

# 2020 Minnesota State Mechanical Code MN rule chapter 1346 2018 International Mechanical Code 2018 International Fuel Gas Code

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Education, Codes, Rules and Grants

What is the objective for us today?

**Objective: Provide an overview of basic and essential requirements of the 2020 Minnesota Mechanical and Fuel Gas Codes.**

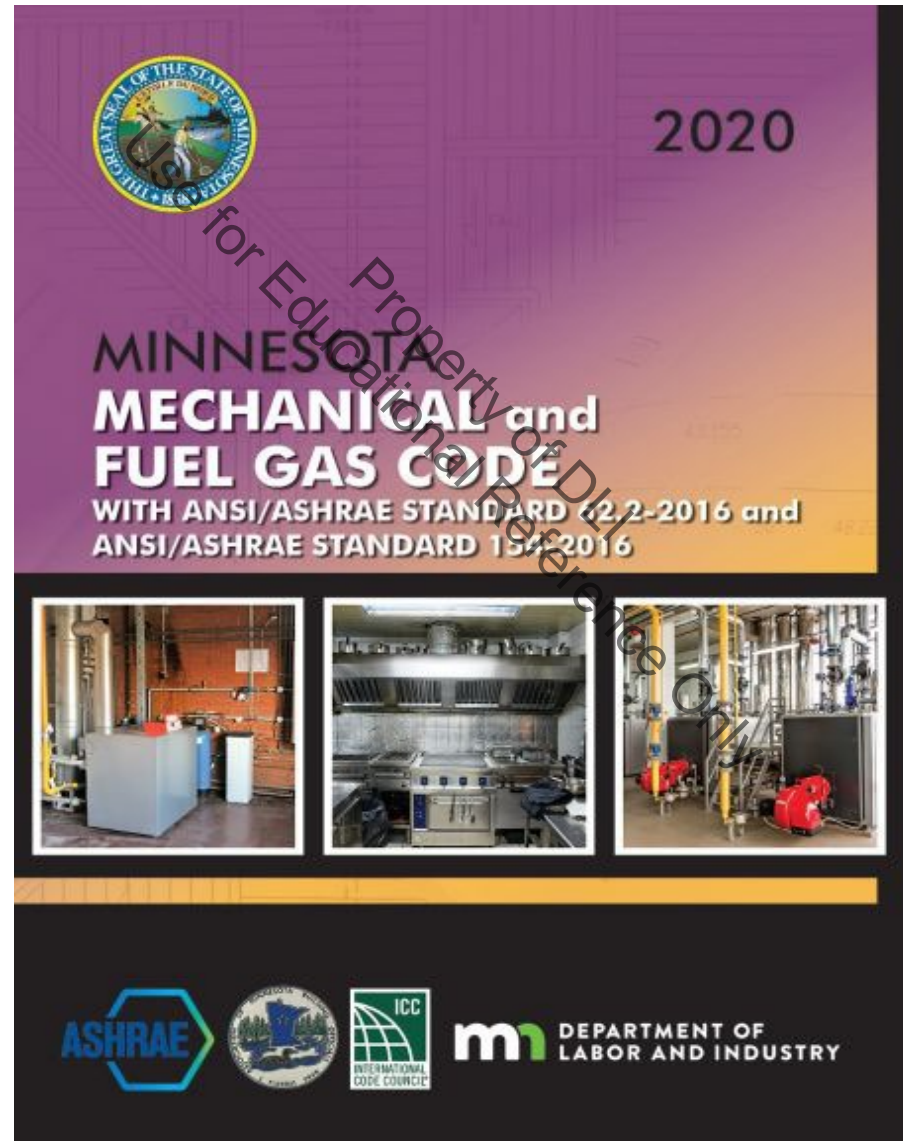
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# What is the outcome for us today?

**Outcome: Participants will gain an understanding of basics of the code book and some things to look for when performing inspections.**

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# 2020 Minnesota Mechanical Code

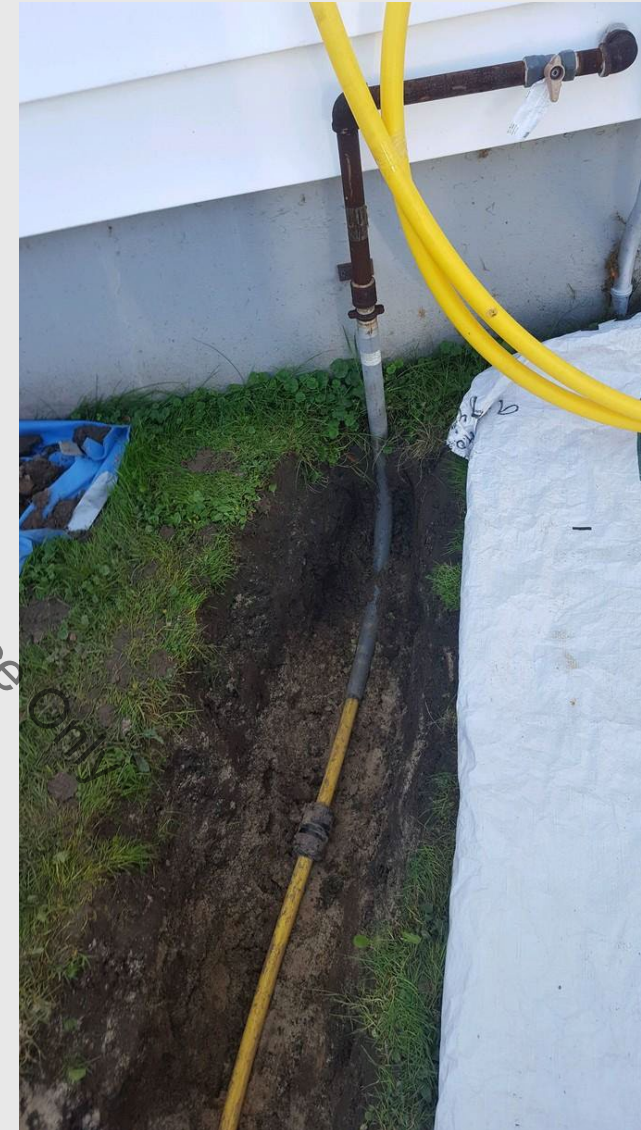


# Minnesota mechanical code make up

- **Chapters 2 to 15 of the 2018 edition of the International Mechanical Code (IMC)**
- **Chapters 2 to 8 of the 2018 edition of the International Fuel Gas Code (IFGC)**
- **Minnesota Administrative Rules**
  - **Chapter 1346, Minnesota Mechanical and Fuel Gas Codes (Minnesota Amendments)**

- **MR 1346.0060** References to other codes adopted in Minnesota.
- **MR 1346.0101 Scope.** What is covered by the Minnesota Mechanical Code.
- **MR 1346.0106 Required Inspections.** Underground before covering. Rough-in before any covering of HVAC. Final upon completion of HVAC before occupancy.

# 2020 Minnesota Mechanical Code Underground Inspection



# 2020 Minnesota Mechanical Code Rough-In Inspection



# 2020 Minnesota Mechanical Code Final Inspection



In English, please!

## Chapter 2 Definitions

- **AIR.** All air supplied to mechanical *equipment* and appliances for *combustion*, ventilation, cooling, etc. Standard air is air at standard temperature and pressure, namely, 70°F and 29.92 inches of mercury.
- **AIR, EXHAUST.** Air being removed from any space, *appliance* or piece of *equipment* and conveyed directly to the atmosphere by means of openings or ducts.
- **COMBUSTION AIR.** Air necessary for complete *combustion* of a fuel, including *theoretical air* and excess air.

- **EXCESS AIR.** The amount of air provided in addition to *theoretical air* to achieve complete *combustion* of a fuel, thereby preventing the formation of dangerous products of *combustion*.
- **ENVIRONMENTAL AIR.** Air that is conveyed to or from occupied areas through ducts which are not part of the heating or air-conditioning system, such as ventilation for human usage, domestic kitchen range exhaust, bathroom exhaust, domestic clothes dryer exhaust and parking garage exhaust.
- **OUTDOOR AIR.** Air taken from the outdoors, and therefore not previously circulated through the system.

- **POWERED MAKEUP AIR.** Air which must be brought in from the outdoors by means of a fan to replenish the air expelled by a mechanical exhausting device.
- **RETURN AIR.** Air removed from an *approved* conditioned space or location and recirculated or exhausted.
- **SUPPLY AIR.** That air delivered to each or any space supplied by the air distribution system or the total air delivered to all spaces supplied by the air distribution system, which is provided for ventilating, heating, cooling, humidification, dehumidification and other similar purposes.

- **THEORETICAL AIR.** The exact amount of air required to supply oxygen for complete *combustion* of a given quantity of a specific fuel.
- **VENTILATION AIR.** That portion of supply air that comes from the outside (outdoors), plus any recirculated air that has been treated to maintain the desired quality of air within a designated space.

