CHAPTER 7676
DEPARTMENT OF COMMERCE
ENERGY CODE; OTHER BUILDINGS

BUILDINGS NOT COVERED BY CHAPTER 7672 OR 7674

7676.0100 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 remodeled elements of all buildings except one- and two-family residential and multifamily buildings of three stories or less, as well as to provide alternatives for demonstrating compliance with those minimum criteria. The intent of these criteria is to provide a means for assuring building durability and permitting energy efficient operation.

Statutory Authority: *MS s 216C.19*

History: *23 SR 145*

7676.0200 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 and remodeled elements of buildings.** This chapter applies to all new and remodeled elements of commercial and all other buildings.

Subp. 3. **Existing buildings.** Additions, alterations, and repairs to existing buildings or structures must comply with part 7676.1400.

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. If minor accessory uses occupy no more than ten percent of the area of any floor of the building, the major use is considered the building occupancy.

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.

Subp. 7. **Application to greenhouses, inflated structures, and processes requiring heat for cold weather protection.** Requirements for greenhouses, inflated structures, and processes requiring heat for cold weather protection are provided in part 7676.0900.

Subp. 8. **Other.** This chapter also applies to driveways, walkways, entrances, parking lots, and grounds.

Statutory Authority: *MS s 216C.19*

History: *23 SR 145*

7676.0300 MATERIALS, EQUIPMENT, AND SPECIFICATION.

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. design criteria;

B. exterior envelope component materials;

C. U-values of windows, doors, skylights, and opaque envelope components;

D. R-values of insulating materials;

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

F. air sealing requirements;

G. size and type of apparatus and equipment;

H. equipment and systems controls; and

I. other data needed to indicate conformance with the requirements of 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*

7676.0400 INCORPORATIONS BY REFERENCE.

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

A. ASHRAE Standard 90.1-1989, Section 13, "Building Energy Cost Budget Method";

B. ASHRAE, 1997 Handbook of Fundamentals, Chapter 28;

C. ASHRAE Standard 84-1991, Method of Testing Air-to-Air Heat Exchangers;

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

E. 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;

F. COMcheck-MN program, a computer program for energy analysis of medium to small nonresidential buildings developed by Battelle Pacific Northwest Laboratories;

G. ENVSTD, Envelope System Performance Compliance Calculation program, a computer program developed by Battelle Pacific Northwest Laboratories;

H. HVAC Air Duct Leakage Test Manual, Section 4, 1985 edition, as published by the Sheet Metal and Air Conditioning Contractors National Association, Inc., Vienna, Virginia;

I. "Lighting Efficiency Program Input Wattage Guide," Northern States Power Company, Minneapolis, MN;

J. Energy Policy Act of 1992, section 122(d), Nominal Full Load Efficiency Requirements for Motors;

K. National Electrical Manufacturers Association Standards Publication X TP 1-1996, Guide for Determining Energy Efficiency for Distribution Transformers; and

L. UL181A, Factory Made Air Ducts and Duct Connectors, 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 216C.19*

History: *23 SR 145*

7676.0500 DEFINITIONS.

Subpart 1. **Definitions.** The definitions in this part apply to this chapter. Additional terms relating to lighting requirements of this chapter are contained in part 7676.1300, subpart 2.

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. **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. 4. **Automatic.** "Automatic" means self-acting, operating by its own mechanism when actuated by some impersonal influence, for example, a change in current strength, pressure, temperature, or mechanical configuration.

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 the exterior or semiconditioned spaces.

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

Subp. 7. **Conditioned space.** "Conditioned space" means space within a building which is conditioned either directly or indirectly by an energy-using system and is capable of maintaining at least 65 degrees Fahrenheit at winter design conditions or less than 78 degrees Fahrenheit at summer design conditions identified in part 7676.1100.

Subp. 8. **Commercial parking facility.** "Commercial parking facility" means a parking garage or ramp except those used exclusively to house vehicles for public emergency, ambulance, public transit, or public utility emergency response.

Subp. 9. **Deadband.** "Deadband" means the temperature range in which no heating or cooling is used.

Subp. 10. **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. 11. **Gross wall area.** "Gross wall area" means the building envelope wall area bounding interior space from grade to the roof/ceiling assembly enclosing conditioned or semiconditioned 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. 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. **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. 14. **HVAC.** "HVAC" means heating, ventilating, and air conditioning.

Subp. 15. **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. 16. **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.

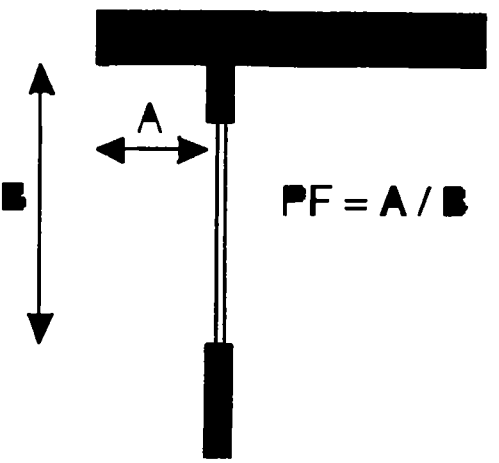
Subp. 17. **Interior air barrier.** "Interior air barrier" means a material or combination of materials which are durable and installed at the warm side of the building envelope and continuously sealed to resist the passage of air and airborne moisture from a conditioned or semiconditioned space into 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. 18. **Manual.** "Manual" means capable of being operated by personal intervention.

Subp. 19. **New energy.** "New energy" means energy, other than recovered energy, used for the purpose of heating or cooling.

Subp. 20. **Opaque areas.** "Opaque areas" means all exposed areas of a building envelope which enclose conditioned space, except openings for windows, skylights, glass in doors, and building service systems.

Subp. 21. **Projection factor or PF.** "Projection factor" or "PF" means the ratio of the horizontal depth of the external shading projection divided by the sum of the height of the fenestration and the distance from the top of the fenestration to the bottom of the furthest point of the exterior shading projection, in consistent units, as illustrated in this subpart.



Subp. 22. **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. 23. **Recooling.** "Recooling" means the removal of heat by sensible cooling of the supply air, directly or indirectly, that has been previously heated above the temperature to which the air is to be supplied to the conditioned space for proper control of the temperature of that space.

Subp. 24. **Recovered energy.** "Recovered energy" means energy used which would otherwise be wasted.

Subp. 25. **Reheat.** "Reheat" means the application of sensible heat to supply air that has been previously cooled below the temperature of the conditioned space by either mechanical refrigeration or the introduction of outdoor air to provide cooling.

Subp. 26. **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. 27. **Reset.** "Reset" means adjustment of the set point of a control instrument to a higher or lower value automatically or manually to conserve energy.

Subp. 28. **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 or semiconditioned space.

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

Subp. 29. **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. 30. **Service water heating.** "Service water heating" means the supply of hot water for domestic or commercial purposes other than space heating.

Subp. 31. **Semiconditioned space.** "Semiconditioned space" means space within a building which is conditioned either directly or indirectly by an energy-using system to have limited capability of maintaining less than 65 degrees Fahrenheit at winter design conditions or greater than 78 degrees Fahrenheit at summer design conditions, as identified in part 7676.1100, subpart 4.

Subp. 32. **Solar heat gain coefficient or SHGC.** "Solar heat gain coefficient" or "SHGC" means the ratio of the solar heat gain entering the space through the fenestration area to the incident solar radiation. Solar heat gain includes directly transmitted solar heat and absorbed solar radiation, which is then reradiated, conducted, or convected into the space. In the absence of a measured SHGC, the conversion from shading coefficient to SHGC is: SHGC = 0.870 x shading coefficient.

Subp. 33. **Thermal conductance.** "Thermal conductance" means time rate of heat flow through a body, frequently per unit area, from one of its bounding surfaces to the other for unit temperature difference between the two surfaces, under steady conditions (Btu/h ft^2 °F).

Subp. 34. **Thermal resistance or R.** "Thermal resistance" or "R" means the reciprocal of thermal conductance (h ft^2 ° F/Btu).

Subp. 35. **Thermal transmittance or U.** "Thermal transmittance" or "U" means the coefficient of heat transmission (air-to-air). It is the time rate of heat flow per unit area and unit temperature differential between the warm side and cold side of air films (Btu/h ft^2 °F).

Subp. 36. **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. 37. **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. 38. **Unconditioned space.** "Unconditioned space" means space within a building which is neither conditioned nor semiconditioned, including outdoor space and spaces within a building with uncontrolled ventilation to outdoors.

Subp. 39. **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. 40. **Warm side.** "Warm side" means the location within a building envelope element between the interior surface and the winter design condition dew point.

Subp. 41. **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.

Subp. 42. **Zone.** "Zone" means a space or group of spaces within a building with heating or cooling requirements sufficiently similar so that comfort conditions can be maintained throughout by a single controlling device. Each floor of a nonresidential building must be considered at least one separate zone.

Statutory Authority: *MS s 216C.19*

History: *23 SR 145*

7676.0600 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. Buildings must be designed and constructed to permit continuity of air barriers and thermal insulation as required in this part. Building assemblies are

required to maintain the thermal performance of installed insulation and the integrity of building materials.

B. 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, including exposed edges of slabs on grade, which enclose conditioned or semiconditioned spaces 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.

Subp. 3. **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.

EXCEPTION: This subpart shall not apply to alterations and additions.

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. 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.

D. 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.

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 prior to 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, 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.

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 prior to covering or making inaccessible so that a continuous interior air barrier is maintained. All penetrations made prior to framing inspection must be sealed prior to framing inspection.

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 an 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 and on ceilings, floor rim joist areas, and earth floors of unvented crawl spaces.

For buildings meeting the criteria of part 7676.0800 for semiconditioned buildings or buildings with high internal heat gain, or part 7676.0900 for greenhouses, inflated structures, or processes requiring heat for cold weather protection, consideration must be given to the use of a vapor retarder on the warm side of building envelope components.

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

EXCEPTION: A wind wash barrier is not required to extend greater than 24 inches above the top plate.

B. A sealed wind wash barrier must be installed at floors, overhangs, and floor rim joist areas separating conditioned 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. All 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 product installation requirements.** Minimum clearance between the rough opening framing and fenestration product frame must be maintained in accordance with the manufacturer's instructions to facilitate insulation. When

manufacturer's installation instructions require insulation between the rough opening and the 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 by the installer at the time of the fenestration product installation. The installer must also provide a durable exterior side infiltration and weather seal 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 for the building types identified in this chapter. Floor rim joist framing must have an interior air barrier on the warm side according to subpart 4 and a 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 designs 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. The insulation installer shall place identification in accordance with this subpart 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 of R-22.2 for ceiling panels and R-13 for wall panels, and must be weatherstripped.

