

1.1 **Department of Labor and Industry**

1.2 **Proposed Permanent Rules Relating to Mechanical and Fuel Gas Codes**

1.3 **1346.0050 TITLE; INCORPORATION BY REFERENCE.**

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

1.6 Chapters 2 to 15 of the ~~2000~~ 2006 edition of the International Mechanical Code,
1.7 promulgated by the International Code Council, Inc., 5203 Leesburg Pike, Suite
1.8 600, Falls Church, Virginia 22041-3401, are incorporated by reference as part of the
1.9 Minnesota Mechanical Code ~~with the amendments~~ as amended in this chapter. Portions
1.10 of this chapter reproduce text and tables from the International Mechanical Code. The
1.11 International Mechanical Code is copyright 2006 by the International Code Council, Inc.
1.12 All rights reserved. As used in this chapter, "IMC" means the International Mechanical
1.13 Code incorporated in this part.

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

1.17 Chapters 1 to 15 of the 2004 edition of NFPA 96 Standard for Ventilation Control and
1.18 Fire Protection of Commercial Cooking Operations, promulgated by the National Fire
1.19 Protection Association, 1 Batterymarch Park, Quincy, MA 02169-7471, are incorporated
1.20 by reference as part of the Minnesota Mechanical Code as amended in this chapter.
1.21 Portions of this chapter reproduce text and tables for the NFPA 96. The NFPA 96 is
1.22 copyright 2004 by the National Fire Protection Association. All rights reserved. As used
1.23 in this chapter, "NFPA 96" means the NFPA 96 Standard for Ventilation Control and Fire
1.24 Protection of Commercial Cooking Operations incorporated into this part.

1.25 The NFPA 96 is not subject to frequent change and a copy of the NFPA 96, with
1.26 amendments for use in Minnesota, is available in the office of the commissioner of labor
1.27 and industry.

2.1 **1346.0060 REFERENCES TO OTHER INTERNATIONAL CODE COUNCIL**
2.2 **(ICC) CODES.**

2.3 [For text of subps 1 to 10, see M.R.]

2.4 Subp. 11. **Fire code.** References to the International Fire Code in this code mean
2.5 the Minnesota State Fire Code, adopted pursuant to chapter ~~7510~~ 7511 and Minnesota
2.6 Statutes, chapter 299F.

2.7 **1346.0101 SECTION 101 SCOPE.**

2.8 IMC Section 101 is amended to read as follows:

2.9 **101 Scope.** This code shall regulate the design, installation, maintenance, alteration, and
2.10 inspection of mechanical systems that are permanently installed and utilized to provide
2.11 control of environmental conditions and related processes within buildings. Fuel gas
2.12 piping systems, fuel gas utilization equipment, and related accessories shall be regulated
2.13 by parts 1346.5050 through ~~1346.5900~~ 1346.6000.

2.14 This code shall also regulate those mechanical systems, system components,
2.15 equipment, and appliances specifically addressed in the IMC and IFGC. This code
2.16 shall also regulate process piping installed within, or in conjunction with, buildings or
2.17 structures. For the purposes of this section, the term "process piping" includes piping
2.18 or tubing which conveys gas, liquid, or fluidized solids and which is used directly in
2.19 research, laboratory, or production processes. Process piping and tubing shall be installed
2.20 in accordance with ~~ASME B31.3-1999~~ ASME B31.3-2006, Process Piping Code, or
2.21 ~~ASME B31.9-1996~~ ASME B31.9-2008, Building Services Piping Code, as applicable.
2.22 Refer to chapter 1300 for additional administrative provisions of the Minnesota State
2.23 Building Code. For purposes of this section, refer to Minnesota Statutes, section 13.37,
2.24 subdivision 1, paragraph (b), on disclosure of nonpublic data.

2.25 **1346.0202 SECTION 202 GENERAL DEFINITIONS.**

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

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

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

3.10 **COMMERCIAL KITCHEN HOODS:**

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

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

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

3.26 **Single island canopy hood.** A single island canopy hood is placed over a cooking
3.27 line that is not installed along a wall. It is open on all sides and overhangs the front, rear,

4.1 ~~and sides of the appliances. A single island canopy is more susceptible to cross drafts and~~
4.2 ~~requires greater exhaust airflow to capture effluent than an equivalent sized wall canopy~~
4.3 ~~hood. Filter racks or grease extractor plenums should be mounted in the center of these~~
4.4 ~~canopies for optimal capture and containment.~~

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

4.11 ~~COMMERCIAL KITCHEN COOKING APPLIANCES.~~

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

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

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

4.24 ~~**Medium duty cooking appliance.** Medium duty cooking appliances with a~~
4.25 ~~minimum average cooking surface temperature of 400°F (204°C) include electric and gas~~
4.26 ~~open-burner ranges (with or without oven), electric and gas hot-top ranges, electric and~~
4.27 ~~gas griddles, electric and gas double-sided griddles, electric and gas fryers (including open~~

5.1 ~~deep fat fryers, donut fryers, kettle fryers, and pressure fryers), electric and gas pasta~~
5.2 ~~cookers, electric and gas conveyor pizza ovens, electric and gas tilting skillets (braising~~
5.3 ~~pans), electric and gas rotisseries, and electric and gas salamander broilers.~~

5.4 **DECORATIVE SOLID FUEL BURNING APPLIANCE.** ~~An atmospherically vented~~ A
5.5 natural draft appliance, usually a fireplace, intended primarily for viewing of the fire and
5.6 which may or may not incorporate doors that substantially close off the firebox opening
5.7 when the appliance is in operation.

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

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

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

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

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

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

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

6.1 **SOLID FUEL APPLIANCE.** ~~An atmospherically vented~~ A natural draft appliance
6.2 that is either a closed combustion solid fuel burning appliance or a decorative solid fuel
6.3 burning appliance.

6.4 **1346.0301 SECTION 301 GENERAL.**

6.5 IMC Section 301.4 is amended to read as follows:

6.6 **301.4 Listed and labeled.** Appliances regulated by this code shall be listed and labeled to
6.7 an appropriate standard by a nationally recognized testing laboratory which is qualified to
6.8 evaluate the appliance, unless otherwise approved in accordance with the administrative
6.9 provisions of the Minnesota State Building Code, Minnesota Rules, chapter 1300. The
6.10 approval of unlisted appliances shall be based upon engineering evaluation. Unlisted
6.11 appliances shall be installed with clearances to combustibles in accordance with IMC
6.12 Chapter 8. Unlisted appliances with a fuel input rating of less than 12,500,000 Btu/hr
6.13 (3,660 kW) shall have fuel trains, controls, and safety devices installed in accordance with
6.14 Part CF, Combustion Side Control, of ASME ~~CSD-1~~ CSD-1-2006. Unlisted appliances
6.15 with a fuel input rating of 12,500,000 Btu/hr (3,660 kW) or greater shall have fuel trains,
6.16 controls, and safety devices installed in accordance with NFPA ~~85-2001~~ 85-2007.

6.17 **1346.0306 SECTION 306 ACCESS AND SERVICE SPACE.**

6.18 IMC Section 306.5 is amended to read as follows:

6.19 **306.5 Mechanical equipment and appliances on roofs or elevated structures.** Where
6.20 mechanical equipment or appliances requiring periodic inspection, service, or maintenance
6.21 are installed on roofs or elevated structures, a permanent stair shall be provided for access.

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

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

7.3 1. The stair shall be installed at an angle of not more than 60 degrees measured
7.4 from the horizontal plane.

7.5 2. The stair shall have flat treads at least 6 inches (152 mm) deep and a clear width of
7.6 at least 18 inches (457 mm) with equally spaced risers at least 10.5 inches (267 mm) high
7.7 and not exceeding 14 inches (356 mm).

7.8 3. The stair shall have intermediate landings not exceeding 18 feet (5.5 m) vertically.

7.9 4. Continuous handrails shall be installed on both sides of the stair.

7.10 5. Interior stairs shall terminate at the under side of the roof at a hatch or scuttle of at
7.11 least 8 square feet (0.74m^2) with a minimum dimension of 20 inches (508 mm).

7.12 6. When a roof access hatch or scuttle is located within 10 feet (3.0 m) of a roof edge,
7.13 a guard shall be installed in accordance with IMC Section 304.9.

7.14 7. Exterior stairs shall terminate at the roof access point or at a level landing of at
7.15 least 8 square feet (0.74m^2) with a minimum dimension of 20 inches (508 mm). The
7.16 landing shall have a guard installed in accordance with IMC Section ~~304.9~~ 304.10.

7.17 **306.5.1 Permanent ladders.** Where a change in roof elevation greater than 30 inches
7.18 (762 mm) but not exceeding 16 feet (4.9 m) exists, a permanent ladder shall be provided.
7.19 The ladder may be vertical and shall be as required by relevant safety regulations, but
7.20 shall not be less than the following:

7.21 1. Width shall be at least 16 inches (406 mm).

7.22 2. Rung spacing shall be a maximum of 14 inches (356 mm).

7.23 3. Toe space shall be at least 6 inches (152 mm).

7.24 4. Side railings shall extend at least 30 inches (762 mm) above the roof or parapet
7.25 wall.

7.26 **306.5.2 Electrical requirements.** A receptacle outlet shall be provided at or near the
7.27 equipment location in accordance with the ICC Electrical Code.

8.1 **1346.0401 SECTION 401 GENERAL.**

8.2 IMC Section ~~401.5~~ 401.4 is amended to read as follows:

8.3 **401.5 401.4 Opening location.** Outside air exhaust and intake openings, in buildings
8.4 other than dwellings and Group R-3 occupancies, shall be located a minimum of 10 feet
8.5 (3048 mm) from lot lines or buildings on the same lot. Where openings front on a street or
8.6 public way, the distance shall be measured to the centerline of the street or public way.

8.7 **401.5.1 401.4.1 Intake openings.** Mechanical outside air intake openings shall be located
8.8 a minimum of 10 feet (3048 mm) from any hazardous or noxious contaminant, such as
8.9 chimneys, plumbing vents, streets, alleys, parking lots, and loading docks, except as
8.10 otherwise specified in this code. Where a source of contaminant is located within 10 feet
8.11 (3048 mm) of an intake opening, the intake opening shall be located a minimum of 3 feet
8.12 (914 mm) below the contaminant source, unless the intake opening is a combustion air
8.13 intake of a direct-vent appliance.

8.14 **401.5.2 401.4.2 Exhaust openings.** Outside exhaust openings, including bathroom
8.15 exhaust, toilet exhaust, domestic kitchen range exhaust, and domestic clothes dryer
8.16 exhaust, shall be located at least 3 feet (914 mm) from doors, operable windows, and
8.17 nonmechanical intake openings. Exhaust air shall not be directed onto public walkways.

8.18 **401.4.3 Flood hazard.** For structures located in flood hazard areas, outdoor exhaust
8.19 openings shall be at or above the design flood elevation.

8.20 **401.5.3 401.4.4 Venting system terminations.** Venting system terminations shall comply
8.21 with IMC Section 804 and IFGC Section 503.8.

8.22 **1346.0403 SECTION 403 MECHANICAL VENTILATION.**

8.23 [For text of subpart 1, see M.R.]

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

8.25 **403.2 Outdoor air required.** The minimum ventilation rate of required outdoor air
8.26 shall be determined in accordance with the Ventilation Rate Procedure, Section ~~6.1~~ 6.2
9.1 of ASHRAE ~~62-2001~~ 62.1-2004, or the Indoor Air Quality Procedure, Section ~~6.2~~ 6.3
9.2 of ASHRAE ~~62-2001~~ 62.1-2004.

9.3 **Exceptions:**

- 9.4 1. Enclosed parking garages shall comply with amended IMC Section 404.
- 9.5 2. Dwellings ~~shall comply with the Minnesota Energy Code, that are required to~~
9.6 comply with Minnesota Rules, chapter 7670 or 7672, as applicable 1322.
- 9.7 3. Buildings or portions of buildings that are not intended for normal human
9.8 occupancy, or where the primary purpose is not associated with human comfort.

9.9 **403.2.1 Recirculation of air.** The air required by the Ventilation Rate Procedure, Section
9.10 ~~6.1~~ 6.2 of ASHRAE ~~62-2001~~ 62.1-2004, or the Indoor Air Quality Procedure, Section
9.11 ~~6.2~~ 6.3 of ASHRAE ~~62-2001~~ 62.1-2004, shall not be recirculated. Air in excess of that
9.12 required shall not be prohibited from being recirculated as a component of supply air
9.13 to building spaces, except that:

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

9.19 3. Where mechanical exhaust is required by the Ventilation Rate Procedure, Section
9.20 ~~6.1~~ 6.2 of ASHRAE ~~62-2001~~ 62.1-2004, or the Indoor Air Quality Procedure, Section
9.21 ~~6.2~~ 6.3 of ASHRAE ~~62-2001~~ 62.1-2004, recirculation of air from such spaces shall be
9.22 prohibited. All air supplied to such spaces shall be exhausted, including any air in excess
9.23 of that required.

9.24 **403.2.2 Transfer air.** Except where recirculation from such spaces is prohibited by the
9.25 Ventilation Rate Procedure, Section ~~6.1~~ 6.2 of ASHRAE ~~62-2001~~ 62.1-2004, or the Indoor
9.26 Air Quality Procedure, Section ~~6.2~~ 6.3 of ASHRAE ~~62-2001~~ 62.1-2004, air transferred
9.27 from occupied spaces is not prohibited from serving as makeup air for required exhaust
10.1 systems in such spaces as kitchens, baths, toilet rooms, elevators, and smoking lounges.
10.2 The amount of transfer air and exhaust air shall be sufficient to provide the flow rates

10.3 as specified in the Ventilation Rate Procedure, Section ~~6-1~~ 6.2 of ASHRAE ~~62-2001~~
10.4 62.1-2004, or the Indoor Air Quality Procedure, Section ~~6-2~~ 6.3 of ASHRAE ~~62-2001~~
10.5 62.1-2004. The required outdoor air rates shall be introduced directly into such spaces or
10.6 into the occupied spaces from which air is transferred, or a combination of both.

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

10.8 **403.3 Ventilation rate.** Ventilation systems shall be designed to have the capacity to
10.9 supply the minimum outdoor airflow rate determined in accordance with the Ventilation
10.10 Rate Procedure, Section ~~6-1~~ 6.2 of ASHRAE ~~62-2001~~ 62.1-2004 or the Indoor Air Quality
10.11 Procedure, Section ~~6-2~~ 6.3 of ASHRAE ~~62-2001~~ 62.1-2004, based on the occupancy
10.12 of the space and the occupant load or other parameters as stated therein. The occupant
10.13 load utilized for design of the ventilation system shall not be less than the number
10.14 determined from the estimated maximum occupant load rate indicated in the Ventilation
10.15 Rate Procedure, Section ~~6-1~~ 6.2 of ASHRAE ~~62-2001~~ 62.1-2004, or the Indoor Air
10.16 Quality Procedure, Section ~~6-2~~ 6.3 of ASHRAE ~~62-2001~~ 62.1-2004. Ventilation rates for
10.17 occupancies not represented shall be determined by an approved engineering analysis.
10.18 The ventilation system shall be designed to supply the required rate of ventilation air
10.19 continuously during the period the building is occupied, except as otherwise stated in
10.20 other provisions of the code.

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

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

10.25 **403.3.1 System operation.** The minimum flow rate of outdoor air that the ventilation
10.26 system must be capable of supplying during its operation shall be permitted to be based
10.27 on the rate per person indicated in the Ventilation Rate Procedure, Section ~~6-1~~ 6.2 of
11.1 ASHRAE ~~62-2001~~ 62.1-2004, or the Indoor Air Quality Procedure, Section ~~6-2~~ 6.3 of
11.2 ASHRAE ~~62-2001~~ 62.1-2004, and the actual number of occupants present.

11.3 [For text of subp 5, see M.R.]

11.4 **1346.0404 SECTION 404 GARAGES.**

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

11.6 **404.1 Enclosed parking garages.** Mechanical ventilation systems for enclosed parking
11.7 garages shall provide a minimum exhaust rate of 0.75 cfm per square foot (~~0.0038 m³/s~~
11.8 0.228m³ per minute per square meter) of floor area. Mechanical ventilation systems are
11.9 not required to operate continuously where the system is arranged to operate automatically
11.10 upon detection of a concentration of carbon monoxide of 25 parts per million (ppm)
11.11 by approved automatic detection devices.