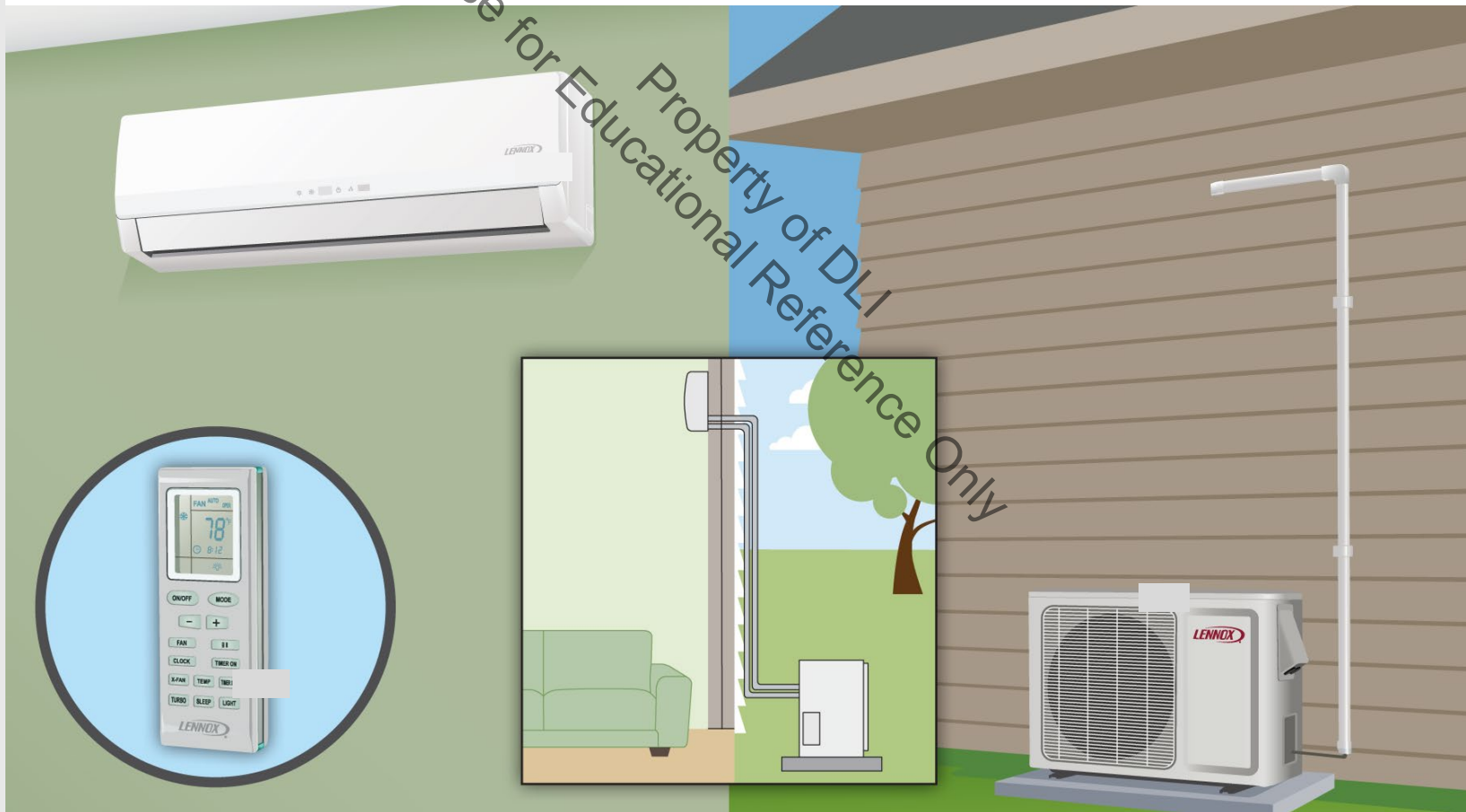
**COMMERCIAL COOKING APPLIANCE.** An appliance specifically designed to be used in a food-service-establishment kitchen, including but not limited to a restaurant or cafeteria kitchen. Appliances designed for residential use shall be treated as commercial appliances when installed in commercial food-service establishments.



### **DUCTLESS MINI-SPLIT SYSTEM.**

A heating and cooling system that is comprised of one or multiple indoor evaporator/air-handling units and an outdoor condensing unit that is connected by refrigerant piping and electrical wiring. A ductless mini-split system is capable of cooling or heating one or more rooms without the use of a traditional ductwork system.

### DUCTLESS MINI-SPLIT SYSTEM.



### PRESS-CONNECT JOINT

A permanent mechanical joint incorporating an elastomeric seal or an elastomeric seal and corrosion-resistant grip ring. The joint is made with a pressing tool and jaw or ring approved by the fitting manufacturer.



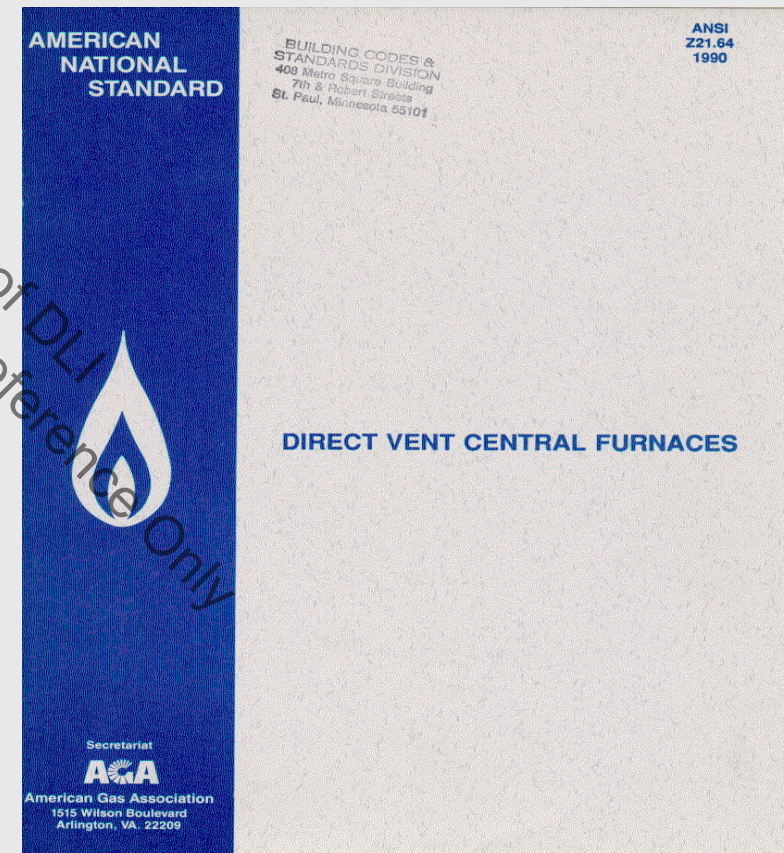
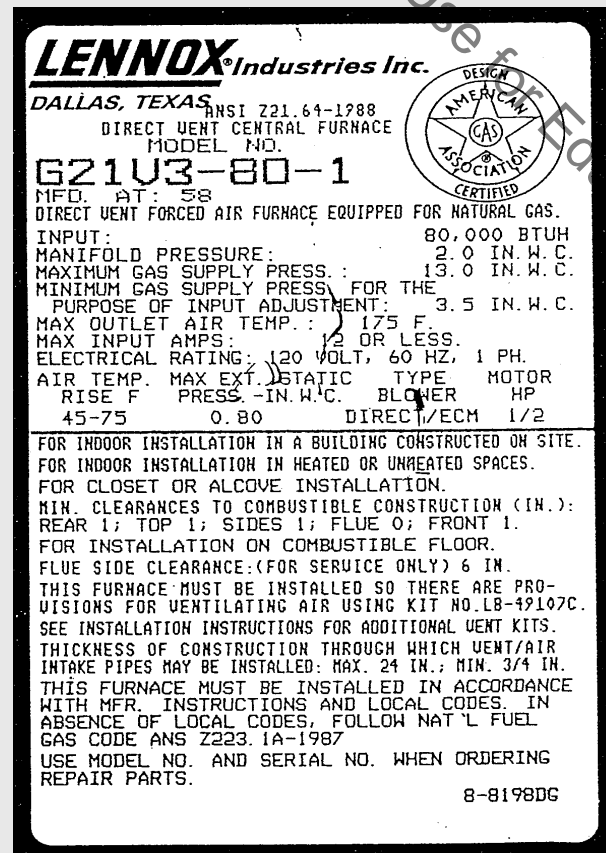


## Chapter 3 General Regulations

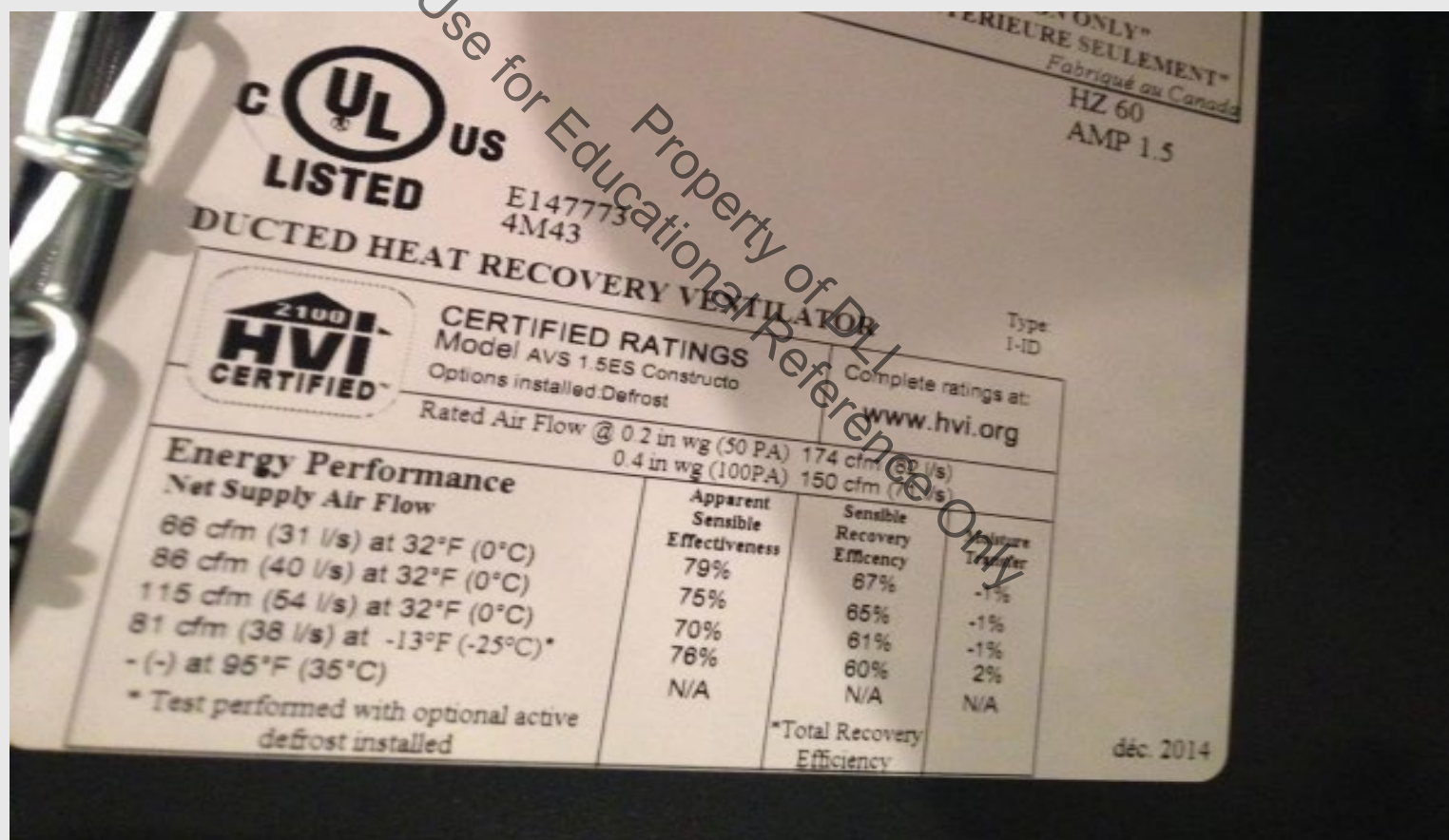
### 301.7 Listed and labeled.