Statutory Authority: *MS s 216C.19*

History: *23 SR 145*

7676.0700 METHODS FOR COMPLIANCE.

Subpart 1. **Scope.** All buildings except low-rise residential that are conditioned must comply with the requirements of subpart 3 and subpart 5, 6, 7, 8, or 9.

Subp. 2. **Calculations.** Calculation of component thermal transmittance (U-values) and overall thermal transmittance values (U_o-values) must be according to chapter 7678.

Subp. 3. **Minimum requirements.** Fenestration products (windows, doors, and skylights) must have air infiltration rates not exceeding those listed in part 7678.0600. Fenestration thermal performance must be determined according to part 7678.0600.

Subp. 4. **Total heat gain or loss for entire building.** The value of U_o for any assembly such as roof/ceiling, wall, or floor may be increased and traded off by decreasing the value of U_o 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_o specified in this part.

Subp. 5. **Building component performance method.** Compliance with this subpart may be demonstrated for buildings where no more than 75 percent of the window area is on one side of the building. The maximum window area as a percentage of exposed wall must not exceed the values given in item A or B using the overall thermal transmittance of the opaque wall, the average thermal transmittance of the windows, and the average SHGC of the windows. Interpolations to intermediate values are permitted. Extrapolations beyond the values found in the tables shall not be permitted. The minimum criteria specified in part 7676.0600 must be met.

A. Buildings located in Zone I, northern Minnesota, as defined in part 1305.5400, must comply with this item. The combined thermal transmittance factor (U_o) for the roof/ceiling must not exceed 0.040 Btu/h ft² °F.

Maximum Window Area Zone I - Northern Minnesota

Window U-value =	0.3	0.4	0.5	0.6
Opaque Wall U = 0.06				
SHGC 0.7	32%	27%	23%	20%
SHGC 0.5	39%	30%	25%	20%
SHGC 0.3	45%	33%	26%	22%
Opaque Wall U = 0.07				
SHGC 0.7	30%	26%	22%	18%
SHGC 0.5	37%	29%	23%	19%
SHGC 0.3	43%	31%	24%	20%
Opaque Wall U = 0.08				
SHGC 0.7	29%	24%	20%	17%
SHGC 0.5	35%	27%	21%	17%
SHGC 0.3	41%	29%	22%	18%
Opaque Wall U = 0.09				
SHGC 0.7	27%	22%	18%	15%
SHGC 0.5	33%	24%	19%	16%
SHGC 0.3	38%	26%	20%	16%

B. Buildings located in Zone II, southern Minnesota, as defined in part 1305.5400, must comply with this item. The combined thermal transmittance factor (U_o) for the roof/ceiling must not exceed 0.045 Btu/h ft² °F.

Maximum Window Area Zone II - Southern Minnesota

Window U-value =	0.3	0.4	0.5	0.6
Opaque Wall U = 0.06				
SHGC 0.7	23%	22%	20%	18%
SHGC 0.5	32%	28%	25%	22%
SHGC 0.3	44%	35%	30%	26%
Opaque Wall U = 0.07				
SHGC 0.7	23%	21%	19%	18%
SHGC 0.5	30%	26%	24%	20%
SHGC 0.3	43%	35%	29%	24%
Opaque Wall U = 0.08				
SHGC 0.7	22%	20%	18%	16%
SHGC 0.5	29%	25%	22%	20%
SHGC 0.3	41%	33%	27%	23%
Opaque Wall U = 0.09				
SHGC 0.7	21%	19%	17%	16%
SHGC 0.5	28%	24%	21%	19%
SHGC 0.3	39%	31%	25%	22%

Subp. 6. **ENVSTD performance method.**

A. The envelope criteria for buildings located anywhere in Minnesota may be determined by the Envelope System Performance Compliance Calculation (ENVSTD) program. The minimum criteria specified in part 7676.0600 must be met. If equipment power density values for the building types listed in item B are unknown, the default values in item B shall be used.

B. Default values for ENVSTD:

Building Type	Equipment Power Density
Assembly	0.25
Health and Institutional	1.00
Hotel and Motel	0.25
Multifamiy High-rise	0.75
Office	0.75
Restaurant	0.10
Retail	0.25
School	0.50
Warehouse and Storage	0.10

Subp. 7. **COMcheck-MN performance method for small buildings.** Buildings of 30,000 square feet gross floor area and less are deemed to comply with this part if the thermal envelope passes the COMcheck-MN program. The minimum criteria specified in part 7676.0600 must be met.

Subp. 8. ***Prescriptive method for small buildings.*** Buildings of 30,000 square feet gross floor area and less shall be deemed to meet the requirements of this subpart if

the thermal envelope meets the criteria of item A or B. The minimum criteria specified in part 7676.0600 must be met. "CMU" means concrete masonry unit and "PF" means the average projection factor for the building. "Cavity insulation" means insulation between framing members or furring strips and does not refer to integral insulation in CMUs. "Continuous insulation" means insulation which is installed continuously across structural members with its effectiveness undiminished by compression or bridging, except for fasteners.

A. Buildings located in Zone I, northern Minnesota, as defined in part 1305.5400, must comply with this item.

(1) Window area ten percent or less of above-grade wall area:

Window Area 10% or Less of Above-Grade Wall Area

Element		Conditions		
Above-Grade Walls	No Framing	Metal Framing		Wood Framing
Framed	NA	Cavity: R-13 Continuous: R-3		Cavity: R-13 Continuous: R-0
CMU, ≥8 in. with integral insulation	R-6 Continuous	Cavity: R-13 Continuous: R-0		Cavity: R-11 Continuous: R-0
Other masonry walls	R-6 Continuous	Cavity: R-13 Continuous: R-0		Cavity: R-11 Continuous: R-0
Window assemblies		PF<0.25	0.25≤PF<0.50	PF≥0.50
	SHGC	0.7	Any	Any
	U-value	0.5	0.5	0.5
Skylights	U-value		0.6	

Roof Assemblies	Insulation Between Framing	Continuous Insulation
All-wood joist/truss	R-30	R-23
Nonwood joist/truss	R-30	R-24
Concrete slab or deck	NA	R-23
Metal purlin with thermal break	X	R-24
Metal purlin without thermal break	X	R-24

Floor Assemblies	Insulation Between Framing	Continuous Insulation
All-wood joist/truss	R-25	R-22
Nonwood joist/truss	R-30	R-23
Concrete slab or deck	NA	R-22

Slab or below-grade wall	R-8

(2) Window area over ten percent but not greater than 25 percent of above-grade wall area:

Window Area Over 10% But Not Greater Than 25% Of Above-Grade Wall Area

Element		Conditions		
Above-Grade Walls	No Framing	Metal Framing		Wood Framing
Framed	NA	Cavity: R-13 Continuous: R-3		Cavity: R-13 Continuous: R-0
CMU, ≥8 in. with integral insulation	R-6 Continuous	Cavity: R-13 Continuous: R-0		Cavity: R-11 Continuous: R-0
Other masonry walls	R-9 Continuous	Cavity: R-13 Continuous: R-3		Cavity: R-13 Continuous: R-0
Window assemblies		PF<0.25	0.25≤PF<0.50	PF≥0.50
	SHGC	0.7	Any	Any
	U-value	0.4	0.4	0.4
Skylights	U-value		0.6	

Roof Assemblies	Insulation Between Framing	Continuous Insulation
All-wood joist/truss	R-30	R-23
Nonwood joist/truss	R-30	R-24
Concrete slab or deck	NA	R-23
Metal purlin with thermal break	X	R-24
Metal purlin without thermal break	X	R-24

Floor Assemblies	Insulation Between Framing	Continuous Insulation
All-wood joist/truss	R-25	R-22
Nonwood joist/truss	R-30	R-23
Concrete slab or deck	NA	R-22

Slab or below-grade wall R-8

(3) Window area over 25 percent but not greater than 40 percent above-grade wall area:

Window Area Over 25% But Not Greater Than 40% Of Above-Grade Wall Area

Element		Conditions	
Above-Grade	No Framing	Metal	Wood

Walls		Framing	Framing
Framed	NA	Cavity: R-13 Continuous: R-4	Cavity: R-13 Continuous: R-3
CMU, ≥8 in. with integral insulation	R-10 Continuous	Cavity: R-13 Continuous: R-4	Cavity: R-11 Continuous: R-3
Other masonry walls	R-10 Continuous	Cavity: R-13 Continuous: R-4	Cavity: R-13 Continuous: R-3

Window assemblies		PF<0.25	0.25≤PF<0.50	PF≥0.50
	SHGC	0.7	Any	Any
	U-value	0.4	0.4	0.4

Skylights	U-value	0.6

Roof Assemblies	Insulation Between Framing	Continuous Insulation
All-wood joist/truss	R-30	R-23
Nonwood joist/truss	R-30	R-24
Concrete slab or deck	NA	R-23
Metal purlin with thermal break	X	R-24
Metal purlin without thermal break	X	R-24

Floor Assemblies	Insulation Between Framing	Continuous Insulation
All-wood joist/truss	R-25	R-22
Nonwood joist/truss	R-30	R-23
Concrete slab or deck	NA	R-22

Slab or below-grade wall	R-8

B. Buildings located in Zone II, southern Minnesota, as defined in part 1305.5400, must comply with this item.

(1) Window area ten percent or less of above-grade wall area:

Window Area 10% or Less of Above-Grade Wall Area

Element		Conditions	
Above-Grade Walls	No Framing	Metal Framing	Wood Framing
Framed	NA	Cavity: R-13 Continuous: R-3	Cavity: R-11 Continuous: R-0
CMU, ≥8 in. with integral insulation	R-5 Continuous	Cavity: R-11 Continuous: R-0	Cavity: R-11 Continuous: R-0

Other masonry walls	R-5 Continuous	Cavity: R-11 Continuous: R-0		Cavity: R-11 Continuous: R-0
Window assemblies		PF<0.25	0.25≤PF<0.50	PF≥0.50
	SHGC	0.7	Any	Any
	U-value	0.6	0.6	0.6
Skylights	U-value		0.6	

Roof Assemblies	Insulation Between Framing	Continuous Insulation
All-wood joist/truss	R-25	R-19
Nonwood joist/truss	R-25	R-20
Concrete slab or deck	NA	R-19
Metal purlin with thermal break	R-30	R-20
Metal purlin without thermal break	X	R-20

Floor Assemblies	Insulation Between Framing	Continuous Insulation
All-wood joist/truss	R-25	R-22
Nonwood joist/truss	R-30	R-23
Concrete slab or deck	NA	R-22