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

11.13 **404.2 Motor vehicle repair garages.** Mechanical ventilation systems for motor vehicle
11.14 repair garages shall provide a minimum exhaust rate of 0.75 cfm per square foot (~~0.0038~~
11.15 m³/s 0.228m³ per minute per square meter) of floor area ~~instead of the rate specified in~~
11.16 ~~ASHRAE 62-2001.~~

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

11.18 **404.3 Occupied spaces accessory to public garages.** Connecting offices, waiting rooms,
11.19 ticket booths, and similar uses that are accessory to a public garage shall be maintained
11.20 at a positive pressure and shall be provided with ventilation in accordance with the
11.21 Ventilation Rate Procedure, Section ~~6-1~~ 6.2 of ASHRAE ~~62-2001~~ 62.1-2004, or the Indoor
11.22 Air Quality Procedure, Section ~~6-2~~ 6.3 of ASHRAE ~~62-2001~~ 62.1-2004.

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

12.1 **404.4 Prohibition of heated commercial parking garages.** Commercial parking
12.2 garages shall comply with the Minnesota Commercial Energy Code, ~~Minnesota Rules,~~
12.3 ~~part 7676.1100, subpart 2~~ chapter 1323.

12.4 **1346.0501 SECTION 501 GENERAL.**

12.5 Subpart 1. **Section ~~501.3~~ 501.2**. IMC Section ~~501.3~~ 501.2 is amended to read
 12.6 as follows:

12.7 **~~501.3 Outdoor discharge.~~** ~~The air removed by every mechanical exhaust system shall~~
 12.8 ~~be discharged outdoors at a point where it will not cause a nuisance and from which it~~
 12.9 ~~cannot again be readily drawn in by a ventilating system. Exhaust ducts shall terminate~~
 12.10 ~~outside of the building in accordance with amended IMC Section 401.5.2 and shall be~~
 12.11 ~~equipped with a backdraft damper at the point of termination. Air shall not be exhausted~~
 12.12 ~~into an attic or crawl space.~~

12.13 **501.2 Exhaust discharge.** The air removed by every mechanical exhaust system shall
 12.14 be discharged outdoors at a point where it will not cause a nuisance and not less than
 12.15 the distances specified in Section 501.2.1. The air shall be discharged to a location
 12.16 from which it cannot again be readily drawn in by a ventilating system. Air shall not be
 12.17 exhausted into an attic or crawl space and the exhaust system shall be equipped with a
 12.18 backdraft damper at the point of discharge.

12.19 **Exception:**

12.20 **1. Commercial cooking recirculating systems.**

12.21 Subp. 2. **Section ~~501.4~~ 501.3**. IMC Section ~~501.4~~ 501.3 is amended to read as
 12.22 follows:

12.23 **~~501.4~~ 501.3 Pressure equalization.** Mechanical exhaust systems shall be sized and
 12.24 operated to remove the quantity of air required by this chapter. If a greater quantity of air
 12.25 is supplied by a mechanical ventilating supply system than is removed by a mechanical
 13.1 exhaust system for a room, adequate means shall be provided for the natural exit of the
 13.2 excess air supplied.

13.3 **~~501.4.1~~ 501.3.1 Makeup air in new dwellings.** Makeup air quantity for new dwellings
 13.4 shall be determined by using Table ~~501.4.1~~ 501.3.1 and shall be supplied in accordance
 13.5 with IMC Section ~~501.4.2~~ 501.3.2.

13.6 **Exception.** Makeup air provisions of IMC Section ~~501.4.1~~ 501.3.1 are not required
13.7 when any of the following are demonstrated:

- 13.8 1. ~~A dwelling is constructed under the Minnesota Energy Code, Minnesota Rules,~~
13.9 ~~chapter 7672.~~
- 13.10 2. A test is performed according to ASTM Standard ~~E1998-99~~ E1998-02 2007,
13.11 *Standard Guide for Assessing Depressurization-Induced Backdrafting and Spillage*
13.12 *from Vented Combustion Appliances*, and documentation is provided that the vented
13.13 combustion appliances continue to operate within established parameters of the test.
- 13.14 3. 2. A test approved by the building official verifies proper operation of vented
13.15 combustion appliances.

13.16 ~~501.4.2~~ 501.3.2 **Makeup air supply.** Makeup air shall be provided by one of the
13.17 following methods:

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

13.20 1.1 Passive makeup air openings from the outdoors shall be sized according
13.21 to Table ~~501.4.2~~ 501.3.2.

13.22 1.2 Barometric dampers are prohibited in passive makeup air openings when
13.23 any atmospherically vented appliance is installed.

13.24 1.3 Single passive openings larger than 8 inches (204 mm) diameter, or
13.25 equivalent, shall be provided with a motorized damper that is electrically interlocked
13.26 with the largest exhaust system.

- 14.1 2. Powered makeup air shall be provided if the size of a single opening or multiple
14.2 openings exceeds 11 inches (280 mm) diameter, or equivalent, when sized according to
14.3 Table ~~501.4.2~~ 501.3.2. Powered makeup air shall comply with the following:

14.4 2.1 Powered makeup air shall be electrically interlocked with the largest exhaust
14.5 system.

14.6 2.2 Powered makeup air shall be matched to the airflow of the largest exhaust
14.7 system.

14.8 3. Makeup air shall be provided by a combination of passive openings and powered
14.9 means according to Table ~~501.4.2~~ 501.3.2 and the following:

14.10 3.1 Passive makeup air openings shall comply with Item 1.

14.11 3.2 Powered makeup air shall be supplied for the quantity of airflow in excess
14.12 of the passive makeup air opening provided, and it shall be electrically interlocked with
14.13 the exhaust system.

14.14 ~~501.4.2.1~~ 501.3.2.1 **Makeup air ducts.** Makeup air ducts shall be constructed and
14.15 installed according to IMC Chapter 6 and Section ~~501.4.2~~ 501.3.2.

14.16 ~~501.4.2.2~~ 501.3.2.2 **Makeup air intake.** Makeup air intake openings shall be located to
14.17 avoid intake of exhaust air in accordance with IMC Section 401.5.2 and IFGC Section
14.18 503.8, and shall be covered with corrosion resistant screen of not less than 1/4 inch (6.4
14.19 mm) mesh. Makeup air intake openings shall be located at least 12 inches (305 mm)
14.20 above adjoining grade level.

14.21 ~~501.4.2.3~~ 501.3.2.3 **Makeup air location.** Makeup air requirements of 175 cubic feet
14.22 per minute (cfm) ($0.084 \text{ m}^3/\text{s}$) and greater shall be introduced to the dwelling in one of
14.23 the following locations:

14.24 1. In the space containing the vented combustion appliances.

14.25 2. In the space containing the exhaust system.

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

15.3 ~~501.4.2.4~~ 501.3.2.4 **Makeup air termination restriction.** A makeup air opening shall
15.4 not terminate in the return air plenum of a forced air heating system unless it is installed
15.5 according to the heating equipment manufacturer's installation instructions.

15.6 ~~501.4.2.5~~ 501.3.2.5 **Separate makeup air and combustion air openings.** When both
15.7 makeup air and combustion air openings are required, they shall be provided through

15.8 separate openings to the outdoors. Refer to IFGC Section 304, to determine requirements
15.9 for air for combustion and ventilation.

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

15.13 ~~501.4.2.6~~ 501.3.2.6 **Makeup air effectiveness.** The makeup air shall not reduce the
15.14 effectiveness of exhaust systems or performance of vented combustion appliances, and
15.15 makeup air shall not adversely affect the heating or cooling capability of the mechanical
15.16 equipment.

15.17 ~~501.4.3~~ 501.3.3 **Additions, alterations, or installations of mechanical systems in**
15.18 **existing dwellings.** Makeup air shall be supplied to existing dwellings when any of the
15.19 following conditions occur:

15.20 1. If a dwelling was constructed after 2003 using the makeup air provisions of IMC
15.21 Section ~~501.4.1~~ 501.3.2, makeup air quantity shall be determined by using Table ~~501.4.1~~
15.22 501.3.1 and shall be supplied according to IMC Section ~~501.4.2~~ 501.3.2 when any of
15.23 the following conditions occur:

15.24 1.1 A vented combustion appliance, including a solid fuel appliance, is installed
15.25 or replaced.

15.26 1.2 An exhaust system is installed or replaced.

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

16.3 2. If a dwelling was constructed after 1999 using the provisions of the Minnesota
16.4 Energy Code, Minnesota Rules, chapter 7672, makeup air quantity shall be determined by
16.5 using IMC Table ~~501.4.1~~ 501.3.1 and shall be supplied in accordance with IMC Section
16.6 ~~501.4.2~~ 501.3.2 when any of the following conditions occur:

16.7 2.1 A vented combustion appliance, including a solid fuel appliance, is installed
16.8 or replaced.

16.9 2.2 An exhaust system is installed or replaced.

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

16.12 3. When a solid fuel appliance is installed in a dwelling constructed during or after
16.13 1994 under the Minnesota Energy Code, Minnesota Rules, chapter 7670, makeup air
16.14 quantity shall be determined by using IMC Table ~~501.4.1~~ 501.3.1 and shall be supplied
16.15 according to IMC Section ~~501.4.2~~ 501.3.2.

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

16.19 4. When an exhaust system with a rated capacity greater than 300 cfm (0.144 m³/s)
16.20 is installed in a dwelling constructed during or after 1994 under the Minnesota Energy
16.21 Code, Minnesota Rules, chapter 7670, makeup air quantity shall be determined by using
16.22 IMC Table ~~501.4.3(1)~~ 501.3.3(1) and shall be supplied according to IMC Section ~~501.4.2~~
16.23 501.3.2.

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

16.26 5. When an exhaust system with a rated capacity greater than 300 cfm (0.144
16.27 m³/s) is installed in a dwelling constructed prior to 1994, makeup air quantity shall be
17.1 determined by using IMC Table ~~501.4.3(2)~~ 501.3.3(2) and shall be supplied according
17.2 to IMC Section ~~501.4.2~~ 501.3.2.

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

17.5 6. When a solid fuel appliance is installed in a dwelling constructed prior to 1994,
 17.6 makeup air quantity shall be determined by using IMC Table ~~501.4.3(3)~~ 501.3.3(3) and
 17.7 shall be supplied according to IMC Section ~~501.4.2~~ 501.3.2.

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

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

17.13 1. A test is performed according to ASTM Standard ~~E1998-99~~ E1998-02 2007,
 17.14 *Standard Guide for Assessing Depressurization-Induced Backdrafting and Spillage*
 17.15 *from Vented Combustion Appliances*, and documentation is provided that the vented
 17.16 combustion appliances continue to operate within established parameters of the test.

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

17.19 Table ~~501.4.1~~ 501.3.1

17.20 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 atmospherically vented gas or oil appliance or one solid fuel appliance ^C | Multiple atmospherically vented gas or oil appliances or solid fuel appliances ^D |
|-------|--|--|---|--|
| 17.21 | | | | |
| 17.22 | | | | |
| 17.23 | | | | |
| 17.24 | | | | |
| 17.25 | | | | |
| 17.26 | | | | |
| 17.27 | 1. Use the Appropriate Column to Estimate House Infiltration | | | |
| 17.28 | a) pressure factor | | | |
| 17.29 | (cfm/sf) 0.15 | 0.09 | 0.06 | 0.03 |
| 18.1 | b) conditioned | | | |
| 18.2 | floor area (sf) _____ | _____ | _____ | _____ |
| 18.3 | (including unfinished basements) | | | |
| 18.4 | Estimated House | | | |
| 18.5 | Infiltration (cfm): | | | |
| 18.6 | [1a x 1b] _____ | _____ | _____ | _____ |

| | | | | |
|-------|--|------------|-------|-------|
| 18.7 | 2. Exhaust Capacity | | | |
| 18.8 | a) continuous | | | |
| 18.9 | exhaust-only | | | |
| 18.10 | ventilation | | | |
| 18.11 | system (cfm): | _____ | _____ | _____ |
| 18.12 | (not applicable to balanced ventilation systems such as HRV) | | | |
| 18.13 | b) clothes dryer | 135 | 135 | 135 |
| 18.14 | c) 80% of largest | | | |
| 18.15 | exhaust rating | | | |
| 18.16 | (cfm): | _____ | _____ | _____ |
| 18.17 | (not applicable if recirculating system or if powered makeup air is electrically interlocked | | | |
| 18.18 | and matched to exhaust) | | | |
| 18.19 | d) 80% of next | | | |
| 18.20 | largest exhaust | not | | |
| 18.21 | rating (cfm): | applicable | _____ | _____ |
| 18.22 | (not applicable if recirculating system or if powered makeup air is electrically interlocked | | | |
| 18.23 | and matched to exhaust) | | | |
| 18.24 | Total Exhaust | | | |
| 18.25 | Capacity (cfm): | | | |
| 18.26 | [2a+2b+2c+2d] | _____ | _____ | _____ |
| 18.27 | 3. Makeup Air Requirement | | | |
| 18.28 | a) Total Exhaust | | | |
| 18.29 | Capacity (from | | | |
| 18.30 | above) | | | |
| 18.31 | b) Estimated | | | |
| 18.32 | House Infiltration | | | |
| 18.33 | (from above) | | | |
| 19.1 | Makeup Air | | | |
| 19.2 | Quantity (cfm): | | | |
| 19.3 | [3a - 3b] | _____ | _____ | _____ |
| 19.4 | (if value is negative, no makeup air is needed) | | | |

19.5 4. For Makeup Air Opening Sizing, refer to Table ~~501.4.2~~ 501.3.2

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

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

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

19.12 ^DUse this column if there are multiple atmospherically vented gas or oil appliances
 19.13 using a common vent or if there are atmospherically vented gas or oil appliances and
 19.14 solid fuel appliances.

19.15 ~~Table 501.4.2~~ 501.3.2
 19.16 Makeup Air Opening Sizing Table for New and Existing Dwellings

| 19.17 | 19.18 | 19.19 | 19.20 | 19.21 | 19.22 | 19.23 |
|-------|--|--|---|--|--|----------|
| | One or multiple power vent or direct vent appliances <i>or</i> no combustion appliances ^A | One or multiple fan-assisted appliances <i>and</i> power vent or direct vent appliances ^B | One atmospher- ically vented gas or oil appliance <i>or</i> one solid fuel appliance ^C | Multiple atmospher- ically vented gas or oil appliances <i>or</i> solid fuel appliances ^D | Passive makeup air opening duct diameter ^{E,F,G} | |
| 19.24 | Type of opening or system | (cfm) | (cfm) | (cfm) | (cfm) | (inches) |
| 19.25 | Passive Opening | 1-36 | 1-22 | 1-15 | 1-9 | 3 |
| 19.26 | Passive Opening | 37-66 | 23-41 | 16-28 | 10-17 | 4 |
| 19.27 | Passive Opening | 67-109 | 42-66 | 29-46 | 18-28 | 5 |
| 19.28 | Passive Opening | 110-163 | 67-100 | 47-69 | 29-42 | 6 |
| 19.29 | Passive Opening | 164-232 | 101-143 | 70-99 | 43-61 | 7 |
| 19.30 | Passive Opening | 233-317 | 144-195 | 100-135 | 62-83 | 8 |
| 19.31 | Passive Opening with Motorized Damper | 318-419 | 196-258 | 136-179 | 84-110 | 9 |
| 20.1 | Passive Opening with Motorized Damper | 420-539 | 259-332 | 180-230 | 111-142 | 10 |
| 20.2 | | | | | | |
| 20.3 | | | | | | |
| 20.4 | | | | | | |
| 20.5 | | | | | | |
| 20.6 | | | | | | |

| | | | | | | |
|-------|------------------|---------|---------|---------|---------|------------|
| 20.7 | Passive Opening | | | | | |
| 20.8 | with Motorized | | | | | |
| 20.9 | Damper | 540-679 | 333-419 | 231-290 | 143-179 | 11 |
| 20.10 | Powered Makeup | | | | | Not |
| 20.11 | Air ^H | >679 | >419 | >290 | >179 | Applicable |

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

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

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

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

20.21 ^EAn equivalent length of 100 feet of round smooth metal duct is assumed. Subtract
20.22 40 feet for the exterior hood and ten feet for each 90-degree elbow to determine the
20.23 remaining length of straight duct allowable.

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

20.26 ^GBarometric dampers are prohibited in passive makeup air openings when any
20.27 atmospherically vented appliance is installed.

20.28 ^HPowered makeup air shall be electrically interlocked with the largest exhaust system.