Appliances regulated by this code shall be ***listed and labeled*** to an appropriate standard. The approval of unlisted ***appliances*** shall be based upon engineering evaluation. ***Unlisted appliances*** with a fuel input rating of less than 12,500,000 Btu/hr shall have fuel trains, controls, and safety devices installed in accordance with Part CF, Combustion Side Control, of ASME CSD-1. ***Unlisted appliances*** with a fuel input rating of 12,500,000 Btu/hr or greater shall have fuel trains, controls, and safety devices installed in accordance with NFPA 85.

# Equipment Approval & Listing



## Equipment Approval & Listing



### **R602.6: Drilling and notching of studs:** shall be in accordance with the following:

1. Notching. Any stud in an exterior wall or bearing partition may be cut or notched to a depth not exceeding 25% of its width. Studs in nonbearing partitions may be notched to a depth not to exceed 40% of a single stud width.

2. Drilling. Any stud may be bored or drilled, provided that the diameter of the resulting hole is no more than 60% of the stud width, the edge of the hole is no more than  $\frac{5}{8}$  inch to the edge of the stud, and the hole is not located in the same section as a cut or notch. Studs located in exterior walls or bearing partitions drilled over 40% and up to 60% shall also be doubled with no more than two successive doubled studs bored.

### **R602.6.1: Drilling and notching of top plate.**

When piping or ductwork is placed in or partly in an exterior wall or interior load-bearing wall, necessitating cutting, drilling or notching of the top plate by more than 50% of its width, a galvanized metal tie not less than 0.054 inch thick (16 ga) and 1½ inches wide shall be fastened across and to the plate at each side of the opening with not less than eight 10d having a minimum length of 1½ inches at each side or equivalent. The metal tie must extend a minimum of 6 inches past the opening.

- Cutting and Notching
- Cut plate strap



- **304.1 General.**

*Equipment* and appliances shall be installed in accordance with the listing, the manufacturer's installation instructions and this code. Installation instructions shall be available for the inspection.

- **304.2 Conflicts.**

Where conflicts between this code and the conditions of listing or the manufacturer's installation instructions occur, the provisions of this code shall apply. **Exception:** Where a code provision is less restrictive the manufacturer's installation instructions shall apply.



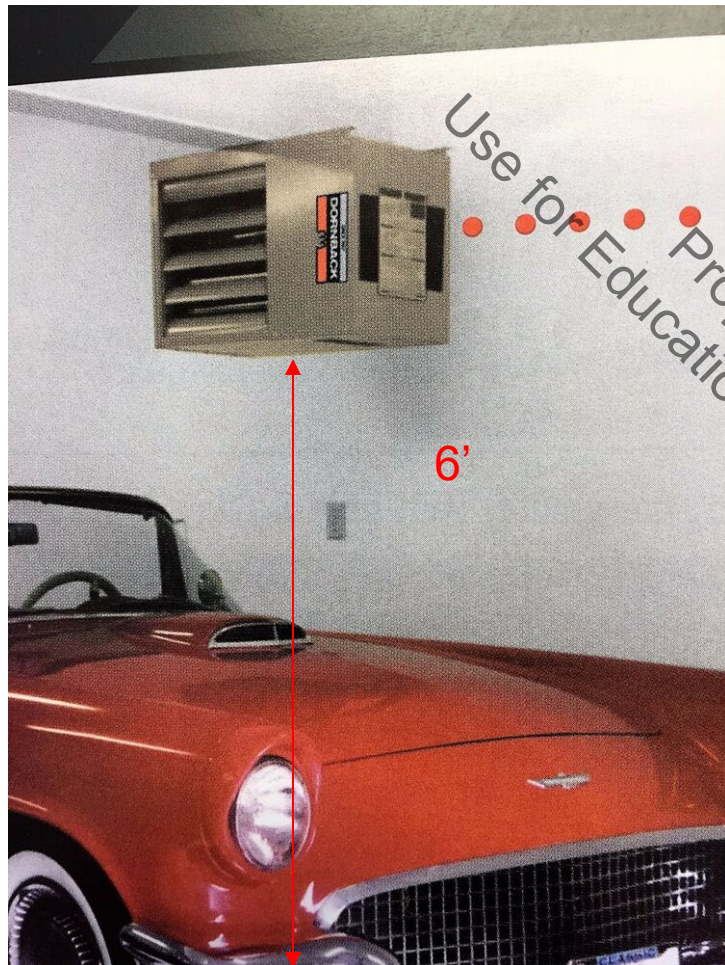
- **304.3 Elevation of ignition source.**

Equipment and appliances having an *ignition source* and located in hazardous locations and public garages, private garages, repair garages, automotive motor fuel-dispensing facilities and parking garages shall be elevated such that the source of ignition is not less than **18 inches** above the floor. For the purpose of this section, rooms or spaces that are not part of the living space of a *dwelling unit* and that communicate directly with a private garage through openings shall be considered to be part of the private garage.

- **304.7 Private garages.**

Appliances located in private garages and carports shall be installed with a minimum clearance of **6 feet** above the floor.

- **Exception:** The requirements of this section shall not apply where the appliances are protected from motor vehicle impact and installed in accordance with Section 304.3.



### 304.11 Guards.

Guards shall be provided where appliances, *equipment*, fans or other components that require service and roof hatch openings are located within 10' of a roof edge or open side of a walking surface and such edge or open side is located more than 30" above the floor, roof or grade below. The guard shall extend not less than 30" beyond each end of such appliances, *equipment*, fans, components and roof hatch openings and the top of the guard shall be located not less than 42" above the elevated surface adjacent to the guard. The guard shall be constructed to prevent the passage of a 21" diameter sphere and shall comply with the loading requirements for guards specified in the *International Building Code*.

## Chapter 304.11 Guards



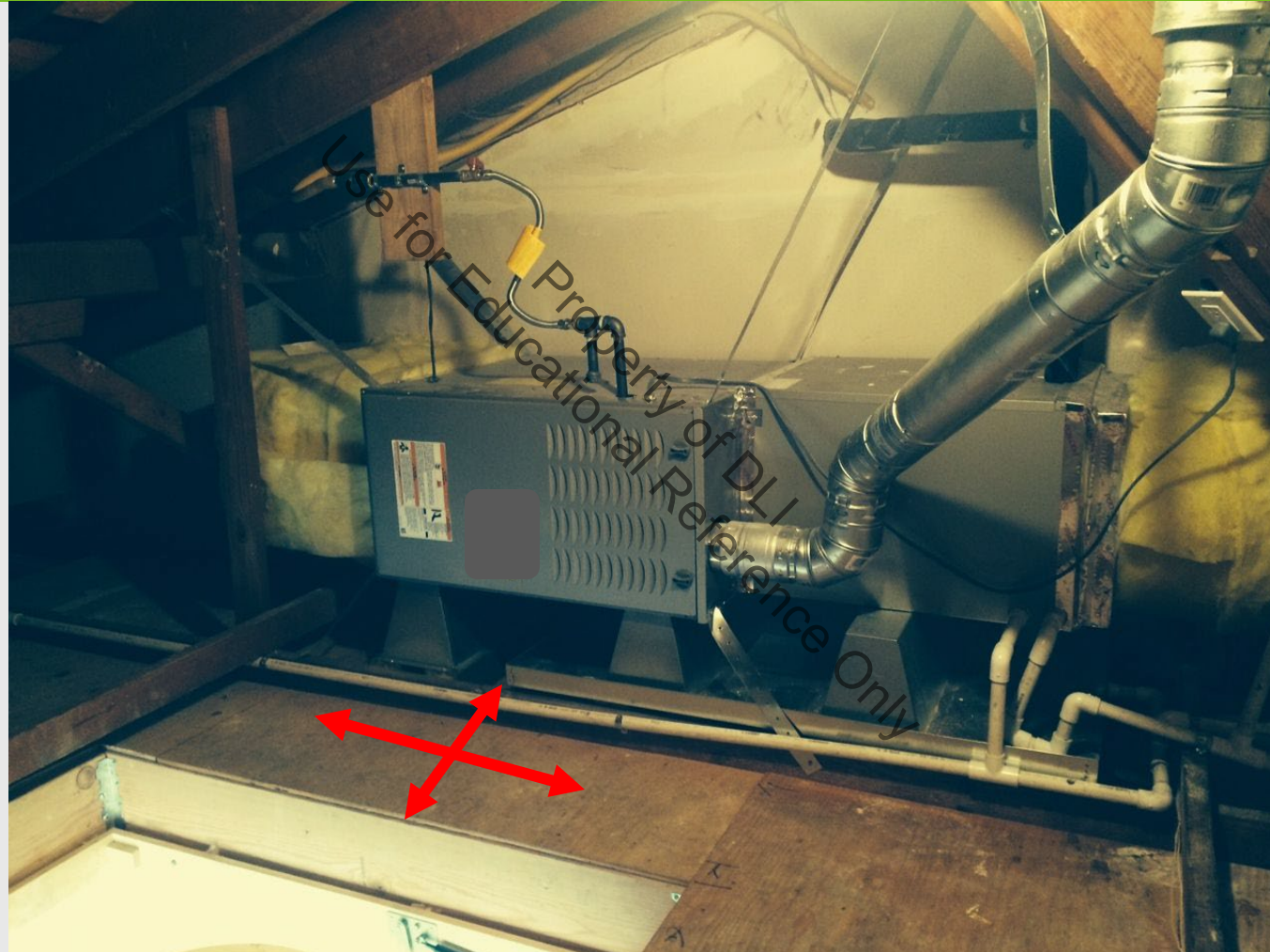
### **Exception:**

Guards are not required where fall arrest/restraint anchorage connector devices that comply with ANSI/ASSE Z 359.1 are installed.

