AUTHORITY AND PURPOSE.

This chapter is adopted pursuant to Minnesota Statutes, section 216C.19, subdivision 8. The purpose of this chapter is to establish the minimum energy code criteria necessary to construct new and altered elements of buildings classified as Group R, Division 3 Occupancies which are detached single–family and two–family dwellings, as well as to provide alternatives for demonstrating compliance with those minimum criteria. The intent of these criteria is to provide a means for furnishing quality indoor air, assuring building durability, and permitting energy efficient operation.

Statutory Authority: *MS s 16B.165; 216C.19; 216C.195*

History: *23 SR 145; 23 SR 2057*

7672.0200 APPLICATION.

Subpart 1. **General.** This chapter is a part of the Minnesota State Building Code, adopted according to Minnesota Statutes, sections 16B.59 to 16B.73. Enforcement of this chapter must not abridge safety, health, or environmental requirements under other applicable codes or ordinances.

Subp. 2. **New buildings.** This chapter applies to all new buildings classified as Group R, Division 3 Occupancies which are detached single–family and two–family dwellings.

Subp. 3. **Existing residences.** Additions, alterations, and repairs to existing buildings classified as Group R, Division 3 Occupancies which are detached single–family and two–family dwellings must comply with part 7672.1200.

Subp. 4. **Mixed occupancy.** If a building houses more than one occupancy, each portion of the building must conform to the requirements for the occupancy housed in that portion.

Subp. 5. **Historic buildings.** Alterations to historic buildings and changes of occupancy are regulated by the Minnesota State Building Code, part 1305.0010.

Subp. 6. **Exempt buildings.** This chapter does not cover buildings, structures, or portions of buildings or structures whose peak design rate of energy usage is less than 3.4 Btu's per hour per square foot or 1.0 watt per square foot of floor area for all purposes.

Statutory Authority: *MS s 16B.165; 216C.19; 216C.195*

History: *23 SR 145; 23 SR 2057*

7672.0300 MATERIALS AND EQUIPMENT.

Subpart 1. **Identification.** Materials and equipment must be identified in order to show compliance with this chapter.

Subp. 2. **Plans and specifications.** Plans, specifications, and either calculations or compliance forms must demonstrate compliance with all requirements of this chapter including:

A. exterior envelope component materials;

B. U–values of windows, doors, and skylights;

C. R–values of insulating materials;

D. location of interior air barrier, vapor retarder, and wind wash barrier;

E. air sealing requirements;

F. size and type of equipment;

G. equipment controls; and

H. other data needed to indicate conformance with this chapter.

Subp. 3. **Maintenance information.** Required regular maintenance actions must be clearly stated and incorporated on a readily accessible label. The label may be limited to identifying, by title or publication number, the operation and maintenance manual for that particular model and type of product. Maintenance instructions must be furnished for equipment that requires preventive maintenance for efficient operation.

Subp. 4. **Thermal insulation.** Thermal insulation used must conform to chapter 7640, Minnesota Thermal Insulation Standards, adopted by the Department of Commerce. All thermal insulation must achieve stated performance at 75 degrees Fahrenheit mean temperature and no less than stated performance at winter design conditions.

EXCEPTION: Thermal insulation designed to reduce summer cooling load only is not required to achieve stated performance at winter design conditions.

Statutory Authority: *MS s 216C.19*

History: *23 SR 145; L 2001 1Sp4 art 6 s 1*

7672.0400 INCORPORATIONS BY REFERENCE.

Subpart 1. **Incorporated items.** The following standards and references are incorporated by reference:

A. ASHRAE, 1997 Handbook of Fundamentals, chapter 27;

B. ASHRAE Standard 84–1991, Method of Testing Air–to–Air Heat Exchangers;

C. ASTM E283–91, Standard Method of Test for Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors;

D. ASTM E779–87 (1992)e1, Standard Test Method for Determining Air Leakage Rate by Fan Pressurization;

E. ASTM E1677–95, Standard Specification for an Air Retarder (AR) Material or System for Low–Rise Framed Building Walls;

F. CAN/CSA–439–88, Standard Methods of Test for Rating the Performance of Heat Recovery Ventilators, Canadian Standards Association;

G. CGSB Standard 51.71, The Spillage Test, Canadian General Standards Board;

H. Children, Families, and Learning Worst Case Draft Test, as published in the State of Minnesota Plan for Weatherization Assistance for Low–Income Persons, March 10, 1997;

I. HVI Standard 915–10/95, Procedure for Loudness Rating of Residential Fan Products, Home Ventilating Institute;

J. HVI Standard 916 (April 1995), Airflow Test Standard, Home Ventilating Institute;

K. HVI Standard 920, Product Certification Procedure;

L. Manual J, Load Calculation for Residential Winter and Summer Air Conditioning, 7th ed., Air Conditioning Contractors of America;

M. The Model Energy Code, 1995 Edition, Chapter 4, as published by the Council of American Building Officials, Falls Church, Virginia;

N. MNcheck, residential energy code compliance personal computer program published by the Minnesota Department of Commerce;

O. NFRC 100–91, Procedure for Determining Fenestration Product Thermal Properties (Currently Limited to U–values), and NFRC 100, 1997 ed., Procedure for Determining Fenestration Product U–factors, National Fenestration Rating Council;

P. UL181A, Duct Sealing for Flexible Ducts, and UL181B, Duct Sealing for Fiberglass Ducts, Underwriters Laboratories, Inc.;

Q. UL1812, Ducted Heat Recovery Ventilators, Underwriters Laboratories, Inc.; and

R. UL2034, Single and Multiple Station Carbon Monoxide Detectors, Underwriters Laboratories, Inc.

Subp. 2. **Availability.** All standards and documents incorporated by reference are available for public inspection at the Minnesota State Law Library and through the Minitex interlibrary loan system.

Statutory Authority: *MS s 16B.165; 216C.19; 216C.195*

History: *23 SR 145; 23 SR 2057; L 2001 1Sp4 art 6 s 1*

7672.0500 DEFINITIONS.

Subpart 1. **Definitions.** The terms used in this chapter have the meanings given them in this part. Additional definitions pertinent to protection against depressurization and residential ventilation systems are contained in parts 7672.0900 and 7672.1000, respectively.

Subp. 2. **Accessible.** "Accessible" means having access to but which first may require the removal of an access panel, door, or similar obstruction covering the item described.

Subp. 3. **Annual fuel utilization efficiency or AFUE.** "Annual fuel utilization efficiency" or "AFUE" means the efficiency descriptor for furnaces and boilers determined using test procedures prescribed in Code of Federal Regulations, title 10, part 430.

Subp. 4. **Attic bypass.** "Attic bypass" means a passageway where air may pass from a conditioned space to the unconditioned side of a roof or attic. Attic bypasses include utility penetrations, interior soffits, openings in top plates, fan penetrations, and light fixture penetrations.

Subp. 5. **Building envelope.** "Building envelope" means the elements of a building which enclose conditioned spaces through which thermal energy may be transferred to or from unconditioned spaces.

Subp. 6. **Cfm.** "Cfm" means cubic feet per minute.

Subp. 7. **Efficiency, thermal.** "Efficiency, thermal" means the results of a thermal efficiency test referenced in Code of Federal Regulations, title 10, part 430 or 435.

Subp. 8. **Energy.** "Energy" means the capacity for doing work, taking a number of forms which may be transformed from one into another such as thermal (heat), mechanical (work), electrical, and chemical, in customary units measured in kilowatt–hours (kWh's) or British thermal units (Btu's).

Subp. 9. **Fenestration (window, door, or skylight) area.** "Fenestration (window, door, or skylight) area" means the area of a window, door, or skylight equal to the rough opening of the window, door, or skylight, respectively, less installation clearances.

Subp. 10. **Gross wall area.** "Gross wall area" means the building envelope wall area bounding interior space from grade to the roof/ceiling assembly enclosing conditioned space, including opaque wall, window, and door area.

For basement walls with an average below–grade area less than 50 percent of the total wall area, including openings, all walls, including the below–grade portion, are included as part of the gross wall area. Windows and doors in basement walls are also included in the gross wall area.

Subp. 11. **Heat trap.** "Heat trap" means a device for preventing convection in supply and return pipes serving service water heaters and tanks. It includes pipe loop configurations to prevent convection. For water heaters, it does not include mechanical heat traps that are not included as part of the manufacturer's testing and performance rating of the appliance.

Subp. 12. **Heated slab.** "Heated slab" means slab–on–grade construction in which the heating elements or hot air distribution system is in contact with or placed within the slab or below the slab.