Slab or below-grade wall R-8

(2) Window area over ten percent but not greater than 25 percent of above-grade wall area:

Window Area Over 10% But Not Greater Than 25% Of Above-Grade Wall Area

Element		Conditions		
Above-Grade Walls	No Framing	Metal Framing		Wood Framing
Framed	NA	Cavity: R-13 Continuous: R-3		Cavity: R-11 Continuous: R-0
CMU, ≥8 in. with integral insulation	R-5 Continuous	Cavity: R-11 Continuous: R-0		Cavity: R-11 Continuous: R-0
Other masonry walls	R-9 Continuous	Cavity: R-13 Continuous: R-3		Cavity: R-11 Continuous: R-0
Window assemblies		PF<0.25	0.25≤PF<0.50	PF≥0.50
	SHGC	0.7	Any	Any
	U-value	0.5	0.5	0.5

Skylights	U-value	0.6

Roof Assemblies	Insulation Between Framing	Continuous Insulation
All-wood joist/truss	R-30	R-23
Nonwood joist/truss	R-30	R-24
Concrete slab or deck	NA	R-23
Metal purlin with thermal break	X	R-24
Metal purlin without thermal break	X	R-24

Floor Assemblies	Insulation Between Framing	Continuous Insulation
All-wood joist/truss	R-25	R-22
Nonwood joist/truss	R-30	R-23
Concrete slab or deck	NA	R-22

Slab or below-grade wall	R-8

(3) Window area over 25 percent but not greater than 40 percent of above-grade wall area:

Window Area Over 25% But Not Greater Than 40% Of Above-Grade Wall Area

Element		Conditions	
Above-Grade Walls	No Framing	Metal Framing	Wood Framing
Framed	NA	Cavity: R-13 Continuous: R-3	Cavity: R-11 Continuous: R-0
CMU, ≥8 in. with integral insulation	R-5 Continuous	Cavity: R-13 Continuous: R-0	Cavity: R-11 Continuous: R-0
Other masonry walls	R-9 Continuous	Cavity: R-13 Continuous: R-3	Cavity: R-13 Continuous: R-0

Window assemblies		PF<0.25	0.25≤PF<0.50	PF≥0.50
	SHGC	0.5	0.6	0.7
	U-value	0.4	0.4	0.4

Skylights	U-value	0.6

Roof Assemblies	Insulation Between Framing	Continuous Insulation
All-wood joist/truss	R-30	R-23

Nonwood joist/truss	R-30	R-24
Concrete slab or deck	NA	R-23
Metal purlin with thermal break	X	R-24
Metal purlin without thermal break	X	R-24

Floor Assemblies	Insulation Between Framing	Continuous Insulation
All-wood joist/truss	R-25	R-22
Nonwood joist/truss	R-30	R-23
Concrete slab or deck	NA	R-22

Slab or below-grade wall	R-8

Subp. 9. **Building design by systems analysis method.**

A. Building design by systems analysis must comply with this subpart. The intent of this subpart is to allow flexibility in the design process while ensuring that the annual energy quantity or energy cost of a proposed design is no more than that allowed under the prescriptive path.

(1) A design by systems analysis consists of a comparison of the annual energy or energy cost of the proposed design with the annual energy or energy cost of a prescriptive design.

(2) 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 and meet the requirements of chapter 7678 for the comparative analysis.

(3) Analysis procedures requiring annual average weather data must use the most recently published 30-year average annual heating and cooling data for the nearest location.

B. Design by systems analysis for buildings of 5,000 square feet and less of conditioned or semiconditioned floor area must use either this item or item C.

Adjustment must be made for a proposed heating or cooling system (Eff, proposed) exceeding the efficiency requirements of chapter 7678 (Eff, minimum) in accordance with this subitem. The proposed opaque envelope components' overall thermal transmittance must be adjusted (U_o, adjusted) by modifying the standard required thermal transmittance (U_o, standard) according to the equation in this subitem. For heating systems more efficient than the minimum required, the P used in the equation must be 1.20. For cooling systems more efficient than the minimum required, the P used in the equation must be 0.02.

U_o, adjusted = U_o, standard x (1 + P x (Eff, proposed - Eff, minimum)/(Eff, minimum)).

C. Design by systems analysis for buildings greater than 5,000 square feet of conditioned or semiconditioned floor area must use this item. The design by systems analysis must be prepared by an engineer or architect licensed to practice in Minnesota. The design by systems analysis must comply with:

(1) calculation of the 8,760 hour (one-year) analysis using annual average weather data for the location closest to the building site; or

(2) the energy cost budget method using ASHRAE 90.1-1989, Section 13, amended by replacing references to sections 5 to 12 with parts 7676.0600 to 7676.1000.

Subp. 10. **Daylight credits for skylights.** Skylights used in conjunction with automatic lighting controls may be excluded from the calculation of roof U_o-value when the requirements of this subpart are met.

A. Automatic daylighting controls must be installed to control all of the luminaires in the daylighted area. Controls must be capable of reducing lighting power to 50 percent of full power when adequate daylight is available. The daylighting area is the floor area beneath the skylight and 45 degrees in all directions from the edges of the skylight. Daylighted areas from two or more skylights that overlap cannot be counted twice.

B. Skylights must have a U-value not greater than 0.45. The skylight curb must have a U-value of 0.21 or less. Skylight infiltration must be 0.05 cfm per foot of crack or less under standard test conditions.

C. The maximum skylight area that may be excluded from the calculation of roof U_o-value calculation is the percentage of the total roof area given in this item. If the skylights are shaded so as to block more than 50 percent of the sunlight during the peak cooling design condition, the excluded skylight area may be increased by 50 percent.

(1) Maximum skylight area that may be excluded as a percentage of total roof area for skylight glazing visible light transmission of 0.75:

	Range of Lighting Power Density, (W/ft²)			
Light level, fc	less than 1.0	1.01 to 1.50	1.51 to 2.0	above 2.0
30	2.3	3.4	4.5	5.6
50	2.5	4.0	5.5	7.0
70	2.8	4.6	6.4	8.2

(2) Maximum skylight area that may be excluded as a percentage of total roof area for skylight glazing visible light transmission of 0.50:

	Range of Lighting Power Density, (W/ft²)			
Light level, fc	less than 1.0	1.01 to 1.50	1.51 to 2.0	above 2.0
30	3.6	5.1	6.6	8.1
50	3.9	6.0	8.1	10.2
70	4.2	6.9	9.6	12.3

Statutory Authority: *MS s 216C.19*

History: *23 SR 145*

7676.0800 COMPLIANCE CRITERIA FOR SEMICONDITIONED BUILDINGS OR PORTIONS OF BUILDINGS.

Subpart 1. **Scope.** Semiconditioned buildings and buildings classified in the 1994 UBC as "F" or "S" occupancies must comply with this part. Speculative buildings where it is not known whether the building will be conditioned or semiconditioned must meet the requirements for conditioned buildings in part 7676.0600.

Subp. 2. **Criteria.** The combined thermal transmittance U_o-values must not exceed:

A. 0.23 Btu/h ft² °F for walls;

B. 0.060 Btu/h ft² °F for roof/ceilings;

C. 0.040 Btu/h ft² °F for floors over unconditioned spaces;

D. slab on grade insulation to design frost depth of not less than R-5; and

E. the minimum criteria specified in part 7676.0600.

Statutory Authority: *MS s 216C.19*

History: *23 SR 145*

7676.0900 COMPLIANCE CRITERIA FOR GREENHOUSES, INFLATED STRUCTURES, AND PROCESSES REQUIRING HEAT FOR COLD WEATHER PROTECTION.

Subpart 1. **Greenhouse and inflated structures.** The glazing and fabric elements for greenhouses and inflated structures, respectively, and processes requiring heat for cold weather protection, are exempt from the envelope requirements of this chapter, provided the requirements of this subpart are met.

A. The minimum requirements of this chapter for slab on grade floors, foundation walls, floors over unconditioned spaces, HVAC systems and equipment, service water heating, and lighting and electrical apply.

B. All energy conserving measures with a ten-year and less simple payback must be done to all elements of the building.

C. Greenhouses must incorporate a thermal screen to retard nighttime heat loss through the roof.

Subp. 2. **Processes requiring heat for cold weather protection.** Processes requiring heat for cold weather protection must be enclosed with thermal protection meeting the requirements of this part unless it is demonstrated that there would not be a ten-year simple payback considering the cost of enclosing the process with thermal protection and the resulting energy savings.

EXCEPTION: Industrial processes.

Statutory Authority: *MS s 216C.19*

History: *23 SR 145*

7676.1000 COMPLIANCE CRITERIA FOR METAL BUILDINGS.

Subpart 1. **Scope.** Envelope components of metal buildings constructed with purlins or girts must comply with this part.

Subp. 2. **Thermal performance.** Thermal performance of building components must be in accordance with part 7676.0700, 7676.0800, or 7676.0900 as appropriate. Thermal transmittance of walls and roofs must be determined in accordance with part 7678.0500, subpart 6.

Subp. 3. **Girts.** Girts must be separated from interior wall finish by a thermal break. The thermal break must be not less than one-inch foam block or compressed mineral fiber insulation. Foam blocks must be a minimum R-value of 5 (2 pound density).

Subp. 4. **Thermal insulation.** Thermal insulation must be protected by an interior air barrier and vapor retarder. Seams must be sealed with nonrubberized sealant or tape, compatible with the interior air barrier and vapor retarder materials.

Statutory Authority: *MS s 216C.19*

History: *23 SR 145*

7676.1100 BUILDING MECHANICAL SYSTEMS.

Subpart 1. **General.**

A. Building mechanical systems must be designed and constructed in accordance with this part. Standards and definitions for building mechanical systems, including, but not limited to, service systems, sequence, system, thermostat, terminal element, and zone, are located in Code of Federal Regulations, title 10, parts 430 and 435, Energy Conservation Standards for Consumer Products and Energy Conservation Voluntary Performance Standards for new buildings.

B. EXCEPTIONS: Special applications, including, but not limited to, hospitals, laboratories, thermally sensitive equipment rooms, computer rooms, and facilities with open refrigerated display cases may be exempt from certain requirements of this part when approved by the building official.

C. Other design temperatures may be used for equipment selection if it results in a lower energy usage. Other design parameters may be used, such as a reduction in pipe insulation or not using setback controls, if it does not increase building energy use.

Subp. 2. **Prohibition of heated commercial parking garages.** A new enclosed structure or portion of an enclosed structure used primarily as a commercial parking facility for three or more motor vehicles may not be heated. Incidental heating resulting from building exhaust air passing through a parking facility is not prohibited if substantially all useful heat previously has been removed from the air.