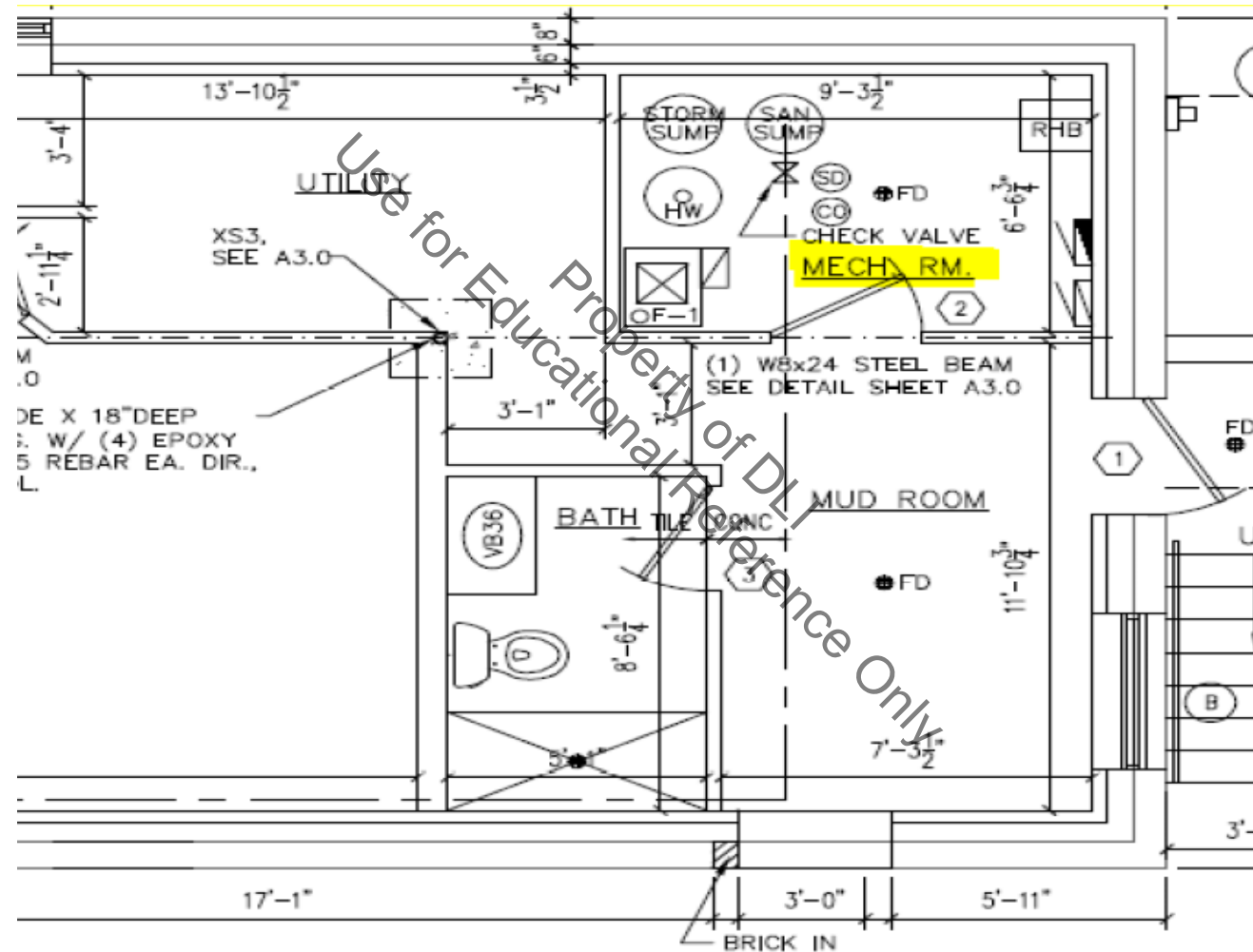


### 306.1 Access for maintenance and replacement.

Appliances, control devices, heat exchangers and HVAC system components that utilize energy shall be accessible for inspection, service, repair and replacement without disabling the function of a fire-resistance-rated assembly or removing permanent construction, other appliances, venting systems or any other piping or ducts not connected to the *appliance* being inspected, serviced, repaired or replaced. A level working space at least **30" deep** and **30" wide** shall be provided in front of the control side to service an *appliance*.



**306.2 Appliances in rooms.** Within a *dwelling unit*, appliances installed in a compartment, alcove, basement or similar space shall be accessed by an opening or door and an unobstructed passageway measuring not less than **24"** wide and large enough to allow removal of the largest *appliance* in the space, provided that a level service space of not less than **30"** deep and the height of the *appliance*, but not less than **30"**, is present at the front or service side of the *appliance* with the door open.



- **307.1 Fuel-burning appliances.**

Condensate must discharge to an *approved* plumbing fixture or disposal area in accordance with the manufacturer's installation instructions. Piping shall maintain a minimum pitch in the direction of discharge of not less than **1/8" per ft.**

- **307.2.2 Drain pipe materials & sizes.** (evaporators & cooling coils)

The condensate piping shall be cast iron, galvanized steel, copper, cross-linked polyethylene, polybutylene, polyethylene, ABS, CPVC or PVC pipe or tubing.

Condensate drain line size shall be not less than **3/4"** and shall not decrease in size from the drain pan to the place of condensate disposal.

- **307.2.3 Auxiliary and secondary drain systems.**

Where damage to any building components could occur as a result of overflow, one of the following auxiliary protection methods shall be provided for each cooling coil or fuel-fired *appliance* that produces condensate:

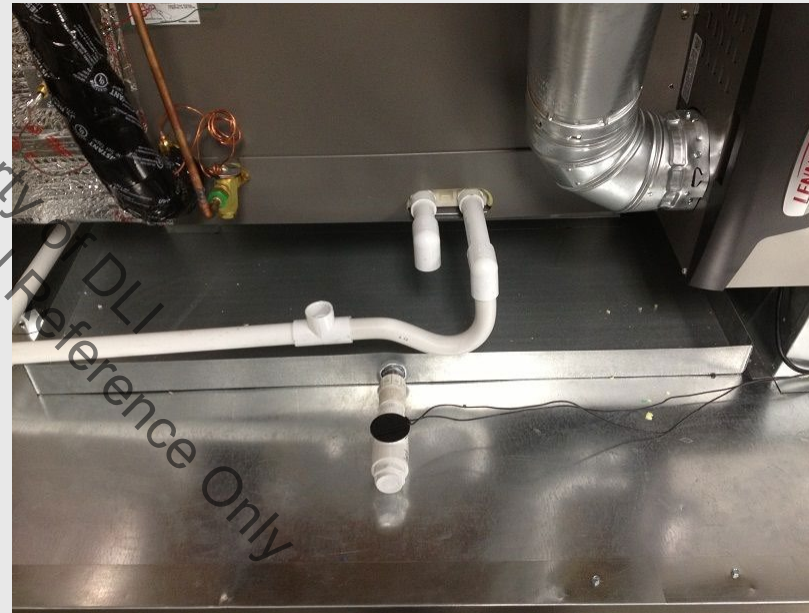
1. A drain pan with a separate drain shall be provided under the coils on which condensation will occur. The auxiliary pan drain shall discharge to a conspicuous point of disposal to alert occupants in the event of a stoppage of the primary drain. The pan shall have a minimum depth of  $1\frac{1}{2}$ " , shall not be less than **3"** larger than the unit or the coil dimensions in width and length and shall be constructed of corrosion-resistant material.

### 307.2.3 Auxiliary and secondary drain systems. (Cont.)

2. A separate overflow drain line shall be connected to the drain pan. The overflow drain shall discharge to a conspicuous point of disposal in the event of a stoppage of the primary drain. The overflow drain line shall connect to the pan at a higher level than the primary drain connection.
3. An auxiliary drain pan without a separate drain line shall be provided under the coils on which condensate will occur. Such pan shall be equipped with a **water-level detection device conforming to UL 508** that will shut off the *equipment* served prior to overflow of the pan.

### 307.2.3 Auxiliary and secondary drain systems. (Cont.)

4. A water-level detection device conforming to UL 508 shall be provided that will shut off the *equipment* served in the event that the primary drain is blocked. The device shall be installed in the primary drain line, the overflow drain line, or in the equipment-supplied drain pan, located at a point higher than the primary drain line connection and below the overflow rim of such pan.



- **312.1 Load calculations.**

Heating and cooling system design loads for the purpose of sizing systems, appliances and *equipment* shall be determined in accordance with the procedures described in the ASHRAE/ACCA Standard 183. Alternatively, design loads shall be determined by an *approved* equivalent computation procedure, using the design parameters specified in Chapter 3 of the *International Energy Conservation Code*.

# Chapter 3 Heating and Cooling Load Calculations

**Heat Loss Calculation Table for Residential Construction**

MANUAL or COMPUTERIZED CALCULATIONS

Contractor/Builder:				Address or Master#:				Date:							
1	Space under consideration				Crawl space		Basement		Main Floor		Upper Floor		Entire House		
2	Running perimeter of exterior wall (feet)														
3	Floor area (square feet)														
4	Wall Height (feet)														
	TYPE OF EXPOSURE	Material	R	U	ΔT	Area	BTU/hr	Area	BTU/hr	Area	BTU/hr	Area	BTU/hr	Area	BTU/hr
5	Net exposed walls	A. Concrete earth			25										
B. Concrete air				68											
C. 2x4				68											
D. 2x6				68											
6	Windows and Glass doors	E. Window bsmt			68										
F. Window other				68											
G. Glass door				68											
7	Solid doors	H.			68										
8	Net roof	I. Flat ceiling			68										
	Skylights	J.			68										
8a	Net roof	Ja Sloped ceiling			68										
	Pitch in 12														
	Skylights	Ja			68										
9	Floors on grade	K. Slab insulation			25										
10	Floors / unheated	L.			68										
11	Floors / exterior	M.			68										
12	Building Envelope Heat Loss (Sum rows 5 through 11)						BTU/hr	BTU/hr	BTU/hr	BTU/hr	BTU/hr	BTU/hr	BTU/hr	BTU/hr	
13	Infiltration Heat Loss (Row 3 x Row 4 x 0.52)						BTU/hr	BTU/hr	BTU/hr	BTU/hr	BTU/hr	BTU/hr	BTU/hr	BTU/hr	
14	Total Heat Loss (Sum Rows 12 and 13)						BTU/hr	BTU/hr	BTU/hr	BTU/hr	BTU/hr	BTU/hr	BTU/hr	BTU/hr	
15	Altitude Deration	Caloric deration of natural gas				Output	Output	Output	Output	Output	Output	Output	Output	Total Output	
		Multiply Row 14 by: 1.25				BTU/hr	BTU/hr	BTU/hr	BTU/hr	BTU/hr	BTU/hr	BTU/hr	BTU/hr	BTU/hr	
16	Efficiency Deration	Efficiency of heating equipment				Input	Input	Input	Input	Input	Input	Input	Input	Total Input	
		Divide Row 15 by: %				BTU/hr	BTU/hr	BTU/hr	BTU/hr	BTU/hr	BTU/hr	BTU/hr	BTU/hr	BTU/hr	

September 2006

# MN Amendment to IMC 313

## Carbon Monoxide Alarms

### 1346.0313 SECTION 313 CARBON MONOXIDE ALARMS.

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

**313.1 General.** Carbon monoxide alarms shall be installed in new and existing rooms containing a fuel-burning appliance that is utilized to control environmental conditions and produces carbon monoxide during operation.