Subp. 13. **HVAC.** "HVAC" means heating, ventilating, and air conditioning.

Subp. 14. **HVAC system.** "HVAC system" means a system that provides either collectively or individually the processes of comfort heating, ventilating, or air conditioning within or associated with a building.

Subp. 15. **Infiltration.** "Infiltration" means the uncontrolled air leakage through cracks and interstices in any building element and around windows and doors of a building caused by the pressure effects of wind or the effect of differences in the indoor and outdoor air density.

Subp. 16. **Interior air barrier.** "Interior air barrier" means a material or combination of materials which are durable and installed at the warm side of the building envelope and continuously sealed to resist the passage of air and airborne moisture from a conditioned space into the building envelope. Acceptable air barrier materials include supported four mil polyethylene, gypsum board, wood products, rigid insulation, plastic, metal, sealed concrete products, and any air impermeable material that qualifies as a draft stop, fire stop, or fire block.

Subp. 17. **Manual.** "Manual" means capable of being operated by personal intervention.

Subp. 18. **Readily accessible.** "Readily accessible" means capable of being reached safely and quickly for operation, repair, or inspection, without requiring those to whom ready access is requisite to climb over or remove obstacles or to resort to the use of portable access equipment.

Subp. 19. **Renewable energy sources.** "Renewable energy sources" means sources of energy, excluding minerals, derived from incoming solar radiation, including natural daylighting and photosynthetic processes, including biomass, from resulting phenomena including wind, waves and tides, and lake or pond thermal differences, and energy derived from the internal heat of the earth, including nocturnal thermal exchanges.

Subp. 20. **Roof/ceiling assembly.** "Roof/ceiling assembly" means all components of the roof/ceiling envelope through which heat flows, thus creating a building transmission heat loss or gain, where the assembly is exposed to outdoor air and encloses a conditioned space.

The gross area of a roof/ceiling assembly consists of the total interior surface of the assembly, including skylights exposed to the conditioned space.

Subp. 21. **Seal.** "Seal" means to secure at all edges, joints, openings, and penetrations of barrier materials in a permanent manner to resist the passage of air and airborne moisture.

Subp. 22. **Service water heating.** "Service water heating" means the supply of hot water for domestic or commercial purposes other than space heating.

Subp. 23. **Thermal resistance or R.** "Thermal resistance" or "R" means the reciprocal of thermal conductance (h ft^2 ° F/Btu).

Subp. 24. **Thermal transmittance, overall or U_o.** "Thermal transmittance, overall" or "U_o" means the overall thermal transmittance of an exterior building envelope component, such as a wall, floor, or roof/ceiling. The value of U_o is calculated by the parallel path heat flow method using the areas and thermal transmittance values of the various elements, such as windows, doors, and opaque surfaces that comprise the gross area of the building component.

Subp. 25. **Unconditioned space.** "Unconditioned space" means space within a building which is not conditioned, including outdoor space and spaces within a building with uncontrolled ventilation to outdoors.

Subp. 26. **UL181 or equivalent.** "UL181 or equivalent" means a duct sealing product that meets standards UL181A, UL181B, or the UL standard for metal duct sealant. It also means a duct tape with metal foil backing and acrylic or silicone adhesive. It does not mean cloth–backed tape with rubber adhesive.

Subp. 27. **Vapor retarder.** "Vapor retarder" means a material or assembly to impede water vapor passage designed to meet a maximum permeability rating of 1.0 grain per hour

per square foot per inch Hg pressure differential. Polyethylene material which is used to meet the requirements of this subpart must either be designed to have a minimum thickness of four mils, be cross laminated, or be shown to have the strength and puncture resistance of not less than cross laminated polyethylene.

Subp. 28. **Warm side.** "Warm side" means the location within a building envelope element between the interior surface and the winter design condition dew point.

Subp. 29. **Wind wash barrier.** "Wind wash barrier" means a material or combination of materials, rigid or flexible, to resist the passage of unconditioned air into the building envelope. Wind wash barrier materials must be suitable for exterior conditions. Flexible wind wash barrier materials must meet ASTM E1677.

Statutory Authority: *MS s 16B.165; 216C.19; 216C.195*

History: *23 SR 145; 23 SR 2057*

7672.0600 MINIMUM ENVELOPE CRITERIA.

Subpart 1. **General.**

A. Buildings that are heated or mechanically cooled and heated slabs must be constructed so as to provide the required thermal performance for components identified in this part.

B. Buildings must be designed and constructed to permit continuity of air barriers and thermal insulation as required in this part.

C. The minimum criteria specified in this part must be met for new buildings in all cases, and shall not be made less stringent by a trade off.

D. Where sealed materials are required, sealants must be compatible with substrate and other materials being sealed. Consideration must be given to the installation conditions, temperature, moisture, gap width, and permanence of seal required when selecting appropriate material for sealing.

Subp. 2. **Foundation walls and slabs on grade.**

A. Foundation walls enclosing conditioned spaces, including exposed edges of slabs on grade, must be insulated. The insulation must be continuous except where the insulation must be interrupted for purposes such as penetrations or structural requirements, provided that the insulation is sealed or tightly abutted at the penetration or structural member.

B. Foundation wall insulation must be not less than R–5 from the top of the wall down to the top of the footing, or top of the floor if insulation is on the interior.

C. Slabs on grade, including heated aprons located outside of a building, must be insulated around the perimeter. The insulation must extend from the top of the slab downward to either the design frost line or to the top of the footing, whichever is less. The thermal insulation must be not less than R–5.

D. If foundation wall insulation is on the exterior, the portion from the top of the foundation wall to six inches below grade must be covered by an approved protective coating finish to protect the insulation from deterioration due to sunlight and physical abuse.

E. If foundation wall insulation is on the interior, a moisture barrier must be located between the insulation and the foundation wall from the floor to grade.

Subp. 3. **Wood framed components.** All buildings must be constructed in a manner that provides a continuous, durable interior air barrier on the warm side of the building envelope.

A. Insulated ceilings must have a vertical clearance of not less than six inches from the outside edge of the exterior wall top plate to the roof sheathing, and not less than R–19 insulation at the inside edge of the top plate.

B. Exterior corners must be framed so that insulation can be installed after the exterior sheathing is installed.

C. Intersections of interior partition walls with exterior walls must be framed so that insulation can be installed between the partition wall and exterior sheathing after the exterior sheathing is installed.

D. Gaps between framing which are less than one–half inch in width must be either eliminated by securing the framing members together, or must be insulated at the time of assembly.

E. Whenever interior framing meets an insulated ceiling or exterior wall, a continuous interior air barrier must be installed on the ceiling or exterior wall before installation of interior framing to allow continuity with adjacent interior air barriers. This requirement applies to dropped ceilings, soffits, stairs, fire or draft stops, fireplace framing, partition walls, and similar elements.

EXCEPTION: An interior air barrier need not be installed above partition top plates if adjacent interior air barrier materials are sealed to the top plate, provided that penetrations in the top plate are sealed.

F. Prior to installing a tub, shower, or spa located at an exterior wall, a continuously sealed interior air barrier must be installed on the exterior wall to allow continuity with adjacent interior air barriers. The interior air barrier must be covered to protect against physical abuse.

G. Exterior wall intersections of wood, masonry, and other dissimilar materials must be sealed to maintain interior air barrier continuity.

H. Walls exposed to attic areas and skylight shafts must be constructed to meet the same requirements as exterior walls, including wind wash barrier, insulation, vapor retarder, and interior air barrier requirements. If sheathing is not installed, the wind wash barrier must be supported between solid blocking.

Subp. 4. **Interior air barrier.** A sealed, continuous interior air barrier must be installed on the warm side of the building envelope to resist air leakage and movement of moisture into the building envelope at ceilings, walls, and floor rim joist areas.

A. An interior air barrier must be installed on the warm side of insulated ceilings, and on walls. The interior air barrier must be sealed at all edges, joints, openings, and penetrations.

EXCEPTIONS: An interior air barrier is not required at concrete foundation wall insulation or at fenestration rough openings.

B. An interior air barrier must be installed at floor rim joist areas.

Subp. 5. **Interior air barrier penetrations.**

A. All penetrations installed through an interior air barrier must be sealed so that a continuous interior air barrier is maintained. All penetrations made prior to framing inspection must be sealed prior to framing inspection, and no work may be covered or made inaccessible without sealing all penetrations.