EXCEPTION: Parking facilities that are appurtenant to dwelling unit occupancies.

Subp. 3. **Design conditions and calculation procedures.**

A. The exterior design temperature must be selected from this subpart. Design condition adjustments may be made as determined by the building official to reflect local climates which differ from the tabulated temperatures or local weather experience.

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

B. Indoor design temperature must be 72 degrees Fahrenheit for heating and 74 degrees Fahrenheit for cooling.

C. Heating and cooling system design loads for the purpose of sizing systems and equipment must be determined in accordance with the procedures described in ASHRAE Handbook of Fundamentals, chapter 28.

D. Design loads may, at the designer's option, be increased by as much as ten percent to account for unexpected loads or changes in space usage.

E. Transient loads such as warm-up or cool-down loads that occur after off-hours setback or shutoff may be calculated from principles based on the heat capacity of the building and its contents, the degree of setback, and the desired recovery time; or may be assumed to be up to 30 percent for heating and ten percent for cooling of the steady-state design loads. The steady-state load may include a safety factor according to item D.

Subp. 4. **System and equipment sizing.**

A. HVAC systems and equipment must be sized to provide no more than the space and system loads calculated in accordance with subpart 3.

B. EXCEPTIONS:

(1) Equipment capacity may exceed the design load if the equipment selected is the smallest size needed to meet the load within available options of the desired equipment line.

(2) Equipment whose capacity exceeds the design load may be specified if oversizing the equipment can be shown to not increase the overall annual energy costs.

(3) Standby equipment may be installed if controls and devices are provided that allow standby equipment to operate automatically only when the primary equipment is not operating.

(4) Multiple units of the same equipment type such as multiple chillers and boilers, with combined capacities exceeding the design load, may be specified to operate concurrently only if controls are provided that sequence or otherwise optimally control the operation of each unit based on load.

(5) For a single piece of equipment that has both heating and cooling capability, only one function, either the heating or the cooling, need meet the requirements of this part. Capacity for the other function must be, within available equipment options, the smallest size necessary to meet the load. For equipment efficiencies, see chapter 7678.

Subp. 5. **Alternate procedure for simple HVAC systems.**

A. HVAC systems may use the simplified procedure if:

(1) the system serves a single HVAC zone;

(2) the cooling capacity supplied by the system is less than or equal to 65,000 Btu/h;

(3) no HVAC equipment is water-cooled; and

(4) the HVAC system is not hydronic.

B. If system fan power is greater than ten horsepower, the system must comply with subpart 9, or if pump power is greater than ten horsepower, the system must comply with subpart 10.

C. Controls must be provided according to this item.

(1) The system must be controlled by a manual or automatic change-over or dual set-point thermostat.

(2) Heat pumps must be controlled as required in subpart 7.

(3) All controls must be tested to ensure that control elements are calibrated, adjusted, and in proper working condition.

D. Outdoor air intakes and exhausts must have dampers in accordance with subpart 8.

E. Ducts must be insulated and constructed in accordance with subparts 15 and 16, respectively. Pipes must be insulated according to subpart 17.

F. Testing and balancing must be performed according to this item.

(1) Construction documents must require the system to be air balanced in accordance with industry-accepted procedures to within ten percent of specified volume.

(2) If the system contains a fan motor greater than one horsepower, fan speed must be adjusted to meet design air system flow.

(3) All controls must be tested to ensure that control elements are calibrated, adjusted, and in proper working condition.

G. An operation manual must be provided according to subpart 18.

H. HVAC equipment must meet the requirements of part 7678.0700.

Subp. 6. **Simultaneous heating and cooling.**

A. Use of simultaneous heating and cooling by reheating or recooling supply air or by concurrent operation of independent heating and cooling systems serving a common zone must be restricted according to items B to D.

B. Recovered energy in excess of the new energy expended in the recovery process may be used for control of temperature and humidity.

C. New energy may be used to prevent relative humidity from rising above 60 percent for comfort control or to prevent condensation on terminal units or outlets, or functioning of special equipment.

D. New energy may be used for temperature control if minimized in accordance with this item.

(1) Systems employing reheat and serving multiple zones, other than those employing variable air volume for temperature control, must be provided with a control that will automatically reset the system cold-air supply to the highest temperature level that will satisfy the zone requiring the highest cooling load.

(2) Single-zone reheat systems must be controlled to sequence reheat and cooling.

(3) Dual duct and multizone systems, other than those employing variable air volume for temperature control, must be provided with a control that will automatically reset:

(a) the cold-deck air supply to the highest temperature that will satisfy the zone requiring the highest cooling load; and

(b) the hot-deck air supply to the lowest temperature that will satisfy the zone requiring the highest heating load.

(4) Systems in which heated air is recooled, directly or indirectly, to maintain space temperature must be provided with a control that will automatically reset the temperature to which the supply air is heated to the lowest level that will satisfy the zone requiring the highest heating load.

(5) For systems with multiple zones, one or more zones may be chosen to represent a number of zones with similar heating and cooling characteristics. A multiple zone system that employs reheating or recooling for control of not more than 5,000 cfm, or 20 percent of the total supply air of the system, whichever is less, is exempt from the supply air temperature reset requirements in subitems (1) to (4).

(6) Concurrent operation of independent heating and cooling systems serving common spaces and requiring the use of new energy for heating or cooling must be minimized by:

(a) providing sequential temperature control of both heating and cooling capacity in each zone; or

(b) limiting the heat energy input through automatic reset control of the heating medium temperature, or energy input rate, to only that necessary to offset heat loss due to transmission and infiltration and, where applicable, to heat the ventilation air supply to the space.

Subp. 7. **Heat pumps.**

A. 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.

B. 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, must be accepted as meeting this requirement. The cut-on temperature for the compression heating must be higher than the cut-on temperature for the supplementary heat.

Subp. 8. **Mechanical ventilation.**

A. Ventilation systems must be designed according to the Minnesota State Mechanical Code, chapter 1346. Ventilation quantities must be according to ASHRAE Standard 62, adopted by chapter 1305.

B. Both supply and exhaust ducts of mechanical ventilation systems must be equipped with controls that permit shutoff or volume reduction and shutoff when ventilation is not required. Automatic or gravity dampers that close when the system is not operating must be provided for outdoor air intakes and exhausts. Automatic or manual dampers installed for the purpose of shutting off ventilation systems must be designed with tight shutoff characteristics to minimize air leakage.

EXCEPTIONS: Manual dampers for outdoor air intakes may be used for multi-family residential buildings, and if the fan system capacity is less than 2,500 cfm. Dampers are not required when the ventilation system is designed for continuous operation.

Subp. 9. **Fan system design criteria.** Total fan power must be no greater than specified in this subpart.

EXCEPTIONS: HVAC systems where the total fan power is ten horsepower or less; unitary equipment for which the energy used by the fan is considered in the efficiency ratings of the equipment; or that portion of fan power required by air treatment and filtration systems which is in excess of one inch of water column.

A. The power required by motors of constant air volume fan systems must not exceed 0.8 W/cfm of supply air at design conditions.

B. The power required by motors of variable air volume fan systems must not exceed 1.25 W/cfm of supply air at design conditions.

C. Variable air volume fans with motors 7-1/2 horsepower and larger must provide controls for the fan motor to demand no more than 50 percent of design wattage at 50 percent of design air volume, based on the manufacturer's test data.

Subp. 10. **Piping system design criteria.** Piping systems must be designed according to this subpart.

EXCEPTION: If the total pump system motor power to supply fluid from the heating and cooling source to the conditioned spaces or heat transfer devices and return it back to the source is ten horsepower or less at design conditions.

A. Piping systems must be designed at a friction pressure loss rate of no more than 4.0 feet of water per 100 equivalent feet of pipe where a C-factor of 125 is used.

B. Pumping systems serving control valves designed to modulate or step open and closed as a function of load must be designed for variable fluid flow. The system must be capable of reducing system flow to 50 percent of design flow or less by either variable speed driven pumps or staged multiple pumps.

EXCEPTIONS:

(1) systems where a minimum flow greater than 50 percent of the design flow is required for the proper operation of equipment served by the system, such as chiller loops;

(2) systems that serve no more than one control valve; and

(3) systems that include supply temperature reset controls according to subpart 11.

Subp. 11. **System temperature reset controls.** HVAC systems supplying multiple zones must include controls to automatically reset supply air or water temperatures by representative building loads or by outside air temperature.

A. Air systems controls must be able to reset temperature by at least 25 percent of the design supply-to-return air or water temperature difference. Air system controls for zones which are expected to experience relatively constant loads, such as interior zones, must be designed for the fully reset supply temperature.

EXCEPTIONS:

(1) if at least 75 percent of the energy for reheating or providing warm air in the mixing system is provided by a renewable energy source;

(2) if humidity levels required to satisfy special needs cannot be met while complying with this item; or

(3) if the design supply air quantity is 300 cfm or less.

B. Hydronic systems must have controls to reset temperature by at least 50 percent of the design supply-to-return air or water temperature difference.

EXCEPTIONS:

(1) systems with variable flow pumping according to subpart 10, item B, if none of the exceptions are used;

(2) systems for which temperature reset cannot be implemented without causing improper operation of heating, cooling, humidification, or dehumidification systems; or

(3) systems with less than 600,000 Btu/h capacity.

Subp. 12. **Balancing.** Means must be provided to balance air and water systems according to this part.

A. Air systems must be balanced. Fan speed must be adjusted to meet design air system flow.

EXCEPTIONS: Speed adjustment is not required for air system balancing with fan motors of one horsepower or less, or if throttling results in no greater than one-third horsepower fan power draw above that required if the fan speed were adjusted.

B. Hydronic systems must be balanced. Pump impellers must be trimmed or pump speed must be adjusted to meet design system flow.

EXCEPTION: Impeller trimming or speed adjustment is not required for hydronic system balancing with pump motors of ten horsepower or less.

C. Systems balancing reports must be submitted to the building owner.

Subp. 13. **Economizer cycle.**

A. For HVAC systems with fan capacity of greater than 3,000 cfm and less than 5,000 cfm, each fan system must be designed to use up to and including 50 percent of the fan system capacity for cooling with outdoor air automatically whenever its use will result in lower usage of new energy.

B. For HVAC systems with fan capacity of 5,000 cfm or more, each fan system must be designed to use up to and including 85 percent of the fan system capacity for cooling with outdoor air automatically whenever its use will result in lower usage of new energy.

EXCEPTION: If the use of 85 percent outside air will cause coil frosting, the quantity of outside air may be limited to less than 85 percent by automatic controls.

C. Activation of the economizer cycle must be controlled by sensing outdoor air enthalpy or outdoor air dry bulb temperature.

