

CHAPTER 1346

DEPARTMENT OF LABOR AND INDUSTRY

MINNESOTA MECHANICAL AND FUEL GAS CODES

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MINNESOTA MECHANICAL CODE

1346.0050 TITLE; INCORPORATION BY REFERENCE.

This chapter is known and may be cited as the “Minnesota Mechanical Code.” As used in this chapter, “the code” and “this code” refer to this chapter.

Chapters 2 to 15 of the 2000 edition of the International Mechanical Code, promulgated by the International Code Council, Inc., 5203 Leesburg Pike, Suite 600, Falls Church, Virginia 22041–3401, are incorporated by reference as part of the Minnesota Mechanical Code with the amendments in this chapter. As used in this chapter, “IMC” means the International Mechanical Code incorporated in this part.

The IMC is not subject to frequent change and a copy of the IMC, with amendments for use in Minnesota, is available in the office of the commissioner of labor and industry.

Statutory Authority: *MS s 16B.59; 16B.61; 16B.64*

History: *15 SR 71; 19 SR 1306; 29 SR 299; L 2007 c 140 art 1 s 1*

1346.0060 REFERENCES TO OTHER INTERNATIONAL CODE COUNCIL (ICC) CODES.

Subpart 1. **General.** References to other codes and standards promulgated by the International Code Council in the IMC and IFGC are modified in subparts 2 to 11.

Subp. 2. **Building code.** References to the International Building Code in this code mean the Minnesota Building Code, adopted pursuant to this chapter and Minnesota Statutes, section 16B.61, subdivision 1.

Subp. 3. **Residential code.** References to the International Residential Code in this code mean the Minnesota Residential Code, adopted pursuant to chapter 1309 and Minnesota Statutes, section 16B.61, subdivision 1.

Subp. 4. **Electrical code.** References to the International Code Council Electrical Code in this code mean the Minnesota Electrical Code, adopted pursuant to chapter 1315 and Minnesota Statutes, section 326.243.

Subp. 5. **Fuel gas code.** References to the International Fuel Gas Code in this code mean the Minnesota Fuel Gas Code, adopted pursuant to chapter 1346 and Minnesota Statutes, section 16B.61, subdivision 1.

Subp. 6. **Mechanical code.** References to the International Mechanical Code in this code mean the Minnesota Mechanical Code, adopted pursuant to chapter 1346 and Minnesota Statutes, section 16B.61, subdivision 1.

Subp. 7. **Plumbing code.** References to the International Plumbing Code in this code mean the Minnesota Plumbing Code, adopted pursuant to chapter 4715 and Minnesota Statutes, section 16B.61, subdivisions 1 and 2.

Subp. 8. **Private sewage disposal code.** References to the International Private Sewage Disposal Code in this code mean the Minnesota Pollution Control Agency's minimum standards and criteria for individual sewage treatment systems adopted pursuant to chapter 7080 and Minnesota Statutes, chapters 103F, 103G, 115, and 116.

Subp. 9. **Energy conservation code.** References to the International Energy Conservation Code in this code mean the Minnesota Energy Code, adopted pursuant to Minnesota Statutes, section 16B.617.

Subp. 10. **Property maintenance code.** References to the International Property Maintenance Code in this code do not apply.

Subp. 11. **Fire code.** References to the International Fire Code in this code mean the Minnesota State Fire Code, adopted pursuant to chapter 7511 and Minnesota Statutes, chapter 299F.

Statutory Authority: *MS s 16B.59; 16B.61; 16B.64*

History: *29 SR 299*

1346.0101 SECTION 101 SCOPE.

IMC Section 101 is amended to read as follows:

101 Scope. This code shall regulate the design, installation, maintenance, alteration, and inspection of mechanical systems that are permanently installed and utilized to provide control of environmental conditions and related processes within buildings. Fuel gas piping systems, fuel gas utilization equipment, and related accessories shall be regulated by parts 1346.5050 through 1346.5900. This code shall also regulate those mechanical systems, system components, equipment, and appliances specifically addressed in the IMC and IFGC. This code shall also regulate process piping installed within, or in conjunction with, buildings or structures. For the purposes of this section, the term "process piping" includes piping or tubing

which conveys gas, liquid, or fluidized solids and which is used directly in research, laboratory, or production processes. Process piping and tubing shall be installed in accordance with ASME B31.3–1999, Process Piping Code, or ASME B31.9–1996, Building Services Piping Code, as applicable. Refer to chapter 1300 for additional administrative provisions of the Minnesota State Building Code. For purposes of this section, refer to Minnesota Statutes, section 13.37, subdivision 1, paragraph (b), on disclosure of nonpublic data.

Statutory Authority: *MS s 16B.59; 16B.61; 16B.64*

History: 29 SR 299

1346.0102 SECTION 102 EXISTING INSTALLATIONS.

IMC Section 102 is amended to read as follows:

102 Existing installations. Except as otherwise provided for in this chapter, a provision in this code shall not require the removal, alteration, or abandonment of, nor prevent the continued utilization and maintenance of, a mechanical system lawfully in existence at the time of the adoption of this code.

Statutory Authority: *MS s 16B.59; 16B.61; 16B.64*

History: 29 SR 299

1346.0103 SECTION 103 MAINTENANCE.

IMC Section 103 is amended to read as follows:

103 Maintenance. Mechanical systems, both existing and new, and parts of those systems, shall be maintained in proper operating condition in accordance with the original design and in a safe and sanitary condition. Devices or safeguards which are required by this code shall be maintained in compliance with the code edition under which they were installed. The owner or the owner's designated agent shall be responsible for maintenance of mechanical systems. To determine compliance with this provision, the building official shall have the authority to require a mechanical system to be reinspected.

Statutory Authority: *MS s 16B.59; 16B.61; 16B.64*

History: 29 SR 299

1346.0104 SECTION 104 ADDITIONS, ALTERATIONS, RENOVATIONS, OR REPAIRS.

IMC Section 104 is amended to read as follows:

104 Additions, alterations, renovations, or repairs. Additions, alterations, renovations, or repairs to a mechanical system shall conform to that required for a new mechanical system without requiring the existing mechanical system to comply with all of the requirements of this code. Additions, alterations, renovations, or repairs shall not cause an existing mechanical system to become unsafe, hazardous, or overloaded.

Minor additions, alterations, renovations, and repairs to existing mechanical systems shall meet the provisions for new construction, unless that work is done in the same manner and arrangement as was in the existing system, is not hazardous, and is approved.

Statutory Authority: *MS s 16B.59; 16B.61; 16B.64*

History: 29 SR 299

1346.0105 SECTION 105 WORK EXEMPT FROM PERMIT.

IMC Section 105 is amended to read as follows:

105 Work exempt from permit. Permits shall not be required for the following:

1. portable heating, cooking, or clothes drying appliances not connected to a permanent fuel supply, excluding a factory power supply cord;
2. portable ventilation appliances and equipment;
3. portable cooling units;
4. steam, hot water, or chilled water piping within any heating or cooling equipment or appliances regulated by this code;

5. replacement of any minor part that does not alter the approval of equipment or an appliance or make such equipment or appliance unsafe;
6. portable evaporative coolers; and
7. self-contained refrigeration systems that contain 10 pounds (4.5 kg) or less of refrigerant, or that are actuated by motors of 1 horsepower (0.75 kW) or less.

Statutory Authority: *MS s 16B.59; 16B.61; 16B.64*

History: 29 SR 299

1346.0106 SECTION 106 REQUIRED INSPECTIONS.

IMC Section 106 is amended to read as follows:

106 Required inspections. The building official, upon notification from the permit holder or the permit holder's agent, shall make the following inspections and other such inspections as necessary, and shall either release that portion of the construction or shall notify the permit holder or the permit holder's agent of violations that must be corrected. The holder of the permit shall be responsible for the scheduling of these inspections.

1. Underground inspection shall be made after trenches or ditches are excavated and bedded, piping installed, and before backfill is put in place. When excavated soil contains rocks, broken concrete, frozen chunks, and other rubble that would damage or break the piping or cause corrosive action, clean backfill shall be on the job site.

2. Rough-in inspection shall be made after the roof, framing, fireblocking, and bracing are in place and all ducting and other components to be concealed are complete, and prior to the installation of wall or ceiling membranes.

3. Final inspection shall be made upon completion of the mechanical system.

Exception: Ground-source heat pump loop systems tested in accordance with this code shall be permitted to be backfilled prior to inspection.

Statutory Authority: *MS s 16B.59; 16B.61; 16B.64*

History: 29 SR 299

1346.0107 SECTION 107 TESTING.

IMC Section 107 is amended to read as follows:

107 Testing. Mechanical systems shall be tested as required in this code in accordance with IMC Sections 107.1 through 107.3. Tests shall be made by the permit holder and observed by the building official.

107.1 New, altered, extended, or repaired systems. New mechanical systems and parts of existing systems, which have been altered, extended, renovated, or repaired, shall be tested as prescribed in this code to disclose leaks and defects.

107.2 Apparatus, material, and labor for tests. Apparatus, material, and labor required for testing a mechanical system or part of a system shall be furnished by the permit holder.

107.3 Reinspection and testing. Where any work or installation does not pass an initial test or inspection, the necessary corrections shall be made so as to achieve compliance with this code. The work or installation shall then be resubmitted to the building official for inspection and testing.

Statutory Authority: *MS s 16B.59; 16B.61; 16B.64*

History: 29 SR 299

1346.0108 [Repealed, 29 SR 299]

1346.0108 SECTION 108 AUTHORITY TO CONDEMN MECHANICAL SYSTEMS.

IMC Section 108 is amended to read as follows:

108 Authority to condemn mechanical systems. Whenever the building official determines that any mechanical system or portion of a system regulated by this code has become hazardous to life, health, or property, or has become insanitary, the building official shall or-

der in writing that the system either be removed or restored to a safe condition. A time limit for compliance with the building official's order shall be specified in the written order. A person shall not use or maintain a defective mechanical system after receiving a notice under this section.

When a mechanical system is to be disconnected, written notice shall be given. In cases of immediate danger to life or property, the disconnection shall be made immediately without notice.

Statutory Authority: *MS s 16B.59; 16B.61; 16B.64*

History: *19 SR 1306; 29 SR 299*

1346.0109 SECTION 109 AUTHORITY TO ORDER DISCONNECTION OF ENERGY SOURCES.

IMC Section 109 is amended to read as follows:

109 Authority to order disconnection of energy sources. The building official shall have the authority to order disconnection of energy sources supplied to a building, structure, or mechanical system regulated by this code, when it is determined that the mechanical system or any portion of the system has become hazardous or unsafe. Written notice of an order to disconnect service and the causes of the order shall be given within 24 hours to the owner and occupant of the building, structure, or premises, provided, however, that in cases of immediate danger to life or property, the disconnection shall be made immediately without notice. Where energy sources are provided by a public utility, the building official shall immediately notify the serving utility in writing of the issuance of an order to disconnect.

Statutory Authority: *MS s 16B.59; 16B.61; 16B.64*

History: *29 SR 299*

1346.0110 SECTION 110 CONNECTION AFTER ORDER TO DISCONNECT.

IMC Section 110 is amended to read as follows:

110 Connection after order to disconnect. A person shall not make energy source connections to mechanical systems regulated by this code which have been disconnected or ordered to be disconnected by the building official, or the use of which has been ordered to be discontinued by the building official until the building official authorizes the reconnection and use of such mechanical systems.

When a mechanical system is maintained in violation of this code, and in violation of a notice issued pursuant to this section, the building official shall institute appropriate action to prevent, restrain, correct, or abate the violation.

Statutory Authority: *MS s 16B.59; 16B.61; 16B.64*

History: *29 SR 299*

1346.0201 [Repealed, 19 SR 1306]

1346.0201 SECTION 201 GENERAL.

IMC Section 201.4 is amended to read as follows:

201.4 Terms not defined. Where terms are not defined through the methods authorized by this chapter, the Merriam-Webster Collegiate Dictionary, available at www.m-w.com, shall be considered as providing ordinarily accepted meanings. The dictionary is incorporated by reference, is subject to frequent change, and is available through the Minitex interlibrary loan system.

Statutory Authority: *MS s 16B.59; 16B.61; 16B.64*

History: *29 SR 299*

1346.0202 SECTION 202 GENERAL DEFINITIONS.

IMC Section 202 is amended by adding or amending the following definitions:

ATMOSPHERICALLY VENTED GAS OR OIL APPLIANCE. An appliance, also known as natural draft, that utilizes a venting system designed to remove flue or vent gases under nonpositive static vent pressure entirely by natural draft.

CLOSED COMBUSTION SOLID FUEL BURNING APPLIANCE. A heat producing appliance that employs a combustion chamber having no openings other than the flue collar, fuel charging door, and adjustable openings provided to control the amount of combustion air that enters the combustion chamber and includes doors with gaskets or flanges that permit tight closure and glass or ceramic panels which must be tightly sealed or gasketed at their frames.

COMMERCIAL KITCHEN HOODS.

Backshelf hood. A backshelf hood is also referred to as a low-proximity hood, a pass over hood, a plate shelf hood, or a downdraft hood. Its front lower lip is set back a maximum of 12 inches (305 mm) from the leading edge of the cooking surface, and it is supported from above. Backshelf hoods are sometimes used as island hoods when suspended over conveyor ovens that toast sandwiches or bake convenience foods.

Double island canopy hood. A double island canopy hood is placed over back-to-back appliances or appliance lines, and it is supported from above. The hood inlet runs down the center of the hood, not along the outside perimeter. It overhangs both fronts and the sides of the appliances and sometimes has a wall panel between the backs of the appliances. The exhaust air is drawn from both sides of the double canopy and meets in the center, which causes each side of the hood to emulate a wall canopy hood. It functions similarly with or without a wall panel between the backs of the appliances.

Eyebrow hood. An eyebrow hood is mounted directly to the face of an appliance, such as an oven and dishwasher, above the opening or door from which effluent is emitted. It extends past the sides and overhangs the front of the opening to capture the effluent.

Single island canopy hood. A single island canopy hood is placed over a cooking line that is not installed along a wall. It is open on all sides and overhangs the front, rear, and sides of the appliances. A single island canopy is more susceptible to cross drafts and requires greater exhaust airflow to capture effluent than an equivalent sized wall canopy hood. Filter racks or grease extractor plenums should be mounted in the center of these canopies for optimal capture and containment.

Wall canopy hood. A wall canopy exhaust hood is usually mounted against a wall above a cooking line of appliances, but sometimes it is freestanding with a vertical back panel from the rear of the appliances to the hood. It overhangs the front and sides of the appliances on all open sides. The wall acts as a back panel, forcing the makeup air to be drawn across the front of the cooking equipment, which increases the effectiveness of the hood to capture and contain effluent generated by the cooking operation.

COMMERCIAL KITCHEN COOKING APPLIANCES.

Extra-heavy duty cooking appliance. Extra-heavy duty cooking appliances include appliances using solid fuel such as wood, charcoal, briquettes, and mesquite as the primary source of heat for cooking.

Heavy duty cooking appliance. Heavy duty cooking appliances with a minimum average cooking surface temperature of 600°F (316°C) include electric under-fired broilers, electric chain (conveyor) broilers, gas under-fired broilers, gas chain (conveyor) broilers, electric and gas wok ranges, and electric and gas oven-fired upright broilers.

Light duty cooking appliance. Light duty cooking appliances include gas and electric ovens (including standard, bake, roasting, revolving, retherm, convection, combination convection/steamer, conveyor, deck or deck-style pizza, and pastry), electric and gas steam-jacketed kettles, electric and gas compartment steamers (both pressure and atmospheric), and electric and gas cheesemelters.

Medium duty cooking appliance. Medium duty cooking appliances with a minimum average cooking surface temperature of 400°F (204°C) include electric and gas open-burner ranges (with or without oven), electric and gas hot-top ranges, electric and gas griddles, electric and gas double-sided griddles, electric and gas fryers (including open deep fat fryers, donut fryers, kettle fryers, and pressure fryers), electric and gas pasta cookers, electric and gas conveyor pizza ovens, electric and gas tilting skillets (braising pans), electric and gas rotisseries, and electric and gas salamander broilers.

DECORATIVE SOLID FUEL BURNING APPLIANCE. An atmospherically vented appliance, usually a fireplace, intended primarily for viewing of the fire and which may or

may not incorporate doors that substantially close off the firebox opening when the appliance is in operation.

DIRECT VENT APPLIANCE. An appliance that is constructed and installed so that all air for combustion is derived from the outside atmosphere and all flue gases are discharged to the outside atmosphere.

EXHAUST SYSTEM. An assembly of connected ducts, plenums, fittings, registers, grilles and hoods, including domestic kitchen exhaust hoods, domestic kitchen and bathroom exhaust fans, clothes dryers, central vacuums, and radon exhaust systems through which air is conducted from the space or spaces and exhausted to the outside atmosphere or an attached residential garage.

FAN-ASSISTED APPLIANCE. An appliance equipped with an integral mechanical means to either draw or force products of combustion through the combustion chamber or heat exchanger.

POWER VENT APPLIANCE. An appliance with a venting system which uses a fan or other mechanical means to cause the removal of flue or vent gases under positive static vent pressure.

POWERED MAKEUP AIR. Air which must be brought in from the outdoors by means of a fan to replenish the air expelled by a mechanical exhausting device.

READY ACCESS (TO). That which enables a device, appliance or equipment to be directly reached, without requiring the removal or movement of any panel, door or similar obstruction, and without requiring the use of portable access equipment (see "Access").

SEALED. Secured with a product meeting UL 181 or equivalent.

SOLID FUEL APPLIANCE. An atmospherically vented appliance that is either a closed combustion solid fuel burning appliance or a decorative solid fuel burning appliance.

Statutory Authority: *MS s 16B.59; 16B.61; 16B.64*

History: 29 SR 299

1346.0203 [Repealed, 29 SR 299]

1346.0204 [Repealed, 29 SR 299]

1346.0301 SECTION 301 GENERAL.

IMC Section 301.4 is amended to read as follows:

301.4 Listed and labeled. Appliances regulated by this code shall be listed and labeled to an appropriate standard by a nationally recognized testing laboratory which is qualified to evaluate the appliance, unless otherwise approved in accordance with the administrative provisions of the Minnesota State Building Code, Minnesota Rules, chapter 1300. The approval of unlisted appliances shall be based upon engineering evaluation. Unlisted appliances shall be installed with clearances to combustibles in accordance with IMC Chapter 8. Unlisted appliances with a fuel input rating of less than 12,500,000 Btu/hr (3,660 kW) shall have fuel trains, controls, and safety devices installed in accordance with Part CF, Combustion Side Control, of ASME CSD-1. Unlisted appliances with a fuel input rating of 12,500,000 Btu/hr (3,660 kW) or greater shall have fuel trains, controls, and safety devices installed in accordance with NFPA 85-2001.

Statutory Authority: *MS s 16B.59; 16B.61; 16B.64*

History: 29 SR 299

1346.0302 [Repealed, 29 SR 299]

1346.0304 [Repealed, 29 SR 299]

1346.0306 SECTION 306 ACCESS AND SERVICE SPACE.

IMC Section 306.5 is amended to read as follows:

306.5 Mechanical equipment and appliances on roofs or elevated structures. Where mechanical equipment or appliances requiring periodic inspection, service, or maintenance are installed on roofs or elevated structures, a permanent stair shall be provided for access.

Exception: A portable ladder may be used for dwellings, replacement equipment on existing buildings, and exterior roof access points not exceeding 16 feet (4.9 m) above grade, unless the building official determines that the unique shape of the roof does not allow safe access with a portable ladder.

The permanent stair shall be as required by relevant safety regulations, but shall not be less than the following:

1. The stair shall be installed at an angle of not more than 60 degrees measured from the horizontal plane.
2. The stair shall have flat treads at least 6 inches (152 mm) deep and a clear width of at least 18 inches (457 mm) with equally spaced risers at least 10.5 inches (267 mm) high and not exceeding 14 inches (356 mm).
3. The stair shall have intermediate landings not exceeding 18 feet (5.5 m) vertically.
4. Continuous handrails shall be installed on both sides of the stair.
5. Interior stairs shall terminate at the under side of the roof at a hatch or scuttle of at least 8 square feet (0.74m²) with a minimum dimension of 20 inches (508 mm).
6. When a roof access hatch or scuttle is located within 10 feet (3.0 m) of a roof edge, a guard shall be installed in accordance with IMC Section 304.9.
7. Exterior stairs shall terminate at the roof access point or at a level landing of at least 8 square feet (0.74 m²) with a minimum dimension of 20 inches (508 mm). The landing shall have a guard installed in accordance with IMC Section 304.9.

306.5.1 Permanent ladders. Where a change in roof elevation greater than 30 inches (762 mm) but not exceeding 16 feet (4.9 m) exists, a permanent ladder shall be provided. The ladder may be vertical and shall be as required by relevant safety regulations, but shall not be less than the following:

1. Width shall be at least 16 inches (406 mm).
2. Rung spacing shall be a maximum of 14 inches (356 mm).
3. Toe space shall be at least 6 inches (152 mm).
4. Side railings shall extend at least 30 inches (762 mm) above the roof or parapet wall.

Statutory Authority: *MS s 16B.59; 16B.61; 16B.64*

History: 29 SR 299

1346.0309 SECTION 309 TEMPERATURE CONTROL.

IMC Section 309 is amended by adding a section to read as follows:

309.2 Balancing. All mechanical ventilation and hydronic systems shall be capable of being balanced in accordance with this section.

309.2.1 Mechanical ventilation system balancing. Mechanical ventilation systems shall provide airflow rates within ± 10 percent of design capacities and fan speed shall be adjusted to meet design airflow conditions.

Exceptions:

1. Speed adjustment is not required for fan motors rated at one horsepower (0.746 kW) or less.
2. Residential exhaust-only ventilation systems shall be capable of exhausting the minimum ventilation rate required in the Minnesota Energy Code, Minnesota Rules, chapter 7670 or 7672.

309.2.2 Hydronic system balancing. Hydronic systems shall provide flow rates within ± 10 percent of design capacities and pump impellers shall be trimmed or pump speed shall be adjusted to meet design flow conditions.

Exception: Impeller trimming or speed adjustment is not required for pump motors rated at five horsepower (3.73 kW) or less.