B. Penetrations that must be sealed include piping and ducts, wires and equipment, and flue and chimney penetrations.

C. Sealing for wires and equipment must include the service entrance, wires, conduit, cables, panels, recessed light fixtures, electronic equipment, heating appliances, electrical boxes, and fan housings. Recessed light fixtures must be sealed in an approved manner.

D. Penetration openings must be of appropriate dimensions to facilitate the sealing method. Penetrations in a flexible interior air barrier must be supported by rigid material or approved method to facilitate permanent air sealing.

Subp. 6. **Vapor retarder requirements.** A vapor retarder must be installed on the warm side of all walls, ceilings, floor rim joist areas, and earth floors of unvented crawl spaces.

Subp. 7. **Exterior wind wash barrier.** A barrier must be provided to resist wind wash. Where sealing is required, the wind wash barrier must be caulked, be gasketed, have sealed exterior wrap, or be otherwise sealed in an approved manner to provide a permanent air seal and to prevent entry of wind and wind–driven rain. In wood framing construction, wind wash barrier penetrations must occur through rigid material or approved hardware to enable effective sealing. Penetrations in the wind wash barrier must be sealed prior to covering or making inaccessible so that a continuous wind wash barrier is maintained.

A. A rigid wind wash barrier must be tightly installed at the exterior edge of the exterior wall top plate, extending vertically to the underside of the truss top chord, or for non-

truss wood framing to within 3–1/2 inches of the roof deck, or to the top of the required ceiling insulation.

B. A sealed wind wash barrier must be installed at floors, overhangs, and floor rim joist areas separating conditioned spaces from unconditioned spaces.

C. Sheathing joints which are not supported by framing and framing joints which are not covered by sheathing must be sealed at the exterior side of the joint.

D. Sheathing penetrations must be sealed.

E. A sealed wind wash barrier must be installed between an attached garage and interior conditioned spaces.

Subp. 8. **Fenestration products; installation requirements.** Minimum clearance between rough opening framing and fenestration product frame must be maintained according to the manufacturer's instructions to facilitate insulation. When manufacturer's installation instructions require insulation between the rough opening and frame, the portion of the rough opening which is located to the exterior side of the glazing must be insulated. The required insulation must be installed at the time of fenestration product installation. A durable exterior side infiltration and weather seal must be installed at the time of fenestration product installation around the perimeter of the product frame.

Subp. 9. **Floors over unconditioned spaces.** Floors over unconditioned spaces must have a maximum overall thermal transmittance as required in this subpart. While the U–value may be increased or decreased by trade off calculations, in all cases it must have a maximum overall thermal transmittance of 0.033. Floor rim joist framing must have an interior air barrier on the warm side according to subpart 4 and sealed wind wash barrier according to subpart 7.

Subp. 10. **Thermal insulation placement and support.**

A. Thermal insulation must be installed in ceilings and walls in a permanent manner and in substantial contact with the interior air barrier.

B. When framing or equipment is installed that will restrict access to building cavities requiring insulation, those cavities must be insulated prior to restricting access.

C. All insulation in floors and walls must be supported and protected on the unconditioned side by sheathing or other approved materials to resist insulation movement and wind wash.

D. In buildings having eave ventilation and loose fill attic insulation, a barrier must be installed to prevent the insulation from entering the eave. Loose fill insulation must be installed after eave protection is installed, unless prior loose fill insulation is required to prevent cold weather freezing of interior applied building materials.

E. Where building design and code requirements allow, thermal insulation must be continuous and uninterrupted by ducts, pipes, wiring, bracing, and other elements which are capable of being installed to the interior or exterior side of the insulation.

Subp. 11. **Performance and identification of loose fill insulation.**

A. Loose fill insulation installed to meet the requirements of this chapter must provide the required performance at 75 degrees Fahrenheit mean temperature and no less than the required performance at winter design conditions.

B. Insulation must be installed according to the bag count on the manufacturer's coverage chart.

C. Identification must be placed in accordance with this item in accessible attics of all buildings with loose fill insulation.

(1) A means must be provided to verify the claimed insulation level by installing insulation thickness markers labeled with a minimum of one–inch increments at approximately ten–foot spacing throughout the attic.

(2) A completed insulation receipt attic card must be attached to the framing near the access opening in a clearly visible place. The attic card must identify the type of insulation installed, the manufacturer, the installer, the R–value, the design settled thickness, the square footage of attic coverage area, and the number of bags installed, and must be signed and dated by the installer.

(3) Notification must be posted near the building inspection card indicating the installed attic R–value and date of installation.

D. Attic access panels must be insulated to a minimum R–38 for ceiling panels and R–19 for wall panels, and must be weatherstripped.

Statutory Authority: *MS s 16B.165; 216C.19; 216C.195*

History: *23 SR 145; 23 SR 2057*

7672.0700 FENESTRATION PRODUCTS (WINDOWS, DOORS, AND SKYLIGHTS).

Subpart 1. **Thermal performance of windows, doors, and skylights.** All windows must be labeled with their overall assembly U–value according to this part.

Subp. 2. **Air infiltration.** Fenestration products (windows, doors, and skylights) must have air infiltration rates not exceeding those shown in this subpart. The manufacturer must test infiltration rates according to ASTM E283 and window infiltration rates according to applicable industry standards. A labeled statement from the manufacturer that the product meets or exceeds the requirements of the Model Energy Code shall be deemed to comply with these requirements:

A. windows, 0.37 cfm per lineal foot of operable sash crack;

B. doors, swinging, 0.50 cfm per square foot of door area; and

C. doors, sliding, 0.37 cfm per square foot of door area.

Subp. 3. **Thermal transmittance.** Thermal transmittance of fenestration products (doors, windows, and skylights) must be determined in accordance with item A or B.

A. Thermal performance (U–values) of windows, doors, and skylights must be determined according to the National Fenestration Rating Council Standard 100–91 or 100 (1997 ed.), or equivalent, by an accredited, independent laboratory, and labeled and certified by the manufacturer.

Such certified and labeled values shall be site verifiable and used for purposes of determining compliance with the building envelope requirements of this chapter.

B. If a manufacturer has not determined product U–value according to NFRC standards for a particular product line, compliance with the building envelope requirements of this chapter must be determined by assigning products a default U–value from the U–value default table. Product features must be verifiable for the product to qualify for the default value associated with those features. If the existence of a particular feature cannot be determined with reasonable certainty, the product must not receive credit for that feature. If a composite of materials from two different product types is used, the product U–value must be the higher U–value.

(1) U–value default table for windows, glass doors, and skylights:

Frame/Glazing Features	Double Pane	Double Pane With Low–E Permanent Label on Glass	Triple Pane
	U–value	U–value	U–value
Metal with Thermal Break			
Operable	0.67	0.62	0.54
Fixed	0.63	0.57	0.47
Glass door	0.66	0.60	0.50
Skylight	1.13	1.06	0.93
Metal–clad Wood			
Operable	0.60	0.56	0.46
Fixed	0.58	0.52	0.41
Glass door	0.57	0.52	0.43
Skylight	0.88	0.82	0.71

Wood/vinyl			
Operable	0.56	0.52	0.43
Fixed	0.57	0.52	0.41
Glass door	0.56	0.51	0.42
Skylight	0.85	0.79	0.67
Glass Block Assemblies	0.60		

(2) U–value default table for nonglazed doors:

Steel Doors	U–value
Without foam core	0.60
With foam core	0.35

Wood Doors	Without Storm U–value	With Storm U–value
Panel with 7/16 inch panels	0.54	0.36
Panel with 1–1/8 inch panels	0.39	0.28
Solid core flush	0.40	0.26

Statutory Authority: *MS s 216C.19*

History: *23 SR 145*

7672.0800 METHODS FOR COMPLIANCE.

Subpart 1. **Scope.** One– and two–family residential buildings must demonstrate compliance with subpart 3 and one of the methods of subpart 4, 6, 7, or 8.

Subp. 2. **Calculation of U_o.** Calculation of overall thermal transmittance values (U_o–values) must be according to chapter 7678.

Subp. 3. **Minimum R–values, maximum U–values, and other minimum requirements.** The minimum criteria specified in this subpart must be met for new buildings in all cases, and shall not be made less stringent by a trade off.

A. The average U–values for fenestration products used in the building must not exceed:

(1) U–0.37 for windows and glass doors except foundation windows 5.6 square feet and less;

(2) U–0.55 for skylights;

(3) U–0.51 for foundation windows 5.6 square feet and less.