20.29 Table 501.4.3(1) 501.3.3(1)

21.1 Procedure to Determine Makeup Air Quantity for Exhaust Equipment in Existing
21.2 Dwellings

21.3 (Refer to Item 4 in Section ~~501.4.3~~ 501.3.3 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 atmospherically vented gas or oil appliance or one solid fuel appliance ^C | Multiple atmospherically vented gas or oil appliances or solid fuel appliances ^D |
|------|---|---|--|---|
| 21.4 | | | | |
| 21.5 | | | | |
| 21.6 | | | | |
| 21.7 | | | | |
| 21.8 | | | | |
| 21.9 | | | | |

21.10 1. Use the Appropriate Column to Estimate House Infiltration

21.11 a) pressure factor

| | | | | |
|----------------|------|------|------|------|
| 21.12 (cfm/sf) | 0.15 | 0.09 | 0.06 | 0.03 |
|----------------|------|------|------|------|

21.13 b) conditioned

| | | | | |
|-----------------------|-------|-------|-------|-------|
| 21.14 floor area (sf) | _____ | _____ | _____ | _____ |
|-----------------------|-------|-------|-------|-------|

21.15 Estimated House

21.16 Infiltration (cfm):

| | | | | |
|-----------------|-------|-------|-------|-------|
| 21.17 [1a x 1b] | _____ | _____ | _____ | _____ |
|-----------------|-------|-------|-------|-------|

21.18 2. Exhaust Capacity

21.19 80% of exhaust

21.20 rating = Exhaust

| | | | | |
|-----------------------|-------|-------|-------|-------|
| 21.21 Capacity (cfm): | _____ | _____ | _____ | _____ |
|-----------------------|-------|-------|-------|-------|

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

21.24 3. Makeup Air Requirement

21.25 a) Exhaust

21.26 Capacity (from

| | | | | |
|--------------|-------|-------|-------|-------|
| 21.27 above) | _____ | _____ | _____ | _____ |
|--------------|-------|-------|-------|-------|

21.28 b) Estimated

21.29 House Infiltration

| | | | | |
|--------------------|-------|-------|-------|-------|
| 21.30 (from above) | _____ | _____ | _____ | _____ |
|--------------------|-------|-------|-------|-------|

21.31 Makeup Air

21.32 Quantity (cfm):

| | | | | |
|-----------------|-------|-------|-------|-------|
| 21.33 [3a - 3b] | _____ | _____ | _____ | _____ |
|-----------------|-------|-------|-------|-------|

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

21.35 4. For Makeup Air Opening Sizing, refer to Table 501.4.2 501.3.2

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

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

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

22.7 ^DUse this column if there are multiple atmospherically vented gas or oil appliances
 22.8 using a common vent or if there are atmospherically vented gas or oil appliances and
 22.9 solid fuel appliances.

22.10 Table 501.4.3(2) 501.3.3(2)

22.11 Procedure to Determine Makeup Air Quantity for Exhaust Equipment in Existing
 22.12 Dwellings

22.13 (Refer to Item 5 in Section ~~501.4.3~~ 501.3.3 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 atmospherically vented gas or oil appliance or one solid fuel appliance ^C | Multiple atmospherically vented gas or oil appliances or solid fuel appliances ^D |
|--|--|--|---|--|
|--|--|--|---|--|

22.20 1. Use the Appropriate Column to Estimate House Infiltration

22.21 a) pressure factor

22.22 (cfm/sf) 0.25 0.15 0.10 0.05

22.23 b) conditioned

22.24 floor area (sf) _____ _____ _____ _____

22.25 (including unfinished basements)

22.26 Estimated House

22.27 Infiltration (cfm):

22.28 [1a x 1b] _____ _____ _____ _____

22.29 or

22.30 Alternative

22.31 Calculation (by

22.32 using blower door

22.33 test)^E

23.1 c) conversion

23.2 factor 0.75 0.45 0.30 0.15

- 23.3 d) CFM50 value
- 23.4 (from blower
- 23.5 door test) _____
- 23.6 Estimated House
- 23.7 Infiltration (cfm):
- 23.8 [1c x 1d] _____
- 23.9 2. Exhaust Capacity
- 23.10 80% of exhaust
- 23.11 rating = Exhaust
- 23.12 Capacity (cfm): _____
- 23.13 (not applicable if recirculating system or if powered makeup air is electrically interlocked
- 23.14 with exhaust)
- 23.15 3. Makeup Air Requirement
- 23.16 a) Exhaust
- 23.17 Capacity (from
- 23.18 above) _____
- 23.19 b) Estimated
- 23.20 House Infiltration
- 23.21 (from above) _____
- 23.22 Makeup Air
- 23.23 Quantity (cfm):
- 23.24 [3a - 3b] _____
- 23.25 (if value is negative, no makeup air is needed)
- 23.26 4. For Makeup Air Opening Sizing, refer to Table ~~M501.4.2~~ 501.3.2
- 23.27 ^AUse this column if there are other than fan-assisted or atmospherically vented gas or
- 23.28 oil appliances or if there are no combustion appliances.
- 23.29 ^BUse this column if there is one fan-assisted appliance per venting system. Other
- 23.30 than atmospherically vented appliances may also be included.
- 23.31 ^CUse this column if there is one atmospherically vented (other than fan-assisted) gas
- 23.32 or oil appliance per venting system or one solid fuel appliance.

24.1 ^DUse this column if there are multiple atmospherically vented gas or oil appliances
 24.2 using a common vent or if there are atmospherically vented gas or oil appliances and
 24.3 solid fuel appliances.

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

24.6 Table 501.4.3(3) 501.3.3(3)

24.7 Procedure to Determine Makeup Air Quantity for Exhaust Equipment in Existing
 24.8 Dwellings

24.9 (Refer to Item 6 in Section ~~501.4.3~~ 501.3.3 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 atmospherically vented gas or oil appliance or one solid fuel appliance ^C | Multiple atmospherically vented gas or oil appliances or solid fuel appliances ^D |
|--|--|--|---|--|
|--|--|--|---|--|

24.16 1. Use the Appropriate Column to Estimate House Infiltration

24.17 a) pressure factor
 24.18 (cfm/sf)

| | | | |
|------|------|------|------|
| 0.25 | 0.15 | 0.10 | 0.05 |
|------|------|------|------|

24.19 b) conditioned
 24.20 floor area (sf)

| | | | |
|-------|-------|-------|-------|
| _____ | _____ | _____ | _____ |
|-------|-------|-------|-------|

24.21 (including unfinished basements)

24.22 Estimated House
 24.23 Infiltration (cfm):
 24.24 [1a x 1b]

| | | | |
|-------|-------|-------|-------|
| _____ | _____ | _____ | _____ |
|-------|-------|-------|-------|

24.25 or
 24.26 Alternative
 24.27 Calculation (by
 24.28 using blower door
 24.29 test)^E

24.30 c) conversion
 24.31 factor

| | | | |
|------|------|------|------|
| 0.75 | 0.45 | 0.30 | 0.15 |
|------|------|------|------|

24.32 d) CFM50 value
 24.33 (from blower
 24.34 door test)

| | | | |
|-------|-------|-------|-------|
| _____ | _____ | _____ | _____ |
|-------|-------|-------|-------|

| | | | | | |
|-------|--|------------|-------|-------|-------|
| 25.1 | Estimated House | | | | |
| 25.2 | Infiltration (cfm): | | | | |
| 25.3 | [1c x 1d] | _____ | _____ | _____ | _____ |
| 25.4 | 2. Exhaust Capacity | | | | |
| 25.5 | a) continuous | | | | |
| 25.6 | exhaust-only | | | | |
| 25.7 | ventilation | | | | |
| 25.8 | system (cfm) | _____ | _____ | _____ | _____ |
| 25.9 | (not applicable to balanced ventilation systems) | | | | |
| 25.10 | b) clothes dryer | | | | |
| 25.11 | (cfm) | 135 | 135 | 135 | 135 |
| 25.12 | c) 80% of largest | | | | |
| 25.13 | exhaust rating | | | | |
| 25.14 | (cfm): | _____ | _____ | _____ | _____ |
| 25.15 | (not applicable if recirculating system or if powered makeup air is electrically interlocked | | | | |
| 25.16 | and with exhaust) | | | | |
| 25.17 | d) 80% of next | | | | |
| 25.18 | largest exhaust | Not | | | |
| 25.19 | rating (cfm) | applicable | _____ | _____ | _____ |
| 25.20 | (not applicable if recirculating system or if powered makeup air is electrically interlocked | | | | |
| 25.21 | with exhaust) | | | | |
| 25.22 | Total Exhaust | | | | |
| 25.23 | Capacity (cfm): | | | | |
| 25.24 | [2a+2b+2c+2d] | _____ | _____ | _____ | _____ |
| 25.25 | 3. Makeup Air Requirement | | | | |
| 25.26 | a) Total Exhaust | | | | |
| 25.27 | Capacity (from | | | | |
| 25.28 | above) | _____ | _____ | _____ | _____ |
| 25.29 | b) Estimated | | | | |
| 25.30 | House Infiltration | | | | |
| 25.31 | (from above) | _____ | _____ | _____ | _____ |
| 25.32 | Makeup Air | | | | |
| 25.33 | Quantity (cfm): | | | | |
| 25.34 | [3a - 3b] | _____ | _____ | _____ | _____ |
| 25.35 | (if value is negative, no makeup air is needed) | | | | |

26.1 4. For Makeup Air Opening Sizing, refer to Table ~~501.4.2~~ 501.3.2

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

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

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

26.8 ^DUse this column if there are multiple atmospherically vented gas or oil appliances
26.9 using a common vent or if there are atmospherically vented gas or oil appliances and
26.10 solid fuel appliances.

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

26.13 **1346.0504 SECTION 504 CLOTHES DRYER EXHAUST.**

26.14 IMC Section 504.1 is amended to read as follows:

26.15 **504.1 Installation.** Clothes dryers shall be exhausted in accordance with the
26.16 manufacturer's instructions. Dryer exhaust systems shall be independent of all other
26.17 systems and shall convey the moisture and any products of combustion to the outside
26.18 of the building.

26.19 **Exception:** This section shall not apply to listed and labeled condensing (ductless)
26.20 clothes dryers. The room where a listed and labeled condensing (ductless) clothes
26.21 dryer is installed shall be provided with a floor drain or laundry sink and with an
26.22 exhaust ventilation system of 70 cfm or greater.

26.23 **1346.0505 SECTION 505 DOMESTIC KITCHEN EXHAUST EQUIPMENT.**

26.24 IMC Section 505.1 is amended to read as follows:

26.25 **505.1 Domestic systems.** Where domestic range hoods and domestic appliances equipped
26.26 with downdraft exhaust are located within dwellings, the hoods and appliances shall
26.27 discharge to the outdoors through ducts constructed of galvanized steel, stainless steel,

27.2 aluminum, or copper. The ducts shall have smooth inner walls and shall be air tight and
27.3 equipped with a backdraft damper. Domestic kitchen exhaust hoods ducted to the outdoors
27.4 shall have makeup air provided according to ~~IMC Section 501.4~~ part 1346.0501. Refer
27.5 to Appendix C for Table C-1, "Recommended Capacities for Domestic Kitchen Exhaust
27.6 Hoods."

27.7 **Exceptions:**

27.8 1. Where installed according to the manufacturer's installation instructions and where
27.9 mechanical or natural ventilation is otherwise provided according to IMC Chapter
27.10 4, listed and labeled ductless range hoods shall not be required to discharge to the
27.11 outdoors.

27.12 2. Ducts for domestic kitchen cooking appliances equipped with downdraft exhaust
27.13 systems shall be permitted to be constructed of Schedule 40 PVC pipe provided that
27.14 the installation complies with all of the following:

27.15 2.1. The duct shall be installed under a concrete slab poured on grade.

27.16 2.2. The underfloor trench in which the duct is installed shall be completely backfilled
27.17 with sand or gravel.

27.18 2.3. The PVC duct shall extend not greater than 1 inch (25 mm) above the indoor
27.19 concrete floor surface.

27.20 2.4. The PVC duct shall extend not greater than 1 inch (25 mm) above grade outside
27.21 of the building.

27.22 2.5. The PVC ducts shall be primed and solvent cemented in accordance with ASTM
27.23 D2564.

27.24 **1346.0506 SECTION 506 COMMERCIAL KITCHEN GREASE HOOD**
27.25 **VENTILATION SYSTEM DUCTS AND EXHAUST EQUIPMENT.**

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

28.1 **506.3 Ducts serving Type I hoods.** Commercial kitchen exhaust systems serving Type
28.2 I hoods shall be designed, constructed and installed in accordance with NFPA 96-2001.

28.3 96-2004, *Standard for Ventilation Control and Fire Protection of Commercial Cooking*
28.4 *Operations*.

28.5 Subp. 2. ~~Sections 506.3.1 to 506.3.7 and 506.3.9 to 506.3.13.3~~ 506.3.12.3. IMC
28.6 Sections 506.3.1 through 506.3.7 and 506.3.9 through 506.3.13.3 to 506.3.12.3 are deleted
28.7 and replaced with NFPA ~~96-2001~~ 96-2004, sections 5.1.1 and 7.5.2, with the following
28.8 amendments:

28.9 **5.1.1** The hood or that portion of a primary collection means designed for collecting
28.10 cooking vapors and residues shall be constructed of stainless steel not less than 0.94 mm
28.11 (0.037 in.) (No. 20 MSG) in thickness or other approved material of equivalent strength
28.12 and fire and corrosion resistance. Refer to the Minnesota Food Code, Minnesota Rules,
28.13 chapter 4626, for additional requirements for commercial kitchen hoods licensed and
28.14 inspected by the Department of Agriculture, Department of Health, or local authorities
28.15 that conduct inspections of food establishments.

28.16 **7.5.2.1** All seams, joints, penetrations, and duct-to-hood collar connections shall have a
28.17 liquid tight continuous external weld. Listed grease ducts and ducts complying with
28.18 7.5.1 through 7.5.5.5 that are installed within a concealed enclosure shall maintain an air
28.19 pressure test of 0.10 inches water column positive pressure for a minimum of 20 minutes,
28.20 unless an equivalent alternate test is specified by the building official.

28.21 ~~**8.1.2.3** Flexible connectors shall not be used without prior approval from the building~~
28.22 ~~official.~~

28.23 ~~**8.1.3.5** Flexible connectors shall not be used without prior approval from the building~~
28.24 ~~official.~~

28.25 ~~**8.2.1.1** The air velocity through any duct shall be not less than 152.4 m/min (500 ft/min).~~

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

28.27 **506.4.2 Ducts.** Ducts and plenums serving Type II hoods shall be constructed of rigid
28.28 metallic materials. Duct construction, installation, bracing, and supports shall comply with

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

29.5 1. Ducts shall be constructed, joined, and sealed to prevent drips and leaking.

29.6 2. Ducts shall slope not less than one-fourth unit vertical in 12 units horizontal (2
29.7 percent slope) toward the hood or toward an approved reservoir.

29.8 3. Horizontal ducts exceeding 75 feet (22 860 mm) in length shall slope not less than
29.9 one unit vertical in 12 units horizontal (8.3 percent slope).

29.10 4. Ducts subject to positive pressure shall maintain an air pressure test of 0.10 inches
29.11 water column positive pressure for a minimum of 20 minutes, unless an equivalent
29.12 alternate test is specified by the building official.

29.13 **1346.0507 SECTION 507 COMMERCIAL KITCHEN HOODS.**

29.14 Subpart 1. **Section 507.1.** IMC Section 507.1 is amended by adding subsection
29.15 507.1.1 after the exceptions to read as follows:

29.16 **507.1 General.** Commercial kitchen exhaust hoods shall comply with the requirements
29.17 of this section. Hoods shall be Type I or Type II and shall be designed to capture and
29.18 confine cooking vapors and residues.

29.19 ~~**Exception:** Factory-built commercial exhaust hoods which are listed, labeled, and~~
29.20 ~~installed in accordance with UL 710 and installed in accordance with IMC Section~~
29.21 ~~304.1 shall not be required to comply with IMC Sections 507.5, 507.7, 507.12,~~
29.22 ~~amended IMC Section 507.13, and Chapter 5 of NFPA 96-2001.~~

29.23 **507.1.1 Factory built systems with exhaust.** Where factory built commercial cooking
29.24 recirculating systems or dishwashers and potwashers equipped with heat and vapor
29.25 exhaust systems are installed, the sensible and latent heat from the systems shall be
29.26 included in the HVAC design calculations of the kitchen. A mechanical HVAC system
29.27 shall be provided to maintain maximum relative humidity of 65 percent in the space.