### 1346.0313 SECTION 313 CARBON MONOXIDE ALARMS.

#### Exceptions:

1. Rooms containing a boiler that is regulated by Minnesota Rules, chapter 5225 (MN Boiler Code), shall be provided with carbon monoxide alarms in accordance with that chapter.
2. Where the room containing the fuel-burning appliance is located in a building regulated by the **International Residential Code**, **carbon monoxide alarms shall be provided in accordance with Minnesota Rules, chapter 1309.**



## Chapter 4 Ventilation

**401.1 Scope.**

This chapter shall govern the ventilation of spaces within a building intended to be occupied.

Mechanical exhaust systems, clothes dryers and cooking appliances; hazardous exhaust systems; dust, stock and refuse conveyor systems; sub-slab soil exhaust systems; smoke control systems; energy recovery ventilation systems and other systems specified in Section 502 shall comply with Chapter 5.

### **401.2. Ventilation required.**

Every occupied space other than buildings constructed in accordance with the IRC and Group R-2, R-3, and R-4 occupancies three stories and less in height shall be ventilated by natural means per 402 or mechanical means per 403. Ambulatory care facilities and Group I-2 occupancies shall be ventilated by mechanical means in accordance with 407.

- **401.2. Ventilation in IRC Buildings.**

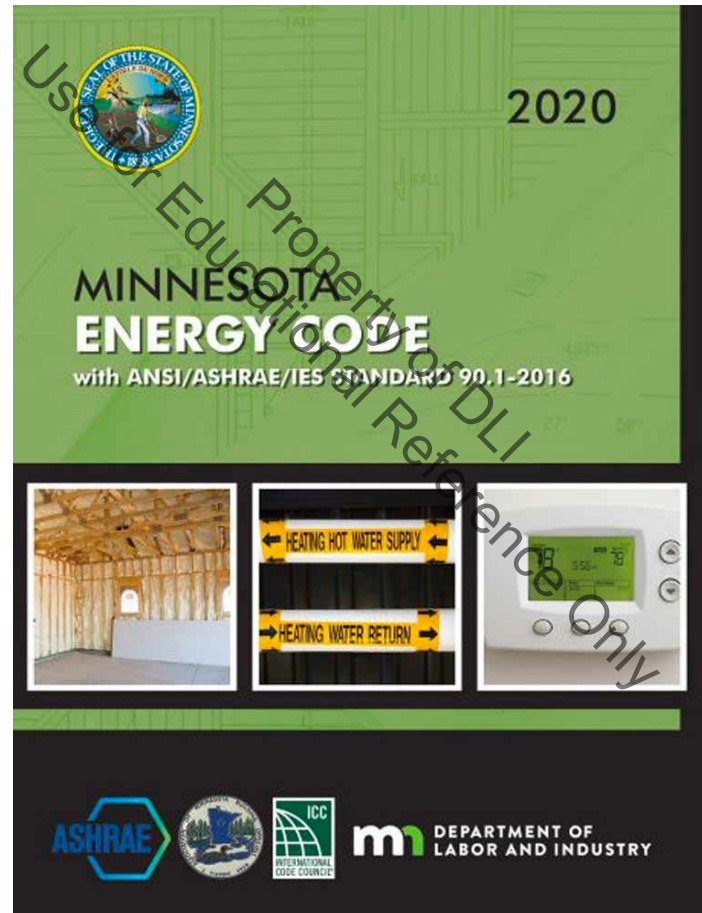
Ventilation in IRC buildings shall comply with Minnesota Rules Chapter 1322

- **401.2.2. Ventilation in R-2, R-3 and R-4 3 stories and less.**

Ventilation in above occupancies 3 stories and less shall have balanced ventilation, fan efficacy as in MR 1322 and ventilation per MR 1322 or ASHRAE 62.2.

- **401.2.3. Ventilation in R-2, R-3 and R-4 more than 3 stories.**

Ventilation in above occupancies over 3 stories shall comply with IMC 402, IMC 403 or ASHRAE 62.2.



# 2020 Minnesota Residential Energy Code MR 1322

- SECTION R403 SYSTEMS
- **R403.1 Controls (Mandatory)**
- **R403.1.1 Programmable thermostat**

- **R403.2 Ducts.**

- **R403.2.1 Insulation (prescriptive)**

All exhaust, supply, and return air ducts and plenums shall be insulated according to Table R403.2.1.

# 2020 Minnesota Residential Energy Code MR 1322

- **R403.2.2 Sealing (Mandatory)**
- **R403.2.2.1 Sealed air handler**
- **R403.2.3 Building cavities (Mandatory)**
- **R403.5 Mechanical ventilation (mandatory)**
- **Table R403.5.1 Ventilation Fan Efficacy (Efficiency)**
- **R403.5.1 Alterations**

# 2020 Minnesota Residential Energy Code MR 1322

- **R403.5.5 Balanced and HRV/ERV systems.**
- **R403.5.6 Installation requirements.**
- **R403.5.6.1 Air distribution/circulation.**
- **R403.5.6.1.1 Forced air circulation systems.**
- **R403.5.6.1.2 Directly ducted and individual room inlets.**
- **R403.5.6.1.3 Airflow verification.**
- **R403.5.7 Fans.**
- **R403.5.8 Multi-fan systems.**

# 2020 Minnesota Residential Energy Code MR 1322

- **R403.5.9 Connection to forced air circulation systems.**
- **R403.5.10 Dampers.**
- **R403.5.11 Intake openings.**
- **R403.5.12 Filtration.**
- **R403.5.13 Noise and vibration.**
- **R403.5.14 Controls.**
- **R403.5.15 Labeling.**
- **R403.5.16 Documentation.**

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# 2020 Minnesota Residential Energy Code MR 1322

- **R403.5.17 Climatic design conditions.**
- **R403.6 Equipment Sizing (Mandatory).**
- **R403.7 Systems serving multiple dwelling units (Mandatory).**
- **R403.8 Snow melt system controls (Mandatory).**
- **R403.9 Pools and inground permanently installed spas (Mandatory).**
- **R403.9.1 Heaters.**

# MN Amendment to IMC 401.2.1 IRC Building Ventilation Requirements

IRC buildings must comply with MR 1322.

- Single family,
- Two-family
- Townhomes (open on minimum 2 sides)



# MN Amendment to IMC 401.2.2

## Group R-2, R-3, R-4; 3 Stories or Less Ventilation Requirements

3-story or less must comply with either MR 1322 **OR** ASHRAE 62.2 (including balancing and fan efficacy provisions of MR 1322)

- R-2: Apartments.
- R-3: Assisted living.
- R-4: Residential building with custodial care.



# MN Amendment to IMC 401.2.2

## Group R-2, R-3, R-4; More than 3 Stories Ventilation Requirements

Over 3 stories must comply with either IMC 402, IMC 403 **OR** ASHRAE 62.2

- R-2: Apartments.
- R-3: Assisted living.
- R-4: Residential building with custodial care.



# 2020 Minnesota Residential Energy Code MR 1322

## DUCT INSULATION FOR DWELLING UNITS REQUIREMENTS

<u>Exterior of building</u>	<u>R-8, V &amp; W</u>
<u>Attics, garages, crawl spaces</u>	<u>R-8 and V</u>
<u>Outdoor air intakes within conditioned spaces</u>	<u>R3.3 and V</u>
<u>Exhaust ducts within conditioned spaces</u>	<u>R3.3 and V</u>
<u>In cement slab or in ground</u>	<u>R3.5 and V</u>
<u>In conditioned spaces and basements with insulated walls</u>	<u>None Required</u>



## R403.5.2 Total ventilation rate.

The mechanical ventilation system shall provide outdoor air for the total ventilation rate average for each 1-hour period in accordance with Table R403.5.2, or Equation R403.5.2, based on the number of bedrooms & square footage, including basement and crawl spaces.

For Table R403.5.2 and Section R403.5.3, the following applies:

a. Equation R403.5.2 **Total ventilation**:  $\text{Total ventilation (cfm)} = (0.02 \times \text{sq/ft conditioned space}) + [15 \times (\text{number of bedrooms} + 1)]$ .

b. Equation R403.5.2.1 **Continuous ventilation** rate:  $\text{Continuous ventilation rate (cfm)} = \text{Total ventilation rate} / 2$ .

# 2020 Minnesota Residential Energy Code MR 1322

1500 sq ft house with 2 bedrooms

**Total ventilation** =  $(1500 \times .02) 30 + (2 \times 15 + 15) 45 = \mathbf{75 \text{ CFM}}$

**Continuous Ventilation** =  $\frac{1}{2}$  total ventilation but not less than **40 CFM**

# 2020 Minnesota Residential Energy Code MR 1322

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



## Chapter 5 Exhaust Systems

- **501.3 Exhaust discharge.**

The air removed by every mechanical exhaust system shall be discharged outdoors not less than the distances specified in IMC Section 501.3.1. Air shall not be exhausted into an attic or crawl space and the exhaust system shall be equipped with a backdraft damper at the point of discharge.