D. EXCEPTIONS: Cooling with outdoor air is not required if:

(1) the use of outdoor air cooling may affect the operation of other systems so as to increase the overall energy consumption of the building;

(2) energy recovered from an internal/external zone heat recovery system exceeds the energy conserved by outdoor air cooling on an annual basis;

(3) the quality of the outdoor air is so poor as to require extensive treatment of the air; or

(4) the need for humidification or dehumidification requires the use of more energy than is conserved by the outdoor air cooling on an annual basis.

Subp. 14. **Controls.**

A. Each system must be provided with at least one temperature control system, either an adjustable thermostat or control system output-space temperature sensor input.

(1) Each thermostat must be capable of being set by adjustment or selection of sensors as follows:

(a) when used to control heating only, it must be capable of being set from 55 to 75 degrees Fahrenheit;

(b) when used to control cooling only, it must be capable of being set from 70 to 85 degrees Fahrenheit; or

(c) when used to control both heating and cooling, it 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. The temperature control system must have an adjustable deadband of at least ten degrees Fahrenheit.

(2) The temperature control system must be capable of shutting off or reducing the energy use. Lowering thermostat set points to reduce energy consumption of heating systems must not cause energy to be expended to reach the reduced setting.

(a) In residential dwelling units, each thermostat must provide a readily accessible manual or automatic means for reducing the temperature.

(b) In other than residential dwelling units, each HVAC system must be capable of automatic setback during periods of nonuse.

EXCEPTIONS: Automatic setback is not required for systems serving areas expected to operate continuously; or where equipment with full load demands of two kW (6826 Btu/h) or less is controlled by readily accessible manual ON/OFF controls.

B. This item sets criteria for humidity control.

(1) A humidity control system must be provided if a system is equipped with a means for adding moisture to maintain specific selected relative humidities in spaces or zones.

(2) A humidity control system must be provided to control ventilating systems serving the pool and spa areas.

(3) Humidity control systems must be capable of being set to prevent new energy from being used to produce space-relative humidity above 30 percent. If a humidistat is used in a system for controlling moisture removal to maintain specific selected relative humidities in spaces or zones, it must be capable of being set to prevent new energy from being used to produce a space-relative humidity of less than 60 percent.

EXCEPTION: Special occupancies requiring different relative humidities.

C. Temperature control systems must be provided for each separate HVAC system or zone. For all buildings except low-rise residential, at least one temperature control system must be provided for each separate system and each separate zone. In a multistory building where the perimeter system offsets only the transmission losses of the exterior wall, an entire side of uniform exposure may be zoned separately.

D. Systems that serve zones which can be expected to operate nonsimultaneously for more than 750 hours per year shall include isolation devices and controls to shut off or set back the supply of heating and cooling to each zone independently. Zones may be grouped into a single isolation area, provided that the total conditioned floor area does not exceed 25,000 square feet per group or include more than one floor.

EXCEPTION: Isolation is not required for zones expected to operate continuously or expected to be inoperative only when all other zones are inoperative.

E. HVAC control systems must be tested to ensure that control elements are calibrated, adjusted, and in proper working condition.

Subp. 15. **Duct insulation.** Ducts must be insulated according to this subpart.

Minimum Required Duct Insulation (see table notes for letter and number interpretations)

Duct Location	Cooling Only or Heating and Cooling	Heating Only
Exterior of building, attics, garages, and ventilated crawl spaces	C, V, and W	C and W
Inside of building and in unconditioned spaces[1] TD less than or equal to 15°F	None required	None required
TD greater than 15°F and less than or equal to 40°F	A and V	A
TD greater than 40°F	B and V	B
Within conditioned space or in basements with insulated walls	None required	None required
Intake and exhaust ducts[2]	A and V	A and V
Within cement slab or within ground	B	B

NOTES:

A. [1]Duct insulation is not required at the following locations:

(1) ceilings which form plenums; and

(2) for that portion of the duct which is located within a wall or a floor-ceiling space with conditioned space on the bottom and sides.

B. [2]Exhaust ducts within a heated space must be insulated for a distance of three feet from the duct outlet.

C. A = a material with installed minimum thermal resistance of R-3.3.

Examples:

(1) 1.5-inch, 0.60 lb/cu ft mineral fiber, slag, or fiberglass blankets;

(2) one-inch, 1.5 to 3.0 lb/cu ft mineral fiber blanket duct liner; and

(3) one-inch, 3.0 to 10.0 lb/cu ft mineral fiber board.

D. B = a material with installed minimum thermal resistance of R-5.0. Insulation encased in cement or within ground must be approved for that application and be installed on the bottom and sides of plenums.

Examples:

(1) 2.5-inch, 0.60 lb/cu ft mineral fiber, slag, or fiberglass blankets;

(2) 1.5-inch, 1.5 to 3.0 lb/cu ft mineral fiber blanket duct liner;

(3) 1.5-inch, 3.0 to 10.0 lb/cu ft mineral fiber board; and

(4) one-inch, 1.35 lb/cu ft extruded polystyrene board.

E. C = a material with installed minimum thermal resistance of R-8.0

Examples:

(1) four-inch, 0.60 lb/cu ft mineral fiber, slag, or fiberglass blankets;

(2) two-inch, 1.5 to 3.0 lb/cu ft mineral fiber blanket duct liner; and

(3) two-inch, 3.0 to 10.0 lb/cu ft mineral fiber board.

The example of materials listed under each type is not meant to limit other available thickness or density combinations with the equivalent installed resistance based on the insulation only.

F. TD = the design temperature differential between the air in the duct and the ambient temperature outside of the duct.

G. V = vapor retarder with all joints sealed.

H. W = approved weatherproof barrier.

Subp. 16. **Duct construction.** Ductwork installation requirements are provided in the Minnesota State Mechanical Code, chapter 1346. Ducts outside of the interior air barrier must be sealed with a product meeting UL181 or equivalent.

Subp. 17. **Pipe insulation.**

A. Piping installed to service buildings and within buildings must be thermally insulated according to this subpart. For service water heating systems, see part 7676.1200.

EXCEPTIONS: Piping insulation is not required if:

(1) piping is installed within HVAC equipment;

(2) piping is at fluid temperatures between 55 and 120 degrees Fahrenheit when not required for energy conservation purposes; or

(3) piping is installed in basements and cellars.

B. Insulation thickness in this subpart assumes 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.

C. Ducts must be sealed according to this item.

Insulation Thickness For Pipe Sizes[1](Inches)

Piping System Types	Fluid Temperature Range °F	Run-outs[2]	1" and Less	1-1/4" to 2"	2-1/2" to 4"	5" to 6"	8" and larger
Heating Systems (Steam Condensate and Hot Water)							
	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
Cooling Systems							
Chilled water	40-55	1/2	1/2	3/4	1	1	1
Refrig-erant or Brine	Below 40	1	1	1-1/2	1-1/2	1-1/2	1-1/2

[1]For piping exposed to outdoor air, increase thickness by one-half inch.

[2]Runouts two inches and less not exceeding 12 feet in length to individual terminal units.

D. For applications with fluid temperatures at 32 degrees Fahrenheit and below, the designer shall consider additional insulation with vapor retarder to prevent condensation.

Subp. 18. **Operation and maintenance manual.** An operation and maintenance manual must be provided. The manual must include basic data relating to the operation and maintenance of HVAC systems and equipment. Required routine maintenance actions must be clearly identified. Where applicable, HVAC controls information such as diagrams, schematics, control sequence descriptions, and maintenance and calibration information must be included.

Subp. 19. **HVAC equipment performance requirements.** HVAC equipment must meet minimum efficiency requirements specified in chapter 7678.

Statutory Authority: *MS s 216C.19*

History: *23 SR 145*

7676.1200 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 in 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 swimming 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 according to part 7676.1000, subpart 14, item B. Additionally, heated indoor swimming pools and spas must provide for energy conservation by at least one of the following methods:

(1) the pool or spa must be equipped with a cover according to part 4717.1575, the Minnesota Department of Health pool cover safety standard;

(2) the ventilating system serving the pool or spa area must provide a heat recovery of 70 percent as calculated by ASHRAE Standard 84-1991 at winter design conditions; or

(3) renewable energy sources must be capable of providing at least 50 percent of the heating energy required for the pool or spa over an operating season.

C. Heated outdoor swimming pools and spas must either be provided with a cover according to part 4717.1575, 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.

EXCEPTION: Piping insulation is not required when the heat loss of the pipeline, without insulation, does not increase the annual energy requirements of the building.

All service water heating pipe in contact with high conductivity material, including concrete and earth, must have a one-inch minimum insulation. 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.

Minimum Insulation Thickness for Pipe Sizes

	Design water temperature, °F		
Pipe Sizes	less than 130°F	131°-160°F	above 160°F
Noncirculating runouts up to 1 inch	1/2 inch	1/2 inch	1/2 inch
Circulating mains and runouts up to 1-1/4 inches	1/2 inch	1/2 inch	1 inch
1-1/2 inches to 2 inches	1/2 inch	1 inch	1-1/2 inches
Over 2 inches	1 inch	1-1/2 inches	2 inches

B. 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.

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

D. 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.

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

Statutory Authority: *MS s 216C.19*

History: *23 SR 145*

7676.1300 ELECTRICAL POWER AND LIGHTING.

Subpart 1. **Electrical energy determination.**

A. In new multifamily dwellings, the electrical energy consumed by each individual dwelling unit must be separately metered with individual metering readily accessible to the individual occupants.

EXCEPTION: Motels, hotels, college dormitories, other transient facilities, and buildings intended for occupancy primarily by persons who are 62 years of age or older or handicapped, or which contain a majority of units not equipped with complete kitchen facilities.

B. In electrical panels of buildings other than residential buildings of three stories or less, all feeder wiring and the panel feeder must be capable of accepting a clamp-on ammeter.

Subp. 2. **Lighting power budget.**

A. Lighting systems must meet the requirements of this item.

(1) The following are covered by this subpart:

(a) interior spaces of buildings;

(b) building exteriors and exterior areas, such as entrances, exits, and loading docks; and

(c) roads, grounds, parking, and other exterior areas where lighting is energized through the building electrical service.