B. Foundation wall insulation must be not less than R–5.

C. Slabs on grade insulation must not be less than R–5.

D. Floors over unconditioned spaces must have a maximum U_o–value of 0.033.

E. All other minimum criteria specified in part 7672.0600 must be met.

Subp. 4. **Cookbook method.**

A. Insulation in ceilings with attics must be R–38 minimum.

B. Insulation in floor rim joist areas must be R–10 minimum.

C. Entrance doors must be a minimum of either 1–3/4 inch solid core wood door, steel door with foam core, or NFRC–rated door with U–value not exceeding 0.40.

EXCEPTION: Swinging and sliding glass patio doors must have a U–value not greater than the window U–value for the building.

D. Floors over unconditioned spaces must be R–30 minimum.

E. Foundation windows 5.6 square feet and less must be insulated glass, one–half inch between panes and wood or vinyl frame, or not greater than U–0.51.

F. The space heating system must be not less than 90 percent AFUE.

G. The average U–value of all windows, except foundation windows 5.6 square feet and less, must not exceed the value listed in the maximum window U–value table corresponding with the maximum total window and door area as a percentage of overall exposed wall area, R–value of insulation within the insulated cavity, sheathing R–value, and foundation wall insulation. Total window and door area includes all foundation windows. Interpolations between chart values to intermediate values are permitted. Extrapolations beyond the values found in the chart shall require compliance with subpart 6, 7, or 8. Other components must meet the requirements of this subpart.

MAXIMUM WINDOW U–VALUE WITH 90% AFUE SPACE HEATING AND WITH R–10 EXTERIOR FOUNDATION WALL INSULATION

	Maximum Total Window and Door Area as Percentage of Exposed Wall									
Percent	10	12	14	16	18	20	22	24	26	28
Wall Type	Maximum Window U–Values									
2x4, R–13 insulation, <R–5 sheathing	0.37	0.37	0.33	0.28	0.25	0.22	0.20	0.18	0.17	0.15
2x4, R–13 insulation, ≥R–5 sheathing	0.37	0.37	0.37	0.37	0.37	0.33	0.30	0.27	0.25	0.23
2x4, R–13 insulation, ≥R–7 sheathing	0.37	0.37	0.37	0.37	0.37	0.36	0.33	0.30	0.27	0.25
2x6, R–19 insulation, <R–5 sheathing	0.37	0.37	0.37	0.37	0.37	0.32	0.29	0.27	0.24	0.23
2x6, R–19 insulation, ≥R–5 sheathing	0.37	0.37	0.37	0.37	0.37	0.37	0.35	0.32	0.29	0.27
2x6, R–21 insulation, <R–5 sheathing	0.37	0.37	0.37	0.37	0.37	0.35	0.31	0.29	0.26	0.24
2x6, R–21 insulation, ≥R–5 sheathing	0.37	0.37	0.37	0.37	0.37	0.37	0.36	0.33	0.30	0.28

ADJUSTMENTS TO MAXIMUM WINDOW U–VALUE FOR R–10 FOUNDATION WALL INSULATION*

Wall Type	U–value Percentage Change for R–5 Foundation Wall Insulation	U–value Percentage Change for R–19 (or greater) Foundation Wall Insulation
2 x 4, R–13 insulation:		
<R–5 sheathing	–8%	+5%
≥R–5 sheathing	–6%	+3%
≥R–7 sheathing	–5%	+3%

2 x 6, R–19 insulation:

<R–5 sheathing	–6%	+3%
≥R–5 sheathing	–5%	+3%

2 x 6, R–21 insulation:

<R–5 sheathing	–5%	+3%
≥R–5 sheathing	–5%	+3%

*This table must be used in conjunction with the maximum window U–value with 90 percent AFUE space heating and the R–10 foundation wall insulation tables. To find the appropriate maximum U–value for using R–5 or R–19 (or greater) foundation wall insulation, multiply the applicable number in the adjustments table by the corresponding U–value in the R–10 table.

Subp. 5. **Total heat gain or loss for entire building.** The value of U_0 for any assembly such as roof/ceiling, wall, or floor may be increased and traded off by decreasing the value of U_0 for other components, provided that the total heat gain or loss for the entire building envelope does not exceed the total resulting from conformance to the values of U_0 specified in this chapter. Window U–value must not be greater than required in subpart 3.

Subp. 6. **Building component performance method.**

A. For the gross wall area above grade,

(1) when foundation wall insulation is R–5, maximum U_0–value is 0.100;

(2) when foundation wall insulation is R–10 or greater, maximum U_0–value is 0.110.

B. For roof/ceilings, U_0–value must not exceed 0.026.

C. For floors over unconditioned spaces, U_0–value must not exceed 0.033.

Subp. 7. **MNcheck performance method.** A building is deemed to meet the requirements of this part if the thermal envelope "passes" using the MNcheck computer program.

Subp. 8. **Building design by systems analysis method.**

A. This subpart establishes design criteria in terms of total energy use by a residential building, including all of its systems. The intent of this subpart is to allow flexibility in the design process while ensuring that the annual energy or energy cost of the proposed design is no more than is allowed under the prescriptive path.

B. Building design by systems analysis must comply with chapter 4 of the Model Energy Code, 1995 edition. Chapter 4 of the Model Energy Code is amended by:

(1) replacing references to chapter 5 or 6 with parts 7672.0100 to 7672.1300;

(2) changing the air changes per hour for the standard design to be 0.10 for calculation purposes only; and

(3) adding a requirement that if the proposed building uses an air or water source heat pump for heating or cooling, the "standard design" building must also use a heat pump with the same energy source for the comparative analysis.

Subp. 9. **Enclosed three–season porches method.**

A. This subpart may be applied to an enclosed three–season porch when heating or cooling systems for the space are either separate or separately zoned from other conditioned spaces and have separate controls capable of complete and independent shut–off of heating and cooling systems.

B. Minimum requirements for the porch and wall separating the porch from conditioned spaces are contained in subitems (1) to (3).

(1) Building components separating conditioned areas of the house from the porch as well as the porch from unconditioned spaces must meet the minimum criteria of part 7672.0600 for separating, including interior air barrier and vapor retarder requirements.

(2) The thermal performance of the porch roof, floors over unconditioned spaces, and fenestration products must be not less than required in subpart 3, 4, 6, 7, or 8.

(3) The U_0–values of the walls separating other conditioned areas of the house from the porch and the porch from unconditioned spaces must not exceed the values identified in this subitem, or a U_0–value not greater than 0.11 for the combined thermal resistance of both walls in series.

Porch wall	Separation wall
0.14	0.15
0.18	0.14
0.22	0.13
0.26	0.13
0.30	0.13
0.34	0.12

Statutory Authority: *MS s 16B.165; 216C.19; 216C.195*

History: *23 SR 145; 23 SR 2057*

7672.0900 MECHANICAL SYSTEMS.

Subpart 1. **Equipment sizing.**

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

B. Design conditions must be determined from the outdoor design conditions table. Design condition adjustments may be made as determined by the building official to reflect local climates that differ from the tabulated temperatures or local weather experience.

Outdoor Design Conditions

City	Summer Db/Wb	Winter Db
Albert Lea	87/72	–17
Alexandria	88/72	–22
Bemidji	85/69	–31
Brainerd	87/71	–20
Duluth	82/68	–21
Faribault	88/72	–17
Fergus Falls	88/72	–21
International Falls	83/68	–29
Mankato	88/72	–17
Minneapolis	89/73	–16
Rochester	87/72	–17
St. Cloud	88/72	–15
St. Paul	89/73	–16
Virginia	83/68	–25
Willmar	88/72	–15
Winona	88/73	–14

Db = dry bulb temperature, degrees Fahrenheit

Wb = wet bulb temperature, degrees Fahrenheit

C. Indoor design conditions temperature must be not greater than 72 degrees Fahrenheit for heating and not less than 74 degrees Fahrenheit for cooling.

Subp. 2. **Controls.**

A. A thermostat must provide a readily accessible manual or automatic means for controlling the temperature. A thermostat used to control both heating and cooling must be capable of being set from 55 to 85 degrees Fahrenheit and must be capable of operating the system heating and cooling in sequence.

B. Heat pumps must be provided with a control to prevent supplementary heater operation when the operating load can be met by the heat pump alone. Supplementary heater operation is permitted during transient periods of no more than 15 minutes, such as start–ups,

following room thermostat set–point advance, and during defrost. A two–stage thermostat, which controls the supplementary heat on its second stage, is acceptable for meeting this requirement.

Subp. 3. **Duct construction.** Ductwork installation requirements are provided in the Minnesota State Mechanical Code, chapter 1346, adopted by the Department of Labor and Industry. Ducts outside of the interior air barrier must be sealed with a product meeting UL181 or equivalent.