- **501.3.1 Location of exhaust outlets.**

The termination point of exhaust outlets and ducts discharging to the outdoors shall be located with the following minimum distances:



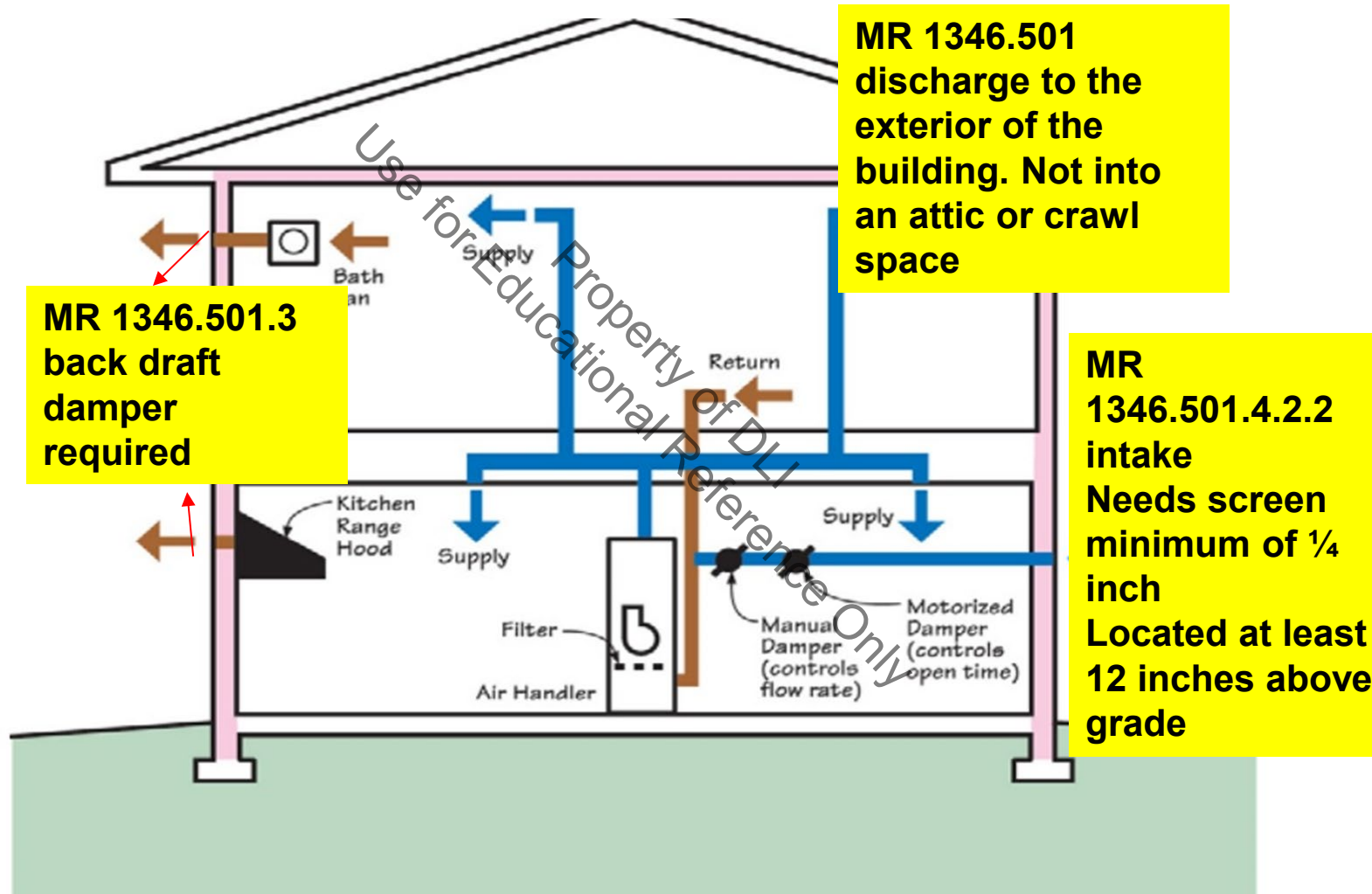


3. For all environmental air exhaust: **3 feet** from property lines; **3 feet** from operable openings into buildings for all occupancies other than Group U, and **10 feet** from mechanical air intakes. Such exhaust shall not be considered hazardous or noxious.

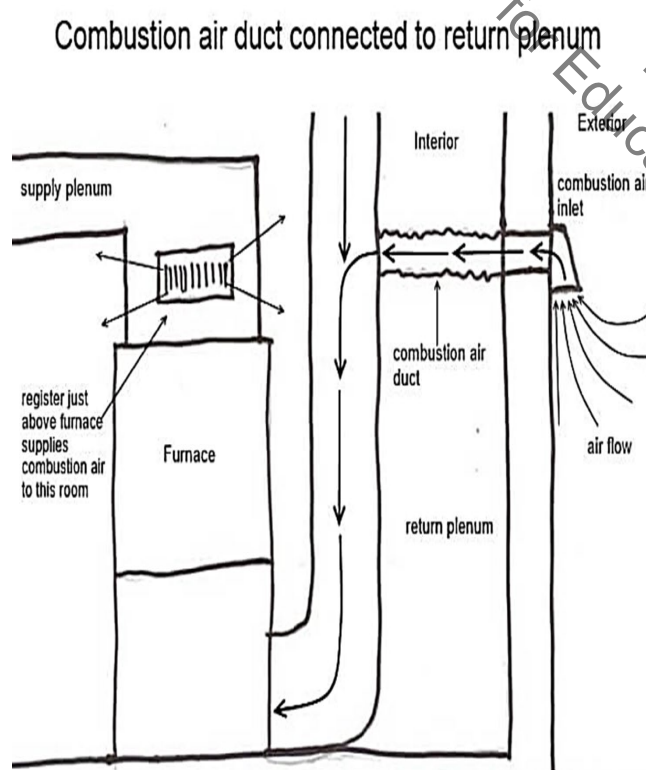


- **ENVIRONMENTAL AIR.** Air that is conveyed to or from occupied areas through ducts which are not part of the heating or air-conditioning system, such as ventilation for human usage, domestic kitchen range exhaust, bathroom exhaust, domestic clothes dryer exhaust and parking garage exhaust.

# What is an Exhaust Air System?



## Mechanical Air Inlet 10' from environmental air exhaust



### Gravity Air Inlet 3' from Environmental Air Exhaust



### 501.3.2 Exhaust opening protection.

Exhaust openings shall be protected with corrosion-resistant screens, louvers or grilles. Openings in screens, louvers and grilles shall be sized not less than  $\frac{1}{4}$  inch and not larger than  $\frac{1}{2}$  inch. Openings shall be protected against local weather conditions. Outdoor openings located in exterior walls shall meet the provisions for exterior wall opening protectives in accordance with the *International Building Code*.



# What is a make up air system

- Replenishes the air removed from the home by exhaust air systems

## Back-drafting Water Heater



# How much make up air is required in (new dwellings)

- **MR 1346.501.4.1 Makeup air in new dwellings.**

- Determined by using IMC Table 501.4.1
- Needs to be supplied in accordance with IMC section 501.4.2

- **MR 1346.501.4.1 Makeup air in new dwellings.**

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

Table 501.4.1 New Dwellings  
Procedure to Determine Makeup Air in Dwellings

	APPLIANCES OR NO COMBUSTION APPLIANCES <sup>A</sup>	APPLIANCES AND POWER VENT OR DIRECT VENT APPLIANCES <sup>B</sup>	APPLIANCE OR ONE SOLID FUEL APPLIANCE <sup>C</sup>	VENTED GAS OR OIL APPLIANCES OR SOLID FUEL APPLIANCES <sup>D</sup>
1. Use the Appropriate Column to Estimate House Infiltration				
a) pressure factor (cfm/sf)	0.15	0.09	0.06	0.03
b) conditioned floor area (sf)	—	—	—	—
(including unfinished basements)				
Estimated House Infiltration (cfm): [1a × 1b]	—	—	—	—
2. Exhaust Capacity				
a) clothes dryer	135	135	135	135
b) 80% of largest exhaust rating (cfm):	—	—	—	—
(not applicable if recirculating system or if powered <i>makeup air</i> is electrically interlocked and matched to exhaust)				
c) 80% of next largest exhaust rating (cfm):	not applicable	—	—	—
(not applicable if recirculating system or if powered <i>makeup air</i> is electrically interlocked and matched to exhaust)				
Total Exhaust Capacity (cfm): [2a+2b+2c]	—	—	—	—
3. Makeup Air Requirement				
a) Total Exhaust Capacity (from above)	—	—	—	—
b) Estimated House Infiltration (from above)	—	—	—	—
Makeup Air Quantity (cfm): [3a - 3b]	—	—	—	—
(if value is negative, no makeup air is needed)				
4. For Makeup Air Opening Sizing, refer to Table 501.4.2.				

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

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

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

# MR. 1346 Table 501.4.1

	ONE OR MULTIPLE POWER VENT OR DIRECT VENT APPLIANCES OR NO COMBUSTION APPLIANCES <sup>A</sup>	ONE OR MULTIPLE FAN-ASSISTED APPLIANCES AND POWER VENT OR DIRECT VENT APPLIANCES <sup>B</sup>	ONE ATMOSPHERICALLY VENTED GAS OR OIL APPLIANCE OR ONE SOLID FUEL APPLIANCE <sup>C</sup>	THAT ARE ATMOSPHERICALLY VENTED GAS OR OIL APPLIANCES OR SOLID FUEL APPLIANCES <sup>D</sup>
1. Use the Appropriate Column to Estimate House Infiltration				
a) pressure factor (cfm/sf)	0.15	0.09	0.06	0.03
b) conditioned floor area (sf)	—	—	—	2092 sq, ft
(including unfinished basements)				
Estimated House Infiltration (cfm): [1a × 1b]	—	—	—	62.76 cfm
2. Exhaust Capacity				
a) clothes dryer	135	135	135	135
b) 80% of largest exhaust rating (cfm):	—	—	—	160 cfm Kitchen exhaust
(not applicable if recirculating system or if powered <i>makeup air</i> is electrically interlocked and matched to exhaust)				
c) 80% of next largest exhaust rating (cfm):	not applicable	—	—	40 cfm bathroom exhaust
(not applicable if recirculating system or if powered <i>makeup air</i> is electrically interlocked and matched to exhaust)				
Total Exhaust Capacity (cfm): [2a+2b+2c]	—	—	—	335 cfm
3. Makeup Air Requirement				
a) Total Exhaust Capacity (from above)	—	—	—	335 cfm
b) Estimated House Infiltration (from above)	—	—	—	62.76 cfm
Makeup Air Quality (cfm): [3a - 3b]	—	—	—	273 cfm
(if value is negative, no makeup air is needed)				
4. For Makeup Air Opening Sizing, refer to Table 501.4.2.				

- A. Use this column if there are other than fan-assisted or atmospherically vented gas or oil *appliances* or if there are no *combustion appliances*.
- B. Use this column if there is one fan-assisted *appliance* per venting system. Other than atmospherically vented *appliances* may also be included.
- C. Use this column if there is one atmospherically vented (other than fan-assisted) gas or oil *appliance* per venting system or one solid fuel *appliance*.