(2) Except for fluorescent lamp ballasts, which must meet the requirements of subitem (1), units (a) and (c), the following are exempt from the lighting power budget standards:

(a) manufacturing facilities, processing facilities, and commercial greenhouses;

(b) lighting power for theatrical production studios and stages, television broadcasting, audio-visual presentation, and entertainment facilities in spaces such as stages, hotel ballrooms, nightclubs, discos, and casinos, and where lighting is an essential technical element for the function performed;

(c) specialized luminaires for medical and dental purposes;

(d) outdoor athletic facilities;

(e) lighting power for display lighting required for art exhibits or displays in galleries, museums, and monuments;

(f) exterior lighting for public monuments;

(g) special lighting needs for research;

(h) commercial greenhouses and power for lighting used solely for indoor plant growth during the hours of 10:00 p.m. to 6:00 a.m.;

(i) emergency lighting that is automatically off during normal operation;

(j) high risk security areas or any area identified by local ordinances or regulations or by security or safety personnel as requiring additional lighting;

(k) lighting power densities for spaces with enhanced lighting specifically designed for primary use by the visually impaired, hard of hearing, or senior citizens;

(l) lighting for the dwelling portion of multifamily buildings;

(m) lighting for signs;

(n) storefront exterior-enclosed display windows in retail facilities;

(o) lighting power for internally illuminated exit signs; and

(p) any lighting application not specifically regulated by this part, including, but not limited to, outdoor auto sales lots, and auto service station outdoor pump lighting.

(3) The definitions in this subitem apply to this subpart.

(a) "Gross lighted area" means the sum of the total lighted areas in a building measured from the inside of the perimeter walls of each floor of the building.

(b) "Programmable timing control" means an automatic control able to program different schedules for occupied and unoccupied days, readily accessible for temporary override with automatic return to the original schedule, and able to keep time during power outages for at least four hours.

(4) The following are acronyms found in this subpart:

(a) AF = area factor;

(b) ALP = adjusted lighting power, watts;

(c) CLP = connected lighting power, watts;

(d) CLPC = connected lighting power for the luminaires controlled by the automatic control device, watts;

(e) ELPA = exterior lighting power allowance, watts;

(f) GLA = gross lighted area, square feet;

(g) ILPA = interior lighting power allowance, watts per square feet;

(h) LPB = lighting power budgets, watts;

(i) LPCC = lighting power control credits, watts;

(j) LSA = listed space area, square feet;

(k) PAF = power adjustment factor;

(l) ULPA = unit lighting power allowance, watts per square feet; and

(m) UPD = unit power density, watts per square feet.

(5) A building complies with this subpart if the following conditions are met:

(a) the minimum requirements for controls and fluorescent ballasts in item B are met;

(b) the exterior lighting power to be installed is not greater than the exterior lighting power allowance required in item C; and

(c) the interior connected lighting power to be installed is not greater than the interior lighting power allowance, based on either the whole building criteria in item D or the space-by-space criteria in item E.

(6) For connected lighting power calculations, ballast and luminaire wattage must be determined according to this subitem.

(a) The ballast wattage must be as listed in the Northern States Power Company (NSP) Lighting Efficiency Program Input Wattage Guide, or if the ballast is not listed in the NSP Lighting Efficiency Program Input Wattage Guide, then ballast wattage must be the American National Standards Institute (ANSI) value published by the manufacturer.

(b) The connected lighting power includes permanently installed lighting plus supplemental or task-related lighting provided by movable or plug-in luminaires.

(c) The connected lighting power for luminaires with incandescent medium base sockets is the higher of the following two wattages: the total lamp wattage proposed for the luminaire; or 50 percent of the listed lighting power capacity of the luminaire in watts.

(d) The connected lighting power for track lights is the higher of the following two wattages: the total lamp wattage proposed for the track; or 50 percent of the total listed power capacity of the elements proposed for the track.

(7) Trade offs between interior lighting power allowance and exterior lighting power allowance are not allowed as long as the total connected lighting power of exterior lighting does not exceed the exterior lighting power allowance and the allowance for the building exterior surfaces is not exceeded. Trade offs of the interior lighting power budgets among interior spaces are allowed. Trade offs of exterior lighting power budgets among exterior areas are allowed.

(8) The total lighting power allowances for each building in a multibuilding facility must be calculated separately.

B. Lighting controls and fluorescent lamp ballasts must be in accordance with the minimum requirements of this item.

(1) Lighting controls must be installed to allow efficient operation.

(a) All lighting must be provided with manual, automatic, or programmable controls.

EXCEPTION: Lighting for emergency, exit lighting, lighting for indoor spaces intended for continuous operation, and indoor lighting for security purposes.

(b) Each space enclosed by walls or ceiling-height partitions must be provided with controls that, together or alone, are capable of controlling all lights within that space.

(c) The minimum number of controls must not be less than one lighting control for each space and one lighting control for each task or group of task locations within an area of 450 square feet or less.

i. A reduction in the minimum number of controls is permitted by using the Equivalent Number of Controls table. Control of the same load from more than one location must not be credited as additional control points.

Equivalent Number of Controls

Type of Control	Equivalent Number of Controls
Manually operated on/off switch	1
Occupancy sensor	2
Programmable timing control	2
Three level, including off, step control, or preset dimming	3
Four level, including off, step control, or preset dimming	3
Automatic or continuous dimming	3

ii. EXCEPTIONS: Lighting for spaces that must be used as a whole, such as public lobbies of office buildings, hotels, and hospitals; retail and department stores; and warehouses, storerooms, and service corridors under centralized supervision is permitted to be controlled by a lesser number of controls. Spaces with a single luminaire or single ballast may be controlled by a manually operated ON/OFF switch.

(d) Hotel and motel guest rooms must have one or more master controls at the main entry door that turn off all permanently wired lighting fixtures and lighting and television receptacles. For multiple room suites, controls at the entry of each room, in lieu of a master switch, will meet these requirements.

(e) All lighting controls required by this chapter must be readily accessible to personnel occupying or using the space.

EXCEPTIONS: automatic controls, programmable controls, lighting for safety hazards and security, controls requiring trained operators, and those controls for spaces that must be used as a whole.

(f) Controls to be counted in the determination of minimum controls include those provided for task areas.

(g) Exterior lighting must be automatically controlled by a timer, a photocell, or a combination of timer and photocell. Timers must be of the automatic type capable of adjustment for seven days and for seasonal daylight schedule variations. All time controllers must be equipped with back-up mechanisms to keep time during a four-hour power outage.

(h) When the building is served by an energy management system, programmable controls, shared tenant services that affect interior environments, or intelligent building systems, provisions must be made to incorporate lighting controls into the system if a separate automatically controlled lighting system is not provided.

(2) Fluorescent lamp ballasts must comply with the requirements of this subitem.

(a) Fluorescent lamp ballasts must comply with Code of Federal Regulations, title 10, part 435.103, section 3.3.2, Fluorescent Lamp Ballast Standards.

EXCEPTION: Ballasts specifically designed for use with dimming controls.

(b) Single lamp ballasts are prohibited. Tandem wiring must be used to replace single lamp ballasts with multiple lamp ballasts.

EXCEPTIONS: Single lamp ballasts may be used where luminaire spacing or obstructions cause whip length to exceed ten feet, and odd units at the end arrays.

(c) Fluorescent lamp ballasts must have a power factor equal to or greater than 90 percent.

EXCEPTION: Ballasts for circline lamps and compact fluorescent lamps.

C. Exterior lighting power allowance must be calculated according to this item.

(1) Building exteriors, exterior areas, roads, grounds, and parking must comply with this item. Lighting for streets, highways, and parking lots is regulated by the Department of Transportation, chapter 8885.

(2) The exterior lighting power density must not exceed the exterior lighting power allowance (ELPA). The ELPA is the sum of the allowances for each area of the building.

EXCEPTION: Outdoor security lighting may be exempt when approved by the building official, provided the lamp efficacy is not less than 55 lumens per watt.

(3) Exterior lighting power density must be in accordance with this subitem.

Exterior Lighting Unit Power Density

Area Description	Unit Power Density
Exit (with or without canopy)	25 W/Lin.ft. of door opening
Entrance (without canopy)	30 W/Lin.ft. of door opening
Entrance (with canopy)	
High traffic (retail, hotel, airport, theater, etc.)	10 W/ft^2 of canopied area
Light traffic (hospital, office, school, etc.)	4 W/ft^2 of canopied area
Loading area	0.40 W/ft^2
Loading door	20 W/Lin.ft. of door opening
Building exterior surfaces/facades	0.25 W/ft^2 of surface area to be illuminated
Storage and nonmanufacturing work areas	0.20 W/ft^2

Other activity areas for casual use such as picnic grounds, gardens, parks, and other landscaped areas	0.10 W/ft^2
Private driveways/walkways	0.10 W/ft^2
Public driveways/walkways	0.15 W/ft^2
Private parking lots	0.12 W/ft^2
Public parking lots	0.18 W/ft^2

D. Interior lighting for the whole building procedure must be calculated according to this item.

(1) The definitions in this subitem apply to this item.

(a) "Food service, fast food, and cafeteria" includes cafeterias, hamburger and sandwich stores, bakeries, ice cream parlors, cookie stores, and all other kinds of retail food service establishments in which customers are generally served at a counter and their direct selections are paid for and taken to a table or carried out.

(b) "Garages" includes all types of parking garages, except for service or repair areas.

(c) "Leisure dining and bar" includes cafes, diners, bars, lounges, and similar establishments where orders are placed with a waitperson.

(d) "Mall concourse and multistore service" includes the interiors of multifunctional public spaces, such as shopping center malls, airports, resort concourses and malls, entertainment facilities, and related types of buildings or spaces.

(e) "Offices" includes all kinds of offices, including corporate and professional offices, office/laboratories, governmental offices, libraries, and similar facilities, where paperwork occurs.

(f) "Retail" includes a retail store, including departments for the sale of accessories, clothing, dry goods, electronics, and toys, and other types of establishments that display objects for direct selection and purchase by consumers. "Direct selection" means literally removing an item from display and carrying it to the checkout or pick-up at a customer service facility.

(g) "Schools" include preschool/elementary, junior high/high school, and technical/vocational, both public and private educational institutions for children or adults, and may also include community centers, college and university buildings, and business educational centers.

(h) "Service establishment" includes a retail-like facility, such as watch repair, real estate offices, auto and tire service facilities, parts departments, travel agencies, and similar facilities, in which the customer obtains services rather than the direct selection of goods.

(i) "Warehouse and storage" includes all types of support facilities, such as warehouses, barns, storage buildings, shipping and receiving buildings, boiler or mechanical buildings, electric power buildings, and similar buildings where the primary visual task is large items.

(2) The connected lighting load must not exceed the product of the unit power density from this subitem and the gross floor area of the building.