Subp. 4. **Duct insulation.** Duct insulation requirements are provided in the state Uniform Mechanical Code, chapter 1346.

Subp. 5. **Pipe insulation.** HVAC pipe insulation must be according to part 7676.1100, subpart 17.

Subp. 6. **Testing.** All controls must be tested to ensure that control elements are calibrated, adjusted, and in proper working condition.

Subp. 7. **Equipment efficiency.** HVAC equipment must meet minimum requirements of chapter 7678 and the National Appliance Energy Conservation Act of 1987. Gas–fired and oil–fired furnaces, boilers, and duct furnaces must meet the requirements of this subpart.

Equipment Category	Rating Condition	Efficiency
Gas–fired furnaces	Seasonal rating	78% AFUE
Gas–fired duct furnaces	Maximum rated capacity	78% Et*
Oil–fired furnaces	Seasonal rating	78% AFUE
Gas–fired boilers	Seasonal rating	80% AFUE
Oil–fired boilers	Seasonal rating	80% AFUE

*Et = Thermal efficiency

Subp. 8. **Protection against depressurization.** Provision must be made to limit excessive depressurization in buildings with fuel burning appliances.

EXCEPTION: Dwellings which contain only sealed combustion appliances and when the sum of the rated cfms exhausting capacity of the largest mechanical exhausting devices in the three categories of clothes dryer (150 cfm default value), kitchen exhaust, and other exhaust does not exceed 425 cfm.

A. The definitions in this item apply to this subpart.

(1) "Atmospherically vented gas or oil appliance" means an appliance that is required to be vented through a chimney or vertical vent and that is neither direct nor power vented.

(2) "Closed controlled combustion solid–fuel–burning appliance" means a wood stove, pellet stove, or fireplace capable of efficient heating and controlled combustion. The appliance must include doors with gaskets or flanges that permit tight closure, and glass or ceramic panels which must be tightly sealed or gasketed at their frames.

(3) "Decorative wood–burning appliance" means an appliance, usually a fireplace, intended primarily for viewing of the fire and which may or may not incorporate doors that substantially close off the firebox opening when the appliance is in operation.

(4) "Direct vented appliance" has the meaning given in the state Uniform Mechanical Code, chapter 1346.

(5) "Mechanical exhausting devices" means exhausting devices including kitchen range fan, bath fan, spa and pool fans, clothes dryer, central vacuum that exhausts to the outside, and radon mitigation system.

EXCEPTION: A central vacuum that exhausts to the outside is not a mechanical exhausting device for Prescriptive Paths 0 and 1.

(6) "Power vented appliance" has the meaning given in the state Uniform Mechanical Code, chapter 1346.

(7) "Powered make–up air" means air that must be brought in from outdoors by means of a fan or fans to replenish the air expelled by mechanical exhausting devices.

(8) "Powered to match flow" means powered make–up air fan or fans which are rated for cfm air flow at not less than the rated amount of air flow of the associated mechanical exhausting devices.

(9) "Sealed combustion appliance" means a listed appliance that acquires all air for combustion through a dedicated sealed passage from the outside, to a sealed combustion chamber, and all combustion products are vented to the outside through a separate dedicated sealed vent. The appliance must be able to function and draft properly at a negative pressure of 50 pascals. (Note that a standard for a sealed combustion appliance does not exist at the time of adoption of this chapter. Until a standard is available, equipment may be approved under chapter 1346 of the state Building Code when a manufacturer certifies that the equipment meets the requirements of this definition when installed according to the manufacturer's instructions.)

B. One of the six paths identified in this item must be followed to provide protection against excessive depressurization. Make–up air must be provided as required in item C. Requirements for combustion air (and dilution air) for vented combustion equipment are provided in chapter 1346.

Within each category of exhausting appliance (clothes dryer, kitchen range exhaust, and other exhaust), only the capacity of the largest exhausting appliance within each category must be considered when sizing for make–up air.

Within each category of combustion equipment, when atmospherically vented is specified, the combustion equipment may also be direct vented, or power vented, or sealed combustion. When direct or power vented is specified, the combustion equipment may also be sealed combustion.

(1) PATH 0

	PRESCRIPTIVE PATH 0
Combustion Equipment	
Space Heating	Sealed combustion
Service Water Heating	Sealed combustion
Gas Hearth	Sealed combustion
Wood Hearth	None
CO Alarm Required	No
Ventilation Type	
People ventilation	Balanced or exhaust
Supplemental ventilation	Balanced or exhaust*

*Passive infiltration must not be used to provide make–up air for the supplemental ventilation in excess of 0.05 cfm/sf

Make–Up Air Requirements	
Clothes dryer	
Less than or equal to 175 cfm	Passive infiltration
More than 175 cfm	Passive opening for cfms over 175
Kitchen Exhaust	
Less than or equal to 250	Passive infiltration
251 to 500 cfm	Passive opening for cfms over 250
More than 500 cfm	Powered to match flow for cfms over 500

Other Exhaust	
Up to 140 cfm	Passive opening
More than 140 cfm	Powered to match flow for cfms over 140

(2) PATH 1

	PRESCRIPTIVE PATH 1
Combustion Equipment	
Space Heating Gas/oil	Direct or power vented
Service Water Heating Gas/oil	Direct or power vented
Gas Hearth	Direct or power vented
Wood Hearth	Closed controlled combustion solid–fuel burning appliance*

*If a closed controlled combustion solid–fuel burning appliance is installed in Path 1, then the clothes dryer and any central vacuum that exhausts to the outside must be provided with make–up air by a passive opening to match flow, and a CO alarm must be installed.

CO Alarm Required	No
Ventilation Type	
People ventilation	Balanced or exhaust
Supplemental ventilation	Balanced or exhaust*

*Passive infiltration must not be used to provide make–up air for the supplemental ventilation in excess of 0.05 cfm/sf

Make–Up Air Requirements

Clothes dryer	
Less than or equal to 175 cfm	Passive infiltration
More than 175 cfm	Passive opening for cfms over 175 cfm
Kitchen Exhaust	
Less than or equal to 250 cfm	Passive opening
More than 250 cfm	Powered to match flow for cfms over 250 cfm
Other Exhaust	
Less than or equal to 140 cfm	Passive opening
More than 140 cfm	Powered to match flow for cfms over 140 cfm

(3) PATH 2

	PRESCRIPTIVE PATH 2
Combustion Equipment	
Space Heating Gas/oil	Atmospherically vented*
Service Water Heating Gas/oil	Direct or power vented
Gas Hearth	Atmospherically vented*

Wood Hearth	Closed controlled or decorative*

*Only one atmospherically vented appliance may be installed.

CO Alarm Required	Yes
Ventilation Type	
People ventilation	Balanced
Supplemental ventilation	Balanced or exhaust*

*Passive infiltration or passive openings must not be used to provide make–up air for the supplemental ventilation in excess of 0.05 cfm/sf

Make–Up Air Requirements	
Clothes dryer	
Less than or equal to 175 cfm	Passive opening
More than 175 cfm	Powered to match flow for cfms over 175
Kitchen Exhaust	
Any	Powered to match flow
Other Exhaust	
Any	Powered to match flow

(4) PATH 3	PRESCRIPTIVE PATH 3
Combustion Equipment	
Space Heating Gas/oil	Atmospherically vented
Service Water Heating Gas/oil	Atmospherically vented
Gas Hearth	Direct vent
Wood Hearth	None
CO Alarm Required	Yes
Ventilation Type	
People ventilation	Balanced
Supplemental ventilation	Balanced
Make–Up Air Requirements	
Clothes dryer	
Any	Powered to match flow
Kitchen Exhaust	
Any	Powered to match flow
Other Exhaust	
Any	Powered to match flow

(5)	PERFORMANCE PATH
Combustion Equipment	
Space Heating Gas/oil	Any vented appliance
Service Water Heating Gas/oil	Any vented appliance

Gas Hearth	Any vented appliance
Wood Hearth	Any vented appliance
CO Alarm Required	Yes
Ventilation Type	
People ventilation	Performance
Supplemental ventilation	Performance
Make–Up Air Requirements	
Clothes dryer	Performance
Kitchen Exhaust	Performance
Other Exhaust	Performance

(6) As an alternative to the make–up air cfm requirements in subitems (1) to (5), aggregate make–up air cfms may be provided according to this subitem. The aggregate make–up air cfm requirement is the sum of the air flow capacity of the largest mechanical exhausting devices in each of three categories: clothes dryer (150 cfm default value), kitchen exhaust, and other exhaust. All other requirements of subitems (1) to (5) for ventilation type, make–up air for ventilation, and CO alarm must be met. Make–up air for mechanical exhausting devices in excess of the cfms indicated in this subitem must be provided by a source powered to match flow.