- **501.4.2 Makeup air supply.**

*Makeup air* shall be provided by one of the following methods:

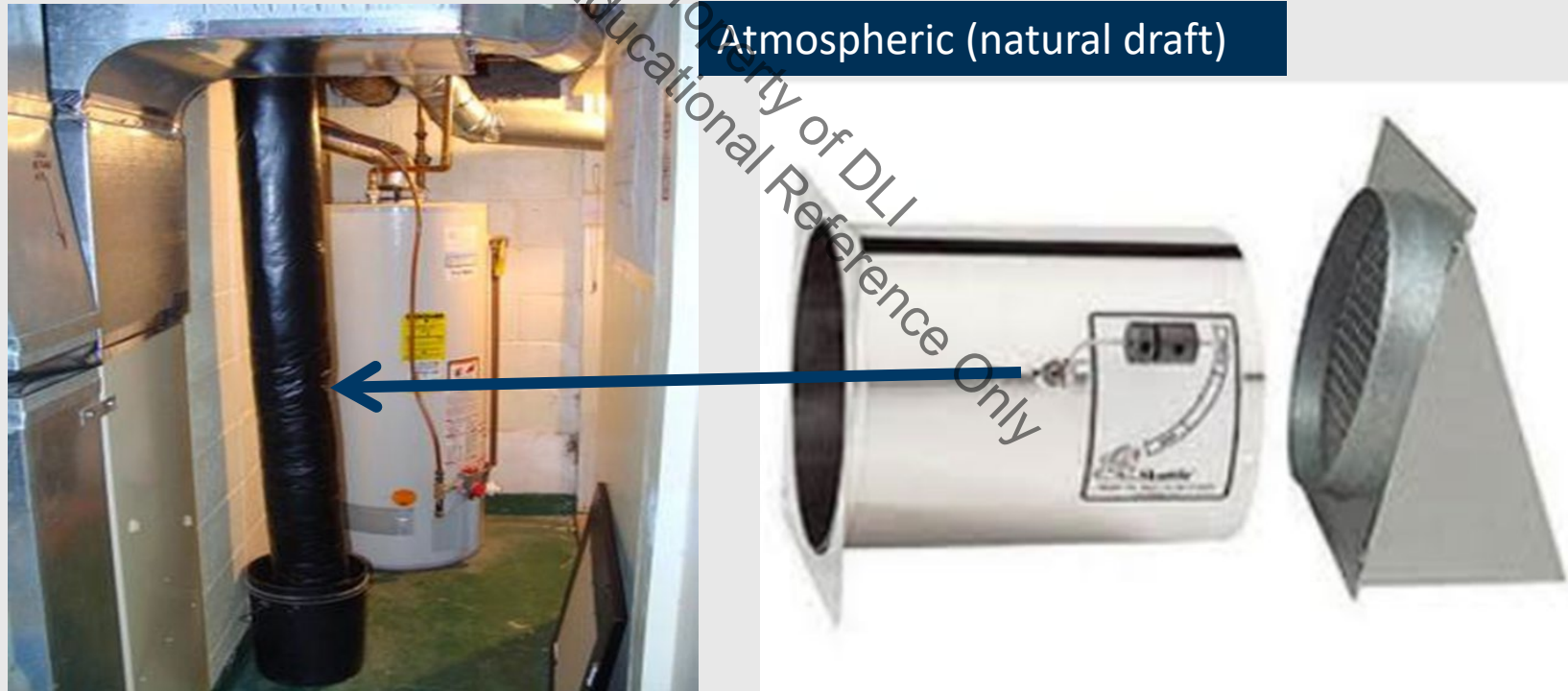
**1.1.** Passive *makeup air* openings shall be sized to Table 501.4.2.

**1.2.** Barometric dampers are prohibited.

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

# Requirements for how make up air is supplied MN 1346.501.4.2

Barometric dampers are prohibited in passive make up air openings when any atmospherically vented appliance is installed



# Requirements for how make up air is supplied MN 1346.501.4.2

Barometric dampers are prohibited in passive make up air openings when any atmospherically vented appliance is installed



### 501.4.2 Makeup air supply. (cont.)

- 2. Powered *makeup air* shall be provided if the size of a single opening or multiple openings exceeds **11 inches diameter**, or equivalent, when sized according to IMC Table 501.4.2. Powered *makeup air* shall comply with the following:
  - 2.1. Powered *makeup air* shall be electrically interlocked with the largest exhaust system.
  - 2.2. Powered makeup air shall be matched to the airflow of the largest exhaust system.

### 501.4.2 Makeup air supply. (cont.)

- 3. *Makeup air* shall be provided by a combination of passive openings and powered means according to IMC Table 501.4.2 and the following:
  - 3.1. Passive makeup air openings shall comply with item 1.
  - 3.2. Powered *makeup air* shall be supplied for the quantity of airflow in excess of the passive *makeup air* opening provided, and it shall be electrically interlocked with the exhaust system.

# MR 1346 Table 501.4.1

	ONE OR MULTIPLE POWER VENT OR DIRECT VENT APPLIANCES OR NO COMBUSTION APPLIANCES <sup>A</sup>	ONE OR MULTIPLE FAN-ASSISTED APPLIANCES AND POWER VENT OR DIRECT VENT APPLIANCES <sup>B</sup>	ONE ATMOSPHERICALLY VENTED GAS OR OIL APPLIANCE OR ONE SOLID FUEL APPLIANCE <sup>C</sup>	THAT ARE ATMOSPHERICALLY VENTED GAS OR OIL APPLIANCES OR SOLID FUEL APPLIANCES <sup>D</sup>
1. Use the Appropriate Column to Estimate House Infiltration				
a) pressure factor (cfm/sf)	0.15	0.09	0.06	0.03
b) conditioned floor area (sf)	—	—	—	2092 sq, ft
(including unfinished basements)				
Estimated House Infiltration (cfm): [1a × 1b]	—	—	—	62.76 cfm
2. Exhaust Capacity				
a) clothes dryer	135	135	135	135
b) 80% of largest exhaust rating (cfm):	—	—	—	160 cfm Kitchen exhaust
(not applicable if recirculating system or if powered <i>makeup air</i> is electrically interlocked and matched to exhaust)				
c) 80% of next largest exhaust rating (cfm):	not applicable	—	—	40 cfm bathroom exhaust
(not applicable if recirculating system or if powered <i>makeup air</i> is electrically interlocked and matched to exhaust)				
Total Exhaust Capacity (cfm): [2a+2b+2c]	—	—	—	335 cfm
3. Makeup Air Requirement				
a) Total Exhaust Capacity (from above)	—	—	—	335 cfm
b) Estimated House Infiltration (from above)	—	—	—	62.76 cfm
Makeup Air Quality (cfm): [3a - 3b]	—	—	—	273 cfm
(if value is negative, no makeup air is needed)				
4. For Makeup Air Opening Sizing, refer to Table 501.4.2.				

- A. Use this column if there are other than fan-assisted or atmospherically vented gas or oil *appliances* or if there are no *combustion appliances*.
- B. Use this column if there is one fan-assisted *appliance* per venting system. Other than atmospherically vented *appliances* may also be included.
- C. Use this column if there is one atmospherically vented (other than fan-assisted) gas or oil *appliance* per venting system or one solid fuel *appliance*.

## 273 cfm right hand chart

TABLE 501.4.2 MAKEUP AIR OPENING SIZING TABLE FOR NEW AND EXISTING DWELLING UNITS

TYPE OF OPENING OR SYSTEM	ONE OR MULTIPLE POWER VENT OR DIRECT VENT APPLIANCES OR NO COMBUSTION APPLIANCES <sup>A</sup>	ONE OR MULTIPLE FAN-ASSISTED APPLIANCES AND POWER VENT OR DIRECT VENT APPLIANCES <sup>B</sup>	ONE OIL APPLIANCE OR ONE SOLID FUEL APPLIANCE <sup>C</sup>	MULTIPLE APPLIANCES THAT ARE ATMOSPHERICALLY VENTED GAS OR OIL APPLIANCES OR SOLID FUEL APPLIANCES <sup>D</sup>	PASSIVE MAKEUP AIR OPENING DUCT DIAMETER <sup>E, F, G</sup>
	(cfm)	(cfm)	(cfm)	(cfm)	(inches)
Passive opening	1-36	1-22	1-15	1-9	3
Passive opening	37-66	23-41	16-28	10-17	4
Passive opening	67-109	42-66	29-46	18-28	5
Passive opening	110-163	67-100	47-69	29-42	6
Passive opening	164-232	101-143	76-99	43-61	7
Passive opening	233-317	144-195	106-135	62-83	8
Passive opening with motorized damper	318-419	196-258	136-179	84-110	9
Passive opening with motorized damper	420-539	259-332	180-230	111-142	10
Passive opening with motorized damper	540-679	333-419	231-290	143-179	11
Powered makeup air <sup>H</sup>	> 679	> 419	> 290	> 179	Not applicable

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

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

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

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

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

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

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

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

## 273 cfm right hand chart

TABLE 501.4.2 MAKEUP AIR OPENING SIZING TABLE FOR NEW AND EXISTING DWELLING UNITS

TYPE OF OPENING OR SYSTEM	ONE OR MULTIPLE POWER VENT OR DIRECT VENT APPLIANCES OR NO COMBUSTION APPLIANCES <sup>A</sup>	ONE OR MULTIPLE FAN-ASSISTED APPLIANCES AND POWER VENT OR DIRECT VENT APPLIANCES <sup>B</sup>	ONE OIL APPLIANCE OR ONE SOLID FUEL APPLIANCE <sup>C</sup>	MULTIPLE APPLIANCES THAT ARE ATMOSPHERICALLY VENTED GAS OR OIL APPLIANCES OR SOLID FUEL APPLIANCES <sup>D</sup>	PASSIVE MAKEUP AIR OPENING DUCT DIAMETER <sup>E, F, G</sup>
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Powered makeup air <sup>H</sup>	> 679	> 419	> 290	> 179	Not applicable

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

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

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

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

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

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

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

- **501.4.2.1 Makeup air ducts.**

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

- **501.4.2.2 Makeup air intake.**

*Makeup air* intake openings shall be located to avoid intake of exhaust air in accordance with IMC Section 401.4 and IFGC Section 503.8, and shall be covered with corrosion resistant screen of not less than **1/4 inch mesh**. *Makeup air* intake openings shall be located at least **12 inches** above adjoining grade level.