309.2.3 Systems balancing reports. Systems balancing reports shall verify system performance and shall specify that the minimum amount of outdoor air required in amended Chapter 4 is provided to the ventilation system. Systems balancing reports shall be submitted to the building official upon request.

Statutory Authority: *MS s 16B.59; 16B.61; 16B.64*

History: 15 SR 71; 29 SR 299

1346.0401 SECTION 401 GENERAL.

IMC Section 401.5 is amended to read as follows:

401.5 Opening location. Outside air exhaust and intake openings, in buildings other than dwellings and Group R-3 occupancies, shall be located a minimum of 10 feet (3048 mm) from lot lines or buildings on the same lot. Where openings front on a street or public way, the distance shall be measured to the centerline of the street or public way.

401.5.1 Intake openings. Mechanical outside air intake openings shall be located a minimum of 10 feet (3048 mm) from any hazardous or noxious contaminant, such as chimneys, plumbing vents, streets, alleys, parking lots, and loading docks, except as otherwise specified in this code. Where a source of contaminant is located within 10 feet (3048 mm) of an intake opening, the intake opening shall be located a minimum of 3 feet (914 mm) below the contaminant source, unless the intake opening is a combustion air intake of a direct-vent appliance.

401.5.2 Exhaust openings. Outside exhaust openings, including bathroom exhaust, toilet exhaust, domestic kitchen range exhaust, and domestic clothes dryer exhaust, shall be located at least 3 feet (914 mm) from doors, operable windows, and nonmechanical intake openings. Exhaust air shall not be directed onto public walkways.

401.5.3 Venting system terminations. Venting system terminations shall comply with IMC Section 804 and IFGC Section 503.8.

Statutory Authority: *MS s 16B.59; 16B.61; 16B.64*

History: 29 SR 299

1346.0403 [Repealed, 19 SR 1306]

1346.0403 SECTION 403 MECHANICAL VENTILATION.

Subpart 1. **Section 403.1.** IMC Section 403.1 is amended to read as follows:

403.1 Ventilation system. Mechanical ventilation shall be provided by a method of supply air and return or exhaust air. The amount of supply air shall be approximately equal to the amount of return and exhaust air. The system to convey ventilation air shall be designed and installed in accordance with IMC Chapter 6.

Ventilation supply systems shall be designed to deliver the required rate of supply air to the occupied zone within an occupied space. The occupied zone shall have boundaries measured at 3 inches (76 mm) and 72 inches (1829 mm) above the floor and 24 inches (610 mm) from the enclosing walls.

Subp. 2. **Section 403.2.** IMC Section 403.2 is amended to read as follows:

403.2 Outdoor air required. The minimum ventilation rate of required outdoor air shall be determined in accordance with the Ventilation Rate Procedure, Section 6.1 of ASHRAE 62-2001, or the Indoor Air Quality Procedure, Section 6.2 of ASHRAE 62-2001.

Exceptions:

1. Enclosed parking garages shall comply with amended Section 404.
2. Dwellings shall comply with the Minnesota Energy Code, Minnesota Rules, chapter 7670 or 7672, as applicable.
3. Buildings or portions of buildings that are not intended for normal human occupancy, or where the primary purpose is not associated with human comfort.

403.2.1 Recirculation of air. The air required by the Ventilation Rate Procedure, Section 6.1 of ASHRAE 62-2001, or the Indoor Air Quality Procedure, Section 6.2 of ASHRAE 62-2001, shall not be recirculated. Air in excess of that required shall not be prohibited from being recirculated as a component of supply air to building spaces, except that:

1. Ventilation air shall not be recirculated from one dwelling unit to another or to dissimilar occupancies.
2. Supply air to a swimming pool and associated deck areas shall not be recirculated unless the air is dehumidified to maintain the relative humidity of the area at 60 percent or less. Air from this area shall not be recirculated to other spaces.

3. Where mechanical exhaust is required by the Ventilation Rate Procedure, Section 6.1 of ASHRAE 62–2001, or the Indoor Air Quality Procedure, Section 6.2 of ASHRAE 62–2001, recirculation of air from such spaces shall be prohibited. All air supplied to such spaces shall be exhausted, including any air in excess of that required.

403.2.2 Transfer air. Except where recirculation from such spaces is prohibited by the Ventilation Rate Procedure, Section 6.1 of ASHRAE 62–2001, or the Indoor Air Quality Procedure, Section 6.2 of ASHRAE 62–2001, air transferred from occupied spaces is not prohibited from serving as makeup air for required exhaust systems in such spaces as kitchens, baths, toilet rooms, elevators, and smoking lounges. The amount of transfer air and exhaust air shall be sufficient to provide the flow rates as specified in the Ventilation Rate Procedure, Section 6.1 of ASHRAE 62–2001, or the Indoor Air Quality Procedure, Section 6.2 of ASHRAE 62–2001. The required outdoor air rates shall be introduced directly into such spaces or into the occupied spaces from which air is transferred, or a combination of both.

Subp. 3. **Section 403.3.** IMC Section 403.3 is amended to read as follows:

403.3 Ventilation rate. Ventilation systems shall be designed to have the capacity to supply the minimum outdoor airflow rate determined in accordance with the Ventilation Rate Procedure, Section 6.1 of ASHRAE 62–2001, or the Indoor Air Quality Procedure, Section 6.2 of ASHRAE 62–2001, based on the occupancy of the space and the occupant load or other parameters as stated therein. The occupant load utilized for design of the ventilation system shall not be less than the number determined from the estimated maximum occupant load rate indicated in the Ventilation Rate Procedure, Section 6.1 of ASHRAE 62–2001, or the Indoor Air Quality Procedure, Section 6.2 of ASHRAE 62–2001. Ventilation rates for occupancies not represented shall be determined by an approved engineering analysis. The ventilation system shall be designed to supply the required rate of ventilation air continuously during the period the building is occupied, except as otherwise stated in other provisions of the code.

Exception: The occupant load is not required to be based on the estimated maximum occupant load rate where approved statistical data document the accuracy of an alternate anticipated occupant density.

Subp. 4. **Section 403.3.1.** IMC Section 403.3.1 is amended to read as follows:

403.3.1 System operation. The minimum flow rate of outdoor air that the ventilation system must be capable of supplying during its operation shall be permitted to be based on the rate per person indicated in the Ventilation Rate Procedure, Section 6.1 of ASHRAE 62–2001, or the Indoor Air Quality Procedure, Section 6.2 of ASHRAE 62–2001, and the actual number of occupants present.

Subp. 5. **Section 403.3.4.** IMC Section 403.3.4 is amended to read as follows:

403.3.4 Balancing. Ventilation systems shall be balanced in accordance with amended IMC Section 309.2.

Statutory Authority: *MS s 16B.59; 16B.61; 16B.64*

History: *29 SR 299*

1346.0404 SECTION 404 GARAGES.

Subpart 1. **Section 404.1.** IMC Section 404.1 is amended to read as follows:

404.1 Enclosed parking garages. Mechanical ventilation systems for enclosed parking garages shall provide a minimum exhaust rate of 0.75 cfm per square foot (0.0038 m³/s) of floor area. Mechanical ventilation systems are not required to operate continuously where the system is arranged to operate automatically upon detection of a concentration of carbon monoxide of 25 parts per million (ppm) by approved automatic detection devices.

Subp. 2. **Section 404.2.** IMC Section 404.2 is amended to read as follows:

404.2 Motor vehicle repair garages. Mechanical ventilation systems for motor vehicle repair garages shall provide a minimum exhaust rate of 0.75 cfm per square foot (0.0038 m³/s) of floor area instead of the rate specified in ASHRAE 62–2001.

Subp. 3. **Section 404.3.** IMC Section 404.3 is amended to read as follows:

404.3 Occupied spaces accessory to public garages. Connecting offices, waiting rooms, ticket booths, and similar uses that are accessory to a public garage shall be maintained at a positive pressure and shall be provided with ventilation in accordance with the Ventilation Rate Procedure, Section 6.1 of ASHRAE 62–2001, or the Indoor Air Quality Procedure, Section 6.2 of ASHRAE 62–2001.

Subp. 4. **Section 404.4.** IMC Section 404.4 is amended by adding a section to read as follows:

404.4 Prohibition of heated commercial parking garages. Commercial parking garages shall comply with the Minnesota Energy Code, Minnesota Rules, part 7676.1100, subpart 2.

Statutory Authority: *MS s 16B.59; 16B.61; 16B.64*

History: *15 SR 71; 29 SR 299*

1346.0405 [Repealed, 29 SR 299]

1346.0406 [Repealed, 29 SR 299]

1346.0407 [Repealed, 29 SR 299]

1346.0408 [Repealed, 29 SR 299]

1346.0409 [Repealed, 29 SR 299]

1346.0410 [Repealed, 29 SR 299]

1346.0411 [Repealed, 29 SR 299]

1346.0414 [Repealed, 29 SR 299]

1346.0418 [Repealed, 29 SR 299]

1346.0421 [Repealed, 29 SR 299]

1346.0424 [Repealed, 29 SR 299]

1346.0501 SECTION 501 GENERAL.

Subpart 1. **Section 501.3.** IMC Section 501.3 is amended to read as follows:

501.3 Outdoor discharge. The air removed by every mechanical exhaust system shall be discharged outdoors at a point where it will not cause a nuisance and from which it cannot again be readily drawn in by a ventilating system. Exhaust ducts shall terminate outside of the building in accordance with amended IMC Section 401.5.2 and shall be equipped with a backdraft damper at the point of termination. Air shall not be exhausted into an attic or crawl space.

Subp. 2. **Section 501.4.** IMC Section 501.4 is amended to read as follows:

501.4 Pressure equalization. Mechanical exhaust systems shall be sized and operated to remove the quantity of air required by this chapter. If a greater quantity of air is supplied by a mechanical ventilating supply system than is removed by a mechanical exhaust system for a room, adequate means shall be provided for the natural exit of the excess air supplied.

501.4.1 Makeup air in new dwellings. Makeup air quantity for new dwellings shall be determined by using Table 501.4.1 and shall be supplied in accordance with IMC Section 501.4.2.

Exception. Makeup air provisions of IMC Section 501.4.1 are not required when any of the following are demonstrated:

1. A dwelling is constructed under the Minnesota Energy Code, Minnesota Rules, chapter 7672.
2. A test is performed according to ASTM Standard E1998–99, *Standard Guide for Assessing Depressurization–Induced Backdrafting and Spillage from Vented Combustion Appliances*, and documentation is provided that the vented combustion appliances continue to operate within established parameters of the test.
3. A test approved by the building official verifies proper operation of vented combustion appliances.

501.4.2 Makeup air supply. Makeup air shall be provided by one of the following methods:

1. Passive makeup air shall be provided by passive openings according to the following:

1.1 Passive makeup air openings from the outdoors shall be sized according to Table 501.4.2.

1.2 Barometric dampers are prohibited in passive makeup air openings when any atmospherically vented appliance is installed.

1.3 Single passive openings larger than 8 inches (204 mm) diameter, or equivalent, shall be provided with a motorized damper that is electrically interlocked with the largest exhaust system.

2. Powered makeup air shall be provided if the size of a single opening or multiple openings exceeds 11 inches (280 mm) diameter, or equivalent, when sized according to Table 501.4.2. Powered makeup air shall comply with the following:

2.1 Powered makeup air shall be electrically interlocked with the largest exhaust system.

2.2 Powered makeup air shall be matched to the airflow of the largest exhaust system.

3. Makeup air shall be provided by a combination of passive openings and powered means according to Table 501.4.2 and the following:

3.1 Passive makeup air openings shall comply with Item 1.

3.2 Powered makeup air shall be supplied for the quantity of airflow in excess of the passive makeup air opening provided, and it shall be electrically interlocked with the exhaust system.

501.4.2.1 Makeup air ducts. Makeup air ducts shall be constructed and installed according to IMC Chapter 6 and Section 501.4.2.

501.4.2.2 Makeup air intake. Makeup air intake openings shall be located to avoid intake of exhaust air in accordance with IMC Section 401.5.2 and IFGC Section 503.8, and shall be covered with corrosion resistant screen of not less than 1/4 inch (6.4 mm) mesh. Makeup air intake openings shall be located at least 12 inches (305 mm) above adjoining grade level.

501.4.2.3 Makeup air location. Makeup air requirements of 175 cubic feet per minute (cfm) (0.084m³/s) and greater shall be introduced to the dwelling in one of the following locations:

1. In the space containing the vented combustion appliances.

2. In the space containing the exhaust system.

3. In a space that is freely communicating with the exhaust system and is approved by the building official.

501.4.2.4 Makeup air termination restriction. A makeup air opening shall not terminate in the return air plenum of a forced air heating system unless it is installed according to the heating equipment manufacturer's installation instructions.

501.4.2.5 Separate makeup air and combustion air openings. When both makeup air and combustion air openings are required, they shall be provided through separate openings to the outdoors. Refer to IFGC Section 304, to determine requirements for air for combustion and ventilation.

Exception: Combination makeup air and combustion air systems may be approved by the building official where they are reasonably equivalent in terms of health, safety, and durability.

501.4.2.6 Makeup air effectiveness. The makeup air shall not reduce the effectiveness of exhaust systems or performance of vented combustion appliances, and makeup air shall not adversely affect the heating or cooling capability of the mechanical equipment.

501.4.3 Additions, alterations, or installations of mechanical systems in existing dwellings. Makeup air shall be supplied to existing dwellings when any of the following conditions occur:

1. If a dwelling was constructed after 2003 using the makeup air provisions of IMC Section 501.4.1, makeup air quantity shall be determined by using Table 501.4.1 and shall be supplied according to IMC Section 501.4.2 when any of the following conditions occur:

1.1 A vented combustion appliance, including a solid fuel appliance, is installed or replaced.

1.2 An exhaust system is installed or replaced.

Exception: If powered makeup air is electrically interlocked and matched to the airflow of the exhaust system, additional makeup air is not required.

2. If a dwelling was constructed after 1999 using the provisions of the Minnesota Energy Code, Minnesota Rules, chapter 7672, makeup air quantity shall be determined by using IMC Table 501.4.1 and shall be supplied in accordance with IMC Section 501.4.2 when any of the following conditions occur:

2.1 A vented combustion appliance, including a solid fuel appliance, is installed or replaced.

2.2 An exhaust system is installed or replaced.

Exception: If powered makeup air is electrically interlocked and matched to the airflow of the exhaust system, additional makeup air is not required.

3. When a solid fuel appliance is installed in a dwelling constructed during or after 1994 under the Minnesota Energy Code, Minnesota Rules, chapter 7670, makeup air quantity shall be determined by using IMC Table 501.4.1 and shall be supplied according to IMC Section 501.4.2.

Exception. If a closed combustion solid fuel burning appliance is installed with combustion air in accordance with the manufacturer's installation instructions, additional makeup air is not required.

4. When an exhaust system with a rated capacity greater than 300 cfm (0.144 m³/s) is installed in a dwelling constructed during or after 1994 under the Minnesota Energy Code, Minnesota Rules, chapter 7670, makeup air quantity shall be determined by using IMC Table 501.4.3(1) and shall be supplied according to IMC Section 501.4.2.

Exception: If powered makeup air is electrically interlocked and matched to the airflow of the exhaust system additional makeup air is not required.

5. When an exhaust system with a rated capacity greater than 300 cfm (0.144 m³/s) is installed in a dwelling constructed prior to 1994, makeup air quantity shall be determined by using IMC Table 501.4.3(2) and shall be supplied according to IMC Section 501.4.2.

Exception: If powered makeup air is electrically interlocked and matched to the airflow of the exhaust system, additional makeup air is not required.

6. When a solid fuel appliance is installed in a dwelling constructed prior to 1994, makeup air quantity shall be determined by using IMC Table 501.4.3(3) and shall be supplied according to IMC Section 501.4.2.

Exception: If a closed combustion solid fuel burning appliance is installed with combustion air in accordance with the manufacturer's installation instructions, additional makeup air is not required.

Exception: Makeup air is not required in Items 1 to 6 when any of the following are demonstrated:

1. A test is performed according to ASTM Standard E1998-99, *Standard Guide for Assessing Depressurization-Induced Backdrafting and Spillage from Vented Combustion Appliances*, and documentation is provided that the vented combustion appliances continue to operate within established parameters of the test.

2. A test approved by the building official verifies proper operation of vented combustion appliances.

Table 501.4.1
Procedure to Determine Makeup Air Quantity
for Exhaust Equipment in Dwellings

	One or multiple power vent or direct vent appliances or no combustion appliances ^A	One or multiple fan-assisted appliances and power vent or direct vent appliances ^B	One atmo-spherically vented gas or oil appliance or one solid fuel appliance ^C	Multiple atmo-spherically vented gas or oil appliances or solid fuel appliances ^D
1. Use the Appropriate Column to Estimate House Infiltration				
a) pressure factor (cfm/sf)	0.15	0.09	0.06	0.03
b) conditioned floor area (sf)	_____	_____	_____	_____
(including unfinished basements)				
Estimated House Infiltration (cfm): [1a x 1b]	_____	_____	_____	_____
2. Exhaust Capacity				
a) continuous exhaust-only ventilation system (cfm):	_____	_____	_____	_____
(not applicable to balanced ventilation systems such as HRV)				
b) clothes dryer	135	135	135	135
c) 80% of largest exhaust rating (cfm):	_____	_____	_____	_____
(not applicable if recirculating system or if powered makeup air is electrically interlocked and matched to exhaust)				
d) 80% of next largest exhaust rating (cfm):	not appli-cable	_____	_____	_____

(not applicable if recirculating system or if powered makeup air is electrically interlocked and matched to exhaust)

Total

Exhaust

Capacity (cfm):

[2a+2b+2c+2d] _____

3. Makeup Air Requirement

a) Total

Exhaust

Capacity

(from

above)

b) Estimated

House

Infiltration

(from

above)

Makeup Air

Quantity

(cfm):

[3a - 3b]

(if value is negative, no makeup air is needed)

4. For Makeup Air Opening Sizing, refer to Table 501.4.2

^A Use this column if there are other than fan-assisted or atmospherically vented gas or oil appliances or if there are no combustion appliances.

^B Use this column if there is one fan-assisted appliance per venting system. Other than atmospherically vented appliances may also be included.

^C Use this column if there is one atmospherically vented (other than fan-assisted) gas or oil appliance per venting system or one solid fuel appliance.

^D Use this column if there are multiple atmospherically vented gas or oil appliances using a common vent or if there are atmospherically vented gas or oil appliances and solid fuel appliances.

Table 501.4.2
Makeup Air Opening Sizing Table for
New and Existing Dwellings

Type of opening or system	One or multiple power vent or direct vent appli- ances or no com- bustion appli- ances ^A (cfm)	One or multiple fan- assisted appli- ances and power vent or direct vent appli- ances ^B (cfm)	One atmos- pheric- ally vented gas or oil appli- ance or one solid fuel appli- ance ^C (cfm)	Multiple atmos- pheric- ally vented gas or oil appli- ances or solid fuel appli- ances ^D (cfm)	Passive makeup air opening duct dia- meter E,F,G (inches)
Passive Opening	1-36	1-22	1-15	1-9	3
Passive Opening	37-66	23-41	16-28	10-17	4

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Passive Opening	67-109	42-66	29-46	18-28	5
Passive Opening	110-163	67-100	47-69	29-42	6
Passive Opening	164-232	101-143	70-99	43-61	7
Passive Opening	233-317	144-195	100-135	62-83	8
Passive Opening with Motorized Damper	318-419	196-258	136-179	84-110	9
Passive Opening with Motorized Damper	420-539	259-332	180-230	111-142	10
Passive Opening with Motorized Damper	540-679	333-419	231-290	143-179	11
Powered Makeup Air ^H	>679	>419	>290	>179	Not Appli- cable

^A Use this column if there are other than fan-assisted or atmospherically vented gas or oil appliances *or* if there are no combustion appliances.

^B Use this column if there is one fan-assisted appliance per venting system. Other than atmospherically vented appliances may also be included.

^C Use this column if there is one atmospherically vented (other than fan-assisted) gas or oil appliance per venting system *or* one solid fuel appliance.

^D Use this column if there are multiple atmospherically vented gas or oil appliances using a common vent *or* if there are atmospherically vented gas or oil appliances *and* solid fuel appliance(s).

^E An equivalent length of 100 feet of round smooth metal duct is assumed. Subtract 40 feet for the exterior hood and ten feet for each 90-degree elbow to determine the remaining length of straight duct allowable.

^F If flexible duct is used, increase the duct diameter by one inch. Flexible duct shall be stretched with minimal sags.

^G Barometric dampers are prohibited in passive makeup air openings when any atmospherically vented appliance is installed.

^H Powered makeup air shall be electrically interlocked with the largest exhaust system.

Table 501.4.3(1)

Procedure to Determine Makeup Air Quantity
for Exhaust Equipment in Existing Dwellings
(Refer to Item 4 in Section 501.4.3 to
determine applicability of this table)

One or multiple power vent or direct vent appliances or no combustion appliances ^A	One or multiple fan-assisted appliances and power vent or direct vent appliances ^B	One atmo- spherically vented gas or oil appliance or one solid fuel appliance ^C	Multiple atmo- spherically vented gas or oil appliances or solid fuel appliances ^D
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I. Use the Appropriate Column to Estimate House Infiltration

a) pressure factor (cfm/sf)	0.15	0.09	0.06	0.03
-----------------------------------	------	------	------	------

b) conditioned
floor
area
(sf)

Estimated
House
Infiltration
(cfm):
[1a x 1b]

2. Exhaust Capacity

80% of
exhaust
rating =
Exhaust
Capacity
(cfm):

(not applicable if recirculating system or if powered makeup air is electrically interlocked and matched to exhaust)

3. Makeup Air Requirement

a) Exhaust
Capacity
(from
above)

b) Estimated
House
Infiltration
(from
above)

Makeup Air
Quantity
(cfm):
[3a – 3b]

(if value is negative, no makeup air is needed)

4. For Makeup Air Opening Sizing, refer to Table 501.4.2

^A Use this column if there are other than fan-assisted or atmospherically vented gas or oil appliances or if there are no combustion appliances.

^B Use this column if there is one fan-assisted appliance per venting system. Other than atmospherically vented appliances may also be included.

^C Use this column if there is one atmospherically vented (other than fan-assisted) gas or oil appliance per venting system or one solid fuel appliance.

^D Use this column if there are multiple atmospherically vented gas or oil appliances using a common vent or if there are atmospherically vented gas or oil appliances and solid fuel appliances.