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

30.2 **507.2 Where required.** ~~A Type I hood shall be installed above all commercial food~~
30.3 ~~heat-processing appliances that produce grease-laden vapors or smoke. A Type I or Type~~
30.4 ~~II hood shall be installed at or above all commercial food heat-processing appliances that~~
30.5 ~~produce fumes, steam, odor, or heat. A Type II hood shall be installed above commercial~~
30.6 ~~dishwashing machines. A Type I or Type II hood shall be installed at or above all~~
30.7 commercial cooking appliances in accordance with Sections 507.2.1 and 507.2.2. Where
30.8 any cooking appliance under a single hood requires a Type I hood, a Type I hood shall be
30.9 installed. Where a Type II hood is required, a Type I or Type II hood shall be installed.

30.10 **Exceptions:**

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

30.19 **507.2.1 Type I hoods.** Type I hoods shall be installed where cooking appliances produce
30.20 grease or smoke, such as occurs with griddles, fryers, broilers, ovens, ranges, and wok
30.21 ranges.

30.22 **507.2.1.1 Operation.** Type I hood systems shall be designed and installed to automatically
30.23 activate the exhaust fan whenever cooking operations occur. The activation of the exhaust
30.24 fan shall occur through an interlock with the cooking appliances, by means of heat sensors
30.25 or by means of other approved methods.

31.1 **507.2.2 Type II hoods.** Type II hoods shall be installed where cooking or dishwashing
31.2 appliances produce heat, steam, or products of combustion and do not produce grease or
31.3 smoke, such as steamers, kettles, pasta cookers, and dishwashing machines.

31.4 **Exceptions:**31.5 1. Under-counter-type commercial dishwashing machines.31.6 2. A Type II hood is not required for dishwashers and potwashers that are provided
31.7 with heat and water vapor exhaust systems that are supplied by the appliance
31.8 manufacturer and are installed in accordance with the manufacturer's instructions.31.9 The additional heat and moisture loads generated by such appliances shall be
31.10 accounted for in the design of the HVAC system. The HVAC system shall maintain a
31.11 maximum relative humidity of 65 percent in the space.31.12 3. A single light-duty electric convection, bread, retherm, or microwave oven that are
31.13 rated at 3.7 kW or less. The additional heat and moisture loads generated by such
31.14 appliances shall be accounted for in the design of the HVAC system. The HVAC
31.15 system shall maintain a maximum relative humidity of 65 percent in the space.31.16 4. A Type II hood is not required for the following electrically heated appliances:
31.17 toasters, steam tables, popcorn poppers, hot dog cookers, coffee makers, rice cookers,
31.18 egg cookers, and holding/warming ovens that are rated at 3.7 kW or less. The
31.19 additional heat and moisture loads generated by such appliances shall be accounted
31.20 for in the design of the HVAC system. The HVAC system shall maintain a maximum
31.21 relative humidity of 65 percent in the space.31.22 Subp. 3. [See repealer.]31.23 Subp. 4. **Section ~~507.2.2~~ 507.2.3.** IMC Section ~~507.2.2~~ 507.2.3 is amended to read
31.24 as follows:31.25 **507.2.2 507.2.3 Domestic cooking appliances used for commercial purposes.** Domestic
31.26 cooking appliances utilized for commercial purposes shall be provided with Type I or II
31.27 hoods as required for the type of appliances and processes in accordance with amended
32.1 IMC Section 507.2. Refer to the Minnesota Food Code, Minnesota Rules, chapter 4626,
32.2 for additional requirements for commercial kitchen hoods licensed and inspected by

32.3 the Department of Agriculture, Department of Health, or local authorities that conduct
32.4 inspections of food establishments.

32.5 Subp. 5. [See repealer.]

32.6 [For text of subps 6 to 8, see M.R.]

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

32.9 **507.7.1 Type I hoods.** Type I hoods shall be designed, constructed, and installed in
32.10 accordance with Chapter 5 of NFPA ~~96-2001~~ 96-2004.

32.11 [For text of subp 10, see M.R.]

32.12 Subp. 11. [See repealer.]

32.13 Subp. 12. ~~Sections 507.15 and 507.16~~ **Section 507.14.** IMC Sections ~~507.15 and~~
32.14 ~~507.16~~ are Section 507.14 is deleted.

32.15 Subp. 13. [See repealer.]

32.16 **1346.0508 SECTION 508 COMMERCIAL KITCHEN MAKEUP AIR.**

32.17 Subpart 1. **Section 508.1.** IMC Section 508.1 is amended to read as follows:
32.18 **508.1 Makeup air.** Makeup air shall be supplied during the operation of commercial
32.19 kitchen exhaust systems that are provided for commercial food heat-processing appliances.
32.20 The amount of makeup air supplied shall be approximately equal to the exhaust air. A
32.21 minimum of 80 percent of the makeup air shall be supplied into the space where the
32.22 exhaust hood is located. The makeup air shall not reduce the effectiveness of the exhaust
32.23 system. Makeup air shall be provided by mechanical means and the exhaust and makeup
32.24 air systems shall be electrically interlocked to insure that makeup air is provided whenever
33.1 the exhaust system is in operation. Makeup air intake openings shall comply with IMC
33.2 Section ~~401.5~~ 401.4 and amended IMC Section ~~401.5.1~~ 401.4.1.

33.3 **Exception:** This section shall not apply to dwelling units.

33.4 **508.1.1 Makeup air temperature.** Makeup air shall be not less than 50°F (10°C),
33.5 measured at the flow of air from the supply diffuser into the space.

33.6 **508.1.2 Makeup and ventilation air distribution.** Makeup and ventilation air supply
33.7 diffusers located within 12 feet (3.7 m) of an exhaust hood shall be directed away from
33.8 the hood.

33.9 [For text of subp 2, see M.R.]

33.10 **1346.0510 SECTION 510 HAZARDOUS EXHAUST SYSTEMS.**

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

33.13 **Exception:** Other than sections 510.4 and 510.7, this section shall not apply to
33.14 laboratory ventilation systems that comply with NFPA ~~45~~ 45-2004.

33.15 Subp. 2. [See repealer.]

33.16 Subp. 3. [See repealer.]

33.17 **1346.0602 SECTION 602 PLENUMS.**

33.18 IMC Section 602.2.1 is amended by adding a subsection to read as follows:

33.19 **Section 602.2.1.7. Piping in Plenums.** Piping carrying flammable or combustible gases
33.20 or liquids in a plenum must have all connections made by welding or brazing. No flanges,
33.21 valves, threaded fittings, unions, or connectors are permitted.

33.22 **1346.0603 SECTION 603 DUCT CONSTRUCTION AND INSTALLATION.**

33.23 Subpart 1. [See repealer.]

34.1 Subp. 2. **Section ~~603.3~~ 603.4.** IMC Section ~~603.3~~ 603.4 is amended to read as
34.2 follows:

34.3 **603.3 603.4 **Metallic ducts.**** All metallic ducts shall be constructed as specified in the
34.4 *SMACNA HVAC Duct Construction Standards - Metal and Flexible*.

34.5 **Exception:** Ducts installed within a single dwelling unit shall have a minimum
34.6 thickness as specified in Table ~~603.3~~ 603.4.

34.7 ~~603.3.1~~ 603.4.1 **Elbows.** Radius elbows with velocities exceeding 1,000 feet per minute
34.8 (fpm) (76.2 m/min) shall have an inside radius not less than the width of the duct or shall
34.9 have turning vanes. Square throat elbows with velocities exceeding 1,000 feet per minute
34.10 (fpm) (76.2 m/min) shall have turning vanes.

34.11 **Exception:** Ducts installed within a single dwelling unit.

34.12 ~~603.3.2~~ 603.4.2 **Transition fittings.** Transition fittings shall be constructed with a
34.13 maximum slope of 45 degrees.

34.14 ~~603.3.3~~ 603.4.3 **Obstructions.** Where a pipe or other obstruction passes through a duct, a
34.15 streamlined sleeve must be constructed equal in type and gage to the duct. The area of
34.16 the duct, at the point of obstruction, must be increased by an amount equal to the area
34.17 of the streamlined sleeve.

34.18 Subp. 3. **Section ~~603.6~~ 603.7.** IMC Section ~~603.6~~ 603.7 is amended to read as
34.19 follows:

34.20 ~~603.6~~ 603.7 **Rigid duct penetrations.** Duct system penetrations of walls, floors, ceilings,
34.21 and roofs and air transfer openings in any of those building components shall be protected
34.22 as required by IMC Section 607. Ducts in a private garage and ducts penetrating the
34.23 walls or ceilings separating a dwelling from a private garage shall be continuous and
34.24 constructed of minimum 26 gage (0.48 mm) galvanized sheet metal and shall have no
34.25 openings into the garage. Fire and smoke dampers are not required in such ducts passing
34.26 through the wall or ceiling separating a dwelling from a private garage, unless required
34.27 by International Building Code Chapter 7.

35.1 Subp. 4. **Section ~~603.7~~ 603.8.** IMC Section ~~603.7~~ 603.8 is amended to read as
35.2 follows:

35.3 ~~603.7~~ **603.8 Underground ducts.** Ducts shall be approved for underground installation.
35.4 Metallic ducts not having an approved protective coating shall be completely encased in a
35.5 minimum of 2 inches (51 mm) of concrete.

35.6 Subp. 5. ~~Section 603.7.1~~ **603.8.1.** IMC Section ~~603.7.1~~ 603.8.1 is amended to read
35.7 as follows:

35.8 ~~603.7.1~~ 603.8.1 Slope. Ducts shall slope to allow drainage to a point provided with access
35.9 for inspection and cleaning at each low point of the duct system.

35.10 Subp. 6. ~~Section 603.7.2~~ **603.8.2.** IMC Section ~~603.7.2~~ 603.8.2 is amended to read
35.11 as follows:

35.12 ~~603.7.2~~ 603.8.2 Sealing. Ducts shall have a polyethylene vapor retarder of at least 4 mils
35.13 (0.102 mm) thickness installed around the outside. Where encased in concrete, the ducts
35.14 shall be sealed and secured prior to pouring the concrete encasement.

35.15 Subp. 7. ~~Section 603.7.5~~ **603.8.3.** IMC Section ~~603.7~~ 603.8.3 is amended by adding
35.16 a section to read as follows:

35.17 ~~603.7.5 Drainage.~~ Underground ducts shall be provided with drain tile around the
35.18 perimeter of the duct system to prevent water intrusion. The top of the drain tile shall
35.19 be installed at an elevation lower than the bottom of the underground duct system.
35.20 The building official may approve an alternate drainage system if soil conditions are
35.21 adequate. 603.8.3 Plastic ducts and fittings. Plastic ducts shall be constructed of PVC or
35.22 high-density polyethylene having a minimum pipe stiffness of 8 psi (55 kPa) at 5-percent
35.23 deflection when tested in accordance with ASTM D2412. Plastic duct fittings shall be
35.24 constructed of either PVC or high-density polyethylene. Plastic duct and fittings shall be
35.25 utilized in underground installations only. The maximum design temperature for systems
35.26 utilizing plastic duct and fittings shall be 150°F (66°C).

36.1 Subp. 8. ~~Section 603.7.6~~ **603.8.** IMC Section ~~603.7~~ 603.8 is amended by adding a
36.2 section subsection to read as follows:

| | | | |
|-------|---------------|------------------------------|------------------------------------|
| 37.5 | All locations | Greater than 0.50 to 3.0 | All transverse joints and duct |
| 37.6 | | inches (125 to 750 Pa) water | wall penetrations shall be |
| 37.7 | | gauge | sealed. |
| 37.8 | All locations | 0.50 inches (125 Pa) water | All transverse joints, |
| 37.9 | | gauge and less | longitudinal seams, and |
| 37.10 | | | duct wall penetrations shall |
| 37.11 | | | have no visible gaps and |
| 37.12 | | | shall be sufficiently airtight |
| 37.13 | | | in accordance with Section |
| 37.14 | | | 1.7 of the <i>SMACNA HVAC</i> |
| 37.15 | | | <i>Duct Construction Standards</i> |
| 37.16 | | | - <i>Metal & Flexible</i> |

37.17 * Representative sections totaling no less than 25 percent of the total installed duct area for
 37.18 the designated pressure class shall be tested. Duct systems with pressure ratings in excess
 37.19 of three inches water column shall be identified in the construction documents.

37.20 Subp. 10. **Section ~~603.15~~ 603.17**. IMC Section ~~603.15~~ 603.17 is amended by adding
 37.21 a subsection to read as follows:

37.22 **~~603.15 Registers, grilles and diffusers.~~** ~~Duct registers, grilles, and diffusers shall be~~
 37.23 ~~installed in accordance with the manufacturer's installation instructions. Balancing~~
 37.24 ~~dampers or other means of supply air adjustment shall be provided in the branch ducts.~~
 37.25 ~~Volume dampers shall be provided for all supply ducts, and they shall be adjusted~~
 37.26 ~~according to the required air measurement of the system and locked in place. In finished~~
 37.27 ~~or inaccessible locations, a friction-type register box may be used.~~

37.28 **603.17.3 Adjustment of volume dampers.** Volume dampers shall be adjusted to the
 37.29 required airflow of the system and locked in place. In finished or inaccessible locations,
 37.30 a friction-type register box may be used.

38.1 **1346.0604 SECTION 604 INSULATION.**

38.2 IMC Section 604.1 is amended to read as follows:

38.3 **604.1 General.** Duct insulation shall conform to the thickness required by this section and
 38.4 Sections 604.2 through 604.13.

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

38.7 **Minimum Required Duct Installation Insulation** (see notes for explanations)

| 38.8 Duct Location | Requirements |
|--|-----------------------------|
| 38.9 Attics, garages, and ventilated crawl spaces | R-8 and V |
| 38.10 Exterior of building | R-8, V and W |
| 38.11 Inside of building and in unconditioned spaces | |
| 38.12 TD less than or equal to 15°F | None required |
| 38.13 TD greater than 15°F and less than or equal to 40°F | R-3.3 and V |
| 38.14 TD greater than 40°F | R-5 and V |
| 38.15 Within conditioned spaces, in basements with insulated walls, and in | |
| 38.16 plenums within conditioned spaces | None required |
| 38.17 Intake and exhaust ducts within conditioned spaces [*] | R-3.3 and V |
| 38.18 Within cement slab or within ground (also see IMC Section 603.7) | R-5 <u>R-3.5</u> |

38.19 Notes:

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

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

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

38.26 W = Approved weatherproof barrier.

38.27 **1346.0703 SECTION 703 OUTDOOR AIR.**

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

39.1 **703.1 All air from the outdoors.** Where all combustion and dilution air is to be provided
 39.2 by outdoor air, the required combustion and dilution air shall be obtained by opening the
 39.3 room to the outdoors. Openings connecting the room to the outdoor air shall comply with
 39.4 IMC Sections 703.1.1 through 703.1.2.2.

39.5 **703.1.1 One permanent opening method.** When any natural draft equipment is installed,
39.6 one permanent opening, commencing within 12 inches (300 mm) of the bottom of the
39.7 enclosure, shall be provided. When other than natural draft equipment is installed, one
39.8 permanent opening, commencing within 12 inches (300 mm) of the top of the enclosure,
39.9 shall be provided. The opening shall directly communicate with the outdoors or shall
39.10 communicate through a vertical or horizontal duct to the outdoors or spaces that freely
39.11 communicate with the outdoors and shall have a minimum free area of 1 inch²/3,000
39.12 Btu/hr (700 mm²/kW mm²/kW/hr) of the total input rating of all equipment located in
39.13 the enclosure.

39.14 **703.1.2 Two permanent openings method.** Two openings shall be provided, one within
39.15 1 foot (305 mm) of the ceiling of the room and one within 1 foot (305 mm) of the floor.

39.16 **703.1.2.1 Size of horizontal openings.** The net free area of each opening, calculated in
39.17 accordance with IMC Chapter 709 and connected to the outdoors through a horizontal
39.18 duct, shall be a minimum of 1 square inch per 2,000 Btu/h (1,100 mm²/kW) of combined
39.19 input rating of the fuel-burning appliances drawing combustion and dilution air from the
39.20 room. The cross-sectional area of the duct shall be equal to or greater than the required
39.21 size of the opening.

39.22 **703.1.2.2 Size of vertical openings.** The net free area of each opening, calculated in
39.23 accordance with IMC Chapter 709 and connected to the outdoors through a vertical
39.24 duct, shall be a minimum of 1 square inch per 4,000 Btu/h (550 mm²/kW) of combined
39.25 input rating of the fuel-burning appliances drawing combustion and dilution air from the
39.26 room. The cross-sectional area of the duct shall be equal to or greater than the required
39.27 size of the opening.