	Path 0	Path 1	Path 2	Path 3	Performance
Maximum cfms of make–up air for mechanical exhausting devices that can be provided by infiltration	425	175*	0	0	Performance
Maximum cfms of make–up air for mechanical exhausting devices that can be provided by infiltration and by passive openings	985	565	175	0	Performance

*If a closed controlled combustion solid–fuel burning appliance is installed in Path 1, then a passive opening must be installed to provide make–up air for the clothes dryer and for any central vacuum that exhausts to the outside.

C. Make–up air required in item B must be provided by designated openings (except for passive infiltration) according to this item.

(1) A means of providing make–up air must have one or more inlets to the dwelling. Make–up air must be available whenever the associated exhausting device is activated. Manually operated dampers must not be installed in make–up air openings.

(2) Make–up air must be provided by means of passive infiltration, passive opening, powered source, or a combination of those sources. When item B specifies passive infiltration, make–up air may also be provided by passive opening, or powered source. When item B specifies passive opening, make–up air may also be provided by powered source.

(3) Make–up air requirements of 175 cfm and greater must be introduced into the dwelling either in each space containing combustion appliances or into the same space containing the exhaust inlets. The same space means without separation of walls, floors, or doors.

(4) Table to Size Passive Make–Up Air Openings

Make–Up Air – CFM Provided by Smooth Ductwork[a]

Duct Diameter[b,c,d]	Prescriptive Path 2	Prescriptive Path 1	Prescriptive Path 0
3 inches	15	35	50
4 inches	30	60	90
5 inches	45	100	140
6 inches	65	140	200
7 inches	85	190	270
8 inches	110	250	350
9 inches	140	320	450
10 inches	180	400	570

[a] This table assumes 20 feet of smooth unobstructed duct with three 90–degree elbows and a screened hood. For other combinations of lengths and elbows, adjustments to duct size shall be made according to accepted duct calculation methods using pressures of 5 Pascals for Prescriptive Path 2, 25 Pascals for Prescriptive Path 1, and 50 Pascals for Prescriptive Path 0.

[b] This table assumes a round duct. A rectangular duct with equivalent friction loss is acceptable.

[c] If a make–up air opening is used with no duct or elbows, the diameter can be decreased by one inch.

[d] If flex duct is used, increase diameter by one inch. Flex duct must be stretched with minimal sags.

(5) Verification of the make–up air system shall be performed by visual and physical examination to ensure that all components are functioning in the manner intended.

D. The performance path option for compliance must be conducted according to this item. Protection against depressurization must be demonstrated for any vented combustion appliance according to either CGSB Standard 51.71, or when tested according to the requirements of subitem (1), the pressure within the dwelling unit must not decrease from atmospheric pressure by more than the values in subitem (2).

(1) The measurement of pressure decrease must be determined with the building components configured according to units (a) and (b), and conducted according to unit (c).

(a) Balancing of air flow rates to and/or from individual rooms with the system operating at minimum ventilation capacity must be carried out prior to flow measurements. If the ventilation air distribution system is used for heating or cooling, any air balancing required for heating or cooling must have been done before carrying out the air flow rate measurements. If it is used for both, any air balancing must be for the heating condition. Air circulation systems that are part of the ventilation system must be kept operating.

(b) The house set–up and system configuration shall be as given in the house set–up and system configuration table.

House Set–up and System Configuration Table

Component	Conditions During Measurement of Minimum Ventilation Capacity
Windows and exterior doors	Close
Interior doors	Open
Attic hatch	Close
Fireplace flue damper	Close
Fireplace combustion air intake damper	Close

Doors on enclosed furnace rooms	Close
Vented fuel–fired appliances	Off
Furnace combustion air intake	Seal
Air intake and exhaust vents for make–up air or pressure relief	Normal operating mode
Floor drains	Fill
Plumbing traps	Fill
Clothes dryer	Off
Other exhaust fans not part of ventilation system	Off
Ventilation system supply and exhaust fans, including exhaust air heat recovery devices that are part of the minimum ventilation capacity system	Normal operating mode
Air intake and exhaust openings that are part of the minimum ventilation capacity system	No preparation
Ventilation system exhaust fans designed to operate intermittently, and any associated supply fans	Off
Intake and exhaust openings for the above	No preparation
Furnace blower when part of the minimum ventilation capacity system	Operate in venti–lation mode
Furnace blower when not part of the minimum ventilation capacity system	Off
Openings for future equipment	Seal

(c) The pressure decrease from atmospheric pressure shall be measured. The apparatus shall be capable of measuring pressure differences within plus or minus two pascals or plus or minus 20 percent of the pressure limit, whichever is the larger. The pressure difference shall be measured first with the system off and then under the reference exhaust flow rate condition. The reference exhaust flow rate condition is met when the ventilation system, the clothes dryer, and the largest other exhausting device are operating in their normal mode. If a clothes dryer exhausting to outdoors or any other exhaust device that is part of the reference exhaust flow rate condition has not been installed, its effect shall be simulated by the use of alternate equipment exhausting air at 150 cfm for a clothes dryer, or at the rated capacity of other missing devices. The difference between the two sets of pressure measurements shall be taken as the increase or decrease in pressure difference across the house envelope due to operation under the reference exhaust flow rate condition.

(2) Maximum depressurization with conditions of subitem (1) for various appliances:

Appliance	Maximum Depressurization
Appliances with manufacturer certified negative pressure tolerance rating	The manufacturer–certified negative pressure tolerance rating
Direct vented appliance*	25 Pascals (0.10–inch water column)
Power vented appliance*	25 Pascals (0.10–inch water column)
Thermal mass wood–burning appliance*	15 Pascals (0.06–inch water column)
Closed controlled combustion wood–burning appliances*	7 Pascals (0.028–inch water column)
Decorative wood–burning appliances	5 Pascals (0.02–inch water column)
Atmospherically vented oil and gas systems*	5 Pascals (0.02–inch water column)
Atmospherically vented water heater*	2 Pascals (0.008–inch water column)

*Without manufacturer–certified negative pressure tolerance rating.

(3) A carbon monoxide alarm which conforms to the UL2034 Standard must be installed according to the manufacturer's instructions.

Statutory Authority: *MS s 16B.165; 216C.19; 216C.195*

History: *23 SR 145; 23 SR 2057; L 2007 c 140 art 1 s 1*

7672.1000 RESIDENTIAL VENTILATION SYSTEM.

Subpart 1. **General.** All new residential buildings covered by this chapter must be equipped with a residential ventilation system meeting the requirements of this part.

A. Ventilation systems must be designed in accordance with the Minnesota State Mechanical Code, chapter 1346. Ventilation quantities must be in accordance with ASHRAE Standard 62, adopted by chapter 1305, with the exception that neither infiltration nor natural ventilation (operable windows and doors) satisfy the requirement for ventilation.

B. Exhaust requirements for kitchens and baths are provided in the Minnesota State Building Code.

C. As an alternative to the requirements of subparts 3 to 6, the residential ventilation system may be designed, installed, and tested according to the alternate performance procedure in subpart 7.

Subp. 2. **Definitions.** The definitions in this subpart apply to this chapter.

A. "Air, exhaust" means air discharged from any space to the outside by the residential ventilation system.

B. "Air, outdoor" means the air that is taken from the external atmosphere and, therefore, not previously circulated through the HVAC system or the conditioned space.

C. "Forced air system" means an air heating or cooling system.

D. "Heat recovery ventilator" or "energy recovery ventilator" means a device or combination of devices applied to transfer energy from the exhaust air stream for use within the dwelling or an attached building. The use of the term heat recovery ventilator includes energy recovery ventilator.

E. "People ventilation" means the cfm of outdoor air needed for normal occupancy of the house. It is designed to be operated whenever the house is occupied. The air flow rate depends upon the number of bedrooms in the house.

F. "Supplemental ventilation" means the additional cfm of air flow needed for periods of peak occupant use.

G. "Total ventilation" means the sum of the people ventilation and supplemental ventilation. The total ventilation rate is calculated at 0.05 cfm per square foot of the house, and is approximately equal to 0.35 air changes per hour.

H. "Ventilation design conditions" means outdoor conditions of minus 13 degrees Fahrenheit and indoor conditions of 72 degrees Fahrenheit and 40 percent relative humidity.