Table 501.4.3(2)
Procedure to Determine Makeup Air Quantity for
Exhaust Equipment in Existing Dwellings
(Refer to Item 5 in Section 501.4.3 to determine
applicability of this table)

	One or multiple power vent or direct vent appliances or no combustion appliances ^A	One or multiple fan-assisted appliances and power vent or direct vent appliances ^B	One atmo- spherically vented gas or oil appliance or one solid fuel appliance ^C	Multiple atmo- spherically vented gas or oil appliances or solid fuel appliances ^D
1. Use the Appropriate Column to Estimate House Infiltration				
a) pressure factor (cfm/sf)	0.25	0.15	0.10	0.05
b) conditioned floor area (sf)	_____	_____	_____	_____
(including unfinished basements)				
Estimated House Infiltration (cfm): [1a x 1b]	_____	_____	_____	_____
or				
Alternative Calculation (by using blower door test) ^E				
c) conversion factor	0.75	0.45	0.30	0.15
d) CFM50 value (from blower door test)	_____	_____	_____	_____
Estimated House Infiltration (cfm): [1c x 1d]	_____	_____	_____	_____

2. Exhaust Capacity

80% of
exhaust
rating =
Exhaust
Capacity
(cfm):

(not applicable if recirculating system or if powered makeup air is electrically interlocked with exhaust)

3. Makeup Air Requirement

a) Exhaust
Capacity
(from
above)

b) Estimated
House
Infiltration
(from
above)

Makeup Air
Quantity
(cfm):
[3a – 3b]

(if value is negative, no makeup air is needed)

4. For Makeup Air Opening Sizing, refer to Table M501.4.2

^A Use this column if there are other than fan-assisted or atmospherically vented gas or oil appliances or if there are no combustion appliances.

^B Use this column if there is one fan-assisted appliance per venting system. Other than atmospherically vented appliances may also be included.

^C Use this column if there is one atmospherically vented (other than fan-assisted) gas or oil appliance per venting system or one solid fuel appliance.

^D Use this column if there are multiple atmospherically vented gas or oil appliances using a common vent or if there are atmospherically vented gas or oil appliances and solid fuel appliances.

^E As an alternative, the Estimated House Infiltration may be calculated by performing a blower door test and multiplying the conversion factor by the CFM50 value.

Table 501.4.3(3)
Procedure to Determine Makeup Air Quantity
for Exhaust Equipment in Existing Dwellings
(Refer to Item 6 in Section 501.4.3 to
determine applicability of this table)

One or multiple power vent or direct vent appliances or no combustion appliances ^A	One or multiple fan-assisted appliances and power vent or direct vent appliances ^B	One atmo- spherically vented gas or oil appliance or one solid fuel appliance ^C	Multiple atmo- spherically vented gas or oil appliances or solid fuel appliances ^D
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1. Use the Appropriate Column to Estimate House Infiltration

a) pressure
factor
(cfm/sf)

0.25

0.15

0.10

0.05

b) conditioned
floor
area (sf)

(including unfinished basements)

Estimated
House
Infiltration
(cfm):
[1a x 1b]

or

Alternative
Calculation
(by using
blower door
test)^E

c) conversion
factor

0.75

0.45

0.30

0.15

d) CFM50 value
(from blower
door test)

Estimated
House
Infiltration
(cfm):
[1c x 1d]

2. Exhaust Capacity

a) continuous
exhaust-
only
ventilation
system
(cfm)

(not applicable to balanced ventilation systems)

b) clothes
dryer
(cfm)

135

135

135

135

c) 80% of
largest
exhaust
rating
(cfm):

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(not applicable if recirculating system or if powered makeup air is electrically interlocked and with exhaust)

d) 80% of
next
largest
exhaust
rating
(cfm)

Not
appli-
cable

(not applicable if recirculating system or if powered makeup air is electrically interlocked with exhaust)

Total
Exhaust
Capacity
(cfm):
[2a+2b+2c+2d]

3. Makeup Air Requirement

a) Total
Exhaust
Capacity
(from
above)

b) Estimated
House
Infiltration
(from
above)

Makeup Air
Quantity
(cfm):
[3a - 3b]

(if value is negative, no makeup air is needed)

4. For Makeup Air Opening Sizing, refer to Table 501.4.2

^A Use this column if there are other than fan-assisted or atmospherically vented gas or oil appliances or if there are no combustion appliances.

^B Use this column if there is one fan-assisted appliance per venting system. Other than atmospherically vented appliances may also be included.

^C Use this column if there is one atmospherically vented (other than fan-assisted) gas or oil appliance per venting system or one solid fuel appliance.

^D Use this column if there are multiple atmospherically vented gas or oil appliances using a common vent or if there are atmospherically vented gas or oil appliances and solid fuel appliances.

^E As an alternative, the Estimated House Infiltration may be calculated by performing a blower door test and multiplying the conversion factor by the CFM50 value.

Statutory Authority: *MS s 16B.59; 16B.61; 16B.64*

History: 29 SR 299

1346.0504 [Repealed, 29 SR 299]

1346.0505 SECTION 505 DOMESTIC KITCHEN EXHAUST EQUIPMENT.

IMC Section 505.1 is amended to read as follows:

505.1 Domestic systems. Where domestic range hoods and domestic appliances equipped with downdraft exhaust are located within dwellings, the hoods and appliances shall discharge to the outdoors through ducts constructed of galvanized steel, stainless steel, aluminum, or copper. The ducts shall have smooth inner walls and shall be air tight and equipped with a backdraft damper. Domestic kitchen exhaust hoods ducted to the outdoors shall have makeup air provided according to IMC Section 501.4. Refer to Appendix C for Table C-1, "Recommended Capacities for Domestic Kitchen Exhaust Hoods."

Exceptions:

1. Where installed according to the manufacturer's installation instructions and where mechanical or natural ventilation is otherwise provided according to IMC Chapter 4, listed and labeled ductless range hoods shall not be required to discharge to the outdoors.
2. Ducts for domestic kitchen cooking appliances equipped with downdraft exhaust systems shall be permitted to be constructed of Schedule 40 PVC pipe provided that the installation complies with all of the following:
 - 2.1. The duct shall be installed under a concrete slab poured on grade.
 - 2.2. The underfloor trench in which the duct is installed shall be completely back-filled with sand or gravel.
 - 2.3. The PVC duct shall extend not greater than 1 inch (25 mm) above the indoor concrete floor surface.
 - 2.4. The PVC duct shall extend not greater than 1 inch (25 mm) above grade outside of the building.
 - 2.5. The PVC ducts shall be solvent cemented.

Statutory Authority: *MS s 16B.59; 16B.61; 16B.64*

History: 29 SR 299

1346.0506 SECTION 506 COMMERCIAL KITCHEN GREASE DUCTS AND EXHAUST EQUIPMENT.

Subpart 1. **Section 506.3.** IMC Section 506.3 is amended to read as follows:

506.3 Ducts serving Type I hoods. Commercial kitchen exhaust systems serving Type I hoods shall be designed, constructed and installed in accordance with NFPA 96-2001, *Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations*.

Subp. 2. **Sections 506.3.1 to 506.3.7 and 506.3.9 to 506.3.13.3.** IMC Sections 506.3.1 through 506.3.7 and 506.3.9 through 506.3.13.3 are deleted and replaced with NFPA 96-2001 with the following amendments:

5.1.1 The hood or that portion of a primary collection means designed for collecting cooking vapors and residues shall be constructed of stainless steel not less than 0.94 mm (0.037 in.) (No. 20 MSG) in thickness or other approved material of equivalent strength and fire and corrosion resistance. Refer to the Minnesota Food Code, Minnesota Rules, chapter 4626, for additional requirements for commercial kitchen hoods licensed and inspected by the Department of Agriculture, Department of Health, or local authorities that conduct inspections of food establishments.

7.5.2.1 All seams, joints, penetrations, and duct-to-hood collar connections shall have a liquid tight continuous external weld. Listed grease ducts and ducts complying with 7.5.1 through 7.5.5.5 that are installed within a concealed enclosure shall maintain an air pressure test of 0.10 inches water column positive pressure for a minimum of 20 minutes, unless an equivalent alternate test is specified by the building official.

8.1.2.3 Flexible connectors shall not be used without prior approval from the building official.

8.1.3.5 Flexible connectors shall not be used without prior approval from the building official.

8.2.1.1 The air velocity through any duct shall be not less than 152.4 m/min (500 ft/min).

Subp. 3. **Section 506.4.2.** IMC Section 506.4.2 is amended to read as follows:

506.4.2 Ducts. Ducts and plenums serving Type II hoods shall be constructed of rigid metallic materials. Duct construction, installation, bracing, and supports shall comply with IMC

Chapter 6. Ducts subject to positive pressure and ducts conveying moisture-laden or waste heat-laden air shall comply with the following requirements:

1. Ducts shall be constructed, joined, and sealed to prevent drips and leaking.
2. Ducts shall slope not less than one-fourth unit vertical in 12 units horizontal (2 percent slope) toward the hood or toward an approved reservoir.
3. Horizontal ducts exceeding 75 feet (22 860 mm) in length shall slope not less than one unit vertical in 12 units horizontal (8.3 percent slope).
4. Ducts shall maintain an air pressure test of 0.10 inches water column positive pressure for a minimum of 20 minutes, unless an equivalent alternate test is specified by the building official.

Statutory Authority: *MS s 16B.59; 16B.61; 16B.64*

History: *29 SR 299*

1346.0507 SECTION 507 COMMERCIAL KITCHEN HOODS.

Subpart 1. **Section 507.1.** IMC Section 507.1 is amended to read as follows:

507.1 General. Commercial kitchen exhaust hoods shall comply with the requirements of this section. Hoods shall be Type I or Type II and shall be designed to capture and confine cooking vapors and residues.

Exception: Factory-built commercial exhaust hoods which are listed, labeled, and installed in accordance with UL 710 and installed in accordance with IMC Section 304.1 shall not be required to comply with IMC Sections 507.5, 507.7, 507.12, amended IMC Section 507.13, and Chapter 5 of NFPA 96–2001.

Subp. 2. **Section 507.2.** IMC Section 507.2 is amended to read as follows:

507.2 Where required. A Type I hood shall be installed above all commercial food heat-processing appliances that produce grease-laden vapors or smoke. A Type I or Type II hood shall be installed at or above all commercial food heat-processing appliances that produce fumes, steam, odor, or heat. A Type II hood shall be installed above commercial dishwashing machines.

Exceptions:

1. Food heat-processing appliances installed within a dwelling unit.
2. Under-counter-type commercial dishwashing machines.
3. Electric countertop appliances with a heat input less than 3.7 kW used for heating food with limited grease emissions including warming ovens, microwave ovens, toasters, soup warmers, hotdog rollers, pretzel warmers, coffee makers, heated display cases, and hot air popcorn poppers.
4. Integral recirculating (ductless) hoods listed, labeled, and installed in accordance with UL 197 and Chapter 13 of NFPA 96–2001.

Subp. 3. **Section 507.2.1.** IMC Section 507.2.1 is deleted.

Subp. 4. **Section 507.2.2.** IMC Section 507.2.2 is amended to read as follows:

507.2.2 Domestic cooking appliances used for commercial purposes. Domestic cooking appliances utilized for commercial purposes shall be provided with Type I or II hoods as required for the type of appliances and processes in accordance with amended IMC Section 507.2. Refer to the Minnesota Food Code, Minnesota Rules, chapter 4626, for additional requirements for commercial kitchen hoods licensed and inspected by the Department of Agriculture, Department of Health, or local authorities that conduct inspections of food establishments.

Subp. 5. **Section 507.2.3.** IMC Section 507.2.3 is deleted.

Subp. 6. **Section 507.4.** IMC Section 507.4 is deleted.

Subp. 7. **Section 507.5.** IMC Section 507.5 is amended to read as follows:

507.5 Type II hood materials. Type II hood materials shall be constructed of stainless steel not less than 0.024 inch (0.61 mm) (No. 24 Gage) in thickness, copper sheets weighing not less than 24 ounces per square foot (7.3 kg/m²), or of other approved material and gage. Refer

to the Minnesota Food Code, Minnesota Rules, chapter 4626, for additional requirements for commercial kitchen hoods licensed and inspected by the Department of Agriculture, Department of Health, or local authorities that conduct inspections of food establishments.

Subp. 8. **Section 507.7.** IMC Section 507.7 is amended to read as follows:

507.7 Hood joints, seams, and penetrations. Hood joints, seams, and penetrations shall comply with amended IMC Section 507.7.1 and IMC Section 507.7.2.

Subp. 9. **Section 507.7.1.** IMC Section 507.7.1 is amended by adding a section to read as follows:

507.7.1 Type I hoods. Type I hoods shall be designed, constructed and installed in accordance with Chapter 5 of NFPA 96–2001.

Subp. 10. **Sections 507.8 to 507.11.2.** IMC Sections 507.8 through 507.11.2 are deleted.

Subp. 11. **Section 507.13.** IMC Section 507.13 is amended to read as follows:

507.13 Capacity of hoods. Commercial kitchen hoods shall exhaust a minimum net quantity of air determined in accordance with IMC Sections 507.13.1 through 507.13.4. The net quantity of exhaust air shall be calculated by subtracting any air flow supplied directly to a hood cavity from the total exhaust flow rate of a hood. Where any combination of extra-heavy duty, heavy duty, medium duty, or light duty cooking appliances are utilized under a single section of hood, the highest exhaust rate required by this section shall be used for the entire hood, unless it can be demonstrated that the hood is specifically designed for that application.

507.13.1 Extra-heavy duty cooking appliances. The minimum net airflow for hoods used for extra-heavy duty cooking appliances shall be determined as follows:

Type of Hood	CFM per linear foot of hood
Wall canopy	550
Single island canopy	700
Double island canopy (per side)	550
Backshelf/pass-over	Not allowed
Eyebrow	Not allowed

507.13.2 Heavy duty cooking appliances. The minimum net airflow for hoods used for heavy duty cooking appliances shall be determined as follows:

Type of Hood	CFM per linear foot of hood
Wall canopy	400
Single island canopy	600
Double island canopy (per side)	400
Backshelf/pass-over	400
Eyebrow	Not allowed

507.13.3 Medium duty cooking appliances. The minimum net airflow for hoods used for medium duty cooking appliances shall be determined as follows:

Type of Hood	CFM per linear foot of hood
Wall canopy	300
Single island canopy	500
Double island canopy (per side)	300
Backshelf/pass-over	300
Eyebrow	250

507.13.4 Light duty cooking appliances. The minimum net airflow for hoods used for light duty cooking appliances shall be determined as follows:

Type of Hood	CFM per linear foot of hood
Wall canopy	200
Single island canopy	400

Double island canopy (per side)	250
Backshelf/pass-over	250
Eyebrow	250

Subp. 12. **Sections 507.15 and 507.16.** IMC Sections 507.15 and 507.16 are deleted.

Subp. 13. **Section 507.17.** IMC Section 507.17 is amended by adding a section to read as follows:

507.17.1 Capture and containment test. The performance of the exhaust system shall be verified by a capture and containment test. This test shall be conducted with all appliances under the hood at operating temperatures. Capture and containment shall be verified visually by observing smoke or steam produced by actual or simulated cooking, such as with smoke candles or smoke puffers, etc.

Statutory Authority: *MS s 16B.59; 16B.61; 16B.64*

History: 29 SR 299

1346.0508 SECTION 508 COMMERCIAL KITCHEN MAKEUP AIR.

Subpart 1. **Section 508.1.** IMC Section 508.1 is amended to read as follows:

508.1 Makeup air. Makeup air shall be supplied during the operation of commercial kitchen exhaust systems that are provided for commercial food heat-processing appliances. The amount of makeup air supplied shall be approximately equal to the exhaust air. A minimum of 80 percent of the makeup air shall be supplied into the space where the exhaust hood is located. The makeup air shall not reduce the effectiveness of the exhaust system. Makeup air shall be provided by mechanical means and the exhaust and makeup air systems shall be electrically interlocked to insure that makeup air is provided whenever the exhaust system is in operation. Makeup air intake openings shall comply with IMC Section 401.5 and amended IMC Section 401.5.1.

Exception: This section shall not apply to dwelling units.

508.1.1 Makeup air temperature. Makeup air shall be not less than 50°F (10°C), measured at the flow of air from the supply diffuser into the space.

508.1.2 Makeup and ventilation air distribution. Makeup and ventilation air supply diffusers located within 12 feet (3.7 m) of an exhaust hood shall be directed away from the hood.

Subp. 2. **Section 508.2.** IMC Section 508.2 is amended to read as follows:

508.2 Compensating hoods. Manufacturers of compensating hoods shall provide a label indicating minimum exhaust flow and maximum makeup airflow that provides capture and containment of the exhaust effluent. Short-circuit compensating hoods are prohibited.

Statutory Authority: *MS s 16B.59; 16B.61; 16B.64*

History: 29 SR 299

1346.0510 SECTION 510 HAZARDOUS EXHAUST SYSTEMS.

Subpart 1. **Section 510.1.** IMC Section 510.1 is amended by adding an exception to the end of this section as follows:

Exception: Other than sections 510.4 and 510.7, this section shall not apply to laboratory ventilation systems that comply with NFPA 45.

Subp. 2. **Section 510.4.** IMC Section 510.4 is amended to read as follows:

510.4 Independent system. Hazardous exhaust systems shall be independent of other types of exhaust systems. Incompatible materials, as defined in the International Fire Code, shall not be exhausted through the same hazardous exhaust system. Hazardous exhaust systems where the duct is under positive pressure shall not share common shafts with other duct systems, except where the systems are hazardous exhaust systems originating in the same fire area.

(The second paragraph remains unchanged.)

Subp. 3. **Section 510.7.** IMC Section 510.7 is amended by adding exceptions as follows:

Exceptions: An approved automatic fire suppression system shall not be required in:

1. ducts conveying materials, fumes, mists, and vapors that are nonflammable and noncombustible;
2. ducts where the largest cross-sectional diameter is less than 10 inches (254 mm); or
3. laboratory hoods or exhaust systems having interiors with a flame spread index less than 25 where the laboratory ventilation system is installed in accordance with NFPA 45.

Statutory Authority: *MS s 16B.59; 16B.61; 16B.64*

History: 29 SR 299

1346.0602 [Repealed, 29 SR 299]

1346.0603 SECTION 603 DUCT CONSTRUCTION AND INSTALLATION.

Subpart 1. **Section 603.2.** IMC Section 603.2 is amended to read as follows:

603.2 Duct sizing. Ducts installed within a single dwelling unit shall be sized in accordance with ACCA Manual D, *Residential Duct Systems*, or other approved methods. Ducts installed within all other buildings shall be sized in accordance with Chapter 34 of the *2001 ASHRAE Handbook – Fundamentals* or other equivalent computation procedures.

603.2.1 Duct classification. Ducts shall be classified based on the maximum operating pressure of the duct at pressures of positive or negative 0.5, 1.0, 2.0, 3.0, 4.0, 6.0, or 10.0 inches of water column. The pressure classification of ducts shall equal or exceed the design pressure of the air distribution in which the ducts are utilized.

Subp. 2. **Section 603.3.** IMC Section 603.3 is amended to read as follows:

603.3 Metallic ducts. All metallic ducts shall be constructed as specified in the *SMACNA HVAC Duct Construction Standards – Metal and Flexible*.

Exception: Ducts installed within a single dwelling unit shall have a minimum thickness as specified in Table 603.3.

603.3.1 Elbows. Radius elbows with velocities exceeding 1,000 feet per minute (fpm) (76.2 m/min) shall have an inside radius not less than the width of the duct or shall have turning vanes. Square throat elbows with velocities exceeding 1,000 feet per minute (fpm) (76.2 m/min) shall have turning vanes.

Exception: Ducts installed within a single dwelling unit.

603.3.2 Transition fittings. Transition fittings shall be constructed with a maximum slope of 45 degrees.

603.3.3 Obstructions. Where a pipe or other obstruction passes through a duct, a streamlined sleeve must be constructed equal in type and gage to the duct. The area of the duct, at the point of obstruction, must be increased by an amount equal to the area of the streamlined sleeve.

Subp. 3. **Section 603.6.** IMC Section 603.6 is amended to read as follows:

603.6 Rigid duct penetrations. Duct system penetrations of walls, floors, ceilings, and roofs and air transfer openings in any of those building components shall be protected as required by IMC Section 607. Ducts in a private garage and ducts penetrating the walls or ceilings separating a dwelling from a private garage shall be continuous and constructed of minimum 26 gage (0.48 mm) galvanized sheet metal and shall have no openings into the garage. Fire and smoke dampers are not required in such ducts passing through the wall or ceiling separating a dwelling from a private garage, unless required by International Building Code Chapter 7.

Subp. 4. **Section 603.7.** IMC Section 603.7 is amended to read as follows:

603.7 Underground ducts. Ducts shall be approved for underground installation. Metallic ducts not having an approved protective coating shall be completely encased in a minimum of 2 inches (51 mm) of concrete.

Subp. 5. **Section 603.7.1.** IMC Section 603.7.1 is amended to read as follows:

603.7.1 Slope. Ducts shall slope to allow drainage to a point provided with access for inspection and cleaning at each low point of the duct system.

Subp. 6. **Section 603.7.2.** IMC Section 603.7.2 is amended to read as follows:

603.7.2 Sealing. Ducts shall have a polyethylene vapor retarder of at least 4 mils (0.102 mm) thickness installed around the outside. Where encased in concrete, the ducts shall be sealed and secured prior to pouring the concrete encasement.

Subp. 7. **Section 603.7.5.** IMC Section 603.7 is amended by adding a section to read as follows:

603.7.5 Drainage. Underground ducts shall be provided with drain tile around the perimeter of the duct system to prevent water intrusion. The top of the drain tile shall be installed at an elevation lower than the bottom of the underground duct system. The building official may approve an alternate drainage system if soil conditions are adequate.

Subp. 8. **Section 603.7.6.** IMC Section 603.7 is amended by adding a section to read as follows:

603.7.6 Insulation. Underground ducts shall be insulated in accordance with amended IMC Section 604.1.

Subp. 9. **Section 603.8.** IMC Section 603.8 is amended to read as follows:

603.8 Joints, seams and connections. All transverse joints, longitudinal seams, and connections shall be securely fastened and sealed in accordance with this section. Pressure sensitive tape shall not be used as the primary sealant for ducts designed to operate at static pressure of one inch water gauge or greater.