40.1 **1346.1004 SECTION 1004 BOILERS.**

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

40.3 **1004.1 Standards.** Oil-fired boilers and their control systems shall be listed and labeled in
40.4 accordance with UL 726 or shall utilize burner assemblies and control systems listed and

40.5 labeled in accordance with UL 296 and shall be installed in accordance with NFPA 31
40.6 and the manufacturer's installation instructions. Electric boilers and their control systems
40.7 shall be listed and labeled in accordance with UL 834. Boilers with an input rating above
40.8 400,000 Btu/hr (3,660 kW) shall be designed and constructed in accordance with the
40.9 requirements of the BPVC-2007 ASME Boiler and Pressure Vessel Code, Sections I, II,
40.10 IV, V, VIII and IX, as applicable. Boilers with an input rating above 400,000 Btu/hr
40.11 (117 kW) and less than 12,500,000 Btu/hr (3,660 kW) shall comply with ASME ~~CSD-1~~
40.12 CSD-1-2006, and boilers with an input rating of 12,500,000 Btu/hr (3,660 kW) or greater
40.13 shall comply with NFPA ~~85-2004~~ 85-2007, *Boiler and Combustion Systems Hazards Code*.

40.14 [For text of subp 2, see M.R.]

40.15 **1346.1006 SECTION 1006 SAFETY AND PRESSURE RELIEF VALVES AND**
40.16 **CONTROLS.**

40.17 [For text of subps 1 and 2, see M.R.]

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

40.20 **1006.9 Boiler shutdown switch.** A manually operated remote shutdown switch shall
40.21 be located at the boiler room door and marked for easy identification. The emergency
40.22 shutdown switch shall disable all power to the burner controls as required by ASME
40.23 CSD-1-2004.

40.24 **Exception:** A single hot water boiler with a rated input of less than 400,000 Btu/hr
40.25 (117 kW).

40.26 **1346.1500 CHAPTER 15, REFERENCED STANDARDS.**

41.1 A. ASHRAE ~~2004~~ 2005 *Handbook of Fundamentals*;

41.2 B. ASHRAE ~~15-2004~~ 15-2007 *Safety Code for Mechanical Standard for*
41.3 *Refrigeration Systems*;

- 41.4 C. ASHRAE ~~34-2001~~ 34-2007 *Designation and Safety Classification of*
41.5 *Refrigerants;*
- 41.6 D. ASHRAE ~~62-2001~~ 62.1-2004 *Ventilation for Acceptable Indoor Air Quality;*
41.7 *including addenda h, i, k, n, o, r, t, u, v, x, z, ab, ad, ae, and af;*
- 41.8 E. ASME ~~BPV-2001~~ BPVC-2007 (Sections I, II, IV, V, VIII & IX) *Boiler and*
41.9 *Pressure Vessel Code;*
- 41.10 F. ASME ~~CSD-1-2002~~ CSD-1-2006 *Controls and Safety Devices for*
41.11 *Automatically Fired Boilers;*
- 41.12 G. ASME ~~B31.3-1999~~ B31.3-2006 *Process Piping Code;*
- 41.13 H. ASME ~~B31.9-1996~~ B31.9-2008 *Building Services Piping Code;*
- 41.14 I. ASTM ~~E119-99~~ E1998-02 2007 *Standard Guide for Assessing*
41.15 *Depressurization-Induced Backdrafting and Spillage from Vented Combustion Appliances;*
- 41.16 J. NFPA ~~58-2001~~ 58-2008 *Liquefied Petroleum Gas Code;*
- 41.17 K. NFPA ~~96-2001~~ 96-2004 *Standard for Ventilation Control and Fire Protection*
41.18 *of Commercial Cooking Operations;*
- 41.19 L. NFPA ~~85-2001~~ 85-2007 *Boiler and Combustion Systems Hazards Code;*
- 41.20 M. UL ~~197-1993~~ 197-2003 including revisions through ~~April 10, 2000~~ March
41.21 26, 2007, *Standard for Commercial Electric Cooking Appliances;*
- 41.22 N. UL ~~555-1999~~ 555-2006 *Standard for Fire Dampers;*
- 41.23 O. UL ~~555C-1999~~ 555C-2006 *Standard for Ceiling Dampers;*
- 42.1 P. UL 555S-1999 *Standard for Smoke Dampers;* and
- 42.2 Q. ~~UL 2034-1996~~ including revisions through ~~June 28, 2002~~, *Single and*
42.3 *Multiple Station Carbon Monoxide Alarms* NFPA 45-2004 *Standard on Fire Protection*
42.4 *for Laboratories Using Chemicals.*

42.5 **1346.5050 TITLE; INCORPORATION BY REFERENCE.**

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

42.8 Chapters 2 to ~~7~~ 8 of the ~~2000~~ 2006 edition of the International Fuel Gas Code,
42.9 promulgated by the International Code Council, Inc., 5203 Leesburg Pike, Suite 600, Falls
42.10 Church, Virginia 22041-3401, are incorporated by reference as part of the Minnesota Fuel
42.11 Gas Code with the amendments in this section. Portions of this chapter reproduce text and
42.12 tables from the International Fuel Gas Code. The International Fuel Gas Code is copyright
42.13 2006 by the International Code Council, Inc. All rights reserved. As used in this section,
42.14 "IFGC" means the International Fuel Gas Code incorporated in this part.

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

42.18 **1346.5301 SECTION 301 (IFGC) GENERAL.**

42.19 IFGC Section 301.3 is amended to read as follows:

42.20 **301.3 Listed and labeled.** Appliances regulated by this code shall be listed and labeled to
42.21 an appropriate standard by a nationally recognized testing laboratory which is qualified to
42.22 evaluate the appliance, unless otherwise approved in accordance with the administrative
42.23 provisions of the Minnesota State Building Code, Minnesota Rules, chapter 1300. The
42.24 approval of unlisted appliances shall be based upon engineering evaluation. Unlisted
42.25 appliances shall be installed with clearances to combustibles in accordance with IFGC
42.26 Chapter 5. Unlisted appliances with a fuel input rating of less than 12,500,000 Btu/hr
43.1 (3,660 kW) shall have fuel gas trains, controls and safety devices installed in accordance
43.2 with Part CF, Combustion Side Control, of ASME ~~ESD-1~~ CSD-1-2006. Unlisted
43.3 appliances with a fuel input rating of 12,500,000 Btu/hr (3,660 kW) or greater shall have
43.4 fuel gas trains, controls and safety devices installed in accordance with NFPA ~~85-2001~~
43.5 85-2007.

43.6 **1346.5304 SECTION 304 (IFGC) COMBUSTION, VENTILATION AND**
43.7 **DILUTION AIR.**

43.8 Subpart 1. **Section 304.1.** IFGC Section 304 is ~~deleted and replaced with the~~
43.9 ~~following~~ amended by adding language to the end of the first paragraph to read as follows:

43.10 **304.1 General.** ~~Air for combustion, ventilation, and dilution of flue gases for gas~~
43.11 ~~utilization equipment installed in buildings shall be obtained by application of one of the~~
43.12 ~~methods covered in IFGC Section 304.2, 304.3, 304.4, 304.5, or 304.6. Gas utilization~~
43.13 ~~equipment of other than natural draft, power vent, and category I vented appliances~~
43.14 ~~shall be provided with combustion, ventilation, and dilution air in accordance with~~
43.15 ~~the equipment manufacturer's instructions. Refer to IFGC Appendix E for Worksheet~~
43.16 ~~E-1, "Residential Combustion Air Calculation Method" and Table E-1, "Residential~~
43.17 ~~Combustion Air Required Volume."~~

43.18 **Exceptions:**

- 43.19 1. Direct vent appliances.
- 43.20 2. Type 1 clothes dryers that are provided with makeup air in accordance with the
43.21 manufacturer's installation instructions.
- 43.22 3. Replacement of fuel gas utilization equipment that complies with all of the
43.23 following conditions:
- 43.24 3.1 Replacement equipment has a Btu/hr (kW) input rating not greater than 30 percent
43.25 above the original equipment input rating.
- 43.26 3.2 Combustion air provisions meet the code requirements in effect at the time of
43.27 the original installation.
- 44.1 3.3 Replacement equipment shall not cause an existing mechanical system to become
44.2 unsafe, hazardous, or overloaded.

44.3 **304.1.1 Equipment location.** ~~Equipment shall be located so as not to interfere with~~
44.4 ~~proper circulation of combustion, ventilation, and dilution air.~~

44.5 ~~**304.1.2 Draft hood or regulator.** Where used, a draft hood or a barometric draft regulator~~
44.6 ~~shall be installed in the same room or enclosure as the equipment served so as to prevent~~
44.7 ~~any difference in pressure between the hood or regulator and the combustion air supply.~~

44.8 Subp. 2. [See repealer.]

44.9 Subp. 3. ~~Section **304.3**~~ **304.6.2.** IFGC Section ~~304.3~~ 304.6.2 is amended to read
44.10 as follows:

44.11 ~~**304.3 Outdoor combustion air.** Outdoor combustion air shall be provided through~~
44.12 ~~openings to the outdoors in accordance with IFGC Section 304.3.1 or 304.3.2. The~~
44.13 ~~minimum dimension of air openings shall not be less than 3 inches (80 mm).~~

44.14 ~~**304.3.1 Two permanent openings method.** Two permanent openings, one commencing~~
44.15 ~~within 12 inches (300 mm) of the top, and one commencing within 12 inches (300 mm) of~~
44.16 ~~the bottom, of the enclosure shall be provided. The openings shall communicate directly,~~
44.17 ~~or by ducts, with the outdoors or spaces that freely communicate with the outdoors.~~

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

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

44.24 ~~**304.3.2**~~ **304.6.2 One permanent opening method.** When any natural draft equipment is
44.25 installed, one permanent opening, commencing within 12 inches (300 mm) of the bottom
44.26 of the enclosure, shall be provided. When other than natural draft equipment is installed,
44.27 one permanent opening, commencing within 12 inches (300) of the top of the enclosure,
45.1 shall be provided. The equipment shall have clearances of at least 1 inch (25 mm) from
45.2 the sides and back and 6 inches (160 mm) from the front of the appliance. The opening
45.3 shall directly communicate with the outdoors or shall communicate through a vertical or
45.4 horizontal duct to the outdoors or spaces that freely communicate with the outdoors and

45.5 shall have a minimum free area of 1 inch²/3,000 Btu/hr (700 mm²/kW) of the total input
45.6 rating of all equipment located in the enclosure.

45.7 Subp. 4. [See repealer.]

45.8 Subp. 5. [See repealer.]

45.9 Subp. 6. [See repealer.]

45.10 Subp. 7. [See repealer.]

45.11 Subp. 8. **Section ~~304.8~~ 304.11**. IFGC Section ~~304.8~~ 304.11 is amended to read
45.12 as follows:

45.13 **~~304.8~~ 304.11 Combustion air ducts**. Combustion air ducts shall comply with the
45.14 following:

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

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

45.20 3. Ducts shall serve a single space.

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

45.24 5. Ducts shall not terminate in an attic space.

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

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

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

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

46.12 9. Combustion air intake openings shall be located to avoid intake of exhaust air in
46.13 accordance with IMC Section ~~401.5.2~~ 401.5 and IFGC Section 503.8 and shall be covered
46.14 with corrosion resistant screen of not less than 1/4 inch (6.4 mm) mesh.

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

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

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

46.23 Subp. 9. [See repealer.]

46.24 **1346.5402 SECTION 402 (IFGC) PIPE SIZING.**

46.25 Subpart 1. [See repealer.]

47.1 Subp. 2. **Section ~~402.3~~ 402.4, Tables.** IFGC Section ~~402.3~~ 402.4 is amended by
47.2 adding tables as follows:

47.3 **~~Table 402.3(35)~~**

47.4 **~~Pipe Sizing Table for Natural Gas~~**

47.5 **~~Semi-rigid Copper Tubing~~**

47.6 **~~(Type K or L)~~**

~~Inlet Pressure~~

~~7" we~~

47.7 ~~For 0.60 Specific Gravity~~47.8 ~~Natural Gas~~~~Pressure Drop~~~~1" we~~47.9 ~~Nominal~~ ~~1/4~~ ~~3/8~~ ~~1/2~~ ~~5/8~~ ~~3/4~~47.10 ~~Actual OD~~ ~~3/8~~ ~~1/2~~ ~~5/8~~ ~~3/4~~ ~~7/8~~47.11 ~~Actual ID~~ ~~0.305~~ ~~0.402~~ ~~0.527~~ ~~0.652~~ ~~0.745~~47.12 ~~Length~~ ~~Maximum Capacity in Cubic Feet of Gas per Hour~~47.13 ~~(ft)~~47.14 ~~10~~ ~~38~~ ~~79~~ ~~160~~ ~~280~~ ~~398~~47.15 ~~20~~ ~~26~~ ~~54~~ ~~110~~ ~~193~~ ~~273~~47.16 ~~30~~ ~~21~~ ~~44~~ ~~89~~ ~~155~~ ~~220~~47.17 ~~40~~ ~~18~~ ~~37~~ ~~76~~ ~~132~~ ~~188~~47.18 ~~60~~ ~~15~~ ~~30~~ ~~61~~ ~~106~~ ~~151~~47.19 ~~80~~ ~~12~~ ~~26~~ ~~52~~ ~~91~~ ~~129~~47.20 ~~100~~ ~~11~~ ~~23~~ ~~46~~ ~~81~~ ~~114~~47.21 ~~125~~ ~~10~~ ~~20~~ ~~41~~ ~~72~~ ~~101~~47.22 ~~150~~ ~~9~~ ~~18~~ ~~37~~ ~~65~~ ~~92~~47.23 ~~200~~ ~~8~~ ~~16~~ ~~32~~ ~~55~~ ~~79~~47.24 ~~250~~ ~~7~~ ~~14~~ ~~28~~ ~~49~~ ~~70~~47.25 ~~300~~ ~~6~~ ~~13~~ ~~25~~ ~~45~~ ~~63~~47.26 ~~350~~ ~~6~~ ~~12~~ ~~23~~ ~~41~~ ~~58~~47.27 ~~400~~ ~~5~~ ~~11~~ ~~22~~ ~~38~~ ~~54~~48.1 ~~Nominal~~ ~~1~~ ~~1-1/4~~ ~~1-1/2~~ ~~2~~ ~~2-1/2~~48.2 ~~Actual OD~~ ~~1-1/8~~ ~~1-3/8~~ ~~1-5/8~~ ~~2-1/8~~ ~~2-5/8~~48.3 ~~Actual ID~~ ~~0.995~~ ~~1.245~~ ~~1.481~~ ~~1.959~~ ~~2.435~~48.4 ~~Length~~ ~~Maximum Capacity in Cubic Feet of Gas per Hour~~48.5 ~~(ft)~~48.6 ~~10~~ ~~850~~ ~~1530~~ ~~2412~~ ~~5024~~ ~~8889~~48.7 ~~20~~ ~~584~~ ~~1052~~ ~~1658~~ ~~3453~~ ~~6109~~

| | | | | | | |
|-------|----------------|----------------|----------------|-----------------|-----------------|-----------------|
| 48.8 | 30 | 469 | 844 | 1331 | 2773 | 4906 |
| 48.9 | 40 | 401 | 723 | 1139 | 2373 | 4199 |
| 48.10 | 60 | 322 | 580 | 915 | 1906 | 3372 |
| 48.11 | 80 | 276 | 497 | 783 | 1631 | 2886 |
| 48.12 | 100 | 245 | 440 | 694 | 1446 | 2558 |
| 48.13 | 125 | 217 | 390 | 615 | 1281 | 2267 |
| 48.14 | 150 | 196 | 354 | 557 | 1161 | 2054 |
| 48.15 | 200 | 168 | 303 | 477 | 994 | 1758 |
| 48.16 | 250 | 149 | 268 | 423 | 881 | 1558 |
| 48.17 | 300 | 135 | 243 | 383 | 798 | 1412 |
| 48.18 | 350 | 124 | 224 | 352 | 734 | 1299 |
| 48.19 | 400 | 116 | 208 | 328 | 683 | 1208 |

48.20 ~~Table 402.3(36)~~48.21 ~~Pipe Sizing Table for Natural Gas~~48.22 ~~Semi-rigid Copper Tubing~~48.23 ~~(Type K or L)~~