Whole Building Unit Lighting Power Allowance, W/Ft²
Gross Lighted Area

Building Type/Area Function	0-2,000 ft²	2,001-10,000 ft²	10,001-25,000 ft²	25,001-50,000 ft²	50,001-250,000 ft²	>250,000 ft²
Food Service:						
Fast Food/ Cafeteria	0.92	0.85	0.82	0.81	0.81	0.80
Leisure Dining/ Bar	1.60	1.56	1.52	1.48	1.44	1.40
Offices	1.40	1.34	1.27	1.22	1.16	1.11
Retail*	2.70	2.52	2.32	2.05	1.87	1.72
Mall Concourse/ Multi-store Service	0.69	0.68	0.65	0.63	0.61	0.60
Service Estab-lishment	2.81	2.03	1.78	1.65	1.54	1.46
Garages	0.25	0.24	0.23	0.22	0.21	0.20
Schools	1.77	1.72	1.60	1.49	1.36	1.26
Warehouse/ Storage	0.60	0.50	0.42	0.36	0.32	0.30

*Includes general, merchandising, and display lighting.

(3) If the building has secondary functions that are ten percent or more of the gross lighted area of the buildings that are listed in subitem (1), the UPD must be determined by weighting the fraction of lighted floor of each building type with the respective UPD for that building.

(4) The interior lighting power allowance in partially defined speculative buildings must be determined by using the highest UPD for the likely uses.

E. Interior lighting for the space-by-space procedure must be calculated according to this item.

(1) The total adjusted lighting power in a building must not exceed the sum of the interior lighting power allowances. The adjusted lighting power is equal to the connected lighting power minus the lighting power controls credit.

(2) The total adjusted lighting power in defined areas of partially defined speculative buildings must not exceed the interior lighting power allowance for the defined areas of the building.

(3) The lighting power budget of each interior space must be determined by:

$LPB = A_{wp} \times UPD_b \times AF$

Where:

A_{wp} = Area of the room at the horizontal lighted working plane

UPD_b = Base UPD

(a) The area factor must be determined based on the floor area and ceiling height of the room. Rooms with identical ceiling height and activities, and with similar size, may be treated as a group. The area factor of such a group of rooms must be determined from the average area of the rooms. The equation for area factor (AF) is:

$AF = 0.2 + 0.8 \text{ EXP} - [[[10.21 \times (CH - 2.5)]/\text{SQRT}(A_r) - 1] \times \text{Ln}(0.9)]$

Where:

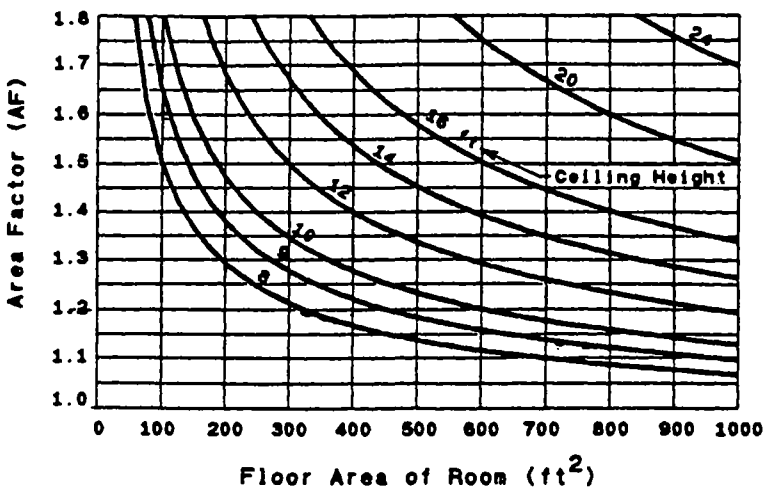
CH = Ceiling height, feet

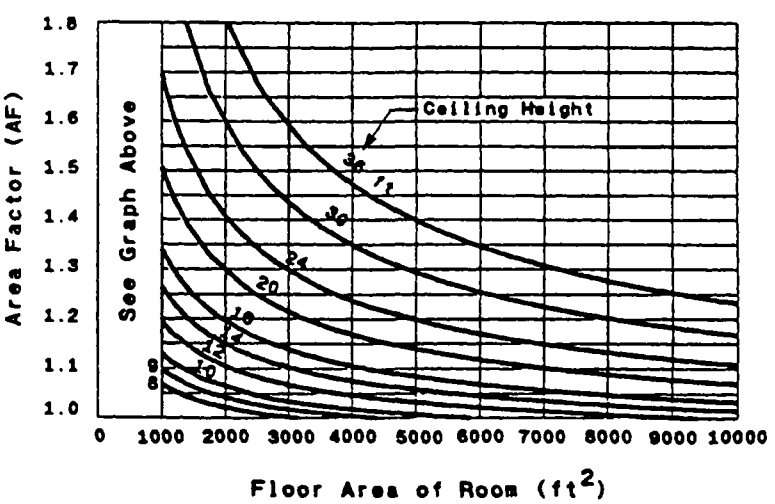
A_r = Floor area of the room, square feet calculated from the inside dimensions of the room

If AF<1.0 then AF = 1.0

If AF>1.8 then AF = 1.8

AREA FACTOR





(b) The unit power density must be selected from the table in this unit. For applications to areas or activities other than those given, select values for similar areas or activities.

Performance Procedure Unit Power Density

Area/Activity	UPD	Note or Area Factor (AF) Required
Common Activity Areas		
Auditorium	1.4	(iv)
Corridor	0.8	AF = 1.0
Classroom/Lecture Hall	1.7	
Elec/Mech Equipment Room:		
General	0.7	AF = 1.0
Control Rooms	1.5	AF = 1.0
Food Service:		
Fast Food/Cafeteria	0.8	
Leisure Dining	1.4	(i)
Bar/Lounge	1.3	(i)
Kitchen	1.4	
Recreation/Lounge	0.5	
Stairs:		
Active Traffic	0.6	
Emergency Exit	0.4	
Toilets and Washing	0.5	
Garage:		
Auto/Pedestrian Circulation	0.25	(iv)
Parking Area	0.2	(iv)
Laboratory	2.2	
Library:		
Audio Visual	1.1	
Stack Visual	1.5	
Card File and Cataloging	0.8	
Reading Area	1.0	
Lobby (General)		
Reception and Waiting	0.55	
Elevator Lobbies	0.4	
Atrium (Multistory):		
First Three Floors	0.4	
Each Additional Floor	0.15	
Locker Room and Shower	0.6	
Office Category 1		

Enclosed offices, of less than 900 ft²		(iii)
All open plan offices w/out partitions or w/partitions power plan 4.5 ft below the ceiling:		
Reading, Typing, and Filing	1.3	AF<1.55
Drafting	2.2	AF<1.55
Accounting	1.8	AF<1.55
Office Category 2		
All open plan offices, 900 ft² or larger w/partitions 3.5 to 4.5 ft below the ceiling:		(iii)
Reading, Typing, and Filing	1.5	AF = 1.0
Drafting	2.6	AF = 1.0
Accounting	2.1	AF = 1.0
Office Category 3		
Open plan offices, 900 ft² or larger w/partitions higher than 3.5 ft below the ceiling:		(iii)
Reading, Typing, and Filing	1.7	AF = 1.0
Drafting	3.0	AF = 1.0
Accounting	2.4	AF = 1.0
Common Activity Areas:		
Conferences/Meeting Room	1.3	(ii)
Computer/Office Equipment	2.1	
Filing, Inactive	1.0	
Mail Room	1.8	
Shop (Nonindustrial)		
Machinery	2.5	
Electrical/Electronic	2.5	
Painting	1.6	
Carpentry	2.3	
Welding	1.2	
Storage and Warehouse:		
Inactive Storage	0.2	
Active Storage, Bulky	0.3	
Active Storage, Fine	0.9	
Material Handling	1.0	
Unlisted Space	0.2	
Specific Building Area/Activity		(v)
Airport, Bus, and Rail Station:		
Baggage Area	0.75	
Concourse/Main Throughway	0.45	
Ticket Counter	1.3	
Waiting and Lounge Area	0.6	
Bank		
Customer Area	0.8	

Banking Activity Area	2.2	
Barber and Beauty Parlor	1.6	
Church, Synagogue, Chapel:		
Worship/Congregational	1.3	
Preaching and Sermon/Choir	1.8	
Dormitory:		
Bedroom	0.6	
Bedroom with Study	1.3	
Study Hall	0.9	
Fire and Police Department:		
Fire Engine Room	0.7	
Jail Cell	0.4	
Hospital/Nursing Home:		
Corridor	0.9	AF<1.55
Dental Suite/Exam/Treatment	1.4	
Emergency	2.0	
Laboratory	1.7	
Lounge/Waiting Room	0.6	
Medical Supplies	2.4	
Nursery	1.6	
Nurse Station	1.8	
Occupational/Physical Therapy	1.4	
Patient Room	0.9	
Pharmacy	1.5	
Radiology	1.8	
Surgery and OB Suites:		
General Area	1.8	
Operating Room	6.0	
Recovery Room	2.0	
Hotel/Conference Center:		
Banquet Room/Multi-purpose	1.4	(ii)
Bathroom/Powder Room	0.6	
Guest Room	0.7	
Public Area	0.8	
Exhibition Hall	1.3	
Conference/Meeting	1.5	AF = 1.0
Lobby	1.3	
Reception Desk	2.4	
Laundry:		
Washing	0.6	
Ironing and Sorting	1.3	
Museum and Gallery:		
General Exhibition	1.2	
Inspection/Restoration	3.0	
Storage (Artifacts):		
Inactive	0.25	
Active	0.5	

Post Office:	
Lobby	0.8
Sorting and Mailing	2.1
Service Station/Auto Repair	0.8
Theater:	
Performance Arts	1.1
Motion Picture	0.75
Lobby	1.0
Retail Establishments: (Merchandising and circulation area applicable to all lighting, including accent and display lighting, installed in merchandising and circulation areas)	
Type A: Jewelry merchandising, where the minute display and examination of merchandise is critical	6.0
Type B: Fine merchandise includes fine apparel and accessories, china, crystal and silver, and art galleries, where the detailed display and examination of merchandise is important	2.9
Type C: Mass merchandising, where focused display and detailed examination of merchandise is important	2.7
Type D: General merchandising includes general apparel, variety, stationery, books, sporting goods, hobby, cameras, gift and luggage, where general display and examination of merchandise are adequate	2.5
Type E: Food and miscellaneous includes bakeries, hardware and housewares, grocery, appliances and furniture, where appetizing appearance is important	2.4
Type F: Service establishments, where functional performance is important	2.6
Mall Concourse	0.6