Location	Design Static Pressure	Minimum Required Sealing
All locations	Greater than 3.0 inches (750 Pa) water gauge	All transverse joints, longitudinal seams, and duct wall penetrations shall be sealed. Ductwork shall be equal to or less than Leakage Class 6 as defined in Section 4 of the <i>SMACNA HVAC Duct Leakage Test Manual*</i> .
Portions of ducts not completely inside the vapor retarder/air barrier enclosing conditioned space	3.0 inches (750 Pa) water gauge and less	All transverse joints, longitudinal seams, and duct wall penetrations shall be sealed.
Portions of return air ducts in the same space as an atmospherically vented or fan-assisted appliance.	3.0 inches (750 Pa) water gauge and less	All transverse joints, longitudinal seams, and duct wall penetrations shall be sealed.
All locations	Greater than 0.50 to 3.0 inches (125 to 750 Pa) water gauge	All transverse joints and duct wall penetrations shall be sealed.

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All locations	0.50 inches (125 Pa) water gauge and less	All transverse joints, longitudinal seams, and duct wall penetrations shall have no visible gaps and shall be sufficiently airtight in accordance with Section 1.7 of the <i>SMACNA HVAC Duct Construction Standards – Metal & Flexible</i> .
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*Representative sections totaling no less than 25 percent of the total installed duct area for the designated pressure class shall be tested. Duct systems with pressure ratings in excess of three inches water column shall be identified in the construction documents.

Subp. 10. **Section 603.15.** IMC Section 603.15 is amended to read as follows:

603.15 Registers, grilles and diffusers. Duct registers, grilles, and diffusers shall be installed in accordance with the manufacturer's installation instructions. Balancing dampers or other means of supply air adjustment shall be provided in the branch ducts. Volume dampers shall be provided for all supply ducts, and they shall be adjusted according to the required air measurement of the system and locked in place. In finished or inaccessible locations, a friction-type register box may be used.

Statutory Authority: *MS s 16B.59; 16B.61; 16B.64*

History: *15 SR 71; 29 SR 299*

1346.0604 SECTION 604 INSULATION.

IMC Section 604.1 is amended to read as follows:

604.1 General. Duct insulation shall conform to the thickness required by this section.

Minimum Required Duct Installation (see notes for explanations)

Duct Location	Requirements
Attics, garages, and ventilated crawl spaces	R-8 and V
Exterior of building	R-8, V and W
Inside of building and in unconditioned spaces TD less than or equal to 15°F	None required
TD greater than 15°F and less than or equal to 40°F	R-3.3 and V
TD greater than 40°F	R-5 and V
Within conditioned spaces, in basements with insulated walls, and in plenums within conditioned spaces	None required
Intake and exhaust ducts within conditioned spaces*	R-3.3 and V
Within cement slab or within ground (also see IMC Section 603.7)	R-5

Notes:

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

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

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

W = Approved weatherproof barrier.

Statutory Authority: *MS s 16B.59; 16B.61; 16B.64*

History: *15 SR 71; 29 SR 299*

1346.0605 [Repealed, 29 SR 299]

1346.0606 [Repealed, 29 SR 299]

1346.0607 [Repealed, 29 SR 299]

1346.0608 [Repealed, 29 SR 299]

1346.0701 SECTION 701 GENERAL.

Subpart 1. **Section 701.4.** IMC Section 701.4 is amended to read as follows:

701.4 Engineered installations. Engineered combustion air installations shall provide adequate supply of combustion, ventilation, and dilution air, and shall be approved by the building official.

Subp. 2. **Sections 701.4.1 and 701.4.2.** IMC Sections 701.4.1 and 701.4.2 are deleted.

Statutory Authority: *MS s 16B.59; 16B.61; 16B.64*

History: *29 SR 299*

1346.0703 SECTION 703 OUTDOOR AIR.

IMC Sections 703.1 through 703.1.2.2 are amended to read as follows:

703.1 All air from the outdoors. Where all combustion and dilution air is to be provided by outdoor air, the required combustion and dilution air shall be obtained by opening the room to the outdoors. Openings connecting the room to the outdoor air shall comply with IMC Sections 703.1.1 through 703.1.2.2.

703.1.1 One permanent opening method. When any natural draft equipment is installed, one permanent opening, commencing within 12 inches (300 mm) of the bottom of the enclosure, shall be provided. When other than natural draft equipment is installed, one permanent opening, commencing within 12 inches (300 mm) of the top of the enclosure, shall be provided. The opening shall directly communicate with the outdoors or shall communicate through a vertical or horizontal duct to the outdoors or spaces that freely communicate with the outdoors and shall have a minimum free area of 1 inch²/3,000 Btu/hr (700 mm²/kW) of the total input rating of all equipment located in the enclosure.

703.1.2 Two permanent openings method. Two openings shall be provided, one within 1 foot (305 mm) of the ceiling of the room and one within 1 foot (305 mm) of the floor.

703.1.2.1 Size of horizontal openings. The net free area of each opening, calculated in accordance with IMC Chapter 709 and connected to the outdoors through a horizontal duct, shall be a minimum of 1 square inch per 2,000 Btu/h (1,100 mm²/kW) of combined input rating of the fuel-burning appliances drawing combustion and dilution air from the room. The cross-sectional area of the duct shall be equal to or greater than the required size of the opening.

703.1.2.2 Size of vertical openings. The net free area of each opening, calculated in accordance with IMC Chapter 709 and connected to the outdoors through a vertical duct, shall be a minimum of 1 square inch per 4,000 Btu/h (550 mm²/kW) of combined input rating of the fuel-burning appliances drawing combustion and dilution air from the room. The cross-sectional area of the duct shall be equal to or greater than the required size of the opening.

Statutory Authority: *MS s 16B.59; 16B.61; 16B.64*

History: *29 SR 299*

1346.0706 [Repealed, 19 SR 1306]

1346.0707 [Repealed, 29 SR 299]

1346.0709 SECTION 709 OPENING OBSTRUCTIONS.

Subpart 1. **Section 709.1.** IMC Section 709.1 is amended to read as follows:

709.1 General. The required size of openings for combustion and dilution air shall be based on the net free area of each opening. The net free area of an opening shall be that specified by the manufacturer of the opening covering. In the absence of such information, openings covered with metal louvers shall be deemed to have a maximum net free area of 75 percent of the area of the opening, and openings covered with wood louvers shall be deemed to have a maximum net free area of 25 percent of the area of the opening. The building official may require the maximum net free area to be calculated based on the actual opening size. Nonmotorized louvers and grilles shall be fixed in the open position.

Exception: Motorized louvers shall be interlocked with the equipment so that they are proven to be in the full open position prior to main burner ignition and during main burner operation. Means shall be provided to prevent the main burner from igniting if the louvers fail to open during burner startup and to shut down the main burner if the louvers close during operation.

Subp. 2. **Section 709.2.** IMC Section 709.2 is amended to read as follows:

709.2 Dampered openings. Where the combustion air openings are provided with motorized dampers, the dampers shall be electrically interlocked with the firing cycle of the appliances served, so as to prevent operation of any appliance that draws combustion and dilution air from the room when any of the dampers are closed. Manually operated dampers shall not be installed in combustion air openings.

Statutory Authority: *MS s 16B.59; 16B.61; 16B.64*

History: 29 SR 299

1346.0710 [Repealed, 29 SR 299]

1346.0801 SECTION 801 GENERAL.

Subpart 1. **Section 801.10.** IMC Section 801.10 is amended to read as follows:

801.10 Connection to fireplace. Connection of appliances to chimney flues serving fireplaces is prohibited. Refer to IFGC Section 602 for *Decorative Appliances for Installation in Fireplaces* and IFGC Section 603 for *Log Lighters*.

Subp. 2. **Section 801.16.1.** IMC Section 801.16.1 is amended to read as follows:

801.16.1 Residential and low-heat appliances; general. Refer to amended IFGC Section 501.12 for masonry chimneys used to vent gas appliances. Flue lining systems for use with residential-type and low-heat appliances shall be limited to the following:

1. Clay flue lining complying with the requirements of ASTM C 315 or equivalent. Clay flue lining shall be installed in accordance with the *International Building Code*.
2. Listed chimney lining systems complying with UL 1777.
3. Other approved materials that will resist, without cracking, softening, or corrosion, flue gases and condensate at temperatures up to 1,800°F (982°C).

Statutory Authority: *MS s 16B.59; 16B.61; 16B.64*

History: 29 SR 299

1346.0803 SECTION 803 CONNECTORS.

IMC Section 803 is amended to read as follows:

803.10.1 Supports and joints. Connectors shall be supported in an approved manner, and joints shall be fastened with a minimum of three equally spaced sheet metal screws, rivets, or other approved means.

Statutory Authority: *MS s 16B.59; 16B.61; 16B.64*

History: 29 SR 299

1346.0807 [Repealed, 29 SR 299]

1346.0808 [Repealed, 29 SR 299]

1346.0809 [Repealed, 29 SR 299]

1346.0901 SECTION 901 GENERAL.

IMC Section 901 is amended by adding a section to read as follows:

901.5 Unvented heaters and appliances. Unvented room heaters, unvented infrared heaters, and unvented decorative appliances shall not be installed in any dwelling or occupancy.

Exception: Unvented infrared heaters may be installed when mechanical ventilation is provided to exhaust at least 4 cubic feet per minute (cfm) (0.0203 m³/s) per 1000 Btu/hr (0.292 kW) input and it is electrically interlocked with the heater. Makeup air shall be provided to the space to be heated.

Statutory Authority: *MS s 16B.59; 16B.61; 16B.64*

History: 29 SR 299

1346.0906 [Repealed, 19 SR 1306]

1346.0913 [Repealed, 29 SR 299]

1346.1001 SECTION 1001 GENERAL.

IMC Section 1001.1 is amended to read as follows:

1001.1 Scope. This chapter shall govern the installation, alteration and repair of boilers, water heaters, heat exchangers, and pressure vessels.

Exceptions:

1. Pressure vessels used for unheated water supply.
2. Portable unfired pressure vessels and Interstate Commerce Commission containers.
3. Containers for bulk oxygen and medical gas.
4. Unfired pressure vessels having a volume of 5 cubic feet (0.14 m³) or less operating at pressures not exceeding 100 pounds per square inch (psi) (1724 kPa) and located within occupancies of Groups B, F, H, M, R, S and U.
5. Pressure vessels used in refrigeration systems that are regulated by Chapter 11 of this code.
6. Pressure tanks used in conjunction with coaxial cables, telephone cables, power cables, and other similar humidity control systems.

Refer to Minnesota Statutes, sections 183.375 to 183.62, and Minnesota Rules, chapter 5225, for additional requirements for boilers and pressure vessels under the jurisdiction of the Department of Labor and Industry. Refer to Minnesota Statutes, chapter 326, and Minnesota Rules, chapter 5230, for additional requirements for high pressure piping under the jurisdiction of the Department of Labor and Industry.

Statutory Authority: *MS s 16B.59; 16B.61; 16B.64*

History: 29 SR 299

1346.1002 [Repealed, 29 SR 299]

1346.1003 SECTION 1003 PRESSURE VESSELS.

IMC Section 1003.3 is amended to read as follows:

1003.3 Welding. Welding on boilers and pressure vessels shall be performed by approved welders in compliance with the *ASME Boiler and Pressure Vessel Code* Section IX and the *National Board Inspection Code*.

Statutory Authority: *MS s 16B.59; 16B.61; 16B.64*

History: 29 SR 299

1346.1004 SECTION 1004 BOILERS.

Subpart 1. **Section 1004.1.** IMC Section 1004.1 is amended to read as follows:

1004.1 Standards. Oil-fired boilers and their control systems shall be listed and labeled in accordance with UL 726 or shall utilize burner assemblies and control systems listed and labeled in accordance with UL 296 and shall be installed in accordance with NFPA 31 and the manufacturer's installation instructions. Electric boilers and their control systems shall be listed and labeled in accordance with UL 834. Boilers with an input rating above 400,000 Btu/hr (3,660 kW) shall be designed and constructed in accordance with the requirements of the *ASME Boiler and Pressure Vessel Code*, Sections I, II, IV, V, VIII and IX, as applicable. Boilers with an input rating above 400,000 Btu/hr (117 kW) and less than 12,500,000 Btu/hr (3,660 kW) shall comply with ASME CSD-1, and boilers with an input rating of 12,500,000 Btu/hr (3,660 kW) or greater shall comply with NFPA 85-2001, *Boiler and Combustion Systems Hazards Code*.

Subp. 2. **Section 1004.2.** IMC Section 1004.2 is amended to read as follows:

1004.2 Installation. In addition to the requirements of this code, the installation of boilers shall conform to the manufacturer's instructions. Operating instructions of a permanent type shall be attached to the boiler. Boilers shall have all controls set, adjusted, and tested by the installer in accordance with amended IMC Chapter 16. A complete control diagram together with complete boiler instructions shall be furnished by the installer. The manufacturer's rating data and the nameplate shall be attached to the boiler.

Statutory Authority: *MS s 16B.59; 16B.61; 16B.64*

History: *19 SR 1306; 29 SR 299*

1346.1005 [Repealed, 29 SR 299]

1346.1006 SECTION 1006 SAFETY AND PRESSURE RELIEF VALVES AND CONTROLS.

Subpart 1. **Section 1006.4.** IMC Section 1006.4 is amended to read as follows:

1006.4 Approval of safety and safety relief valves. Safety and safety relief valves shall meet the requirements of Section I, IV or VIII of the *ASME Boiler and Pressure Vessel Code*, as applicable. All boilers and pressure vessels shall have a safety relief valve stamped with the ASME code symbol and shall be set no higher than the maximum allowable working pressure of the pressure vessel. Safety relief valves shall have a rated volumetric capacity greater than the boiler or pressure vessel can produce at nameplate pressure and shall have a nonadjustable pressure set point below the rating of the boiler or pressure vessel capable of relieving all excess pressure at its pressure set point. Safety and safety relief valves shall have a manual method of lifting the seat, without endangering the operator, to ensure proper mechanical operation.

Subp. 2. **Section 1006.6.** IMC Section 1006.6 is amended to read as follows:

1006.6 Safety and relief valve discharge. Safety and relief valve discharge pipes shall be of rigid pipe that is approved for the temperature and pressure of the system. The discharge pipe shall be no smaller than the diameter of the safety or relief valve outlet and the discharge end shall be reamed and unthreaded. Safety and relief valves shall not discharge so as to be a hazard, a potential cause of damage, or otherwise a nuisance and shall terminate within 18 inches of the floor. High-pressure steam safety valves shall be vented to the outside of the structure in accordance with Minnesota Rules, parts 5225.4100 and 5230.0990 on boilers, pressure vessels, and high-pressure piping under the jurisdiction of the Department of Labor and Industry, as applicable. Where a low-pressure safety valve or a relief valve discharges to the drainage system, the installation shall conform to the Minnesota Plumbing Code, Minnesota Rules, Chapter 4715.

Subp. 3. **Section 1006.9.** IMC Section 1006 is amended by adding a section to read as follows:

1006.9 Boiler shutdown switch. A manually operated remote shutdown switch shall be located at the boiler room door and marked for easy identification. The emergency shutdown switch shall disable all power to the burner controls.

Exception: A single hot water boiler with a rated input of less than 400,000 Btu/hr (117 kW).

Statutory Authority: *MS s 16B.59; 16B.61; 16B.64*

History: 29 SR 299

1346.1007 SECTION 1007 BOILER LOW-WATER CUTOFF.

Subpart 1. **Section 1007.1.** IMC Section 1007.1 is amended to read as follows:

1007.1 General. Steam and hot water boilers shall be protected with a low-water fuel cutoff control to stop the combustion operation when the water level drops below the lowest safe permissible water level in accordance with the following items:

1. An automatically fired hot water boiler or group of boilers piped together having a rated input of 400,000 Btu/hr (117 kW) or above shall be equipped with an automatic low-water fuel cutoff to stop the combustion operation when the water level drops below the lowest safe permissible water level established by the boiler manufacturer.
2. A boiler installed at an elevation where all radiation in the system is below the lowest safe permissible water level shall be equipped with an automatic low-water fuel cutoff to stop the combustion operation when the water level drops below the lowest safe permissible water level established by the boiler manufacturer.
3. A low-water fuel cutoff shall be installed when recommended by the manufacturer's installation instructions or listing and when special consideration and installations will require a low-water fuel cutoff to protect a hot water or steam boiler.
4. A means shall be provided for testing the operation of the low-water fuel cutoff without requiring the entire system to be drained.
5. A watertube or coil-type boiler requiring forced circulation to prevent overheating of the tubes or coils shall have a flow-sensing device installed, in lieu of the low-water fuel cutoff, to automatically stop the combustion operation when the circulating flow is interrupted.

Subp. 2. **Section 1007.2.** IMC Section 1007.2 is deleted.

Statutory Authority: *MS s 16B.59; 16B.61; 16B.64*

History: 29 SR 299

1346.1011 SECTION 1011 TESTS.

IMC Section 1011.1 is amended to read as follows:

1011.1 Tests. Upon completion of the assembly and installation of boilers and pressure vessels, acceptance tests shall be conducted in accordance with the requirements of the *ASME Boiler and Pressure Vessel Code*. Where field assembly of pressure vessels or boilers is required, a copy of the completed Manufacturer's Data Report required by the *ASME Boiler and Pressure Vessel Code* shall be submitted to the building official.

Statutory Authority: *MS s 16B.59; 16B.61; 16B.64*

History: 29 SR 299

1346.1104 [Repealed, 29 SR 299]

1346.1107 [Repealed, 29 SR 299]

1346.1204 SECTION 1204 PIPE INSULATION.

IMC Section 1204.2 is amended to read as follows:

1204.2 Required thickness. Hydronic, steam, and condensate piping shall be insulated in accordance with this section.

Exceptions: Piping insulation is not required for:

1. Piping installed within HVAC equipment; or
2. Piping installed in basements, crawl spaces, and cellars.

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Insulation Thickness for Nominal Pipe Diameters

Fluid Temper- ature Range °F	Runouts (see item C	1 inch (25.4 mm) and Less	1.25 to 2" (31.7 to 50.8 mm)	2.5 to 4" (63.5 to 101.6 mm)	5 to 6" (127 to 152 mm)	8" (203 mm) and Larger
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Piping System Type – Heating

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

Piping System Type – Cooling

40–55	0.5	0.5	0.75	1	1	1
Below 40 (see item D)	1	1	1.5	1.5	1.5	1.5

A. Insulation thickness in this section 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.

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

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

D. For applications with fluid temperatures of 32°F (0°C) and below, a vapor retarder shall be installed in accordance with IMC Section 604.11.

Statutory Authority: *MS s 16B.59; 16B.61; 16B.64*

History: *29 SR 299*

1346.1207 [Repealed, 29 SR 299]

1346.1500 CHAPTER 15, REFERENCED STANDARDS.

- A. ASHRAE 2001 *Handbook of Fundamentals*;
- B. ASHRAE 15–2001 *Safety Code for Mechanical Refrigeration*;
- C. ASHRAE 34–2001 *Designation and Safety Classification of Refrigerants*;
- D. ASHRAE 62–2001 *Ventilation for Acceptable Indoor Air Quality*, including addenda h, i, k, n, o, r, t, u, v, x, z, ab, ad, ae, and af;
- E. ASME BPV–2001 (Sections I, II, IV, V, VIII & IX) *Boiler and Pressure Vessel Code*;
- F. ASME CSD–1–2002 *Controls and Safety Devices for Automatically Fired Boilers*;

- G. ASME B31.3–1999 *Process Piping Code*;
- H. ASME B31.9–1996 *Building Services Piping Code*;
- I. ASTM E119–99 *Standard Guide for Assessing Depressurization–Induced Backdrafting and Spillage from Vented Combustion Appliances*;
- J. NFPA 58–2001 *Liquefied Petroleum Gas Code*;
- K. NFPA 96–2001 *Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations*;
- L. NFPA 85–2001 *Boiler and Combustion Systems Hazards Code*;
- M. UL 197–1993 including revisions through April 10, 2000, *Commercial Electric Cooking Appliances*;
- N. UL 555–1999 *Fire Dampers*;
- O. UL 555C–1999 *Ceiling Dampers*;
- P. UL 555S–1999 *Smoke Dampers*; and
- Q. UL 2034–1996 including revisions through June 28, 2002, *Single and Multiple Station Carbon Monoxide Alarms*.

Statutory Authority: *MS s 16B.59; 16B.61; 16B.64*

History: 29 SR 299

1346.1503 [Repealed, 29 SR 299]

1346.1505 [Repealed, 29 SR 299]

1346.1520 [Repealed, 29 SR 299]

1346.1521 [Repealed, 29 SR 299]

CHAPTER 16 INSTALLATION AND TESTING OF OIL OR LIQUID FUEL–FIRED EQUIPMENT

1346.1601 SECTION 1601 GENERAL.

The IMC is amended by adding a section to read as follows:

SECTION 1601

GENERAL

1601.1 General. Chapter 16 governs the installation, testing, or repair of: oil or liquid fuel burners, oil or liquid fuel burning systems, oil or liquid fuel burning equipment, and the oil or liquid fuel piping systems installed within, or in conjunction with, buildings or structures. The requirements of this chapter shall apply to the following equipment:

1. Equipment utilized to provide control of environmental conditions.

Exception: Equipment and appliances listed and labeled to an appropriate standard by a nationally recognized testing laboratory, which is qualified to evaluate the equipment or appliance, when installed and tested according to the manufacturer's installation instructions.

2. Equipment with a fuel input of 1,000,000 Btu/hr or greater.
3. Unlisted equipment.
4. Miscellaneous equipment when required by the building official.

Statutory Authority: *MS s 16B.59; 16B.61; 16B.64*

History: 29 SR 299

1346.1602 SECTION 1602 EQUIPMENT PLACEMENT.

The IMC is amended by adding a section to read as follows:

SECTION 1602

EQUIPMENT PLACEMENT

1602.1 Placing equipment in operation. After completion of all installations, the installer shall test all safety and operating controls and venting before placing the burner in service.

The correct input of liquid fuel shall be determined and the fuel-to-air ratio set. Each oil or liquid fuel burner shall be adjusted to its proper input according to the manufacturer's instructions. Overrating the burners or the appliance is prohibited. The input range shall be appropriate to the appliance.