Inlet Pressure

2 psig

48.24 ~~For 0.60 Specific Gravity~~48.25 ~~Natural Gas~~

Pressure Drop

1 psig

49.1 ~~Nominal~~ ~~1/4~~ ~~3/8~~ ~~1/2~~ ~~5/8~~ ~~3/4~~49.2 ~~Actual OD~~ ~~3/8~~ ~~1/2~~ ~~5/8~~ ~~3/4~~ ~~7/8~~49.3 ~~Actual ID~~ ~~0.305~~ ~~0.402~~ ~~0.527~~ ~~0.652~~ ~~0.745~~49.4 ~~Length~~ ~~Maximum Capacity in Cubic Feet of Gas Per Hour~~49.5 ~~(ft)~~49.6 ~~10~~ ~~240~~ ~~496~~ ~~1008~~ ~~1763~~ ~~2501~~49.7 ~~20~~ ~~165~~ ~~341~~ ~~693~~ ~~1211~~ ~~1719~~49.8 ~~30~~ ~~133~~ ~~274~~ ~~557~~ ~~973~~ ~~1380~~49.9 ~~40~~ ~~113~~ ~~234~~ ~~476~~ ~~833~~ ~~1181~~49.10 ~~60~~ ~~91~~ ~~188~~ ~~383~~ ~~669~~ ~~949~~

| | | | | | | |
|-------|----------------|--|-----------------|------------------|------------------|------------------|
| 49.11 | 80 | 78 | 161 | 327 | 572 | 812 |
| 49.12 | 100 | 69 | 143 | 290 | 507 | 720 |
| 49.13 | 125 | 61 | 126 | 257 | 449 | 638 |
| 49.14 | 150 | 56 | 115 | 233 | 407 | 578 |
| 49.15 | 200 | 48 | 98 | 199 | 349 | 495 |
| 49.16 | 250 | 42 | 87 | 177 | 309 | 438 |
| 49.17 | 300 | 38 | 79 | 160 | 280 | 397 |
| 49.18 | 350 | 35 | 72 | 147 | 258 | 365 |
| 49.19 | 400 | 33 | 67 | 137 | 240 | 340 |
| 49.20 | Nominal | 1 | 1-1/4 | 1-1/2 | 2 | 2-1/2 |
| 49.21 | Actual OD | 1-1/8 | 1-3/8 | 1-5/8 | 2-1/8 | 2-5/8 |
| 49.22 | Actual ID | 0.995 | 1.245 | 1.481 | 1.959 | 2.435 |
| 49.23 | Length | Maximum Capacity in Cubic Feet of Gas per Hour | | | | |
| 49.24 | (ft) | | | | | |
| 49.25 | 10 | 5341 | 9616 | 15161 | 31577 | 55867 |
| 49.26 | 20 | 3671 | 6609 | 10420 | 21703 | 38397 |
| 49.27 | 30 | 2948 | 5307 | 8368 | 17428 | 30834 |
| 50.1 | 40 | 2523 | 4542 | 7162 | 14916 | 26390 |
| 50.2 | 60 | 2026 | 3648 | 5751 | 11978 | 21192 |
| 50.3 | 80 | 1734 | 3122 | 4922 | 10252 | 18138 |
| 50.4 | 100 | 1537 | 2767 | 4362 | 9086 | 16075 |
| 50.5 | 125 | 1362 | 2452 | 3866 | 8053 | 14247 |
| 50.6 | 150 | 1234 | 2222 | 3503 | 7296 | 12909 |
| 50.7 | 200 | 1056 | 1902 | 2998 | 6245 | 11048 |
| 50.8 | 250 | 936 | 1685 | 2657 | 5535 | 9792 |
| 50.9 | 300 | 848 | 1527 | 2408 | 5015 | 8872 |
| 50.10 | 350 | 780 | 1405 | 2215 | 4614 | 8162 |
| 50.11 | 400 | 726 | 1307 | 2061 | 4292 | 7593 |

50.12 **Table ~~402.3(37)~~ 402.4(2)A**

| Pipe Sizing Table for Natural Gas | | | | | | | | |
|-----------------------------------|-----------------------------------|--|-------|----------------|-------|-------|-------|-------|
| 50.13 | | | | | | | | |
| 50.14 | Schedule 40 Metallic Pipe | | | Inlet Pressure | | | 7" wc | |
| 50.15 | For 0.60 Specific Gravity Natural | | | | | | | |
| 50.16 | Gas | | | Pressure Drop | | | 1" wc | |
| 50.17 | Nominal | 1/4 | 3/8 | 1/2 | 3/4 | 1 | 1-1/4 | 1-1/2 |
| 50.18 | Actual ID | 0.364 | 0.493 | 0.622 | 0.824 | 1.049 | 1.380 | 1.610 |
| 50.19 | Length (ft) | Maximum Capacity in Cubic Feet of Gas per Hour | | | | | | |
| 50.20 | 10 | 61 | 135 | 248 | 518 | 976 | 2004 | 3003 |
| 50.21 | 20 | 42 | 93 | 170 | 356 | 671 | 1378 | 2064 |
| 50.22 | 30 | 34 | 74 | 137 | 286 | 539 | 1106 | 1657 |
| 50.23 | 40 | 29 | 64 | 117 | 245 | 461 | 947 | 1419 |
| 50.24 | 50 | 25 | 56 | 104 | 217 | 409 | 839 | 1257 |
| 50.25 | 60 | 23 | 51 | 94 | 197 | 370 | 760 | 1139 |
| 50.26 | 80 | 20 | 44 | 80 | 168 | 317 | 651 | 975 |
| 50.27 | 100 | 17 | 39 | 71 | 149 | 281 | 577 | 864 |
| 50.28 | 125 | 16 | 34 | 63 | 132 | 249 | 511 | 766 |
| 51.1 | 150 | 14 | 31 | 57 | 120 | 226 | 463 | 694 |
| 51.2 | 175 | 13 | 29 | 53 | 110 | 208 | 426 | 638 |
| 51.3 | 200 | 12 | 27 | 49 | 102 | 193 | 396 | 594 |
| 51.4 | 250 | 11 | 24 | 43 | 91 | 171 | 351 | 626 |
| 51.5 | 300 | 10 | 21 | 39 | 82 | 155 | 318 | 477 |
| 51.6 | 350 | 9 | 20 | 36 | 76 | 143 | 293 | 439 |
| 51.7 | 400 | 8 | 18 | 34 | 70 | 133 | 272 | 408 |
| 51.8 | 450 | 8 | 17 | 32 | 66 | 124 | 256 | 383 |
| 51.9 | 500 | 7 | 16 | 30 | 62 | 118 | 241 | 362 |
| 51.10 | Nominal | 2 | 2-1/2 | 3 | 4 | 5 | 6 | 8 |
| 51.11 | Actual ID | 2.067 | 2.469 | 3.068 | 4.026 | 5.047 | 6.065 | 7.891 |
| 51.12 | Length (ft) | Maximum Capacity in Cubic Feet of Gas per Hour | | | | | | |

| | | | | | | | | |
|-------|-----|------|------|-------|--------|-------|-------|--------|
| 51.13 | 10 | 5784 | 9218 | 16296 | 33239 | 60134 | 97370 | 194195 |
| 51.14 | 20 | 3975 | 6336 | 11200 | 22845 | 41330 | 66922 | 133469 |
| 51.15 | 30 | 3192 | 5088 | 8994 | 18345 | 33189 | 53741 | 107181 |
| 51.16 | 40 | 2732 | 4354 | 7698 | 115701 | 28406 | 45995 | 91733 |
| 51.17 | 50 | 2421 | 3859 | 6822 | 13916 | 25175 | 40765 | 81301 |
| 51.18 | 60 | 2194 | 3497 | 6182 | 12609 | 22811 | 36936 | 73665 |
| 51.19 | 80 | 1878 | 2993 | 5291 | 10791 | 19523 | 31612 | 63047 |
| 51.20 | 100 | 1664 | 2652 | 4689 | 9564 | 17303 | 28017 | 55878 |
| 51.21 | 125 | 1475 | 2351 | 4156 | 8477 | 15335 | 24831 | 49523 |
| 51.22 | 150 | 1336 | 2130 | 3765 | 7680 | 13895 | 22499 | 44872 |
| 51.23 | 175 | 1229 | 1960 | 3464 | 7066 | 12783 | 20699 | 41281 |
| 51.24 | 200 | 1144 | 1823 | 3223 | 6573 | 11892 | 19256 | 38404 |
| 51.25 | 250 | 1014 | 1616 | 2856 | 5826 | 10540 | 17066 | 34037 |
| 51.26 | 300 | 918 | 1464 | 2588 | 5279 | 9550 | 15463 | 30840 |
| 51.27 | 350 | 845 | 1347 | 2381 | 4856 | 8786 | 14226 | 28373 |
| 51.28 | 400 | 786 | 1253 | 2215 | 4518 | 8173 | 13235 | 26395 |
| 52.1 | 450 | 738 | 1176 | 2078 | 4239 | 7669 | 12418 | 24766 |
| 52.2 | 500 | 697 | 1110 | 1963 | 4004 | 7244 | 11730 | 23394 |

52.3 ~~Table 402.3(38)~~52.4 ~~Pipe Sizing Table for Natural Gas~~52.5 ~~Schedule 40 Metallic Pipe~~~~Inlet Pressure~~~~2 psig~~52.6 ~~For 0.60 Specific Gravity~~52.7 ~~Natural Gas~~~~Pressure Drop~~~~1 psig~~52.8 ~~Nominal~~ ~~1/4~~ ~~3/8~~ ~~1/2~~ ~~3/4~~ ~~1~~ ~~1-1/4~~ ~~1-1/2~~52.9 ~~Actual~~52.10 ~~ID~~ ~~0.364~~ ~~0.493~~ ~~0.622~~ ~~0.824~~ ~~1.049~~ ~~1.380~~ ~~1.610~~52.11 ~~Length~~ ~~Maximum Capacity in Cubic Feet of Gas per Hour~~52.12 ~~(ft)~~

| | | | | | | | | |
|-------|---------|--|-------|--------|--------|--------|--------|---------|
| 52.13 | 10 | 382 | 847 | 1558 | 3257 | 6136 | 12597 | 18874 |
| 52.14 | 20 | 263 | 582 | 1071 | 2239 | 4217 | 8658 | 12972 |
| 52.15 | 30 | 211 | 467 | 860 | 1798 | 3386 | 6953 | 10417 |
| 52.16 | 40 | 180 | 400 | 736 | 1539 | 2898 | 5950 | 8916 |
| 52.17 | 50 | 160 | 354 | 652 | 1364 | 2569 | 5274 | 7902 |
| 52.18 | 60 | 145 | 321 | 591 | 1236 | 2327 | 4778 | 7160 |
| 52.19 | 80 | 124 | 275 | 506 | 1057 | 1992 | 4090 | 6128 |
| 52.20 | 100 | 110 | 244 | 448 | 937 | 1765 | 3625 | 5431 |
| 52.21 | 125 | 97 | 216 | 397 | 831 | 1565 | 3212 | 4813 |
| 52.22 | 150 | 88 | 196 | 360 | 753 | 1418 | 2911 | 4361 |
| 52.23 | 175 | 81 | 180 | 331 | 692 | 1304 | 2678 | 4012 |
| 52.24 | 200 | 76 | 167 | 308 | 644 | 1213 | 2491 | 3733 |
| 52.25 | 250 | 67 | 148 | 273 | 571 | 1075 | 2208 | 3308 |
| 52.26 | 300 | 61 | 134 | 247 | 517 | 974 | 2001 | 2997 |
| 52.27 | 350 | 56 | 124 | 228 | 476 | 896 | 1840 | 2758 |
| 53.1 | 400 | 52 | 115 | 212 | 443 | 834 | 1712 | 2565 |
| 53.2 | 450 | 49 | 108 | 199 | 415 | 782 | 1606 | 2407 |
| 53.3 | 500 | 46 | 102 | 188 | 392 | 739 | 1517 | 2274 |
| 53.4 | Nominal | 2 | 2-1/2 | 3 | 4 | 5 | 6 | 8 |
| 53.5 | Actual | | | | | | | |
| 53.6 | ID | 2.067 | 2.469 | 3.068 | 4.026 | 5.047 | 6.065 | 7.891 |
| 53.7 | Length | Maximum Capacity in Cubic Feet of Gas per Hour | | | | | | |
| 53.8 | (ft) | | | | | | | |
| 53.9 | 10 | 36350 | 57936 | 102420 | 208905 | 377939 | 611970 | 1220513 |
| 53.10 | 20 | 24983 | 39819 | 70393 | 143579 | 259755 | 420604 | 838852 |
| 53.11 | 30 | 20062 | 31976 | 56528 | 115299 | 208593 | 337760 | 673627 |
| 53.12 | 40 | 17171 | 27367 | 48381 | 98681 | 178528 | 289079 | 576538 |
| 53.13 | 50 | 15218 | 24255 | 42879 | 87459 | 158226 | 256205 | 510975 |
| 53.14 | 60 | 13789 | 21977 | 38851 | 79244 | 143364 | 232140 | 462980 |

| | | | | | | | | |
|-------|----------------|------------------|------------------|------------------|------------------|-------------------|-------------------|-------------------|
| 53.15 | 80 | 11801 | 18809 | 33252 | 67823 | 122701 | 198682 | 396251 |
| 53.16 | 100 | 10459 | 16670 | 29470 | 60110 | 108748 | 176088 | 351190 |
| 53.17 | 125 | 9270 | 14775 | 26119 | 53275 | 96381 | 156064 | 311253 |
| 53.18 | 150 | 8399 | 13387 | 23666 | 48271 | 87329 | 141405 | 282018 |
| 53.19 | 175 | 7727 | 12316 | 21772 | 44408 | 80341 | 130091 | 259453 |
| 53.20 | 200 | 7189 | 11458 | 20255 | 41313 | 74742 | 121024 | 241371 |
| 53.21 | 250 | 6371 | 10155 | 17952 | 36615 | 66242 | 107262 | 213923 |
| 53.22 | 300 | 5773 | 9201 | 16265 | 33176 | 60020 | 97187 | 193829 |
| 53.23 | 350 | 5311 | 8465 | 14964 | 30522 | 55218 | 89411 | 178321 |
| 53.24 | 400 | 4941 | 7875 | 13921 | 28395 | 51370 | 83179 | 165893 |
| 53.25 | 450 | 4636 | 7389 | 13062 | 26642 | 48198 | 78044 | 155652 |
| 53.26 | 500 | 4379 | 6979 | 12338 | 25166 | 45528 | 73720 | 147028 |

53.27 **1346.5406 SECTION 406 (IFGC) INSPECTION, TESTING AND PURGING.**

53.28 [For text of subpart 1, see M.R.]

54.1 Subp. 2. **Section 406.1.4 406.1.5.** IFGC Section ~~406.1.4~~ 406.1.5 is deleted.

54.2 [For text of subps 3 to 5, see M.R.]

54.3 **1346.5409 SECTION 409 (IFGC) SHUTOFF VALVES.**

54.4 Subpart 1. **Section 409.1.** IFGC Section 409.1 is amended by adding subsection

54.5 409.1.4 to read as follows:

54.6 **409.1 General 409.1.4 Main shutoff valve.** Piping systems shall be provided with an
 54.7 approved main shutoff valve before the first branch line. The main shutoff valve shall be
 54.8 installed in the first available location inside the building that provides ready access and
 54.9 shall have a permanently attached handle. Main shutoff valves controlling several gas
 54.10 piping systems shall be protected from physical damage and shall be placed an adequate
 54.11 distance from each other so they will be easy to operate.

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

54.13 **409.2 Meter valve.** Every meter shall be equipped with a shutoff valve located on the
54.14 supply side of the meter. The main shutoff valve required in amended IFGC Section ~~409.1~~
54.15 409.1.4 shall serve as the shutoff valve.

54.16 [For text of subp 3, see M.R.]

54.17 **1346.5501 SECTION 501 (IFGC) GENERAL.**

54.18 [For text of subpart 1, see M.R.]

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

54.20 **501.8 Equipment not required to be vented.** The following appliances shall not be
54.21 required to be vented.

54.22 1. Ranges.

54.23 2. Built-in domestic cooking units listed and marked for optional venting.

54.24 3. Hot plates and laundry stoves.

55.1 4. Type 1 clothes dryers (Type 1 clothes dryers shall be exhausted in accordance with
55.2 the requirements of IFGC ~~Section~~ Sections 613 and 614).