I. "Ventilation rate" means the average fan powered outdoor air ventilation rate for each one–hour time period.

J. "Ventilation system, balanced" means a residential ventilation system where the design fan powered exhaust air is equal to the fan powered supply air.

K. "Ventilation system, exhaust only" means a residential ventilation system where a fan provides exhaust air and supply air is not fan powered.

L. "Ventilation system, residential" means the mechanical ventilation system, including fans, controls, and ducts, which replaces, by direct or indirect means, air from the habitable rooms with outdoor air.

Subp. 3. **Outdoor air requirements.** Residential ventilation systems must be installed as required by this subpart to provide not less outdoor air than the total ventilation rate (cfm) of 0.05 times the area of the house in square feet. For the purposes of equipment requirements and protection against depressurization requirements of this chapter, the total ventilation rate may be divided into people ventilation and supplemental ventilation rates. If the total ventilation rate is not divided, then the most stringent requirement for either people or ventilation rate must apply.

A. The people ventilation rate is 15 cfm for each bedroom plus an additional 15 cfm. The minimum people ventilation rate is 45 cfm. As an alternative to ventilation requirements of the State Building Code, bathrooms and water closet compartments may be ventilated with a system designed to operate at a continuous rate of 20 cfm and kitchens may be ventilated with a system designed to operate at a continuous rate of 25 cfm.

B. The supplemental ventilation rate is the conditioned floor area of the house multiplied by 0.05 (in cfm) less the people ventilation rate. The conditioned floor area includes the basement.

C. As an alternative to the calculated ventilation rates in items A and B, the ventilation rate may be determined by the table in this item.

Bedroom Count	House Size Range	People Ventilation	Supplemental Ventilation
1	600 – 1,200 sq. ft.	45 cfm	15 cfm
2	1,000 – 1,500 sq. ft.	45 cfm	30 cfm
3	1,200 – 2,000 sq. ft.	60 cfm	40 cfm
4	1,600 – 2,400 sq. ft.	75 cfm	45 cfm
5	2,000 – 3,000 sq. ft.	90 cfm	60 cfm

Subp. 4. **Equipment requirements.**

A. The residential ventilation system must be sized to provide no less air flow than the ventilation rate averaged for a one–hour period at ventilation design conditions. Fans and ducts must be sized according to subpart 5, item D.

B. Fans must be designed to deliver design air flow.

(1) Fans for the people ventilation portion of the residential ventilation system must be designed and certified as capable of continuous operation.

(2) Ventilation system design must be based on fan air flow tested and rated according to HVI Standard 916.

C. Heat recovery ventilator rated design flow rate must be the average flow rate for a one–hour period at the ventilation design conditions. The average hourly ventilation capac-

ity must be determined in consideration of any reduction of exhaust or outdoor air intake, or both, for defrost or other equipment cycling.

(1) Performance must be tested according to CAN/CSA–439, by an approved laboratory meeting the requirements of part 7678.0500, subpart 9, item B. Products certified according to HVI Standard 920 meet the requirements of this subitem.

EXCEPTION: As an alternative to parts 10.6 and 10.7 of CAN/CSA–439, the manufacturer must certify the heat exchanger outdoor air intake and exhaust flow rates and low temperature reduction factor at continuous conditions not less stringent than the ventilation design conditions.

(2) Heat recovery ventilators must meet UL1812 or equivalent.

(3) A label stating the manufacturer or provider of the equipment warranty, net air flow, and sensible recovery efficiency at 32 degrees Fahrenheit and at the ventilation design condition must be permanently affixed to the equipment.

(4) All heat recovery ventilation systems must be equipped with readily accessible air filters.

D. Residential ventilation system fans to provide the people ventilation must have a maximum sound rating of 1.5 sones. Surface mounted fans designed to provide people ventilation must have a maximum sound rating of 1.0 sones. Testing must be in accordance with HVI Standard 915.

EXCEPTION: Heat recovery ventilator fans and in–line fans are exempt from sound testing or rating requirements.

Subp. 5. **Distribution and installation requirements.**

A. Residential ventilation systems must be installed according to the Minnesota State Mechanical Code, chapter 1346, and the manufacturer's installation instructions.

B. Outdoor air inlets in a habitable room with design flow greater than 20 cfm for a residential ventilation system not circulating outdoor air through a forced air system must be designed and installed to temper incoming air to not less than 40 degrees Fahrenheit at ventilation design conditions (outdoor temperature of minus 13 degrees Fahrenheit). Tempered air is measured at the point of distribution to the habitable room when the mechanical ventilation system is neither in defrost mode nor serving as a source of make–up air.

C. Outdoor air must be delivered to each habitable room by individual inlets, separate duct systems, or a forced air system. Where outdoor air supplies are separated from exhaust points by doors, provisions shall be made to ensure air flow by installation of distribution ducts, undercutting doors, installation of grilles, transoms, or similar means where permitted by the Minnesota State Building Code. When outdoor air is not delivered to habitable rooms by either individual inlets or a separate duct system, the forced air system must be controlled according to item H, subitem (2).

D. Fans and ducts must be sized and installed to provide design ventilation flow rate.

(1) All ducts outside the interior air barrier must be sealed with a product meeting UL181 or equivalent.

(2) Fans and ducts must be sized according to accepted duct design procedures.

(3) Adjustable dampers regulating flow must be accessible for adjustment without requiring the removal of fans, motors, or insulating materials.

E. Heat recovery ventilators and condensate lines are subject to subitems (1) and (2).

(1) The heat recovery ventilator and any condensate lines must be installed according to the manufacturer's instructions. Condensate lines must not be exposed to freezing temperature conditions.

(2) Exhaust air ducted to a heat recovery ventilator must not be from clothes dryers and kitchen range ventilators, unless specifically permitted by the manufacturer's installation instructions.

F. The fans serving the residential ventilation system must be controlled by readily accessible switches. These switches must be labeled according to item K. If the ducting for

the residential ventilation system is connected to the duct system of a forced air system, it must be controlled according to item H.

G. Residential ventilation system components must be installed to minimize noise and vibration transmission. The manufacturer's installation instructions must be followed, and materials provided by the manufacturer for this purpose must be used. In the absence of specific materials or instructions, vibration dampening materials such as rubber grommets and flexible straps must be used when connecting fans and heat exchangers to the building structure, and flexible duct connectors must be used to mitigate noise transmission.

H. Air ducts for the residential ventilation system that are connected directly to the duct system of a forced air system must be designed to circulate outdoor air to conditioned spaces.

(1) Either the residential ventilation system outdoor air duct or exhaust air duct may be connected to the forced air system, but not both.

EXCEPTION: Both may be connected to the forced air system if:

(a) controls are installed to ensure that the forced air system blower runs whenever the residential ventilation system is running; and

(b) the exhaust air duct is connected not less than three feet upstream of the outdoor air duct.

(2) Controls must be installed to ensure that whenever the residential ventilation system is running, the forced air system blower provides a minimum average hourly flow rate of 0.15 cfm per square foot of conditioned floor area.

(3) If the residential ventilation system is not designed to run whenever the forced air system is running, the residential ventilation system duct must incorporate a backflow damper to prevent flow when the residential ventilation system is off.

(4) An outdoor air connection must not be connected directly into or within ten feet of a furnace cabinet unless permitted by the manufacturer's installation instructions.

I. Outdoor air intake and exhaust components must be designed according to the Minnesota State Mechanical Code, chapter 1346. Exhaust ducts or outlets for residential ventilation systems designed for continuous operation may be installed without backdraft dampers.

J. The residential ventilation system must be installed with sufficient access for cleaning and servicing all components. Exterior air intake openings must be accessible for inspection and maintenance.

K. Labeling must be provided to notify occupants of purposes and precautions for residential ventilation system components.

(1) The outdoor air intake and exhaust air outlet must include a permanent, weather–resistant identification label which provides proper operation and maintenance instructions and a warning regarding potential problems if it becomes blocked, obstructed, or inoperative. Additional permanent labels must be affixed to all other elements of the residential ventilation system for identification for cleaning and maintenance.

(2) Heat recovery ventilators must be labeled as required in subpart 4, item C, subitem (3).

(3) Residential ventilation system controls for the people capacity required in item F must be identified with the words "VENTILATION" or "VENTILATION FAN."

L. The residential ventilation system fan powered outdoor air must not exceed the residential ventilation system fan powered exhaust air flow by more than ten percent. Air flow for balanced ventilation systems must be balanced within ten percent. Verification shall be performed by visual and physical examination of the system and must include measurement of the air flow at air intake and exhaust points with design air flow of 30 cfm and greater.