1. For conversion burners installed in hot water (liquid) boilers or warm air furnaces, the rate of flow of the oil or liquid fuel in Btu/h shall be adjusted to within plus or minus five percent of the design load, and not to exceed the design rate of the appliance.

2. For conversion burners installed in steam boilers, the oil or liquid fuel hourly input demand shall be adjusted to meet the steam load requirements. The oil or liquid fuel input demand necessitated by an oversized boiler shall be established and added to the input demand for load requirements to arrive at a total input demand.

Statutory Authority: *MS s 16B.59; 16B.61; 16B.64*

History: 29 SR 299

1346.1603 SECTION 1603 PILOT OPERATION.

The IMC is amended by adding a section to read as follows:

SECTION 1603

PILOT OPERATION

1603.1 Pilot operation. Igniter or pilot flames shall be effective to ignite the oil or liquid fuel at the main burner or burners and shall be adequately protected from drafts. Pilot flames shall not become extinguished during the pilot cycle when the main burner or burners are turned on or off in a normal manner either manually or by automatic controls.

Statutory Authority: *MS s 16B.59; 16B.61; 16B.64*

History: 29 SR 299

1346.1604 SECTION 1604 BURNER OPERATION.

The IMC is amended by adding a section to read as follows:

SECTION 1604

BURNER OPERATION

1604.1 Burner operation. In making tests to determine compliance with the requirements of this section, care shall be exercised to prevent the accumulation of unburned liquid fuel in the appliance that might result in an explosion or fire.

1. The flames from the burner shall freely ignite the liquid fuel when operating at the lowest firing position.

2. Burner flames shall not flash back when the liquid fuel is turned on or off by an automatic control mechanism.

3. Main burner flames shall ignite freely from the pilot when the pilot flame is reduced to a minimum point that will actuate the pilot safety device.

4. When ignition is made in a normal manner, the flame shall not flash outside the appliance.

5. Burners shall not expel liquid fuel through air openings when operating at prevailing pressure.

6. Burners shall have a proper liquid fuel air mixture to insure smooth ignition of the main burner.

Statutory Authority: *MS s 16B.59; 16B.61; 16B.64*

History: 29 SR 299

1346.1605 SECTION 1605 TEST METHODS.

The IMC is amended by adding a section to read as follows:

SECTION 1605
TEST METHODS**1605.1 Method of test.**

1. **Operational checking.** The flue gas, venting, safety, and operating controls of the appliance shall be checked to ensure proper and safe operation.

2. **Method of test – atmospheric type/induced draft type/fan assisted types.** The appliance shall be allowed to operate until the stack temperature becomes stabilized after which a sample of the undiluted flue products shall be taken from the appliance flue outlet. The sample taken shall be analyzed for carbon monoxide, carbon dioxide, and oxygen. Stack temperature shall be noted.

Note: Appliance designs incorporating induced draft assemblies may require a flue gas sample to be taken after the draft regulator or induced draft fan.

3. **Performance standards for atmospheric type.**

a. Minimum of 75 percent efficiency as determined by flue gas analysis method at appliance flue outlet.

b. Carbon monoxide concentration in flue gas not greater than 0.04 percent.

c. Stack temperature not greater than 700°F (371°C), plus ambient.

d. Carbon dioxide concentration between 8 and 13 percent, inclusive.

e. Oxygen concentration between 4 and 10 percent.

f. Smoke test no higher than #2 for light oils, or #4 for oils heavier than #4.

g. Draft shall be in accordance with burner manufacturer's specifications.

3a. **Performance standards for induced draft type/fan assisted types.**

a. Minimum of 75 percent efficiency as determined by flue gas analysis method at appliance flue outlet.

b. Carbon monoxide concentration in flue gas not greater than 0.04 percent.

c. Stack temperature not greater than 700°F (371°C), plus ambient.

d. Carbon dioxide concentration between 8 and 13 percent, inclusive.

e. Oxygen concentration between 4 and 10 percent, inclusive.

f. Smoke test no higher than #2 for light oils, or #4 for oils heavier than #4.

g. Draft shall be in accordance with burner manufacturer's specifications.

Note: Induced draft and fan assisted types of appliances may require a sample to be taken after the induced draft fan, which may cause oxygen figures in excess of the limits stated. In such cases, safe liquid fuel combustion ratios shall be maintained and be consistent with appliance listing.

4. **Method of test – power type.** The appliance shall be allowed to operate until the stack temperature becomes stabilized after which a sample of the undiluted flue products shall be taken from the appliance flue outlet. The sample shall be analyzed for carbon monoxide, carbon dioxide, and oxygen. Stack temperature shall be recorded.

5. **Performance standards for power type.**

a. Minimum of 80 percent efficiency as determined by flue gas analysis method at appliance flue outlet.

b. Carbon monoxide concentration in the flue gas not greater than 0.04 percent.

c. Stack temperature not greater than 700°F (371°C) plus ambient.

d. Carbon dioxide concentration between 8 and 13 percent, inclusive.

e. Oxygen concentration between 4 and 10 percent, inclusive.

f. Smoke test no higher than #2 for light oils, or #4 for oils heavier than #4.

g. Draft shall be in accordance with burner manufacturer's specifications.

6. **Test records filing; tag.** After completion of the test of newly installed oil or liquid fuel burner equipment as provided in this section, complete test records shall be filed with the building official on an approved form. The tag stating the date of the test and the name of the installer shall be attached to the appliance at the main valve.

7. **Oxygen concentration.**

a. The concentration of oxygen in the undiluted flue products of oil or liquid fuel burners shall in no case be less than 3 percent nor more than 10 percent, shall be in conformance with applicable performance standards and shall be consistent with the appliance listing.

b. The allowable limit of carbon monoxide shall not exceed 0.04 percent.

c. The flue gas temperature of an oil appliance, as taken on the appliance side of the draft regulator, shall not exceed applicable performance standards and shall be consistent with the appliance listing.

8. Approved oxygen trim system. The oxygen figures may not apply when there is an approved oxygen trim system on the burner that is designed for that use, including a low oxygen interlock when approved by the building official.

9. Supervised start-up.

a. Supervised start-up may be required to verify safe operation of oil or liquid fuel burner and to provide documentation that operation is consistent with this code, listing and approval. Supervised start-up is required for all liquid fuel burners listed in b, c, and d. Supervised start-up requires that the liquid fuel burner shall be tested in the presence of the building official in an approved manner. Testing shall include safety and operating controls, input, flue gas analysis, and venting. Flue gas shall be tested at high, medium, and low fires. Provisions shall be made in the system to allow firing test in warm weather. After completion of the test of newly installed oil or liquid fuel burner equipment as provided in this section, complete test records shall be filed with the building official on an approved form. The tag stating the date of the test and the name of the installer shall be attached to the appliance at the main valve.

b. Oil and liquid fuel burners of 1,000,000 Btu/hr input or more require a supervised start-up as in a.

c. Installation of oxygen trim systems, modulating dampers, or other draft control or combustion devices require a supervised start-up as in a.

d. All direct fired heaters require a supervised start-up as in a.

10. Control diagram. A complete control diagram of the installation and suitable operating instructions shall be supplied to the building official.

Statutory Authority: *MS s 16B.59; 16B.61; 16B.64*

History: 29 SR 299

1346.1606 SECTION 1606 EQUIPMENT.

The IMC is amended by adding a section to read as follows:

**SECTION 1606
EQUIPMENT**

1606.1 Equipment information.

A. All installations of gas or fuel burners with input above 400,000 Btu/hr and all combination gas or fuel burners must be approved before installation. The following information must be supplied as required by the building official.

1. Name, model, and serial number of the burner.

2. Input rating and type of fuel.

3. Name of the nationally recognized testing laboratory that tested and listed the unit.

4. Name, model, and serial number of the furnace or boiler that the burner will be installed in if not part of a complete package.

5. A complete wiring diagram showing the factory and fuel wiring installed or to be installed including all controls, identified by the brand name and model number.

6. A print of the gas or fuel train from the manual shutoff to the appliance showing all controls that will be installed, their names, model numbers, and approvals.

B. All installations of gas or fuel burners with input above 400,000 Btu/hr and all combination gas and oil or other combination fuel burners that are installed in new or renovated boiler or equipment rooms, or are installed in a package with the boiler or furnace, shall include the following information in addition to that required in item A, subitems 1 to 6.

1. A complete piping diagram from the supply source showing all components and materials identified by brand name and model number with relevant approvals.

2. Detailed provisions for combustion air, venting, and stacks.

3. A floor plan drawn to scale showing all relevant equipment. Plans and specifications shall be approved before proceeding with an installation.

Statutory Authority: *MS s 16B.59; 16B.61; 16B.64*

History: 29 SR 299

1346.1906 [Repealed, 29 SR 299]

1346.2002 [Repealed, 29 SR 299]

1346.2003 [Repealed, 29 SR 299]

1346.2101 [Repealed, 29 SR 299]

1346.2102 [Repealed, 29 SR 299]

1346.2104 [Repealed, 29 SR 299]

1346.2106 [Repealed, 29 SR 299]

1346.2107 [Repealed, 29 SR 299]

1346.2108 [Repealed, 29 SR 299]

1346.2109 [Repealed, 29 SR 299]

1346.2110 [Repealed, 29 SR 299]

1346.2111 [Repealed, 29 SR 299]

1346.2113 [Repealed, 29 SR 299]

1346.2114 [Repealed, 29 SR 299]

1346.2115 [Repealed, 29 SR 299]

1346.2120 [Repealed, 29 SR 299]

1346.2122 [Repealed, 29 SR 299]

1346.2123 [Repealed, 29 SR 299]

1346.2124 [Repealed, 29 SR 299]

1346.2125 [Repealed, 29 SR 299]

1346.2126 [Repealed, 29 SR 299]

1346.2127 [Repealed, 29 SR 299]

1346.2133 [Repealed, 29 SR 299]

1346.2201 [Repealed, 29 SR 299]

1346.2202 [Repealed, 29 SR 299]

1346.2205 [Repealed, 29 SR 299]

1346.2206 [Repealed, 29 SR 299]

1346.2211 [Repealed, 29 SR 299]

1346.2212 [Repealed, 29 SR 299]

1346.2213 [Repealed, 29 SR 299]

1346.2215 [Repealed, 29 SR 299]

1346.2216 [Repealed, 29 SR 299]

1346.2220 [Repealed, 29 SR 299]

1346.2226 [Repealed, 29 SR 299]

1346.2500 [Repealed, 29 SR 299]

1346.2600 [Repealed, 29 SR 299]

MINNESOTA FUEL GAS CODE

1346.5050 TITLE; INCORPORATION BY REFERENCE.

This section is known and may be cited as the “Minnesota Fuel Gas Code.” As used in this section, “the code” and “this code” refer to this section.

Chapters 2 to 7 of the 2000 edition of the International Fuel Gas Code, promulgated by the International Code Council, Inc., 5203 Leesburg Pike, Suite 600, Falls Church, Virginia 22041–3401, are incorporated by reference as part of the Minnesota Fuel Gas Code with the amendments in this section. As used in this section, “IFGC” means the International Fuel Gas Code incorporated in this part.

The IFGC is not subject to frequent change and a copy of the IFGC, with amendments for use in Minnesota, is available in the office of the commissioner of labor and industry.

Statutory Authority: *MS s 16B.59; 16B.61; 16B.64*

History: *29 SR 299; L 2007 c 140 art 1 s 1*

1346.5201 SECTION 201 (IFGC) GENERAL.

IFGC Section 201.4 is amended to read as follows:

201.4 Terms not defined. Where terms are not defined through the methods authorized by this chapter, the Merriam–Webster Collegiate Dictionary, available at www.m-w.com, shall be considered as providing ordinarily accepted meanings. The dictionary is incorporated by reference, is subject to frequent change, and is available through the Minitex interlibrary loan system.

Statutory Authority: *MS s 16B.59; 16B.61; 16B.64*

History: *29 SR 299*

1346.5202 SECTION 202 (IFGC) GENERAL DEFINITIONS.

Subpart 1. **Section 202.** IFGC Section 202 is amended by adding the following definitions:

GAS PIPING SYSTEM – LOW PRESSURE. A system that operates at a pressure not exceeding 14 inches of water column. LPG is a pressure not exceeding 14 inches of water column.

GAS PIPING SYSTEM – MEDIUM PRESSURE. A system that operates at a pressure exceeding 14 inches of water column but not exceeding five (5) psig. LPG is a pressure exceeding 14 inches of water column but not exceeding twenty (20) psig.

GAS PIPING SYSTEM – HIGH PRESSURE. A system that operates at a pressure exceeding five (5) psig. LPG is a pressure exceeding twenty (20) psig.

Subp. 2. **Definition amended.** The definition of “Ready Access (to)” in IFGC Section 202, is amended to read as follows:

READY ACCESS (TO). That which enables a device, appliance or equipment to be directly reached, without requiring the removal or movement of any panel, door or similar obstruction, and without requiring the use of portable access equipment (see “Access”).

Statutory Authority: *MS s 16B.59; 16B.61; 16B.64*

History: *29 SR 299*

1346.5301 SECTION 301 (IFGC) GENERAL.

IFGC Section 301.3 is amended to read as follows:

301.3 Listed and labeled. Appliances regulated by this code shall be listed and labeled to an appropriate standard by a nationally recognized testing laboratory which is qualified to eval-

uate the appliance, unless otherwise approved in accordance with the administrative provisions of the Minnesota State Building Code, Minnesota Rules, chapter 1300. The approval of unlisted appliances shall be based upon engineering evaluation. Unlisted appliances shall be installed with clearances to combustibles in accordance with IFGC Chapter 5. Unlisted appliances with a fuel input rating of less than 12,500,000 Btu/hr (3,660 kW) shall have fuel gas trains, controls and safety devices installed in accordance with Part CF, Combustion Side Control, of ASME CSD-1. Unlisted appliances with a fuel input rating of 12,500,000 Btu/hr (3,660 kW) or greater shall have fuel gas trains, controls and safety devices installed in accordance with NFPA 85-2001.

Statutory Authority: *MS s 16B.59; 16B.61; 16B.64*

History: 29 SR 299

1346.5303 SECTION 303 (IFGC) APPLIANCE LOCATION.

IFGC Section 303.3 is amended to read as follows:

303.3 Prohibited locations. Appliances shall not be located in, or obtain combustion air from, any of the following rooms or spaces:

1. Sleeping rooms.
2. Bathrooms.
3. Toilet rooms.
4. Storage closets.
5. Surgical rooms.

Exceptions:

1. Direct-vent appliances.
2. Vented room heaters, wall furnaces, vented decorative appliances and decorative appliances for installation in vented solid fuel-burning fireplaces, provided that the room is not a confined space and the building is not of unusually tight construction.
3. Appliances installed in a dedicated enclosure in which all combustion air is taken directly from the outdoors, in accordance with amended IFGC Section 304.3. Access to such enclosure shall be through a solid door, weather-stripped in accordance with the exterior door air leakage requirements of the Minnesota Energy Code and equipped with an approved self-closing device.

Statutory Authority: *MS s 16B.59; 16B.61; 16B.64*

History: 29 SR 299

1346.5304 SECTION 304 (IFGC) COMBUSTION, VENTILATION AND DILUTION AIR.

Subpart 1. **Section 304.1.** IFGC Section 304 is deleted and replaced with the following:

304.1 General. Air for combustion, ventilation, and dilution of flue gases for gas utilization equipment installed in buildings shall be obtained by application of one of the methods covered in IFGC Section 304.2, 304.3, 304.4, 304.5, or 304.6. Gas utilization equipment of other than natural draft, power vent, and category I vented appliances shall be provided with combustion, ventilation, and dilution air in accordance with the equipment manufacturer's instructions. Refer to IFGC Appendix E for Worksheet E-1, "Residential Combustion Air Calculation Method" and Table E-1, "Residential Combustion Air Required Volume."

Exceptions:

1. Direct vent appliances.
2. Type 1 clothes dryers that are provided with makeup air in accordance with the manufacturer's installation instructions.
3. Replacement of fuel gas utilization equipment that complies with all of the following conditions:
 - 3.1 Replacement equipment has a Btu/hr (kW) input rating not greater than 30 percent above the original equipment input rating.

3.2 Combustion air provisions meet the code requirements in effect at the time of the original installation.

3.3 Replacement equipment shall not cause an existing mechanical system to become unsafe, hazardous, or overloaded.

304.1.1 Equipment location. Equipment shall be located so as not to interfere with proper circulation of combustion, ventilation, and dilution air.

304.1.2 Draft hood or regulator. Where used, a draft hood or a barometric draft regulator shall be installed in the same room or enclosure as the equipment served so as to prevent any difference in pressure between the hood or regulator and the combustion air supply.

Subp. 2. **Section 304.2.** IFGC Section 304.2 is amended to read as follows:

304.2 Indoor combustion air. The required volume of indoor air shall be determined in accordance with IFGC Section 304.2.1, Standard Method, or IFGC Section 304.2.2, Known Air Infiltration Rate Method. The total required volume shall be the sum of the required volume calculated for all appliances located within the space. Rooms communicating directly with the space in which the appliances are installed through openings not furnished with doors, and through combustion air openings sized and located in accordance with IFGC Section 304.2.3 are considered a part of the required volume.

304.2.1 Standard method. The minimum required volume shall be 50 cubic feet per 1,000 Btu/hour (4.8 m³/kW).

304.2.2 Known air infiltration rate method. Where the air infiltration rate of a structure is known, the minimum required volume shall be determined as follows:

Known Air Infiltration Rate Method Equations:

1. **304.2.2.1 For appliances other than fan-assisted and power vent.**

Equation 304.2.2.1:

$$\begin{array}{rcl} & 21 \text{ ft}^3 & (I_{\text{other}}) \\ \text{Required Volume}_{\text{other}} \geq & \underline{\hspace{2cm}} & (\hspace{2cm}) \\ & \text{ACH} & (1,000 \text{ Btu/hr}) \end{array}$$

2. **304.2.2.2 For fan-assisted and power vent appliances.**

Equation 304.2.2.2:

$$\begin{array}{rcl} & 15 \text{ ft}^3 & (I_{\text{fan}}) \\ \text{Required Volume}_{\text{fan}} \geq & \underline{\hspace{2cm}} & (\hspace{2cm}) \\ & \text{ACH} & (1,000 \text{ Btu/hr}) \end{array}$$

Where:

I_{other} = All appliances other than fan-assisted and power vent Input in Btu/hr.

I_{fan} = Fan-assisted and power vent appliances Input in Btu/hr.

ACH = Air change per hour (percent of volume of space exchanged per hour, expressed as a decimal).

3. An infiltration rate greater than 0.60 ACH shall not be used in the calculations in 1. and 2.

304.2.3 Indoor opening size and location. Openings used to connect indoor spaces shall be sized and located in accordance with the following.

304.2.3.1 Combining spaces on the same story. Each opening shall have a minimum free area of 1 inch²/1,000 Btu/hr (220 mm²/kW) of the total input rating of all gas utilization equipment in the space, but not less than 100 inches² (0.06 m²). One opening shall commence within 12 inches (300 mm) of the top, and one opening shall commence within 12 inches (300 mm) of the bottom, of the enclosure. The minimum dimension of air openings shall be not less than 3 inches (80 mm).

304.2.3.2 Combining spaces in different stories. The volumes of spaces in different stories shall be considered as communicating spaces where such spaces are connected by one or

more openings indoors or floors having a total minimum free area of 2 inches²/1,000 Btu/hr of total input rating of all gas utilization equipment.

Subp. 3. **Section 304.3.** IFGC Section 304.3 is amended to read as follows:

304.3 Outdoor combustion air. Outdoor combustion air shall be provided through openings to the outdoors in accordance with IFGC Section 304.3.1 or 304.3.2. The minimum dimension of air openings shall not be less than 3 inches (80 mm).

304.3.1 Two permanent openings method. Two permanent openings, one commencing within 12 inches (300 mm) of the top, and one commencing within 12 inches (300 mm) of the bottom, of the enclosure shall be provided. The openings shall communicate directly, or by ducts, with the outdoors or spaces that freely communicate with the outdoors.

1. Where directly communicating with the outdoors or where communicating to the outdoors through vertical ducts, each opening shall have a minimum free area of 1 inch²/4,000 Btu/hr (550 mm²/kW) of total input rating of all equipment in the enclosure.

2. Where communicating with the outdoors through horizontal ducts, each opening shall have a minimum free area of 1 inch²/2,000 Btu/hr (1,100 mm²/kW) of total input rating of all equipment in the enclosure.

304.3.2 One permanent opening method. When any natural draft equipment is installed, one permanent opening, commencing within 12 inches (300 mm) of the bottom of the enclosure, shall be provided. When other than natural draft equipment is installed, one permanent opening, commencing within 12 inches (300) of the top of the enclosure, shall be provided. The equipment shall have clearances of at least 1 inch (25 mm) from the sides and back and 6 inches (160 mm) from the front of the appliance. The opening shall directly communicate with the outdoors or shall communicate through a vertical or horizontal duct to the outdoors or spaces that freely communicate with the outdoors and shall have a minimum free area of 1 inch²/3,000 Btu/hr (700 mm²/kW) of the total input rating of all equipment located in the enclosure.

Subp. 4. **Section 304.4.** IFGC Section 304.4 is amended to read as follows:

304.4 Combination indoor and outdoor combustion air. The use of a combination of indoor and outdoor combustion air shall be in accordance with IFGC Sections 304.4.1 through 304.4.3.

304.4.1 Indoor openings. Where used, openings connecting the interior spaces shall comply with IFGC Section 304.2.3.

304.4.2 Outdoor openings location. Outdoor openings shall be located in accordance with IFGC Section 304.3.

304.4.3 Outdoor openings size. The outdoor openings size shall be calculated in accordance with the following:

1. The ratio of interior spaces shall be the available volume of all communicating spaces divided by the required volume.

2. The outdoor size reduction factor shall be 1 minus the ratio of interior spaces.

3. The minimum size of outdoor openings shall be the full size of outdoor openings calculated in accordance with Section 304.3, multiplied by the reduction factor.

Subp. 5. **Section 304.5.** IFGC Section 304.5 is amended to read as follows:

304.5 Engineered installations. Engineered combustion air installations shall provide adequate supply of combustion, ventilation, and dilution air and shall be approved by the building official.