55.3 5. A single booster-type automatic instantaneous water heater, where designed and
55.4 used solely for the sanitizing rinse requirements of a dishwashing machine, provided
55.5 that the heater is installed in a commercial kitchen having a mechanical exhaust system.
55.6 Where installed in this manner, the draft hood, if required, shall be in place and unaltered
55.7 and the draft hood outlet shall be not less than 36 inches (914 mm) vertically and 6 inches
55.8 (152 mm) horizontally from any surface other than the heater.

55.9 6. Refrigerators.

55.10 7. Counter appliances.

55.11 8. Direct-fired make-up air heaters.

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

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

55.14 Automatically operated equipment vented with a hood or exhaust system shall comply
55.15 with IFGC Section 503.3.4. Where the appliances and equipment listed in items 5 through
55.16 10 are installed so that the aggregate input rating exceeds 20 Btu/hr per cubic foot (207
55.17 watts per m³) of volume of the room or space in which such appliances and equipment are
55.18 installed, one or more shall be provided with venting systems or other approved means
55.19 for conveying the vent gases to the outdoor atmosphere so that the aggregate input rating
55.20 of the remaining unvented appliances and equipment does not exceed the 20 Btu/hr per
55.21 cubic foot (207 watts per m³) figure. Where the room or space in which the equipment is
55.22 installed is directly connected to another room or space by a doorway, archway, or other
55.23 opening of comparable size that cannot be closed, the volume of such adjacent room or
55.24 space shall be permitted to be included in the calculations.

55.25 [For text of subp 3, see M.R.]

55.26 **1346.5503 SECTION 503 (IFGC) VENTING OF EQUIPMENT.**

56.1 [For text of subpart 1, see M.R.]

56.2 Subp. 2. [See repealer.]

56.3 [For text of subps 3 and 4, see M.R.]

56.4 Subp. 5. [See repealer.]

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

56.6 ~~**503.6.9.1 Category I appliances.** The sizing of natural draft venting systems serving~~
56.7 ~~one or more listed appliances equipped with a draft hood or appliances listed for use~~
56.8 ~~with Type B gas vent, installed in a single story of a building, shall be in accordance~~
56.9 ~~with IFGC Section 504 or in accordance with sound engineering practice. Category I~~
56.10 ~~appliances are either draft hood-equipped or fan-assisted combustion system in design.~~
56.11 ~~Different vent design methods are required for draft hood-equipped and fan-assisted~~
56.12 ~~combustion system appliances.~~

56.13 **Exceptions:**

56.14 ~~1. As an alternate method for sizing an individual gas vent for a single, draft~~
56.15 ~~hood-equipped appliance, the effective area of the vent connector and the gas vent~~
56.16 ~~shall be not less than the area of the appliance draft hood outlet, nor greater than~~
56.17 ~~four times the draft hood outlet area. Vents serving fan-assisted combustion system~~
56.18 ~~appliances shall be sized in accordance with IFGC Section 504 or other approved~~
56.19 ~~engineering methods.~~

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

57.1 **503.6.9.1 Category I appliances.** The sizing of natural draft venting systems serving one
57.2 or more listed appliances equipped with a draft hood or appliances listed for use with Type
57.3 B gas vent, installed in a single story of a building, shall be in accordance with one of
57.4 the following methods:

- 57.5 1. The provisions of Section 504.
- 57.6 2. For sizing an individual gas vent for a single draft-hood-equipped appliance, the
57.7 effective area of the vent connector and the gas vent shall be not less than the area of
57.8 the appliance draft hood outlet, nor greater than four times the draft hood outlet area.
- 57.9 3. For sizing a gas vent connected to two appliances with draft hoods, the effective
57.10 area of the vent shall be not less than the area of the larger draft hood outlet plus 50
57.11 percent of the area of the smaller draft hood outlet, nor greater than four times the
57.12 smaller draft hood outlet area.
- 57.13 4. Approved engineering practices.

57.14 [For text of subp 7, see M.R.]

57.15 Subp. 8. [See repealer.]

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

57.17 **503.10.7 Joints.** Joints between sections of connector piping and connections to flue
57.18 collars and hood outlets shall be fastened by ~~a minimum of three equally spaced sheet~~
57.19 ~~metal screws or other approved means.~~ one of the following methods:

57.20 1. Three sheet metal screws equally spaced in accessible locations on the
57.21 circumference of the vent.

57.22 2. Vent connectors of listed vent material assembled and connected to flue collars or
57.23 draft hood outlets in accordance with the manufacturers' instructions.

57.24 3. Other approved means.

57.25 **1346.5504 SECTION 504 (IFGC) SIZING OF CATEGORY 1 APPLIANCE**
57.26 **VENTING SYSTEMS.**

58.1 [For text of subps 1 and 2, see M.R.]

58.2 Subp. 3. **Section ~~504.3.15~~ 504.3.17.** IFGC Section ~~504.3.15~~ 504.3.17 is amended
58.3 to read as follows:

58.4 **~~504.3.15~~ 504.3.17 Vertical vent maximum size.** Where two or more appliances are
58.5 connected to a vertical vent or chimney, the flow area of the largest section of vertical
58.6 vent or chimney shall not exceed four times the smallest listed appliance categorized
58.7 vent areas, flue collar area, or draft hood outlet area unless designed in accordance with
58.8 approved engineering methods.

58.9 Subp. 4. **Section ~~504.3.17~~ 504.3.19.** IFGC Section ~~504.3.17~~ 504.3.19 is amended
58.10 to read as follows:

58.11 **~~504.3.17~~ 504.3.19 Liner system sizing.** Listed corrugated metallic chimney liner systems
58.12 in masonry chimneys shall be sized by using IFGC Table 504.3(1) or 504.3(2) for Type B
58.13 vents, with the maximum capacity reduced by 20 percent (0.80 x maximum capacity) and

58.14 the minimum capacity as shown in IFGC Table 504.3(1) or 504.3(2). Corrugated metallic
58.15 liner systems installed with bends or offsets shall have their maximum capacity further
58.16 reduced in accordance with IFGC Sections 504.3.5 and 504.3.6. Approved metallic liners,
58.17 other than listed corrugated metallic liner systems, installed in accordance with amended
58.18 IFGC Section 501.12, shall be sized by using IFGC Table 504.3(1) or 504.3(2) for Type
58.19 B vents. When IFGC Table 504.3(1) or 504.3(2) permits more than one diameter for a
58.20 connector or vent of a fan-assisted appliance, the smallest permitted diameter shall be used.

58.21 **1346.5621 SECTION 621 (IFGC) UNVENTED ROOM HEATERS.**

58.22 IFGC Section 621 is deleted in its entirety and replaced with the following:

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

58.25 **1346.5630 SECTION 630 (IFGC) ~~BOILERS~~ INFRARED RADIANT HEATERS.**

58.26 Subpart 1. [See repealer.]

59.1 Subp. 2. [See repealer.]

59.2 Subp. 3. Section 630. IFGC Section 630 is amended by adding a subsection to
59.3 read as follows:

59.4 **630.3 Ventilation air.** Where unvented infrared heaters are installed, mechanical
59.5 ventilation shall be provided to exhaust at least 4 cubic feet per minute (cfm) (0.0203
59.6 m³/s) per 1,000 Btu/hr (0.292 kW) input rating and it shall be electrically interlocked with
59.7 the heater. Makeup air shall be provided to the space to be heated.

59.8 **1346.5631 SECTION 631 (IFGC) BOILERS.**

59.9 IFGC Section 631.1 is amended to read as follows:

59.10 **631.1 Standards.** Boilers with an input rating below 400,000 Btu/hr (3,660 kW) shall
59.11 be listed in accordance with the requirements of ANSI Z21.13/CSA 4.9 or UL 795.

59.12 Boilers with an input rating of 400,000 Btu/hr (3,660 kW) or greater shall be designed
59.13 and constructed in accordance with the BPVC-2007 ASME Boiler and Pressure Vessel

59.14 Code, Sections I, II, IV, V, VIII, and IX, and amended IFGC Section 301.3, as applicable.
 59.15 Boilers with an input rating above 400,000 Btu/hr (117 kW) and less than 12,500,000
 59.16 Btu/hr (3,660 kW) shall comply with ASME CSD-1-2006, and boilers with an input rating
 59.17 of 12,500,000 Btu/hr (3,660 kW) or greater shall comply with NFPA 85-2007, *Boiler*
 59.18 *and Combustion Systems Hazards Code.*

59.19 **~~1346.5801~~ 1346.5901 SECTION ~~801~~ 901 (IFGC) GENERAL.**

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

59.21 SECTION ~~801~~ 901

59.22 GENERAL

59.23 **~~801.1~~ 901.1 General.** Chapter ~~8~~ 9 shall regulate the installation and testing or repair of gas
 59.24 or fuel burning systems, gas or fuel burners, and gas or fuel burning equipment installed
 59.25 within, or in conjunction with, building or structures. The requirements of this chapter
 59.26 shall apply to the following equipment:

60.1 1. Equipment utilized to provide control of environmental conditions.

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

60.6 2. Equipment with a fuel input of 1,000,000 Btu/hr or greater.

60.7 3. Unlisted equipment.

60.8 4. Miscellaneous equipment when required by the building official.

60.9 **~~1346.5802~~ 1346.5902 SECTION ~~802~~ 902 (IFGC) EQUIPMENT PLACEMENT.**

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

60.11 SECTION ~~802~~ 902

60.12 EQUIPMENT PLACEMENT

60.13 **~~802.1~~ 902.1 Placing equipment in operation.** After completion of the installation, all
 60.14 safety and operating controls and venting shall be tested before placing the burner in

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

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

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

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

61.5 ~~1346.5803~~ 1346.5903 **SECTION 803 903 (IFGC) PILOT OPERATION.**

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

61.7 SECTION ~~803~~ 903

61.8 PILOT OPERATION

61.9 ~~803.1~~ 903.1 **Pilot operation.** Pilot flames shall ignite the gas or fuel at the main burner
 61.10 or burners and shall be adequately protected from drafts. Pilot flames shall not become
 61.11 extinguished during pilot cycle when the main burner or burners are turned on or off in a
 61.12 normal manner, either manually or by automatic controls.

61.13 ~~1346.5804~~ 1346.5904 **SECTION 804 904 (IFGC) BURNER OPERATION.**

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

61.15 SECTION ~~804~~ 904

61.16

BURNER OPERATION

61.17

~~804.1~~ 904.1 Burner operation. When testing to determine compliance with this section,

61.18

care shall be exercised to prevent the accumulation of unburned gas or fuel in the appliance

61.19

or flues that might result in explosion or fire.

61.20

1. The flames from each burner shall freely ignite the gas or fuel from adjacent

61.21

burners when operating at the prevailing gas or fuel pressure and when the main control

61.22

valve is regulated to deliver at one-third of the fuel gas or fuel rate.

61.23

2. Burner flames shall not flash back after immediate ignition nor after turning the

61.24

fuel cock until the flow rate to the burner is one-third the full supply.

61.25

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

61.26

an automatic control mechanism.

62.1

4. Main burner flames shall ignite freely from each pilot when the main control valve

62.2

is regulated to one-third the full gas or fuel rate and when the pilot flame is reduced to a

62.3

minimum point at which it will actuate the safety device.

62.4

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

62.5

appliance.

62.6

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

62.7

prevailing pressure.

62.8

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

62.9

burner.

62.10

8. Dual fuel burners may have controls common or independent to both fuels.

62.11

Transfer from one fuel to the other shall be by a manual interlock switching system to

62.12

prevent the gas and other fuel being used simultaneously except by special permission

62.13

from the building official. The building official shall consider whether an exception will

62.14

provide equivalent safety. The transfer switch shall have a center off position and shall not

62.15

pass through the center off position without stopping in the center off position.

62.16 ~~1346.5805~~ 1346.5905 **SECTION 805 905 (IFGC) METHOD OF TEST.**

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

62.18 SECTION ~~805~~ 905

62.19 METHOD OF TEST

62.20 **~~805.1~~ 905.1 Method of test.**

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

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

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

63.3 ~~3~~ 3.1. **Performance standards for atmospheric type.**

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

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

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

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

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

63.11 ~~3a~~ 3.2. **Performance standards for induced draft type/fan-assisted type.**

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

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

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

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

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

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

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

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

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

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

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

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

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

64.12 7. **Oxygen concentration.**

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

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

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

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

64.24 9. **Supervised start-up.**

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

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

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

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

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

65.16 ~~1346.5806~~ 1346.5906 SECTION ~~806~~ 906 (IFGC) PRESSURE REGULATORS.

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

65.18 SECTION ~~806~~ 906

65.19 PRESSURE REGULATORS

65.20 ~~806.1~~ 906.1 Pressure regulators.

65.21 (a) General.

65.22 1. Regulators shall be provided with access for servicing.

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

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

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

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

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

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

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

66.14 (b) Appliance.

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

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

66.20 ~~1346.5807~~ 1346.5907 **SECTION ~~807~~ 907 (IFGC) EQUIPMENT INFORMATION.**

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

66.22 SECTION ~~807~~ 907

66.23 EQUIPMENT INFORMATION

66.24 ~~807.1~~ 907.1 **Equipment information.**

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

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

67.2 2. Input rating and type of fuel.

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

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

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

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

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

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

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

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

67.20 ~~1346.5900~~ 1346.6000 **SECTION 900 1000 MANUFACTURED HOME**
67.21 **PARK/COMMUNITY FUEL GAS EQUIPMENT AND INSTALLATION.**

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

67.23 **CHAPTER 9 10**

67.24 **MANUFACTURED HOME PARK/COMMUNITY FUEL GAS**
67.25 **EQUIPMENT AND INSTALLATION**

67.26 ~~901~~ 1001 **General.** Except as otherwise permitted or required by this chapter, all fuel
67.27 gas equipment and installations in manufactured home parks and communities shall
68.1 comply with the provisions of this code. The provisions of this chapter shall not apply to
68.2 manufactured home gas piping and equipment.

68.3 ~~902~~ 1002 **Required gas supply.** The minimum hourly volume of gas required at each
68.4 manufactured home lot outlet or any section of the manufactured home gas piping system
68.5 shall be calculated as shown in IFGC Table ~~902~~ 1002. Required gas supply for buildings
68.6 or other fuel gas utilization equipment connected to the manufactured home gas piping
68.7 system shall be calculated as provided in this code.

68.8 **Table ~~902~~ 1002**

68.9 **Demand Factors for Calculating Gas Piping Systems in Manufactured Home Parks and**
68.10 **Communities**

| | Number of Manufactured Home Sites | Demand Factor (Btu/hr) per Manufactured Home Site | Demand Factor (Watts) per Manufactured Home Site |
|-------|---|--|--|
| 68.15 | 1 | 125,000 | 36,638 |
| 68.16 | 2 | 117,000 | 34,293 |

| | | | |
|-------|---------|---------|--------|
| 68.17 | 3 | 104,000 | 30,482 |
| 68.18 | 4 | 96,000 | 28,138 |
| 68.19 | 5 | 92,000 | 26,965 |
| 68.20 | 6 | 87,000 | 25,500 |
| 68.21 | 7 | 83,000 | 24,327 |
| 68.22 | 8 | 81,000 | 23,741 |
| 68.23 | 9 | 79,000 | 23,155 |
| 68.24 | 10 | 77,000 | 22,569 |
| 68.25 | 11-20 | 66,000 | 19,345 |
| 68.26 | 21-30 | 62,000 | 18,172 |
| 68.27 | 31-40 | 58,000 | 17,000 |
| 68.28 | 41-60 | 55,000 | 16,121 |
| 68.29 | Over 60 | 50,000 | 14,655 |

69.1 **903 1003 Installation.** Gas piping shall not be installed underground beneath buildings
 69.2 or that portion of the manufactured home lot reserved for the location of manufactured
 69.3 homes, manufactured home accessory buildings or structures, concrete slabs, or
 69.4 automobile parking, unless installed in a gas-tight conduit complying with the following:

69.5 1. The conduit shall be of material approved for installation underground beneath
 69.6 buildings and not less than Schedule 40 pipe. The interior diameter of the conduit shall be
 69.7 not less than 0.5 inch (15 mm) larger than the outside diameter of the gas piping.

69.8 2. The conduit shall extend to a point not less than 12 inches (305 mm) beyond
 69.9 any area where it is required to be installed, or the outside wall of a building, and the
 69.10 outer ends shall not be sealed. Where the conduit terminates within a building, it shall be
 69.11 provided with access, and the space between the conduit and the gas piping shall be sealed
 69.12 to prevent leakage of gas into the building.