Subp. 6. **Requirements for systems.** The installation of balanced and exhaust only ventilation systems must be according to part 7672.0900, subpart 8.

Subp. 7. **Performance path.**

A. This path applies to any building for which this chapter is applicable.

B. The ventilation air capacity specified in subpart 3 must be met. Outdoor air must be delivered to each habitable room.

C. Controls must be installed to provide control to operational modes as designed. Controls must be readily accessible to building occupants and labeled to indicate their function.

D. Pressures must not be less than the negative pressure limit in subitem (1), nor greater than the positive pressure limit in subitem (2).

(1) When the people ventilation and supplemental ventilation, clothes dryer (150 cfm default), and the next largest exhausting fan are all operating, no vented combustion appliance is permitted to spill combustion products into the conditioned space longer than three minutes after start–up at both winter design and summer design conditions.

(2) When the people capacity is met, the positive pressure must not exceed five Pascals.

E. Systems must be tested and balanced. Balancing results shall be posted in an accessible location.

F. Systems must include a permanent identification label with proper operation and maintenance instructions and a warning regarding potential problems if it should become inoperative.

Statutory Authority: *MS s 16B.165; 216C.19; 216C.195*

History: *23 SR 145; 23 SR 2057*

7672.1100 SERVICE WATER HEATING.

Subpart 1. **Ice–making water supply.** Water supplies to ice–making machines and residential refrigerators must be taken from a cold water line of the water distribution system.

Subp. 2. **Efficiency requirements.** Service water heating equipment must meet the minimum efficiency requirements of chapter 7678.

Subp. 3. **Automatic controls.** Service water heating systems must be equipped with automatic temperature controls capable of adjustment from the lowest to the highest temperature settings for the intended use.

Subp. 4. **Shutdown.** A separate switch must be provided to permit turning off the energy supplied to electric service water heating systems. A separate valve must be provided to permit turning off the energy supplied to the main burners of all other types of service water heating systems.

Subp. 5. **Swimming pools and spas.**

A. All pool and spa heaters must be equipped with a readily accessible ON/OFF switch to allow shutting off the operation of the heater without adjusting the thermostat setting and to allow restarting without relighting the pilot light.

B. Indoor pool and spa area ventilating systems must be controlled with a humidistat. Additionally, heated indoor swimming pools and spas must be equipped with a cover or renewable energy sources must be capable of providing at least 50 percent of the heating energy required over an operating season.

C. Heated outdoor swimming pools and spas must either be provided with a cover or the heating system must use renewable energy sources to provide at least 70 percent of the heating energy required over an operating season.

Subp. 6. **Pump operation.** Circulating hot water systems must be equipped with automatic time switches or other controls so that the circulation pumps can be conveniently turned off when the use of hot water is not required.

Subp. 7. **Pipe insulation.**

A. Minimum pipe insulation for domestic and service water heating systems must comply with this subpart. Pipe insulation is assumed to have a k–value of 0.27. If the k–value of a product is less than 0.22, then the thickness must be adjusted to have an equivalent R–value.

(1) Pipes in conditioned spaces must have a one–half inch minimum of insulation.

(2) Pipes in unconditioned spaces must have 1–1/2 inch minimum of insulation.

(3) Pipes in contact with high conductivity material, including concrete and earth, must have a one–inch minimum of insulation.

(4) Pipe insulation is not required at support brackets. For water heaters with a draft diverter pipe, insulation is not required to be closer to the draft diverter than is recommended by the manufacturer or safety codes. Pipe insulation is not required for nonrecirculating systems where the water heater is equipped with heat traps on both the supply and return.

B. For recirculating systems, the entire pipe must be insulated.

C. For nonrecirculating systems with unfired storage tank, the first eight feet of both inlet and outlet pipes from the storage tank must be insulated. Pipes between the water heater and storage tank must be insulated.

D. For nonrecirculating systems with a water heater, both supply and return piping for water heaters must be insulated for a distance of three feet from the water heater.

Statutory Authority: *MS s 16B.165; 216C.19; 216C.195*

History: *23 SR 145; 23 SR 2057*

7672.1200 ADDITIONS, ALTERATIONS, AND REPAIRS TO EXISTING RESIDENTIAL BUILDINGS.

Subpart 1. **General.** Additions, alterations, and repairs to existing buildings classified as Group R, Division 3 Occupancies which are detached single–family or two–family dwellings must comply with the requirements of this part only. Enforcement of this part for dwellings whose permit for initial construction was applied for prior to April 15, 2000, shall not require compliance with either part 7672.0900, subpart 8, protection against depressurization, or part 7672.1000, residential ventilation system. For dwellings whose permit for initial construction was applied for on or after April 15, 2000, enforcement of this part shall require compliance with part 7672.0900, subpart 8, or 7672.1000 if the addition, alteration, or repair would require an increase in either the combustion air, ventilation air, or make–up air requirement.

Subp. 2. **Reducing air leakage.** If an addition or alteration reduces the air leakage characteristics or capacity of a building, and vented appliances are present that are not sealed, direct, or power vented and are without combustion air supply, then a combustion air supply must be provided according to the Minnesota State Building Code, chapter 1346. Alterations that will likely reduce the air leakage characteristics or capacity of a building include attic insulation, wall insulation, applying siding underlayment, or the replacement of a majority of window or door units.

EXCEPTION: A combustion air supply need not be provided where either:

A. a worst case draft test is performed according to Children, Families, and Learning Worst Case Draft Test and documentation is provided that the vented appliances continue to draft within established parameters of the worst case draft test procedure; or

B. a test is performed according to CGSB Standard 51.71, The Spillage Test, and the measured levels of house depressurization can be tolerated by the fuel burning appliances in the house.

Subp. 3. **Additions.** Compliance for an addition may be demonstrated in one of three ways:

A. the addition alone must comply with this chapter; or

B. the addition together with the entire existing building must comply with the requirements of this chapter; or

C. when taken together with the energy improvements of remodeling other components of the building as part of the same permit, the addition meets the requirements of this chapter.

Subp. 4. **Conversions.** A change in the occupancy of an existing building classified as Group R, Division 3 Occupancy which is a detached single–family or two–family dwelling which would require an increase in demand for either fossil fuel or electrical energy supply requires that the building comply with the requirements of this chapter.

EXCEPTION: Existing HVAC and service water heating equipment within an existing building is not required to be replaced.

Subp. 5. **Penetrations.** All penetrations resulting as part of an alteration must be sealed in accordance with part 7672.0600, subpart 5, item D. This includes penetrations for telecommunication wires and equipment, electrical wires and equipment, electronic wires and equipment, fire sprinklers, plumbing and ducts, and penetrations in exterior walls and ceilings.

Subp. 6. **Roof/ceilings.**

A. Ventilation requirements for alterations to roof/ceilings are given in the Minnesota State Building Code, part 1305.0010.

B. Attic insulation may not be installed unless accessible attic bypasses have been sealed.

C. A ceiling vapor retarder may be omitted if the interior ceiling finish is not removed.

D. When an uninsulated attic is finished, the insulation at the sloped ceiling cavity must not be less than R–18.

E. Alterations comprising the removal of at least 50 percent of an existing membrane or a built–up roof covering must comply with this item.

Alterations to a built–up or membrane roof covering must provide for a maximum U–value of 0.033 Btu/°F h ft^2 (R–value of R–30 or greater).

Subp. 7. **Walls.**

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

B. Reglazing and repairs to existing windows are not required to meet the additional requirements of this chapter. Replaced windows must conform to parts 7672.0600, subpart 8, 7672.0700, subpart 2, and 7672.0800, subpart 3, item A.

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

EXCEPTIONS: Walls that are back–plastered, walls that are more than 50 percent filled with insulation, and walls without framing cavities. Also excepted are small openings for purposes including installing, altering, or repairing plumbing, electrical, and mechanical systems.

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

Subp. 8. **Heating, ventilation, and air conditioning; service water heating equipment.** All equipment installed in conjunction with the alteration must comply with the equipment efficiency requirements of part 7672.0900, subpart 7, or chapter 7678.

Statutory Authority: *MS s 16B.165; 216C.19; 216C.195*

History: *23 SR 145; 23 SR 2057; L 1999 c 135 s 9*

7672.1300 EFFECTIVE DATE.

This chapter is effective April 15, 2000.

Statutory Authority: *MS s 216C.19*

History: *23 SR 145; L 1999 c 135 s 9*