Subp. 6. **Section 304.6.** IFGC Section 304.6 is amended to read as follows:

304.6 Mechanical combustion air supply. Where all combustion air is provided by a mechanical air supply system, the combustion air shall be supplied from outdoors at the minimum rate of 0.35 feet³/min (cfm) per 1,000 Btu/hr (0.034 m³/min per kW) for all appliances located within the space.

304.6.1. Where exhaust fans are installed, additional air shall be provided to replace the exhausted air.

304.6.2. Each of the appliances served shall be interlocked to the mechanical air supply system to prevent main burner operation where the mechanical air supply system is not in operation.

304.6.3. Where combustion air is provided by the building's mechanical ventilation system, the system shall provide the specified combustion air rate in addition to the required ventilation air.

Subp. 7. **Section 304.7.** IFGC Section 304.7 is amended to read as follows:

304.7 Louvers and grilles. The required size of openings for combustion, ventilation, and dilution air shall be based on the net free area of each opening. Where the free area through a design of louver or grille is known, it shall be used in calculating the size opening required to provide the free area specified. Where the design and free area are not known, it shall be assumed that wood louvers will have 25 percent free area and metal louvers and grilles will have 75 percent free area. Nonmotorized louvers and grilles shall be fixed in the open position.

304.7.1 Motorized louvers. Motorized louvers shall be interlocked with the equipment so they are proven in the full open position prior to main burner ignition and during main burner operation. Means shall be provided to prevent the main burner from igniting should the louver fail to open during burner startup and to shut down the main burner if the louvers close during burner operation.

Subp. 8. **Section 304.8.** IFGC Section 304.8 is amended to read as follows:

304.8 Combustion air ducts. Combustion air ducts shall comply with the following:

1. Ducts shall be of galvanized steel or an equivalent corrosion-resistant material. If flexible duct is used, increase the duct diameter by one inch. Flexible duct shall be stretched with minimal sags.

2. Ducts shall terminate in an unobstructed space, allowing free movement of combustion air to the appliances.

3. Ducts shall serve a single space.

4. Ducts shall not service both upper and lower combustion air openings where both such openings are used. The separation between ducts serving upper and lower combustion air openings shall be maintained to the source of combustion air.

5. Ducts shall not terminate in an attic space.

6. The remaining space surrounding a chimney liner, gas vent, special gas vent, or plastic piping installed within a masonry, metal or factory-built chimney shall not be used to supply combustion air.

Exception: Direct vent gas-fired appliances designed for installation in a solid fuel-burning fireplace where installed in accordance with the listing and the manufacturer's instructions.

7. Vertical ducts shall not extend through two or more stories without prior approval from the building official.

8. Ducts shall not terminate in the return air plenum of a forced air heating system unless installed in accordance with the heating equipment manufacturer's installation instructions.

9. Combustion air intake openings shall be located to avoid intake of exhaust air in accordance with IMC Section 401.5.2 and IFGC Section 503.8 and shall be covered with corrosion resistant screen of not less than 1/4 inch (6.4 mm) mesh.

10. Combustion air intake openings shall be located at least 12 inches (305 mm) above adjoining grade level.

11. When both makeup air and combustion air openings are required, they shall be provided through separate openings to the outdoors. Refer to IMC Section 501.4 to determine requirements for makeup air.

Exception: Combination makeup air and combustion air systems may be approved by the building official where they are reasonably equivalent in terms of health, safety, and durability.

Subp. 9. **Sections 304.9 through 304.15.** IFGC Sections 304.9 through 304.15 are deleted.

Statutory Authority: *MS s 16B.59; 16B.61; 16B.64*

History: 29 SR 299

1346.5306 SECTION 306 (IFGC) ACCESS AND SERVICE SPACE.

Subpart 1. **Section 306.5.** IFGC Section 306.5 is amended to read as follows:

306.5 Mechanical equipment and appliances on roofs or elevated structures. Where mechanical equipment or appliances requiring periodic inspection, service or maintenance are installed on roofs or elevated structures, a permanent stair shall be provided for access.

Exception: A portable ladder may be used for dwellings, replacement equipment on existing buildings, and for exterior roof access points not exceeding 16 feet (4.9 m) above grade, unless the building official determines that the unique shape of the roof does not allow safe access with a portable ladder.

The permanent stair shall be as required by relevant safety regulations, but shall not be less than the following:

1. The stair shall be installed at an angle of not more than 60 degrees measured from the horizontal plane.
2. The stair shall have flat treads at least 6 inches (152 mm) deep and a clear width of at least 18 inches (457 mm) with equally spaced risers at least 10.5 inches (267 mm) high and not exceeding 14 inches (356 mm).
3. The stair shall have intermediate landings not exceeding 18 feet (5.5 m) vertically.
4. Continuous handrails shall be installed on both sides of the stair.
5. Interior stairs shall terminate at the under side of the roof at a hatch or scuttle of at least 8 square feet (0.74 m²) with a minimum dimension of 20 inches (508 mm).
6. When a roof access hatch or scuttle is located within 10 feet (3.0 m) of a roof edge, a guard shall be installed in accordance with IFGC Section 306.6.
7. Exterior stairs shall terminate at the roof access point or at a level landing of at least 8 square feet (0.74 m²) with a minimum dimension of 20 inches (508 mm). The landing shall have a guard installed in accordance with IFGC Section 306.6.

Subp. 2. **Section 306.5.** IFGC Section 306.5 is amended by adding a section to read as follows:

306.5.3 Permanent ladders. Where a change in roof elevation greater than 30 inches (762 mm) but not exceeding 16 feet (4.9 m) exists, a permanent ladder shall be provided. The ladder may be vertical and shall be as required by relevant safety regulations, but shall not be less than the following:

1. Width shall be at least 16 inches (406 mm).
2. Rung spacing shall be a maximum of 14 inches (356 mm).
3. Toe space shall be at least 6 inches (152 mm).
4. Side railings shall extend at least 30 inches (762 mm) above the roof or parapet wall.

Statutory Authority: *MS s 16B.59; 16B.61; 16B.64*

History: 29 SR 299

1346.5401 SECTION 401 (IFGC) GENERAL.

Section 401.5.1. IFGC Section 401.5 is amended by adding a section to read as follows:

401.5.1 Medium and high pressure identification. Exposed medium and high pressure gas piping systems shall include the operating pressure on the label required by Section 401.5.

Statutory Authority: *MS s 16B.59; 16B.61; 16B.64*

History: 29 SR 299

1346.5402 SECTION 402 (IFGC) PIPE SIZING.

Subpart 1. **Section 402.3.** IFGC Section 402.3 is amended to read as follows:

402.3 Sizing. Gas piping shall be sized in accordance with IFGC Table 402.3(1) through Table 402.3(34) or other approved engineering methods. If the pressure drop is not specified, use IFGC Table 402.3(35) through Table 402.3(38) for the appropriate gas piping material and inlet pressure: (See IFGC Appendix A).

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Subp. 2. **Section 402.3, Tables.** IFGC Section 402.3 is amended by adding tables as follows:

Table 402.3(35)

Pipe Sizing Table for Natural Gas

Semi-rigid Copper Tubing (Type K or L)			Inlet Pressure		7" wc
For 0.60 Specific Gravity Natural Gas			Pressure Drop		1" wc
Nominal	1/4	3/8	1/2	5/8	3/4
Actual OD	3/8	1/2	5/8	3/4	7/8
Actual ID	0.305	0.402	0.527	0.652	0.745
Length (ft)	Maximum Capacity in Cubic Feet of Gas per Hour				
10	38	79	160	280	398
20	26	54	110	193	273
30	21	44	89	155	220
40	18	37	76	132	188
60	15	30	61	106	151
80	12	26	52	91	129
100	11	23	46	81	114
125	10	20	41	72	101
150	9	18	37	65	92
200	8	16	32	55	79
250	7	14	28	49	70
300	6	13	25	45	63
350	6	12	23	41	58
400	5	11	22	38	54
Nominal	1	1-1/4	1-1/2	2	2-1/2
Actual OD	1-1/8	1-3/8	1-5/8	2-1/8	2-5/8
Actual ID	0.995	1.245	1.481	1.959	2.435

Length (ft)	Maximum Capacity in Cubic Feet of Gas per Hour				
10	850	1530	2412	5024	8889
20	584	1052	1658	3453	6109
30	469	844	1331	2773	4906
40	401	723	1139	2373	4199
60	322	580	915	1906	3372
80	276	497	783	1631	2886
100	245	440	694	1446	2558
125	217	390	615	1281	2267
150	196	354	557	1161	2054
200	168	303	477	994	1758
250	149	268	423	881	1558
300	135	243	383	798	1412
350	124	224	352	734	1299
400	116	208	328	683	1208

Table 402.3(36)

Pipe Sizing Table for Natural Gas

Semi-rigid Copper Tubing (Type K or L)			Inlet Pressure		2 psig
For 0.60 Specific Gravity Natural Gas			Pressure Drop		1 psig

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Nominal	1/4	3/8	1/2	5/8	3/4
Actual OD	3/8	1/2	5/8	3/4	7/8
Actual ID	0.305	0.402	0.527	0.652	0.745
Length (ft)	Maximum Capacity in Cubic Feet of Gas Per Hour				
10	240	496	1008	1763	2501
20	165	341	693	1211	1719
30	133	274	557	973	1380
40	113	234	476	833	1181
60	91	188	383	669	949
80	78	161	327	572	812
100	69	143	290	507	720
125	61	126	257	449	638
150	56	115	233	407	578
200	48	98	199	349	495
250	42	87	177	309	438
300	38	79	160	280	397
350	35	72	147	258	365
400	33	67	137	240	340

Nominal	1	1-1/4	1-1/2	2	2-1/2
Actual OD	1-1/8	1-3/8	1-5/8	2-1/8	2-5/8
Actual ID	0.995	1.245	1.481	1.959	2.435

Length (ft)	Maximum Capacity in Cubic Feet of Gas per Hour				
10	5341	9616	15161	31577	55867
20	3671	6609	10420	21703	38397
30	2948	5307	8368	17428	30834
40	2523	4542	7162	14916	26390
60	2026	3648	5751	11978	21192
80	1734	3122	4922	10252	18138
100	1537	2767	4362	9086	16075
125	1362	2452	3866	8053	14247
150	1234	2222	3503	7296	12909
200	1056	1902	2998	6245	11048
250	936	1685	2657	5535	9792
300	848	1527	2408	5015	8872
350	780	1405	2215	4614	8162
400	726	1307	2061	4292	7593

Table 402.3(37)

Pipe Sizing Table for Natural Gas

Schedule 40 Metallic Pipe		Inlet Pressure				7" wc	
For 0.60 Specific Gravity		Pressure Drop				1" wc	
Natural Gas							
Nominal	1/4	3/8	1/2	3/4	1	1-1/4	1-1/2
Actual ID	0.364	0.493	0.622	0.824	1.049	1.380	1.610
Length (ft)	Maximum Capacity in Cubic Feet of Gas per Hour						
10	61	135	248	518	976	2004	3003
20	42	93	170	356	671	1378	2064
30	34	74	137	286	539	1106	1657
40	29	64	117	245	461	947	1419
50	25	56	104	217	409	839	1257

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60	23	51	94	197	370	760	1139
80	20	44	80	168	317	651	975
100	17	39	71	149	281	577	864
125	16	34	63	132	249	511	766
150	14	31	57	120	226	463	694
175	13	29	53	110	208	426	638
200	12	27	49	102	193	396	594
250	11	24	43	91	171	351	626
300	10	21	39	82	155	318	477
350	9	20	36	76	143	293	439
400	8	18	34	70	133	272	408
450	8	17	32	66	124	256	383
500	7	16	30	62	118	241	362

Nominal	2	2-1/2	3	4	5	6	8
Actual ID	2.067	2.469	3.068	4.026	5.047	6.065	7.891

Length (ft)	Maximum Capacity in Cubic Feet of Gas per Hour						
10	5784	9218	16296	33239	60134	97370	194195
20	3975	6336	11200	22845	41330	66922	133469
30	3192	5088	8994	18345	33189	53741	107181
40	2732	4354	7698	15701	28406	45995	91733
50	2421	3859	6822	13916	25175	40765	81301
60	2194	3497	6182	12609	22811	36936	73665
80	1878	2993	5291	10791	19523	31612	63047
100	1664	2652	4689	9564	17303	28017	55878
125	1475	2351	4156	8477	15335	24831	49523
150	1336	2130	3765	7680	13895	22499	44872
175	1229	1960	3464	7066	12783	20699	41281
200	1144	1823	3223	6573	11892	19256	38404
250	1014	1616	2856	5826	10540	17066	34037
300	918	1464	2588	5279	9550	15463	30840
350	845	1347	2381	4856	8786	14226	28373
400	786	1253	2215	4518	8173	13235	26395
450	738	1176	2078	4239	7669	12418	24766
500	697	1110	1963	4004	7244	11730	23394

Table 402.3(38)

Pipe Sizing Table for Natural Gas

Schedule 40 Metallic Pipe		Inlet Pressure						2 psig
For 0.60 Specific Gravity Natural Gas		Pressure Drop						1 psig
Nominal	1/4	3/8	1/2	3/4	1	1-1/4	1-1/2	
Actual ID	0.364	0.493	0.622	0.824	1.049	1.380	1.610	
Length (ft)	Maximum Capacity in Cubic Feet of Gas per Hour							
10	382	847	1558	3257	6136	12597	18874	
20	263	582	1071	2239	4217	8658	12972	
30	211	467	860	1798	3386	6953	10417	
40	180	400	736	1539	2898	5950	8916	
50	160	354	652	1364	2569	5274	7902	
60	145	321	591	1236	2327	4778	7160	
80	124	275	506	1057	1992	4090	6128	
100	110	244	448	937	1765	3625	5431	
125	97	216	397	831	1565	3212	4813	

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150	88	196	360	753	1418	2911	4361
175	81	180	331	692	1304	2678	4012
200	76	167	308	644	1213	2491	3733
250	67	148	273	571	1075	2208	3308
300	61	134	247	517	974	2001	2997
350	56	124	228	476	896	1840	2758
400	52	115	212	443	834	1712	2565
450	49	108	199	415	782	1606	2407
500	46	102	188	392	739	1517	2274

Nominal	2	2-1/2	3	4	5	6	8
Actual ID	2.067	2.469	3.068	4.026	5.047	6.065	7.891

Length (ft)	Maximum Capacity in Cubic Feet of Gas per Hour						
10	36350	57936	102420	208905	377939	611970	1220513
20	24983	39819	70393	143579	259755	420604	838852
30	20062	31976	56528	115299	208593	337760	673627
40	17171	27367	48381	98681	178528	289079	576538
50	15218	24255	42879	87459	158226	256205	510975
60	13789	21977	38851	79244	143364	232140	462980
80	11801	18809	33252	67823	122701	198682	396251
100	10459	16670	29470	60110	108748	176088	351190
125	9270	14775	26119	53275	96381	156064	311253
150	8399	13387	23666	48271	87329	141405	282018
175	7727	12316	21772	44408	80341	130091	259453
200	7189	11458	20255	41313	74742	121024	241371
250	6371	10155	17952	36615	66242	107262	213923
300	5773	9201	16265	33176	60020	97187	193829
350	5311	8465	14964	30522	55218	89411	178321
400	4941	7875	13921	28395	51370	83179	165893
450	4636	7389	13062	26642	48198	78044	155652
500	4379	6979	12338	25166	45528	73720	147028

Statutory Authority: *MS s 16B.59; 16B.61; 16B.64*

History: 29 SR 299

1346.5403 SECTION 403 (IFGC) PIPING MATERIALS.

Subpart 1. **Section 403.8.** IFGC Section 403.8 is amended to read as follows:

403.8 Protective coating. Where in contact with material or atmosphere exerting a corrosive action, metallic piping and fittings coated with a corrosion-resistant material shall be used. Steel pipe exposed in exterior locations shall be galvanized or coated with approved corrosion-resistant material. External or internal coatings or linings used on piping or components shall not be considered as adding strength.

Subp. 2. **Section 403.10.4.** IFGC Section 403.10.4 is amended to read as follows:

403.10.4 Metallic fittings. Metallic fittings, including valves, strainers, and filters, shall comply with the following:

1. Threaded fittings in sizes larger than 2 inches (51 mm) shall not be used except where approved.
2. Fittings used with steel or wrought-iron pipe shall be steel, brass, bronze, or malleable iron.
3. Fittings used with copper or brass pipe shall be copper, brass, or bronze.
4. Fittings used with aluminum alloy pipe shall be of aluminum alloy.
5. Brass, bronze, or copper fittings. Fittings, if exposed to soil, shall have a minimum 80 percent copper content.
6. Aluminum alloy fittings. Threads shall not form the joint seal.

7. Zinc–aluminum alloy fittings. Fittings shall not be used in systems containing flammable gas–air mixtures.

Statutory Authority: *MS s 16B.59; 16B.61; 16B.64*

History: 29 SR 299

1346.5404 SECTION 404 (IFGC) PIPING SYSTEM INSTALLATION.

Subpart 1. **Section 404.4.** IFGC Section 404.4 is amended to read as follows:

404.4 Piping through foundation wall. Underground piping shall not be installed below grade through the outer foundation or basement wall of a building. If necessary due to structural conditions, underground piping may be installed with prior approval from the building official.

Subp. 2. **Section 404.6.** IFGC Section 404.6 is amended to read as follows:

404.6 Piping in solid floors. Piping in solid floors shall be laid in channels in the floor and covered in a manner that will allow access to the piping with a minimum amount of damage to the building. Where such piping is subject to exposure to excessive moisture or corrosive substances, the piping shall be protected in an approved manner. If necessary due to structural conditions, piping may be installed in other locations with prior approval from the building official.

Subp. 3. **Section 404.7.** IFGC Section 404.7 is amend to read as follows:

404.7 Above-ground piping outdoors. All piping installed outdoors shall be elevated not less than 3–1/2 inches (152 mm) above ground and, where installed across roof surfaces, shall be elevated not less than 3–1/2 inches (152 mm) above the roof surface. Piping installed above ground, outdoors, and across the surface of roofs shall be securely supported and located where it will be protected from physical damage. Where passing through an outside wall, the piping shall also be protected against corrosion by coating or wrapping with an inert material. Where piping is encased in a protective sleeve, the annular space between the piping and the sleeve shall be sealed.

Subp. 4. **Section 404.8.** IFGC Section 404.8 is amended to read as follows:

404.8 Protection against corrosion. Metallic pipe or tubing exposed to corrosive action, such as soil condition or moisture, shall be protected in an approved manner. Zinc coatings (galvanizing) shall not be deemed adequate protection for gas piping underground. Steel pipe exposed in exterior locations shall be galvanized or coated with approved corrosion-resistant material. Where dissimilar metals are joined underground, an insulating coupling or fitting shall be used. Piping shall not be laid in contact with cinders.

Subp. 5. **Section 404.11.** IFGC Section 404.11 is amended to read as follows:

404.11 Piping underground beneath buildings. Piping installed underground beneath buildings is prohibited except where the piping is encased in a conduit of wrought iron, plastic pipe, or steel pipe designed to withstand the superimposed loads and with prior approval from the building official. Such conduit shall extend into an occupiable portion of the building and, at the point where the conduit terminates in the building, the space between the conduit and the gas piping shall be sealed to prevent the possible entrance of any gas leakage. Where the end sealing is capable of withstanding the full pressure of the gas pipe, the conduit shall be designed for the same pressure as the pipe. Such conduit shall extend not less than 4 inches (102 mm) outside the building, shall be vented above grade to the outdoors, and shall be installed so as to prevent the entrance of water and insects. Such conduit shall be identified with a yellow label marked "Gas" in black letters, spaced at intervals not exceeding 5 feet (1,524 mm), and shall be located a minimum of 6 inches (152 mm) below the bottom of the concrete floor. The conduit shall be protected from corrosion in accordance with IFGC Section 404.8.

Subp. 6. **Section 404.15.** IFGC Section 404.15 is amended to read as follows:

404.15 Prohibited devices. A device shall not be placed inside the piping or fittings that will obstruct the free flow of gas.

Statutory Authority: *MS s 16B.59; 16B.61; 16B.64*

History: 29 SR 299

1346.5406 SECTION 406 (IFGC) INSPECTION, TESTING AND PURGING.

Subpart 1. **Section 406.1.2.** IFGC Section 406.1.2 is amended to read as follows:

406.1.2 Alterations, repairs and additions. In the event alterations, repairs or additions are made following the pressure test, the affected piping shall be tested.

Exception: Equipment replacement, minor alterations, repairs, or additions, provided the work is inspected and connections are tested with a noncorrosive leak-detecting fluid or other leak-detecting methods approved by the building official.

Subp. 2. **Section 406.1.4.** IFGC Section 406.1.4 is deleted.

Subp. 3. **Section 406.4.1.** IFGC Section 406.4.1 is amended to read as follows:

406.4.1 Test pressure. The test pressure to be used shall be no less than one and one-half times the proposed maximum working pressure, but not less than 25 psig (172 kPa gauge), irrespective of design pressure. Where the test pressure exceeds 125 psig (862 kPa gauge), the test pressure shall not exceed a value that produces a hoop stress in the piping greater than 50 percent of the specified minimum yield strength of the pipe.

Subp. 4. **Section 406.4.2.** IFGC Section 406.4.2 is amended to read as follows:

406.4.2 Test duration. Test duration shall be not less than one-half hour. When testing a system in a single-family dwelling, the test duration shall be permitted to be reduced to 10 minutes with prior approval from the building official.

Subp. 5. **Section 406.4.** IFGC Section 406.4 is amended by adding a section to read as follows:

406.4.3 Test gauges. Tests which utilize dial gauges shall be performed with gauges of 2 psi (13.8 kPa) incrementation or less and shall have a pressure range not greater than twice the test pressure applied. The test pressure shall be within the middle 50 percent of the test gauge pressure range.

Statutory Authority: *MS s 16B.59; 16B.61; 16B.64*

History: 29 SR 299

1346.5407 SECTION 407 (IFGC) PIPING SUPPORT.

IFGC Section 407 is amended by adding a section to read as follows:

407.3 Expansion and flexibility. Piping systems shall be designed to have sufficient flexibility to prevent thermal expansion or contraction from causing excessive stresses in the piping material, excessive bending or loads at joints, or undesirable forces at points of connections to equipment and at anchorage or guide points.