69.13 **Exception:** A gas piping lateral terminating in a manufactured home lot riser
 69.14 surrounded by a concrete slab shall not be required to be installed in a conduit,

69.15 provided the concrete slab is entirely outside the wall line of the manufactured home,
69.16 and is used for stabilizing other utility connections.

69.17 **904 1004 Manufactured home lot shutoff valve.** Each manufactured home lot shall have
69.18 an approved gas shutoff valve installed upstream of the manufactured home lot gas outlet
69.19 and located on the outlet riser at a height at least 6 inches (152 mm) above grade. Such
69.20 valve shall not be located under a manufactured home. When the manufactured home
69.21 lot is not in use, the outlet shall be equipped with an approved cap or plug to prevent
69.22 accidental discharge of gas.

69.23 **905 1005 Manufactured home lot gas outlet.** Each manufactured home lot piped for
69.24 gas shall be provided with an individual outlet riser at the manufactured home lot. The
69.25 manufactured home lot gas outlet shall terminate with the point of delivery in the rear third
69.26 section and within 4 feet (1,219 mm) of the proposed location of the manufactured home.

70.1 **906 1006 Manufactured home gas connector.** Each manufactured home shall be
70.2 connected to the lot outlet by an approved or listed gas connector, a maximum of 6 feet
70.3 (1,829 mm) in length. Approved pipe and fittings may be used between the flexible
70.4 connector and the lot gas outlet when the distance exceeds that required to make a safe
70.5 installation with only an approved or listed gas connector. Gas connectors shall be of a
70.6 size to adequately supply the total demand of the connected manufactured home.

70.7 **907 1007 Mechanical protection.** All gas outlet risers, regulators, meters, valves, or
70.8 other exposed equipment shall be protected from mechanical damage. Atmospherically
70.9 controlled regulators shall be installed in such a manner that moisture cannot enter the
70.10 regulator vent and accumulate above the diaphragm. Where the regulator vent may be
70.11 obstructed due to snow and icing conditions, shields, hoods, or other suitable devices shall
70.12 be provided to guard against closing the vent opening.

70.13 **908 1008 Meters.** Meters shall not be installed in unvented or inaccessible locations or
70.14 closer than 3 feet (914 mm) from sources of ignition. When meters are installed, they shall

70.15 not depend on the gas outlet riser for support, but shall be adequately supported by a post
70.16 or bracket placed on a firm footing, or other means providing equivalent support.

70.17 **909 1009 Meter shutoff valve.** All meter installations shall be provided with a shutoff
70.18 valve located adjacent to and on the inlet side of the meter. For installations utilizing a
70.19 liquefied petroleum gas container, the container service valve shall serve as the shutoff
70.20 valve.

70.21 **910 1010 Gas pipe sizing.** The size of each section of natural gas or liquefied petroleum
70.22 gas piping systems shall be determined as specified in this code.

70.23 **911 1011 Maintenance.** The manufactured home park/community operator shall be
70.24 responsible for maintaining all gas piping installations and equipment in good working
70.25 condition.

70.26 **1346.6010 IMC APPENDIX C, TABLE C-1.**

70.27 IMC Appendix C, Table C-1

71.1 Recommended Capacities for Domestic Kitchen Exhaust Hoods

| 71.2 71.3 71.4 71.5 71.6 Hood Size Area (Sq. Ft.) | 71.2 71.3 Equipment with Grills or Deep Fryers (Number of Exposed Sides) | | 71.2 71.3 Ranges and Ovens (Number of Exposed Sides) | |
|--|--|--------------------------------|---|--------------------------------|
| | 71.5 71.6 Four (CFM) | 71.5 71.6 Three (CFM) | 71.5 71.6 Four (CFM) | 71.5 71.6 Three (CFM) |
| 71.7 Up to 4 | Up to 400 | Up to 300 | Up to 300 | Up to 200 |
| 71.8 4 | 400 | 300 | 300 | 200 |
| 71.9 4.5 | 450 | 338 | 338 | 225 |
| 71.10 5 | 500 | 375 | 375 | 250 |
| 71.11 5.5 | 550 | 413 | 413 | 275 |
| 71.12 6 | 600 | 450 | 450 | 300 |
| 71.13 6.5 | 650 | 488 | 488 | 325 |
| 71.14 7 | 700 | 525 | 525 | 350 |
| 71.15 7.5 | 750 | 563 | 563 | 375 |
| 71.16 8 | 800 | 600 | 600 | 400 |

| | | | | | |
|-------|------|-------|-------|-------|-----|
| 71.17 | 8.5 | 850 | 638 | 638 | 425 |
| 71.18 | 9 | 900 | 675 | 675 | 450 |
| 71.19 | 9.5 | 950 | 713 | 713 | 475 |
| 71.20 | 10 | 1,000 | 750 | 750 | 500 |
| 71.21 | 10.5 | 1,050 | 788 | 788 | 525 |
| 71.22 | 11 | 1,100 | 825 | 825 | 550 |
| 71.23 | 11.5 | 1,150 | 863 | 863 | 575 |
| 71.24 | 12 | 1,200 | 900 | 900 | 600 |
| 71.25 | 12.5 | 1,250 | 938 | 938 | 625 |
| 71.26 | 13 | 1,300 | 975 | 975 | 650 |
| 71.27 | 13.5 | 1,350 | 1,013 | 1,013 | 675 |
| 71.28 | 14 | 1,400 | 1,050 | 1,050 | 700 |
| 71.29 | 14.5 | 1,450 | 1,088 | 1,088 | 725 |
| 71.30 | 15 | 1,500 | 1,125 | 1,125 | 750 |
| 72.1 | 15.5 | 1,550 | 1,163 | 1,163 | 775 |
| 72.2 | 16 | 1,600 | 1,200 | 1,200 | 800 |

72.3 **1346.6012 IFGC APPENDIX E, WORKSHEET E-1.**

72.4 IFGC Appendix E, Worksheet E-1

72.5 Residential Combustion Air Calculation Method

72.6 (for Furnace, Boiler, and/or Water Heater in the Same Space)

72.7 **Step 1:** Complete vented combustion appliance information.

72.8 Furnace/Boiler:

72.9 _____ Draft Hood _____ Fan Assisted _____ Direct Vent Input:
72.10 (Not fan assisted) & Power Vent _____ Btu/hr

72.11 Water Heater:

72.12 _____ Draft Hood _____ Fan Assisted _____ Direct Vent Input:
72.13 (Not fan assisted) & Power Vent _____ Btu/hr

72.14 **Step 2:** Calculate the volume of the Combustion Appliance Space (CAS) containing
72.15 combustion appliances.

72.16 The CAS includes all spaces connected to one another
72.17 by code compliant openings.

CAS volume: _____ ft³

72.18 **Step 3:** Determine Air Changes per Hour (ACH)¹

72.19 Default ACH values have been incorporated into Table E-1 for use with Method 4b (KAIR
72.20 Method). If the year of construction or ACH is not known, use method 4a (Standard
72.21 Method).

72.22 **Step 4:** Determine Required Volume for Combustion Air.

72.23 **4a.** Standard Method

72.24 Total Btu/hr input of all combustion appliances (DO
72.25 NOT COUNT DIRECT VENT APPLIANCES)

Input: _____ Btu/hr

72.26 Use Standard Method column in Table E-1 to find Total
72.27 Required Volume (TRV)

TRV: _____ ft³

72.28 If CAS Volume (from Step 2) *is greater than* TRV then no outdoor openings are needed.

72.29 If CAS Volume (from Step 2) *is less than* TRV then go to **STEP 5.**

73.1 **4b.** Known Air Infiltration Rate (KAIR) Method

73.2 Total Btu/hr input of all fan-assisted and power
73.3 vent appliances (DO NOT COUNT DIRECT VENT
73.4 APPLIANCES)

Input: _____ Btu/hr

73.5 Use Fan-Assisted Appliances column in Table E-1 to
73.6 find Required Volume Fan Assisted (RVFA)

RVFA: _____ ft³

73.7 Total Btu/hr input of all non-fan-assisted appliances

Input: _____ Btu/hr

73.8 Use Non-Fan-Assisted Appliances column in Table E-1
73.9 to find Required Volume Non-Fan-Assisted (RVNFA)

RVNFA: _____ ft³

73.10 Total Required Volume (TRV) = RVFA + RVNFA

73.11 $RV = \text{_____} + \text{_____} = \text{_____} \text{ ft}^3$

73.12 If CAS Volume (from Step 2) *is greater than* TRV then no outdoor openings are needed.

73.13 If CAS Volume (from Step 2) *is less than* TRV then go to **STEP 5.**

73.14 **Step 5:** Calculate the ratio of available interior volume to the total required volume.

73.15 Ratio = CAS Volume (from Step 2)

73.16 *divided by* TRV (from Step 4a or

73.17 Step 4b) Ratio = _____ / _____ = _____

73.18 **Step 6:** Calculate Reduction Factor (RF).

73.19 RF = 1 *minus* Ratio RF = 1 - _____ = _____

73.20 **Step 7:** Calculate single outdoor opening as if all combustion air is from outside.

73.21 Total Btu/hr input of all Combustion Appliances in the

73.22 same CAS (EXCEPT DIRECT VENT) Input: _____ Btu/hr

73.23 Combustion Air Opening Area (CAOA):

73.24 Total Btu/hr *divided by* 3000

73.25 Btu/hr per in²

73.26 CAOA = _____ / 3000 Btu/hr per in² = _____ in²

73.27 **Step 8:** Calculate Minimum CAOA.

74.1 Minimum CAOA = CAOA *multiplied by* RF

74.2 Minimum CAOA = _____ x _____ = _____ in²

74.3 **Step 9:** Calculate Combustion Air Opening Diameter (CAOD)

74.4 CAOD = 1.13 *multiplied by the square root of* Minimum CAOA

74.5 CAOD = 1.13 Minimum CAOA = _____ in

74.6 ¹If desired, ACH can be determined using ASHRAE calculation or blower door test.

74.7 Follow procedures in Section G304.

74.8 **1346.6014 IFGC APPENDIX E, TABLE E-1.**

74.9 IFGC Appendix E, Table E-1

74.10 Residential Combustion Air Required Volume

74.11 (Required Interior Volume Based on Input Rating of Appliances)

74.12 Known Air Infiltration Rate (KAIR)

74.13 Method (ft³)

74.14 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 |
|-------|--------------------------|--|---------------------------------|-----------------------|---------------------------------|-----------------------|
| 74.15 | | | | | | |
| 74.16 | | | | | | |
| 74.17 | | | | | | |
| 74.18 | 5,000 | 250 | 375 | 188 | 525 | 263 |
| 74.19 | 10,000 | 500 | 750 | 375 | 1,050 | 525 |
| 74.20 | 15,000 | 750 | 1,125 | 563 | 1,575 | 788 |
| 74.21 | 20,000 | 1,000 | 1,500 | 750 | 2,100 | 1,050 |
| 74.22 | 25,000 | 1,250 | 1,875 | 938 | 2,625 | 1,313 |
| 74.23 | 30,000 | 1,500 | 2,250 | 1,125 | 3,150 | 1,575 |
| 74.24 | 35,000 | 1,750 | 2,625 | 1,313 | 3,675 | 1,838 |
| 74.25 | 40,000 | 2,000 | 3,000 | 1,500 | 4,200 | 2,100 |
| 74.26 | 45,000 | 2,250 | 3,375 | 1,688 | 4,725 | 2,363 |
| 74.27 | 50,000 | 2,500 | 3,750 | 1,875 | 5,250 | 2,625 |
| 74.28 | 55,000 | 2,750 | 4,125 | 2,063 | 5,775 | 2,888 |
| 74.29 | 60,000 | 3,000 | 4,500 | 2,250 | 6,300 | 3,150 |
| 75.1 | 65,000 | 3,250 | 4,875 | 2,438 | 6,825 | 3,413 |
| 75.2 | 70,000 | 3,500 | 5,250 | 2,625 | 7,350 | 3,675 |
| 75.3 | 75,000 | 3,750 | 5,625 | 2,813 | 7,875 | 3,938 |
| 75.4 | 80,000 | 4,000 | 6,000 | 3,000 | 8,400 | 4,200 |
| 75.5 | 85,000 | 4,250 | 6,375 | 3,188 | 8,925 | 4,463 |
| 75.6 | 90,000 | 4,500 | 6,750 | 3,375 | 9,450 | 4,725 |
| 75.7 | 95,000 | 4,750 | 7,125 | 3,563 | 9,975 | 4,988 |
| 75.8 | 100,000 | 5,000 | 7,500 | 3,750 | 10,500 | 5,250 |
| 75.9 | 105,000 | 5,250 | 7,875 | 3,938 | 11,025 | 5,513 |
| 75.10 | 110,000 | 5,500 | 8,250 | 4,125 | 11,550 | 5,775 |
| 75.11 | 115,000 | 5,750 | 8,625 | 4,313 | 12,075 | 6,038 |
| 75.12 | 120,000 | 6,000 | 9,000 | 4,500 | 12,600 | 6,300 |
| 75.13 | 125,000 | 6,250 | 9,375 | 4,688 | 13,125 | 6,563 |
| 75.14 | 130,000 | 6,500 | 9,750 | 4,875 | 13,650 | 6,825 |
| 75.15 | 135,000 | 6,750 | 10,125 | 5,063 | 14,175 | 7,088 |

| | | | | | | |
|-------|---------|--------|--------|-------|--------|--------|
| 75.16 | 140,000 | 7,000 | 10,500 | 5,250 | 14,700 | 7,350 |
| 75.17 | 145,000 | 7,250 | 10,875 | 5,438 | 15,225 | 7,613 |
| 75.18 | 150,000 | 7,500 | 11,250 | 5,625 | 15,750 | 7,875 |
| 75.19 | 155,000 | 7,750 | 11,625 | 5,813 | 16,275 | 8,138 |
| 75.20 | 160,000 | 8,000 | 12,000 | 6,000 | 16,800 | 8,400 |
| 75.21 | 165,000 | 8,250 | 12,375 | 6,188 | 17,325 | 8,663 |
| 75.22 | 170,000 | 8,500 | 12,750 | 6,375 | 17,850 | 8,925 |
| 75.23 | 175,000 | 8,750 | 13,125 | 6,563 | 18,375 | 9,188 |
| 75.24 | 180,000 | 9,000 | 13,500 | 6,750 | 18,900 | 9,450 |
| 75.25 | 185,000 | 9,250 | 13,875 | 6,938 | 19,425 | 9,713 |
| 75.26 | 190,000 | 9,500 | 14,250 | 7,125 | 19,950 | 9,975 |
| 75.27 | 195,000 | 9,750 | 14,625 | 7,313 | 20,475 | 10,238 |
| 75.28 | 200,000 | 10,000 | 15,000 | 7,500 | 21,000 | 10,500 |
| 75.29 | 205,000 | 10,250 | 15,375 | 7,688 | 21,525 | 10,763 |
| 75.30 | 210,000 | 10,500 | 15,750 | 7,875 | 22,050 | 11,025 |
| 76.1 | 215,000 | 10,750 | 16,125 | 8,063 | 22,575 | 11,288 |
| 76.2 | 220,000 | 11,000 | 16,500 | 8,250 | 23,100 | 11,550 |
| 76.3 | 225,000 | 11,250 | 16,875 | 8,438 | 23,625 | 11,813 |
| 76.4 | 230,000 | 11,500 | 17,250 | 8,625 | 24,150 | 12,075 |

76.5 ¹The 1994 date refers to dwellings constructed under the 1994 Minnesota Energy Code.
 76.6 The default KAIR used in this section of the table is 0.20 ACH.

76.7 ²This section of the table is to be used for dwellings constructed prior to 1994. The default
 76.8 KAIR used in this section of the table is 0.40 ACH.

76.9 **REPEALER.** Minnesota Rules, parts 1346.0107; 1346.0507, subparts 3, 5, 11, and
 76.10 13; 1346.0510, subparts 2 and 3; 1346.0603, subpart 1; 1346.0709; 1346.0801, subpart
 76.11 2; 1346.1001; 1346.1007, subpart 2; 1346.5303; 1346.5304, subparts 2, 4, 5, 6, 7, and
 76.12 9; 1346.5402, subpart 1; 1346.5404, subparts 3 and 4; 1346.5503, subparts 2, 5, and 8;
 76.13 1346.5620; 1346.5629; and 1346.5630, subparts 1 and 2, are repealed.

- 76.14 **EFFECTIVE DATE.** These amendments are effective June 1, 2009, or five working
76.15 days after the notice of adoption is published in the State Register, whichever occurs later.