Retail Support Area:		
Tailoring	2.1	
Dressing/Fitting Room	1.1	
Indoor Athletic Area/Activity		(vi)
Seating Area, All Sports	0.4	AF = 1.0
Badminton:		
Club	0.5	AF = 1.0
Tournament	0.8	AF = 1.0
Basketball/Volleyball:		
Intramural	0.8	AF = 1.0
College/Professional	1.9	AF = 1.0
Bowling:		
Approach Area	0.5	AF = 1.0
Lanes	1.1	AF = 1.0
Boxing or Wrestling (platform)		
Amateur	2.4	AF = 1.0
Professional	4.8	AF = 1.0
Gymnasium:		
General Exercising and Recreation Only	1.0	AF = 1.0
Handball/Racquetball/Squash:		
Club	1.3	AF = 1.0
Tournament	2.6	AF = 1.0
Hockey, Ice:		
Amateur	1.3	AF = 1.0
College or Professional	2.6	AF = 1.0
Skating Rink:		
Recreational	0.6	AF = 1.0
Exhibition/Professional	2.6	AF = 1.0
Swimming:		
Recreational	0.9	AF = 1.0
Exhibition	1.5	AF = 1.0
Underwater	1.0	AF = 1.0
Tennis:		
Recreational (Class III)	1.3	AF = 1.0
Club/College (Class II)	1.9	AF = 1.0
Professional (Class I)	2.6	AF = 1.0
Tennis, Table:		
Club	1.0	AF = 1.0
Tournament	1.6	AF = 1.0

NOTES:

i. Base UPD includes lighting power required for cleanup purpose.

ii. A 1.5 adjustment factor is applicable for multifunctional spaces.

iii. A minimum of 90 percent of all work stations must be enclosed with partitions of the height prescribed.

iv. Outdoor security lighting may be exempted, provided the lamp efficacy is not less than 55 lumens per watt.

v. Use a weighted average UPD in rooms with multiple simultaneous activities, weighted in proportion to the area served.

vi. Consider as ten feet beyond playing boundaries but less than or equal to the total floor area of the sports space minus spectator seating area.

(5) Lighting power for special spaces and activities must comply with this subitem.

(a) For rooms serving multifunctions, such as hotel banquet or meeting rooms and office conference or presentation rooms, an adjustment factor of 1.5 times the base UPD may be used if a supplementary lighting system is actually installed to serve the secondary function of the room and the design meets the following conditions:

i. the installed power for the supplementary system must not be greater than 33 percent of the adjusted lighting power budget calculated for that room; and

ii. independent controls must be installed for the supplementary lighting system.

(b) In rooms containing multiple simultaneous activities, such as a large general office having separate accounting and drafting areas within the same room, the lighting power budget for the rooms must be the weighted average of the activities in proportion to the areas being served.

(c) The floor area of indoor sports activities areas must be considered as the area within the playing boundaries of the sport, plus the floor area ten feet beyond the playing boundaries, not to exceed the total floor area of the indoor room less the spectator seating area.

(d) The interior lighting power allowance must include a 0.20 watts per square foot allowance for unlisted spaces.

(6) The adjusted lighting power is the connected lighting power minus the lighting power controls credit. The adjusted lighting power in a building must not exceed the sum of the interior lighting power allowance. The lighting power controls credit is allowable for luminaires automatically controlled by occupancy sensors, daylight sensors, programmable timing controls, or lumen maintenance controls.

Power Adjustment Factor

Automatic Control Device(s)	Power Adjustment Factor
Daylight Sensing Controls (DS), Continuous Dimming	0.30
DS, Multiple Step Dimming	0.20
DS, on/off	0.10
DS, Continuous Dimming and Programmable Timing	0.35
DS, Multiple Step Dimming and Programmable Timing	0.25
DS, on/off and Programmable Timing	0.15
DS, Continuous Dimming, Programmable Timing, and Lumen Maintenance	0.40
DS, Multiple Step Dimming, Programmable Timing, and Lumen Maintenance	0.30
DS, on/off, Programmable Timing, and Lumen Maintenance	0.20
Lumen Maintenance	0.10

Lumen Maintenance and Programmable Timing Control	0.15
Programmable Timing Control	0.15
Occupancy Sensor	0.30
Occupancy Sensor, DS, Continuous Dimming	0.40
Occupancy Sensor, DS, Multiple Step Dimming	0.35
Occupancy Sensor, DS, on/off	0.35
Occupancy Sensor, DS, Continuous Dimming, and Lumen Maintenance	0.45
Occupancy Sensor, DS, Multiple Step Dimming, and Lumen Maintenance	0.40
Occupancy Sensor, DS, ON/OFF, and Lumen Maintenance	0.35
Occupancy Sensor and Lumen Maintenance	0.35
Occupancy Sensor and Programmable Timing Control	0.35

(a) The lighting power control credits are limited to the specific luminaires controlled by the automatic control device.

(b) Only one adjustment factor may be used for each building space or luminaire, and 50 percent or more of the controlled luminaire must be within the applicable space to qualify for the power adjustment factor.

(c) Controls must be installed in series with the lights and in series with all manual switching devices in order to qualify for an adjustment factor.

(d) Daylight sensing controls must be capable of reducing electrical power consumption for lighting, continuously or in steps, to 50 percent or less of maximum power consumption.

(e) Daylight sensing controls must control all luminaires to which the power adjustment factor is applied and that direct a minimum of 50 percent of their light output into the daylight zone.

F. The COMcheck-MN program is an acceptable method for demonstrating compliance of the lighting system with items C to E.

Subp. 3. **Internally illuminated exit signs.** New internally illuminated exit signs must not exceed five watts per side.

Subp. 4. **Electric motor efficiencies.** All permanently wired, single speed Design A and B polyphase induction motors of one horsepower or more and expected to operate more than 500 hours per year must have National Electric Manufacturers Association (NEMA) nominal efficiencies not less than required by the Energy Policy Act of 1992, section 122(d).

Subp. 5. **Distribution transformers.** New distribution transformers must meet the requirements of this subpart for NEMA class 1 efficiency as defined in NEMA Publication X TP 1-1996, Guide for Determining Energy Efficiency for Distribution Transformers.

A. Efficiency levels for liquid-filled distribution transformers must not be less than required in this item.

NEMA CLASS 1 EFFICIENCY LEVELS FOR LIQUID-FILLED DISTRIBUTION TRANSFORMERS

Reference Condition	Temperature	% of Nameplate Load
Load Loss	85°C	50%
No Load Loss	20°C	50%

kVA	Single Phase Efficiency	kVA	Three Phase Efficiency
10	98.3%	15	98.0%
15	98.5%	30	98.3%
25	98.7%	45	98.5%
37.5	98.8%	75	98.7%
50	98.9%	112.5	98.8%
75	99.0%	150	98.9%
100	99.0%	225	99.0%
167	99.1%	300	99.0%
250	99.2%	500	99.1%
333	99.2%	750	99.2%
500	99.3%	1,000	99.2%
667	99.4%	1,500	99.3%
833	99.4%	2,000	99.4%
		2,500	99.4%

B. Efficiency levels for dry-type distribution transformers must not be less than required in this item.

NEMA CLASS 1 EFFICIENCY LEVELS FOR DRY-TYPE DISTRIBUTION TRANSFORMERS

Reference Condition	Temperature	% of Nameplate Load
Low Voltage	75°C	35%
Medium Voltage	75°C	50%

	Single Phase Efficiency			Three Phase Efficiency	
kVA	Low Voltage	Medium Voltage	kVA	Low Voltage	Medium Voltage
15	97.7%	97.6%	15	97.0%	96.8%
25	98.0%	97.9%	30	97.5%	97.3%
37.5	98.2%	98.1%	45	97.7%	97.6%
50	98.3%	98.2%	75	98.0%	97.9%
75	98.5%	98.4%	112.5	98.2%	98.1%
100	98.6%	98.5%	150	98.3%	98.2%
167	98.7%	98.7%	225	98.5%	98.4%
250	98.8%	98.8%	300	98.6%	98.5%
333	98.9%	98.9%	500	98.7%	98.7%
500		99.0%	750	98.8%	98.8%
667		99.0%	1,000	98.9%	98.9%
833		99.1%	1,500		99.0%
			2,000		99.0%
			2,500		99.1%

Statutory Authority: *MS s 216C.19*
History: *23 SR 145*

7676.1400 ADDITIONS, ALTERATIONS, AND REPAIRS TO EXISTING BUILDINGS.

Subpart 1. **General.** Additions, alterations, and repairs to existing buildings must comply with the requirements of this part only.

Subp. 2. **Affecting air leakage.** If an addition or alteration affects the air leakage characteristics or capacity of a building, and vented appliances are present that are not sealed or power vented and are without combustion air supply, then a combustion air supply must be provided according to the Minnesota State Mechanical Code, chapter 1346. Alterations that will likely affect 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 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.

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

A. the addition alone must comply with this chapter;

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 must meet the requirements of this chapter.

Subp. 4. **Conversions.** A change in the occupancy or use of an existing building or structure constructed under this chapter which would require an increase in demand for either fossil fuel or electrical energy supply shall not be permitted unless the building or structure is made to comply with the requirements of this chapter or chapter 7672 or 7674 as appropriate for the converted building.

Subp. 5. **Penetrations.** All penetrations resulting as part of an alteration must be sealed in accordance with part 7676.0600, subpart 5. 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. **Membrane or built-up roofs.** Alterations comprising the removal of at least 50 percent of existing membrane or built-up roof covering must comply with this subpart. Alterations to buildings need not meet the requirements of this chapter for new buildings, provided that either:

A. the existing roof insulation is at least R-16 for buildings that are conditioned; or

B. the existing roof insulation is at least R-10 for buildings that are semiconditioned.

Subp. 7. **All 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.

Subp. 8. **Walls.**

A. Storm windows may be installed over existing glazing without meeting 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 7676.0600, subpart 8, and 7676.0700, subpart 3.

C. Interior wall finish may not be replaced unless wall cavities have been insulated to full depth. This requirement must 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, walls without framing cavities, or where the building official determines that a new exterior weather barrier must be installed to prevent imminent damage to the wall cavity. 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. 9. **Heating, ventilation, and air conditioning; service water heating; and electrical power equipment and controls.** All new equipment or control devices installed in conjunction with the alteration must comply with the specific requirements of this part and parts 7676.1100, 7676.1200, and 7676.1300 applicable to that equipment or control device.

Subp. 10. **Lighting.** An enclosed space must comply with the applicable requirements of this part if either 50 percent of the luminaires in the enclosed space are replaced, or if the occupancy classification is changed. For alterations to a portion of an enclosed space lighting system, such as moving luminaires or installing control devices, the requirements of this part need not be met, provided that the connected lighting load within the enclosed space is not increased.

Statutory Authority: *MS s 216C.19*

History: *23 SR 145*

7676.1500 EFFECTIVE DATE.

The effective date of this chapter is July 20, 1999.

Statutory Authority: *MS s 216C.19*

History: *23 SR 145*