Statutory Authority: *MS s 16B.59; 16B.61; 16B.64*

History: 29 SR 299

1346.5408 SECTION 408 (IFGC) DRIPS AND SLOPED PIPING.

IFGC Section 408.4 is amended to read as follows:

408.4 Sediment trap. A sediment trap shall be installed before all automatically controlled gas utilization equipment where a sediment trap is not incorporated as part of the equipment. The sediment trap shall be installed as close to the inlet of the equipment as practical, before any regulator or automatic gas valve, and ahead of all pounds-to-inches pressure regulators. The sediment trap shall be either a tee fitting with a capped nipple, a minimum of 3 inches (80 mm) in length, in the bottom opening of the run of the tee, or other device approved as an effective sediment trap. If a tee fitting is used, it shall provide a 90-degree change of direction of gas flow and the cap shall be at an elevation lower than the tee fitting.

Statutory Authority: *MS s 16B.59; 16B.61; 16B.64*

History: 29 SR 299

1346.5409 SECTION 409 (IFGC) SHUTOFF VALVES.

Subpart 1. **Section 409.1.** IFGC Section 409.1 is amended to read as follows:

409.1 General. Piping systems shall be provided with an approved main shutoff valve before the first branch line. The main shutoff valve shall be installed in the first available loca-

tion that provides ready access and shall have a permanently attached handle. Main shutoff valves controlling several gas piping systems shall be protected from physical damage and shall be placed an adequate distance from each other so they will be easy to operate.

Subp. 2. **Section 409.2.** IFGC Section 409.2 is amended to read as follows:

409.2 Meter valve. Every meter shall be equipped with a shutoff valve located on the supply side of the meter. The main shutoff valve required in amended IFGC Section 409.1 shall serve as the shutoff valve.

Subp. 3. **Section 409.3.1.** IFGC Section 409.3.1 is amended to read as follows:

409.3.1 Multiple tenant buildings. In multiple tenant buildings, where a common piping system is installed to supply other than one- and two-family dwellings, shutoff valves shall be provided for each tenant. Each tenant shall have access to the shutoff valve serving that tenant's space. A main shutoff valve shall be installed in a common utility room or otherwise located to provide ready access to all tenants of the building, and it shall not be located in a locked room without prior permission from the building official.

Statutory Authority: *MS s 16B.59; 16B.61; 16B.64*

History: 29 SR 299

1346.5410 SECTION 410 (IFGC) FLOW CONTROLS.

IFGC Section 410.3 is amended to read as follows:

410.3 Venting of regulators. Pressure regulators that require a vent shall have an independent vent to the outside of the building. The vent shall be designed to prevent the entry of water or foreign objects. Regulator vents shall terminate at least 3 feet (914 mm) from doors, operable windows, nonmechanical intake openings, and openings into direct-vent appliances. The vent termination shall be located at least 12 inches (305 mm) above grade and shall be suitably screened and hooded to prevent accidental closure of the vent pipe.

Exception: A vent to the outside of the building is not required for regulators equipped with and labeled for utilization with approved vent-limiting devices installed in accordance with the manufacturer's instructions.

Statutory Authority: *MS s 16B.59; 16B.61; 16B.64*

History: 29 SR 299

1346.5501 SECTION 501 (IFGC) GENERAL.

Subpart 1. **Section 501.7.** IFGC Section 501.7 is amended to read as follows:

501.7 Connection to fireplace. Connection of any appliance to chimney flues serving fireplaces is prohibited. Refer to IFGC Section 602 for Decorative Appliances for Installation in Fireplaces and IFGC Section 603 for Log Lighters.

Subp. 2. **Section 501.8.** IFGC Section 501.8 is amended to read as follows:

501.8 Equipment not required to be vented. The following appliances shall not be required to be vented.

1. Ranges.
2. Built-in domestic cooking units listed and marked for optional venting.
3. Hot plates and laundry stoves.
4. Type 1 clothes dryers (Type 1 clothes dryers shall be exhausted in accordance with the requirements of IFGC Section 613).
5. A single booster-type automatic instantaneous water heater, where designed and used solely for the sanitizing rinse requirements of a dishwashing machine, provided that the heater is installed in a commercial kitchen having a mechanical exhaust system. Where installed in this manner, the draft hood, if required, shall be in place and unaltered and the draft hood outlet shall be not less than 36 inches (914 mm) vertically and 6 inches (152 mm) horizontally from any surface other than the heater.
6. Refrigerators.
7. Counter appliances.
8. Direct-fired make-up air heaters.

9. Other equipment listed for unvented use and not provided with flue collars.

10. *Specialized equipment of limited input such as laboratory burners and gas lights.*

Automatically operated equipment vented with a hood or exhaust system shall comply with IFGC Section 503.3.4. Where the appliances and equipment listed in items 5 through 10 are installed so that the aggregate input rating exceeds 20 Btu/hr per cubic foot (207 watts per m³) of volume of the room or space in which such appliances and equipment are installed, one or more shall be provided with venting systems or other approved means for conveying the vent gases to the outdoor atmosphere so that the aggregate input rating of the remaining unvented appliances and equipment does not exceed the 20 Btu/hr per cubic foot (207 watts per m³) figure. Where the room or space in which the equipment is installed is directly connected to another room or space by a doorway, archway, or other opening of comparable size that cannot be closed, the volume of such adjacent room or space shall be permitted to be included in the calculations.

Subp. 3. **Section 501.12.** IFGC Section 501.12 is amended to read as follows:

501.12 Residential and low-heat appliances flue lining systems. An approved metallic liner shall be installed in masonry chimneys used to vent gas appliances. The liner shall comply with one of the following:

1. Aluminum (1100 or 3003 alloy or equivalent) not less than 0.032 inches thick to 8 inches diameter.

2. Stainless steel (304 or 430 alloy or equivalent) not less than 26 gauge (0.018 inches thick) to 8 inches diameter or not less than 24 gauge (0.024 inches thick) 8 inches diameter and larger.

3. Listed vent systems.

Exception: Metallic liners are not required when each appliance connected into the masonry chimney has a minimum input rating greater than 400,000 Btu/hr.

501.12.1 Terminations. Metallic liners shall terminate in accordance with the requirements for gas vents in IFGC Section 503.6.6.

Statutory Authority: *MS s 16B.59; 16B.61; 16B.64*

History: *29 SR 299*

1346.5503 SECTION 503 (IFGC) VENTING OF EQUIPMENT.

Subpart 1. **Section 503.2.2.** IFGC Section 503.2.2 is deleted.

Subp. 2. **Section 503.5.3.** IFGC Section 503.5.3 is amended to read as follows:

503.5.3 Masonry chimneys. Masonry chimneys shall be built and installed in accordance with NFPA 211, or the IBC and shall be lined with approved clay flue lining, a listed chimney lining system, or other approved material that will resist corrosion, erosion, softening, or cracking from vent gases at temperatures up to 1800° F (982° C). Masonry chimneys used to vent gas appliances shall comply with amended IFGC Section 501.12.

Exception: Masonry chimney flues serving listed gas appliances with draft hoods, Category I appliances, and other gas appliances listed for use with Type B vent shall be permitted to be lined with a chimney lining system specifically listed for use only with such appliances. The liner shall be installed in accordance with the liner manufacturers' instructions and the terms of the listing. A permanent identifying label shall be attached at the point where the connection is to be made to the liner. The label shall read: "This chimney liner is for appliances that burn gas only. Do not connect to solid or liquid fuel-burning appliances or incinerators."

For information on installation of gas vents in existing masonry chimneys, see IFGC Section 503.6.5.

Subp. 3. **Section 503.5.5.** IFGC Section 503.5.5 is amended to read as follows:

503.5.5 Size of chimneys. The effective area of a chimney venting system serving listed appliances with draft hoods, Category I appliances, and other appliances listed for use with Type B vents shall be in accordance with IFGC Section 504 or other approved engineering methods.

Exceptions:

1. As an alternate method of sizing an individual chimney venting system for a single appliance with a draft hood, the effective areas of the vent connector and chimney flue shall be not less than the area of the appliance flue collar or draft hood outlet, nor greater than four times the draft hood outlet area.
2. As an alternate method for sizing a chimney venting system connected to two appliances with draft hoods, the effective area of the chimney flue shall be not less than the area of the larger draft hood outlet plus 50 percent of the area of the smaller draft hood outlet, nor greater than four times the smallest draft hood outlet area.

Where an incinerator is vented by a chimney serving other gas utilization equipment, the gas input to the incinerator shall not be included in calculating chimney size, provided the chimney flue diameter is not less than 1 inch (25.4 mm) larger in equivalent diameter than the diameter of the incinerator flue outlet.

Subp. 4. **Section 503.5.6.** IFGC Section 503.5.6 is amended to read as follows:

503.5.6 Inspection of chimneys. Before replacing an existing appliance or connecting a vent connector to a chimney, the chimney passageway shall be examined to ascertain that it is clear and free of obstructions and it shall be cleaned if previously used for venting solid or liquid fuel-burning appliances or fireplaces.

Exception: Existing chimneys shall be lined in accordance with amended IFGC Section 501.12 unless otherwise approved by the building official.

Subp. 5. **Section 503.5.10.** IFGC Section 503.5.10 is amended to read as follows:

503.5.10 Space surrounding lining or vent. The remaining space surrounding a chimney liner, gas vent, special gas vent, or plastic piping installed within a masonry, metal or factory-built chimney shall not be used to vent another appliance.

Exception: Direct vent gas-fired appliances designed for installation in a solid fuel burning fireplace where installed in accordance with the listing and the manufacturer's instructions.

Subp. 6. **Section 503.6.9.1.** IFGC Section 503.6.9.1 is amended to read as follows:

503.6.9.1 Category I appliances. The sizing of natural draft venting systems serving one or more listed appliances equipped with a draft hood or appliances listed for use with Type B gas vent, installed in a single story of a building, shall be in accordance with IFGC Section 504 or in accordance with sound engineering practice. Category I appliances are either draft hood-equipped or fan-assisted combustion system in design. Different vent design methods are required for draft hood-equipped and fan-assisted combustion system appliances.

Exceptions:

1. As an alternate method for sizing an individual gas vent for a single, draft hood-equipped appliance, the effective area of the vent connector and the gas vent shall be not less than the area of the appliance draft hood outlet, nor greater than four times the draft hood outlet area. Vents serving fan-assisted combustion system appliances shall be sized in accordance with IFGC Section 504 or other approved engineering methods.
2. As an alternate method for sizing a gas vent connected to two appliances with draft hoods, the effective area of the vent shall be not less than the area of the larger draft hood outlet plus 50 percent of the smaller draft hood outlets, nor greater than four times the smallest draft hood outlet area. Vents serving fan-assisted combustion system appliances, or combinations of fan-assisted combustion system and draft hood-equipped appliances, shall be sized in accordance with IFGC Section 504 or other approved engineering methods.

Subp. 7. **Section 503.7.8.** IFGC Section 503.7.8 is amended to read as follows:

503.7.8 Size of single-wall metal pipe. A venting system constructed of single-wall metal pipe shall be sized in accordance with one of the following methods and the equipment manufacturer's instructions:

1. For a draft hood-equipped appliance, in accordance with IFGC Section 504.
2. For a venting system for a single appliance with a draft hood, the areas of the connector and the pipe each shall be not less than the area of the appliance flue collar or draft hood

outlet, whichever is smaller. The vent area shall not be greater than four times the draft hood outlet area.

3. Other approved engineering methods.

Subp. 8. **Section 503.8.** IFGC Section 503.8 is amended to read as follows:

503.8 Venting system termination location. The location of venting system terminations shall comply with the following:

1. A mechanical draft venting system shall terminate at least 3 feet (914 mm) above any mechanical air inlet located within 10 feet (3048 mm).

Exceptions:

a. This provision shall not apply to the combustion air intake of a direct-vent appliance.

b. This provision shall not apply to the separation of the integral outdoor air inlet and flue gas discharge of listed outdoor appliances.

2. A mechanical draft venting system, including power vent and direct-vent appliances, shall terminate in accordance with the following minimum clearances from doors, operable windows, and nonmechanical air inlets:

Input (Btu/hr)	Clearance (inches)	Input (kW)	Clearance (mm)
10,000 or less	6	3 or less	152
10,001 to 50,000	9	3.1 to 14.7	230
Over 50,000	12	Over 14.7	305

Exception: Where this section specifies a minimum clearance that is less restrictive than the conditions of listing of the equipment or appliances, the conditions of listing and the manufacturer's installation instructions shall apply.

3. The bottom of the vent terminal and the air intake of a mechanical draft venting system shall be located at least 12 inches (305 mm) above grade.

4. Through-the-wall vents for Category II and Category IV appliances and noncategorized condensing appliances shall not terminate over public walkways or over an area where condensate or vapor could create a nuisance or hazard or could be detrimental to the operation of regulators, relief valves, or other equipment. Where local experience indicates that condensate is a problem with Category I and Category III appliances, this provision shall also apply.

Subp. 9. **Section 503.10.7.** IFGC Section 503.10.7 is amended to read as follows:

503.10.7 Joints. Joints between sections of connector piping and connections to flue collars and hood outlets shall be fastened by a minimum of three equally spaced sheet metal screws or other approved means.

Statutory Authority: *MS s 16B.59; 16B.61; 16B.64*

History: 29 SR 299

1346.5504 SECTION 504 (IFGC) SIZING OF CATEGORY 1 APPLIANCE VENTING SYSTEMS.

Subpart 1. **Section 504.2.7.** IFGC Section 504.2.7 is amended to read as follows:

504.2.7 Liner system sizing. Listed corrugated metallic chimney liner systems in masonry chimneys shall be sized by using IFGC Table 504.2(1) or 504.2(2) for Type B vents with the maximum capacity reduced by 20 percent (0.80 x maximum capacity) and the minimum capacity as shown in IFGC Table 504.2(1) or 504.2(2). Corrugated metallic liner systems installed with bends or offsets shall have their maximum capacity further reduced in accordance with IFGC Section 504.3. Approved metallic liners, other than listed corrugated metallic liner systems, installed in accordance with amended IFGC Section 501.12, shall be sized by using IFGC Table 504.2(1) or 504.2(2) for Type B vents. When IFGC Table 504.2(1) or 504.2(2) permits more than one diameter for a connector or vent of a fan-assisted appliance, the smallest permitted diameter shall be used.

Subp. 2. **Section 504.2.8.** IFGC Section 504.2.8 is amended to read as follows:

504.2.8 Vent area and diameter. Where the vertical vent has a larger diameter than the vent connector, the vertical vent diameter shall be used to determine the minimum vent capacity, and the connector diameter shall be used to determine the maximum vent capacity. The flow area of the vertical vent shall not exceed four times the flow area of the listed appliance categorized vent area, flue collar area, or draft hood outlet area unless designated in accordance with approved engineering methods.

Subp. 3. **Section 504.3.15.** IFGC Section 504.3.15 is amended to read as follows:

504.3.15 Vertical vent maximum size. Where two or more appliances are connected to a vertical vent or chimney, the flow area of the largest section of vertical vent or chimney shall not exceed four times the smallest listed appliance categorized vent areas, flue collar area, or draft hood outlet area unless designed in accordance with approved engineering methods.

Subp. 4. **Section 504.3.17.** IFGC Section 504.3.17 is amended to read as follows:

504.3.17 Liner system sizing. Listed corrugated metallic chimney liner systems in masonry chimneys shall be sized by using IFGC Table 504.3(1) or 504.3(2) for Type B vents, with the maximum capacity reduced by 20 percent (0.80 x maximum capacity) and the minimum capacity as shown in IFGC Table 504.3(1) or 504.3(2). Corrugated metallic liner systems installed with bends or offsets shall have their maximum capacity further reduced in accordance with IFGC Sections 504.3.5 and 504.3.6. Approved metallic liners, other than listed corrugated metallic liner systems, installed in accordance with amended IFGC Section 501.12, shall be sized by using IFGC Table 504.3(1) or 504.3(2) for Type B vents. When IFGC Table 504.3(1) or 504.3(2) permits more than one diameter for a connector or vent of a fan-assisted appliance, the smallest permitted diameter shall be used.

Statutory Authority: *MS s 16B.59; 16B.61; 16B.64*

History: 29 SR 299

1346.5602 SECTION 602 (IFGC) DECORATIVE APPLIANCES FOR INSTALLATION IN FIREPLACES.

Subpart 1. **Section 602.1.** IFGC Section 602.1 is amended to read as follows:

602.1 General. Decorative appliances for installation in approved solid fuel burning fireplaces shall be tested in accordance with ANSI Z21.50–2000, *Vented Gas Fireplaces*, and ANSI Z21.88–2000, *Vented Gas Fireplace Heaters*, and shall be installed in accordance with the manufacturer's installation instructions. Manually lighted natural gas decorative appliances shall be tested in accordance with an approved method.

Subp. 2. **Section 602.3.** IFGC Section 602.3 is amended to read as follows:

602.3 Prohibited installations. Decorative appliances for installations in fireplaces shall not be installed where prohibited by IFGC Section 303.3. Unvented decorative appliances shall not be installed in any dwelling or occupancy.

Statutory Authority: *MS s 16B.59; 16B.61; 16B.64*

History: 29 SR 299

1346.5620 SECTION 620 (IFGC) UNVENTED ROOM HEATERS.

IFGC Section 620 is deleted and replaced with the following:

620.1 Unvented heaters. Unvented room heaters and unvented decorative appliances shall not be installed in any dwelling or occupancy.

Statutory Authority: *MS s 16B.59; 16B.61; 16B.64*

History: 29 SR 299

1346.5629 SECTION 629 (IFGC) INFRARED RADIANT HEATERS.

IFGC Section 629.3 is amended by adding a section to read as follows:

629.3 Ventilation air. Where unvented infrared heaters are installed, mechanical ventilation shall be provided to exhaust at least 4 cubic feet per minute (cfm) (0.0203 m³/s) per 1,000

Btu/hr (0.292 kW) input rating and it shall be electrically interlocked with the heater. Make-up air shall be provided to the space to be heated.

Statutory Authority: *MS s 16B.59; 16B.61; 16B.64*

History: 29 SR 299

1346.5630 SECTION 630 (IFGC) BOILERS.

Subpart 1. **Section 630.1.** IFGC Section 630.1 is amended to read as follows:

630.1 Standards. Boilers with an input rating below 400,000 Btu/hr (3,660 kW) shall be listed in accordance with the requirements of ANSI Z21.13/CSA 4.9 or UL 795. Boilers with an input rating of 400,000 Btu/hr (3,660 kW) or greater shall be designed and constructed in accordance with the *ASME Boiler and Pressure Vessel Code*, Sections I, II, IV, V, VIII, and IX, and amended IFGC Section 301.3, as applicable. Boilers with an input rating above 400,000 Btu/hr (117 kW) and less than 12,500,000 Btu/hr (3,660 kW) shall comply with ASME CSD-1, and boilers with an input rating of 12,500,000 Btu/hr (3,660 kW) or greater shall comply with NFPA 85-2001, *Boiler and Combustion Systems Hazards Code*.

Subp. 2. **Section 630.2.** IFGC Section 630.2 is amended to read as follows:

630.2 Installation. In addition to the requirements of this code, the installation of boilers shall be in accordance with the manufacturer's instructions and IMC Chapter 10. Operating instructions of a permanent type shall be attached to the boiler. Boilers shall have all controls set, adjusted and tested by the installer in accordance with amended IFGC Chapter 8. A complete control diagram together with complete boiler instructions shall be furnished by the installer. The manufacturer's rating data and the nameplate shall be attached to the boiler.

Statutory Authority: *MS s 16B.59; 16B.61; 16B.64*

History: 29 SR 299

CHAPTER 8

INSTALLATION AND TESTING OF FUEL GAS-FIRED EQUIPMENT

1346.5801 SECTION 801 (IFGC) GENERAL.

The IFGC is amended by adding a chapter to read as follows:

SECTION 801

GENERAL

801.1 General. Chapter 8 shall regulate the installation and testing or repair of gas or fuel burning systems, gas or fuel burners, and gas or fuel burning equipment installed within, or in conjunction with, building or structures. The requirements of this chapter shall apply to the following equipment:

1. Equipment utilized to provide control of environmental conditions.

Exception: Equipment and appliances listed and labeled to an appropriate standard by a nationally recognized testing laboratory, which is qualified to evaluate the equipment or appliance, when installed and tested according to the manufacturer's installation instructions.

2. Equipment with a fuel input of 1,000,000 Btu/hr or greater.
3. Unlisted equipment.
4. Miscellaneous equipment when required by the building official.

Statutory Authority: *MS s 16B.59; 16B.61; 16B.64*

History: 29 SR 299

1346.5802 SECTION 802 (IFGC) EQUIPMENT PLACEMENT.

The IFGC is amended by adding a section to read as follows:

SECTION 802

EQUIPMENT PLACEMENT

802.1 Placing equipment in operation. After completion of the installation, all safety and operating controls and venting shall be tested before placing the burner in service. The cor-

rect input of fuel shall be determined and the fuel-to-air ratio set. Each gas or fuel burner shall be adjusted to its proper input according to the manufacturer's instructions. Overrating the burners or appliance is prohibited. Btu/hr input range shall be appropriate to the appliance.

1. The rate of flow of the gas or fuel shall be adjusted to within plus or minus two percent of the required Btu/hr rating at the manifold pressure specified by the manufacturer. When the prevailing pressure is less than the manifold pressure specified, the rates shall be adjusted at the prevailing pressure.

2. For conversion burners installed in hot water (liquid) boilers or warm air furnaces, the rate of flow of the gas or fuel in Btu/hr shall be adjusted to within plus or minus five percent of the calculated Btu/hr heat loss of the building in which it is installed, or the design load, and shall not exceed the design rate of the appliance.

3. For conversion burners installed in steam boilers, the gas or fuel hourly input demand shall be adjusted to meet the steam load requirements. The gas or fuel input demand necessitated by an oversized boiler shall be established and added to the input demand for load requirements to arrive at a total input demand.

Statutory Authority: *MS s 16B.59; 16B.61; 16B.64*

History: 29 SR 299

1346.5803 SECTION 803 (IFGC) PILOT OPERATION.

The IFGC is amended by adding a section to read as follows:

SECTION 803

PILOT OPERATION

803.1 Pilot operation. Pilot flames shall ignite the gas or fuel at the main burner or burners and shall be adequately protected from drafts. Pilot flames shall not become extinguished during pilot cycle when the main burner or burners are turned on or off in a normal manner, either manually or by automatic controls.

Statutory Authority: *MS s 16B.59; 16B.61; 16B.64*

History: 29 SR 299

1346.5804 SECTION 804 (IFGC) BURNER OPERATION.

The IFGC is amended by adding a section to read as follows:

SECTION 804

BURNER OPERATION

804.1 Burner operation. When testing to determine compliance with this section, care shall be exercised to prevent the accumulation of unburned gas or fuel in the appliance or flues that might result in explosion or fire.

1. The flames from each burner shall freely ignite the gas or fuel from adjacent burners when operating at the prevailing gas or fuel pressure and when the main control valve is regulated to deliver at one-third of the fuel gas or fuel rate.

2. Burner flames shall not flash back after immediate ignition nor after turning the fuel cock until the flow rate to the burner is one-third the full supply.

3. Burner flames shall not flash back when the gas or fuel is turned on or off by an automatic control mechanism.

4. Main burner flames shall ignite freely from each pilot when the main control valve is regulated to one-third the full gas or fuel rate and when the pilot flame is reduced to a minimum point at which it will actuate the safety device.

5. When ignition is made in a normal manner, the flame shall not flash outside the appliance.

6. Burners shall not expel gas or fuel through air openings when operating at prevailing pressure.

7. Burners shall have proper fuel air mixture to ensure smooth ignition of the main burner.

8. Dual fuel burners may have controls common or independent to both fuels. Transfer from one fuel to the other shall be by a manual interlock switching system to prevent the gas and other fuel being used simultaneously except by special permission from the building official. The building official shall consider whether an exception will provide equivalent safety. The transfer switch shall have a center off position and shall not pass through the center off position without stopping in the center off position.

Statutory Authority: *MS s 16B.59; 16B.61; 16B.64*

History: 29 SR 299

1346.5805 SECTION 805 (IFGC) METHOD OF TEST.

The IFGC is amended by adding a section to read as follows:

SECTION 805 METHOD OF TEST

805.1 Method of test.

1. **Operational checking.** The flue gas, venting, safety and operating controls of the appliance shall be checked to ensure proper and safe operation.

2. **Method of test – atmospheric type/induced draft type/fan–assisted type.** The appliance shall be allowed to operate until the stack temperature becomes stabilized after which a sample of the undiluted flue products shall be taken from the appliance flue outlet. The sample taken shall be analyzed for carbon monoxide, carbon dioxide and oxygen. Stack temperature shall be noted.

Note: Appliance designs incorporating induced draft assemblies may require a flue gas sample to be taken after the draft regulator or induced draft fan.

3. Performance standards for atmospheric type.

a. Minimum of 75 percent efficiency as determined by flue gas analysis method at appliance flue outlet.

b. Carbon monoxide concentration in flue gas not greater than 0.04 percent on an air–free basis.

c. Stack temperature not greater than 480°F, plus ambient.

d. Carbon dioxide concentration between 6 and 9 percent, inclusive.

e. Oxygen concentration between 4 and 10 percent, inclusive.

3a. Performance standards for induced draft type/fan–assisted type.

a. Minimum of 75 percent efficiency as determined by flue gas analysis method at appliance flue outlet.

b. Carbon monoxide concentration in flue gas not greater than 0.04 percent on an air free basis.

c. Stack temperature not greater than 480°F, plus ambient.

d. Oxygen concentration between 4 and 10 percent, inclusive, with carbon dioxide concentration between 6 and 9 percent, inclusive.

Note: Induced draft type and fan–assisted type appliances may require a sample to be taken after the induced draft fan, which may cause oxygen figures in excess of limits stated. In such cases, safe fuel combustion ratios shall be maintained and be consistent with appliance listing.

4. **Method of test – power type.** The appliance shall be allowed to operate until the stack temperature becomes stabilized after which a sample of the undiluted flue products shall be taken from the appliance flue outlet. The sample shall be analyzed for carbon monoxide, carbon dioxide and oxygen. Stack temperature shall be recorded.

5. Performance standards for power type.

a. Minimum of 80 percent efficiency as determined by flue gas analysis method method at appliance flue outlet.

b. Carbon monoxide concentration in flue gas not greater than 0.04 percent.

c. Stack temperature not greater than 480°F plus ambient, or 125°F in excess of fluid temperature plus ambient.

d. Carbon dioxide concentration between 6 and 9 percent, inclusive.

e. Oxygen concentration between 3 and 10 percent, inclusive.

6. After completion of the test of newly installed gas or fuel burner equipment as provided in this section, complete test records shall be filed with the building official on an approved form. The tag stating the date of the test and the name of the installer shall be attached to the appliance at the main valve.

7. Oxygen concentration.

a. The concentration of oxygen in the undiluted flue products of gas or fuel burners shall in no case be less than 3 percent nor more than 10 percent, shall be in conformance with applicable performance standards and shall be consistent with the appliance listing.

b. The allowable limit of carbon monoxide shall not exceed 0.04 percent.

c. The flue gas temperature of a gas appliance, as taken on the appliance side of the draft regulator, shall not exceed applicable performance standards and shall be consistent with the appliance listing.

8. **Approved oxygen trim system.** The oxygen figures may not apply when there is an approved oxygen trim system on the burner that is designed for that use, including a low oxygen interlock when approved by the building official. The building official shall consider whether an exception will provide equivalent safety.

9. Supervised start-up.

a. Supervised start-up may be required to verify safe operation of gas or fuel burner and to provide documentation that operation is consistent with this code, listing and approval. Supervised start-up is required for all fuel burners in b, c, and d. Supervised start-up requires that fuel burners shall be tested in the presence of the building official in an approved manner. Testing shall include safety and operating controls, input, flue gas analysis, and venting. Flue gas shall be tested at high, medium and low fires. Provisions shall be made in the system to allow firing test in warm weather. After completion of the test of newly installed gas or fuel burner equipment as provided in this section, complete test records shall be filed with the building official on an approved form. The tag stating the date of the test and the name of the installer shall be attached to the appliance at the main valve.

b. Gas and fuel burners of 1,000,000 Btu/hr input or more require a supervised start-up as in a.

c. Installation of oxygen trim systems, modulating dampers, or other draft control or combustion devices require a supervised start-up as in a.

d. All direct fired heaters require a supervised start-up as in a.

10. A complete control diagram of the installation and suitable operating instructions shall be supplied to the building official.

Statutory Authority: *MS s 16B.59; 16B.61; 16B.64*

History: 29 SR 299

1346.5806 SECTION 806 (IFGC) PRESSURE REGULATORS.

The IFGC is amended by adding a section to read as follows:

SECTION 806

PRESSURE REGULATORS

806.1 Pressure regulators.

(a) General.

1. Regulators shall be provided with access for servicing.

2. Regulators shall be provided with a shutoff valve, union and test taps (both upstream and downstream of the regulator) for servicing.

3. All regulators with inlet gas pressure exceeding 14 inches water column pressure or used on an appliance having an input exceeding 400,000 Btu/hr shall have an approved high pressure manual gas valve in the supply piping upstream of the regulator.

4. All regulators with inlet gas pressure exceeding 14 inches water column pressure or used on an appliance having an input exceeding 400,000 Btu/hr shall be vented to the outdoors in separate vents sized according to the manufacturer's specifications.

Exception: Regulators equipped with limiting orifices installed in accordance with amended IFGC Section 410.3.

5. Regulators may not be vented into a combustion chamber or an appliance vent.

6. Regulator vents shall terminate at least 3 feet (914 mm) from doors, operable windows, nonmechanical intake openings, and openings into direct-vent appliances. The vent termination shall be located at least 12 inches (305 mm) above grade and shall be suitably screened and hooded to prevent accidental closure of the vent pipe.

7. All pounds-to-pounds and pounds-to-inches regulators used as appliance regulators where downstream controls are not rated for upstream pressure shall be of the full lock-up type.

(b) Appliance.

1. Appliance regulators shall be installed consistent with the listing and approval of the equipment and the listing and approval of the regulator manufacturer.

2. Each gas burner or appliance shall have its own gas pressure regulator. This appliance regulator is in addition to any pounds-to-pounds or pounds-to-inches regulators in the system.

Statutory Authority: *MS s 16B.59; 16B.61; 16B.64*

History: 29 SR 299

1346.5807 SECTION 807 (IFGC) EQUIPMENT INFORMATION.

The IFGC is amended by adding a section to read as follows:

SECTION 807

EQUIPMENT INFORMATION

807.1 Equipment information.

A. All installations of gas or fuel burners with input above 400,000 Btu/hr and all combination gas or fuel burners shall be approved before installation. The following information shall be supplied if required by the building official.

1. Name, model, and serial number of the burner.

2. Input rating and type of fuel.

3. Name of the nationally recognized testing laboratory that tested and listed the unit.

4. Name, model, and serial number of the furnace or boiler that the burner will be installed in if not part of a complete package.

5. A complete wiring diagram showing the factory and fuel wiring installed or to be installed including all controls, identified by the brand name and model number.

6. A print of the gas or fuel train from the manual shutoff to the appliance showing all controls that will be installed, their names, model numbers, and approvals.

B. All installations of gas or fuel burners with input above 400,000 Btu/hr and all combination gas and oil or other combination fuel burners that are installed in new or renovated boiler or equipment rooms, or are installed in a package with the boiler or furnace, shall include the following information in addition to that required in item A, subitems 1 to 6.

1. A complete piping diagram from the supply source showing all components and materials identified by brand name and model number with relevant approvals.

2. Detailed provisions for combustion air, venting, and stacks.

3. A floor plan drawn to scale showing all relevant equipment. Plans and specifications shall be approved before proceeding with an installation.

Statutory Authority: *MS s 16B.59; 16B.61; 16B.64*

History: 29 SR 299

1346.5900 SECTION 900 MANUFACTURED HOME PARK/COMMUNITY FUEL GAS EQUIPMENT AND INSTALLATION.

The IFGC is amended by adding a chapter to read as follows:

CHAPTER 9
MANUFACTURED HOME PARK/COMMUNITY FUEL GAS
EQUIPMENT AND INSTALLATION

901 General. Except as otherwise permitted or required by this chapter, all fuel gas equipment and installations in manufactured home parks and communities shall comply with the provisions of this code. The provisions of this chapter shall not apply to manufactured home gas piping and equipment.

902 Required gas supply. The minimum hourly volume of gas required at each manufactured home lot outlet or any section of the manufactured home gas piping system shall be calculated as shown in IFGC Table 902. Required gas supply for buildings or other fuel gas utilization equipment connected to the manufactured home gas piping system shall be calculated as provided in this code.

Table 902
Demand Factors for Calculating Gas Piping Systems
in Manufactured Home Parks and Communities

Number of Manufactured Home Sites	Demand Factor (Btu/hr) per Manu- factured Home Site	Demand Factor (Watts) per Manufactured Home Site
1	125,000	36,638
2	117,000	34,293
3	104,000	30,482
4	96,000	28,138
5	92,000	26,965
6	87,000	25,500
7	83,000	24,327
8	81,000	23,741
9	79,000	23,155
10	77,000	22,569
11-20	66,000	19,345
21-30	62,000	18,172
31-40	58,000	17,000
41-60	55,000	16,121
Over 60	50,000	14,655

903 Installation. Gas piping shall not be installed underground beneath buildings or that portion of the manufactured home lot reserved for the location of manufactured homes, manufactured home accessory buildings or structures, concrete slabs, or automobile parking, unless installed in a gas-tight conduit complying with the following:

1. The conduit shall be of material approved for installation underground beneath buildings and not less than Schedule 40 pipe. The interior diameter of the conduit shall be not less than 0.5 inch (15 mm) larger than the outside diameter of the gas piping.

2. The conduit shall extend to a point not less than 12 inches (305 mm) beyond any area where it is required to be installed, or the outside wall of a building, and the outer ends shall not be sealed. Where the conduit terminates within a building, it shall be provided with access, and the space between the conduit and the gas piping shall be sealed to prevent leakage of gas into the building.

Exception: A gas piping lateral terminating in a manufactured home lot riser surrounded by a concrete slab shall not be required to be installed in a conduit, provided the concrete slab is entirely outside the wall line of the manufactured home, and is used for stabilizing other utility connections.

904 Manufactured home lot shutoff valve. Each manufactured home lot shall have an approved gas shutoff valve installed upstream of the manufactured home lot gas outlet and located on the outlet riser at a height at least 6 inches (152 mm) above grade. Such valve shall not be located under a manufactured home. When the manufactured home lot is not in use, the outlet shall be equipped with an approved cap or plug to prevent accidental discharge of gas.

905 Manufactured home lot gas outlet. Each manufactured home lot piped for gas shall be provided with an individual outlet riser at the manufactured home lot. The manufactured home lot gas outlet shall terminate with the point of delivery in the rear third section and within 4 feet (1,219 mm) of the proposed location of the manufactured home.

906 Manufactured home gas connector. Each manufactured home shall be connected to the lot outlet by an approved or listed gas connector, a maximum of 6 feet (1,829 mm) in length. Approved pipe and fittings may be used between the flexible connector and the lot gas outlet when the distance exceeds that required to make a safe installation with only an approved or listed gas connector. Gas connectors shall be of a size to adequately supply the total demand of the connected manufactured home.

907 Mechanical protection. All gas outlet risers, regulators, meters, valves, or other exposed equipment shall be protected from mechanical damage. Atmospherically controlled regulators shall be installed in such a manner that moisture cannot enter the regulator vent and accumulate above the diaphragm. Where the regulator vent may be obstructed due to snow and icing conditions, shields, hoods, or other suitable devices shall be provided to guard against closing the vent opening.

908 Meters. Meters shall not be installed in unvented or inaccessible locations or closer than 3 feet (914 mm) from sources of ignition. When meters are installed, they shall not depend on the gas outlet riser for support, but shall be adequately supported by a post or bracket placed on a firm footing, or other means providing equivalent support.

909 Meter shutoff valve. All meter installations shall be provided with a shutoff valve located adjacent to and on the inlet side of the meter. For installations utilizing a liquefied petroleum gas container, the container service valve shall serve as the shutoff valve.

910 Gas pipe sizing. The size of each section of natural gas or liquefied petroleum gas piping systems shall be determined as specified in this code.

911 Maintenance. The manufactured home park/community operator shall be responsible for maintaining all gas piping installations and equipment in good working condition.

IMC Appendix C, Table C-1
Recommended Capacities for
Domestic Kitchen Exhaust Hoods

Hood Size	Equipment with Grills or Deep Fryers (Number of Exposed Sides)		Ranges and Ovens (Number of Exposed Sides)	
	Four (CFM)	Three (CFM)	Four (CFM)	Three (CFM)
Area (Sq. Ft.)				
Up to 4	Up to 400	Up to 300	Up to 300	Up to 200
4	400	300	300	200
4.5	450	338	338	225
5	500	375	375	250
5.5	550	413	413	275
6	600	450	450	300
6.5	650	488	488	325
7	700	525	525	350
7.5	750	563	563	375
8	800	600	600	400
8.5	850	638	638	425
9	900	675	675	450
9.5	950	713	713	475
10	1,000	750	750	500
10.5	1,050	788	788	525
11	1,100	825	825	550
11.5	1,150	863	863	575
12	1,200	900	900	600
12.5	1,250	938	938	625
13	1,300	975	975	650
13.5	1,350	1,013	1,013	675

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14	1,400	1,050	1,050	700
14.5	1,450	1,088	1,088	725
15	1,500	1,125	1,125	750
15.5	1,550	1,163	1,163	775
16	1,600	1,200	1,200	800

IFGC Appendix E, Worksheet E-1 Residential Combustion Air Calculation Method (for Furnace, Boiler, and/or Water Heater in the Same Space)

Step 1: Complete vented combustion appliance information.

Furnace/Boiler:

___ Draft Hood (Not fan assisted) ___ Fan Assisted & Power Vent ___ Direct Vent Input: _____ Btu/hr

Water Heater:

___ Draft Hood (Not fan assisted) ___ Fan Assisted & Power Vent ___ Direct Vent Input: _____ Btu/hr

Step 2: Calculate the volume of the Combustion Appliance Space (CAS) containing combustion appliances.

The CAS includes all spaces connected to one another by code compliant openings.

CAS volume: _____ ft³

Step 3: Determine Air Changes per Hour (ACH)¹

Default ACH values have been incorporated into Table E-1 for use with Method 4b (KAIR Method). If the year of construction or ACH is not known, use method 4a (Standard Method).

Step 4: Determine Required Volume for Combustion Air.

4a. Standard Method

Total Btu/hr input of all combustion appliances (DO NOT COUNT DIRECT VENT APPLIANCES)

Input: _____ Btu/hr

Use Standard Method column in Table E-1 to find Total Required Volume (TRV)

TRV: _____ ft³

If CAS Volume (from Step 2) *is greater than* TRV then no outdoor openings are needed.

If CAS Volume (from Step 2) *is less than* TRV then go to **STEP 5**.

4b. Known Air Infiltration Rate (KAIR) Method

Total Btu/hr input of all fan-assisted and power vent appliances (DO NOT COUNT DIRECT VENT APPLIANCES)

Input: _____ Btu/hr

Use Fan-Assisted Appliances column in Table E-1 to find Required Volume Fan Assisted (RVFA)

RVFA: _____ ft³

Total But/hr input of all non-fan-assisted appliances

Input: _____ Btu/hr

Use Non-Fan-Assisted Appliances column in Table E-1 to find Required

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Volume Non-Fan-Assisted (RVNFA) RVNFA: _____ ft³

Total Required Volume (TRV) = RVFA + RVNFA
RV = _____ + _____ = _____ ft³

If CAS Volume (from Step 2) *is greater than* TRV then no outdoor openings are needed.

If CAS Volume (from Step 2) *is less than* TRV then go to **STEP 5**.

Step 5: Calculate the ratio of available interior volume to the total required volume.

Ratio = CAS Volume (from Step 2)

divided by TRV (from Step 4a

or Step 4b)

Ratio = _____ / _____ = _____

Step 6: Calculate Reduction Factor (RF).

RF = 1 *minus* Ratio

RF = 1 - _____ = _____

Step 7: Calculate single outdoor opening as if all combustion air is from outside.

Total Btu/hr input of all Combustion

Appliances in the same CAS

(EXCEPT DIRECT VENT)

Input: _____ Btu/hr

Combustion Air Opening Area (CAOA):

Total Btu/hr *divided by* 3000

Btu/hr per in²

CAOA = _____ / 3000 Btu/hr per in² = _____ in²

Step 8: Calculate Minimum CAOA.

Minimum CAOA = CAOA *multiplied by* RF

Minimum CAOA = _____ x _____ = _____ in²

Step 9: Calculate Combustion Air Opening Diameter (CAOD)

CAOD = 1.13 *multiplied by the square root of* Minimum CAOA

CAOD = 1.13 Minimum CAOA = _____ in

¹ If desired, ACH can be determined using ASHRAE calculation or blower door test. Follow procedures in Section G304.

IFGC Appendix E, Table E-1
Residential Combustion Air Required Volume
(Required Interior Volume Based on Input Rating
of Appliances)

Known Air Infiltration Rate (KAIR)
Method (ft³)

Fan Assisted

Non-Fan-Assisted

Input Rating (Btu/hr)	Standard Method (ft ³)	1994 ¹ to Present	Pre 1994 ²	1994 ¹ to Present	Pre 1994 ²
5,000	250	375	188	525	263
10,000	500	750	375	1,050	525
15,000	750	1,125	563	1,575	788
20,000	1,000	1,500	750	2,100	1,050
25,000	1,250	1,875	938	2,625	1,313
30,000	1,500	2,250	1,125	3,150	1,575
35,000	1,750	2,625	1,313	3,675	1,838

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40,000	2,000	3,000	1,500	4,200	2,100
45,000	2,250	3,375	1,688	4,725	2,363
50,000	2,500	3,750	1,875	5,250	2,625
55,000	2,750	4,125	2,063	5,775	2,888
60,000	3,000	4,500	2,250	6,300	3,150
65,000	3,250	4,875	2,438	6,825	3,413
70,000	3,500	5,250	2,625	7,350	3,675
75,000	3,750	5,625	2,813	7,875	3,938
80,000	4,000	6,000	3,000	8,400	4,200
85,000	4,250	6,375	3,188	8,925	4,463
90,000	4,500	6,750	3,375	9,450	4,725
95,000	4,750	7,125	3,563	9,975	4,988
100,000	5,000	7,500	3,750	10,500	5,250
105,000	5,250	7,875	3,938	11,025	5,513
110,000	5,500	8,250	4,125	11,550	5,775
115,000	5,750	8,625	4,313	12,075	6,038
120,000	6,000	9,000	4,500	12,600	6,300
125,000	6,250	9,375	4,688	13,125	6,563
130,000	6,500	9,750	4,875	13,650	6,825
135,000	6,750	10,125	5,063	14,175	7,088
140,000	7,000	10,500	5,250	14,700	7,350
145,000	7,250	10,875	5,438	15,225	7,613
150,000	7,500	11,250	5,625	15,750	7,875
155,000	7,750	11,625	5,813	16,275	8,138
160,000	8,000	12,000	6,000	16,800	8,400
165,000	8,250	12,375	6,188	17,325	8,663
170,000	8,500	12,750	6,375	17,850	8,925
175,000	8,750	13,125	6,563	18,375	9,188
180,000	9,000	13,500	6,750	18,900	9,450
185,000	9,250	13,875	6,938	19,425	9,713
190,000	9,500	14,250	7,125	19,950	9,975
195,000	9,750	14,625	7,313	20,475	10,238
200,000	10,000	15,000	7,500	21,000	10,500
205,000	10,250	15,375	7,688	21,525	10,763
210,000	10,500	15,750	7,875	22,050	11,025
215,000	10,750	16,125	8,063	22,575	11,288
220,000	11,000	16,500	8,250	23,100	11,550
225,000	11,250	16,875	8,438	23,625	11,813
230,000	11,500	17,250	8,625	24,150	12,075

¹The 1994 date refers to dwellings constructed under the 1994 Minnesota Energy Code. The default KAIR used in this section of the table is 0.20 ACH.

²This section of the table is to be used for dwellings constructed prior to 1994. The default KAIR used in this section of the table is 0.40 ACH.

Statutory Authority: *MS s 16B.59; 16B.61; 16B.64*

History: *29 SR 299*