**Intake Openings must be minimum 12" above grade**



# Requirements for how make up air is supplied MN 1346.501.4.2

## MN 1346.501.4.2.3

Make up air location  $\geq 175$  cfm.  
You need to meet one of the following:

- In the space of vented combustion appliances
- In the space of the exhaust system
- In the space that freely communicates with the exhaust system and
  - Approved by the B.O.



- **501.4.2.4 Makeup air termination restriction.**

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

- **501.4.2.5 Separate makeup air and combustion air openings.**

When both makeup air and *combustion* air openings are required, they shall be provided through separate openings to the outdoors, subject to IFGC Section 304, to determine requirements for air for *combustion* and ventilation:

- **502.14 Motor vehicle operation.**

In areas where motor vehicles operate, mechanical ventilation shall be provided in accordance with Section 403. Additionally, areas in which stationary motor vehicles are operated shall be provided with a *source capture system* that connects directly to the motor vehicle exhaust systems.

**Exceptions:**

- 2. This section shall not apply to one- and two-family dwellings.

# Source Point Exhaust



- **504.1 Installation.**

Clothes dryers shall be exhausted in accordance with the manufacturer's instructions. Dryer exhaust systems shall be independent of all other systems and shall convey the moisture to the outside of the building.

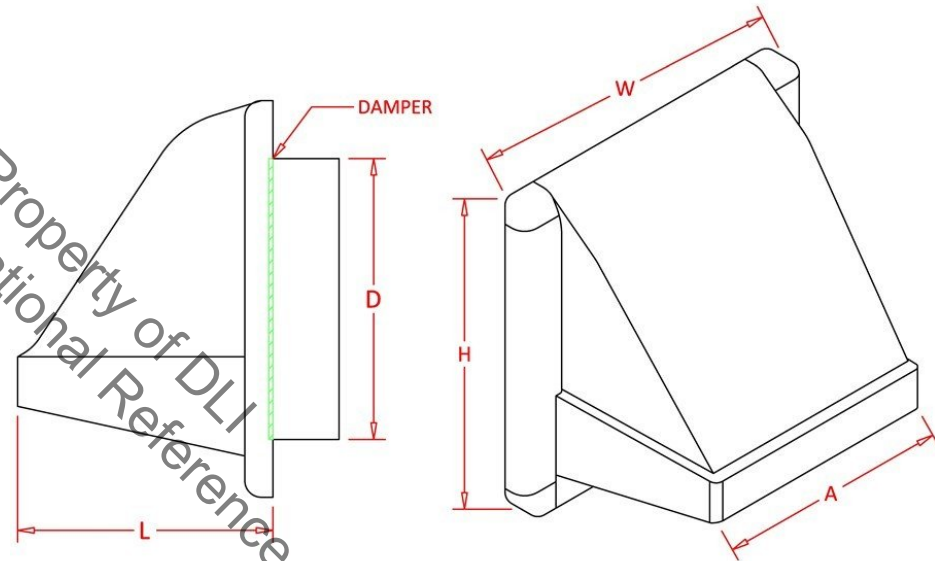
- **504.4 Exhaust installation.**

Dryer exhaust shall terminate outside and have a backdraft damper. Screens shall **not** be installed at the duct termination. Ducts shall not be connected by screws or other fasteners. Dryer exhaust ducts shall not be connected to a vent connector, vent or *chimney*.

# IMC 504.4.1 & IFGC 614.4.1 Clothes Dryer Exhaust

## IMC 504.4.1 & IFGC 614.4.1 Exhaust termination outlet and passageway size.

The passageway size of dryer exhaust duct terminals shall be undiminished in size and shall provide an open area of not less than 12.5 square inches.



DRYER VENT WITH HOOD AND DAMPER						
	SIZE	W/H	L	D	A	FREE AREA IN <sup>2</sup>
	3	6 1/8	4	2 15/16	4 1/2	6.78
	3	6 1/8	4	2 15/16	4 1/2	6.78
	4	6 1/8	4	3 15/16	4 1/2	12.5
	4	6 1/8	4	3 15/16	4 1/2	12.5

# Significant Change to 504.5 & 504.8.3

## Dryer Exhaust duct power ventilators

**504.5** Domestic dryer exhaust duct power ventilators shall be listed and labeled to UL 705 for use in dryer exhaust duct systems. The dryer exhaust duct power ventilator shall be installed in accordance with the manufacturer's instructions.

**504.8.4.3** The maximum length of the exhaust duct shall be determined by the dryer exhaust duct power ventilator manufacturer's installation instructions.



- 504.6 Makeup air.

Where a **closet** is designed for the installation of a clothes dryer, an opening having an area of not less than **100 square inches** shall be provided in the closet enclosure or makeup air shall be provided by other approved means.

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- 504.8.1 Domestic clothes dryer ducts.

Exhaust ducts shall have a smooth interior finish and shall be constructed of metal a minimum 0.016 inch thick. The exhaust duct size shall be 4 inches nominal in diameter.

- 504.8.2 Duct installation.

Exhaust ducts shall be supported at 4-foot intervals and secured in place. The insert end of the duct shall extend into the adjoining duct or fitting in the direction of airflow.

- 504.8.3 Transition ducts.
- Transition ducts used to connect the dryer to the exhaust duct system shall be a single length that is listed and labeled in accordance with UL 2158A. Transition ducts shall be a maximum of **8 feet** in length and shall not be concealed within construction.

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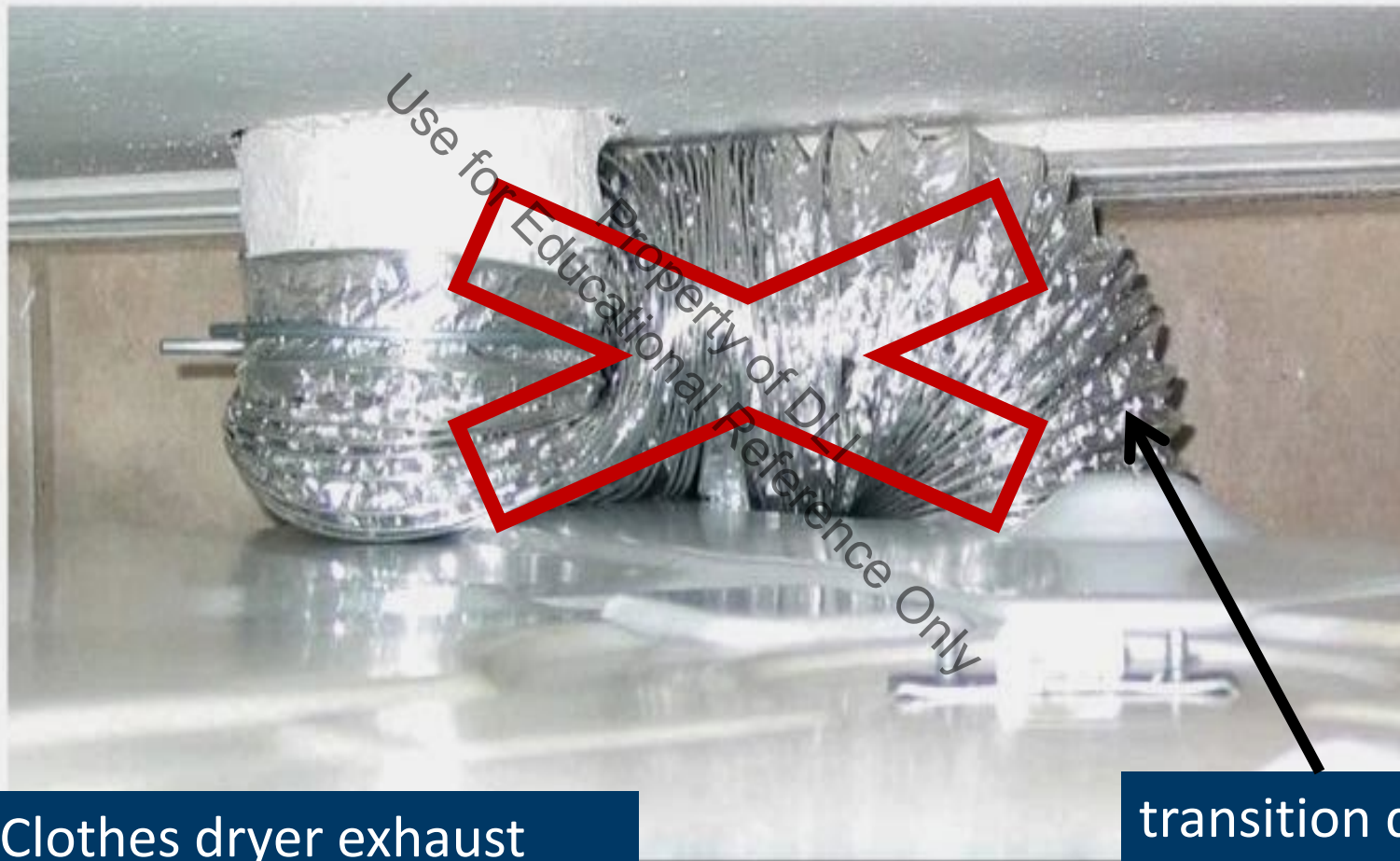
# Laundry exhaust installation



Clothes dryer exhaust  
per IMC section 504

transition duct  
per UL 2158A –  
Max 8 feet

# Laundry exhaust installation



Clothes dryer exhaust  
per IMC section 504

transition duct  
per UL 2158A –  
Max 8 feet

## 504.8.4.1 Specified length.

The maximum length of the exhaust duct shall be 35 feet from the connection to the transition duct from the dryer to the outlet terminal. Where fittings are used, the maximum length of the exhaust duct shall be reduced in accordance with Table 504.8.4.1.

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TABLE 504.8.4.1

## DRYER EXHAUST DUCT FITTING EQUIVALENT LENGTH

## DRYER EXHAUST DUCT FITTING TYPE EQUIVALENT LENGTH

4" radius mitered 45-degree elbow	<b>2 feet 6 inches</b>
4" radius mitered 90-degree elbow	<b>5 feet</b>



- 504.8.4.2 Manufacturer's instructions.
- The maximum length of the exhaust duct shall be determined by the dryer manufacturer's installation instructions. The code official shall be provided with a copy of the installation instructions for the make and model of the dryer. Where the exhaust duct is to be concealed, the installation instructions shall be provided to the code official prior to the concealment inspection. In the absence of fitting equivalent length calculations from the clothes dryer manufacturer, Table 504.6.4.1 shall be used.

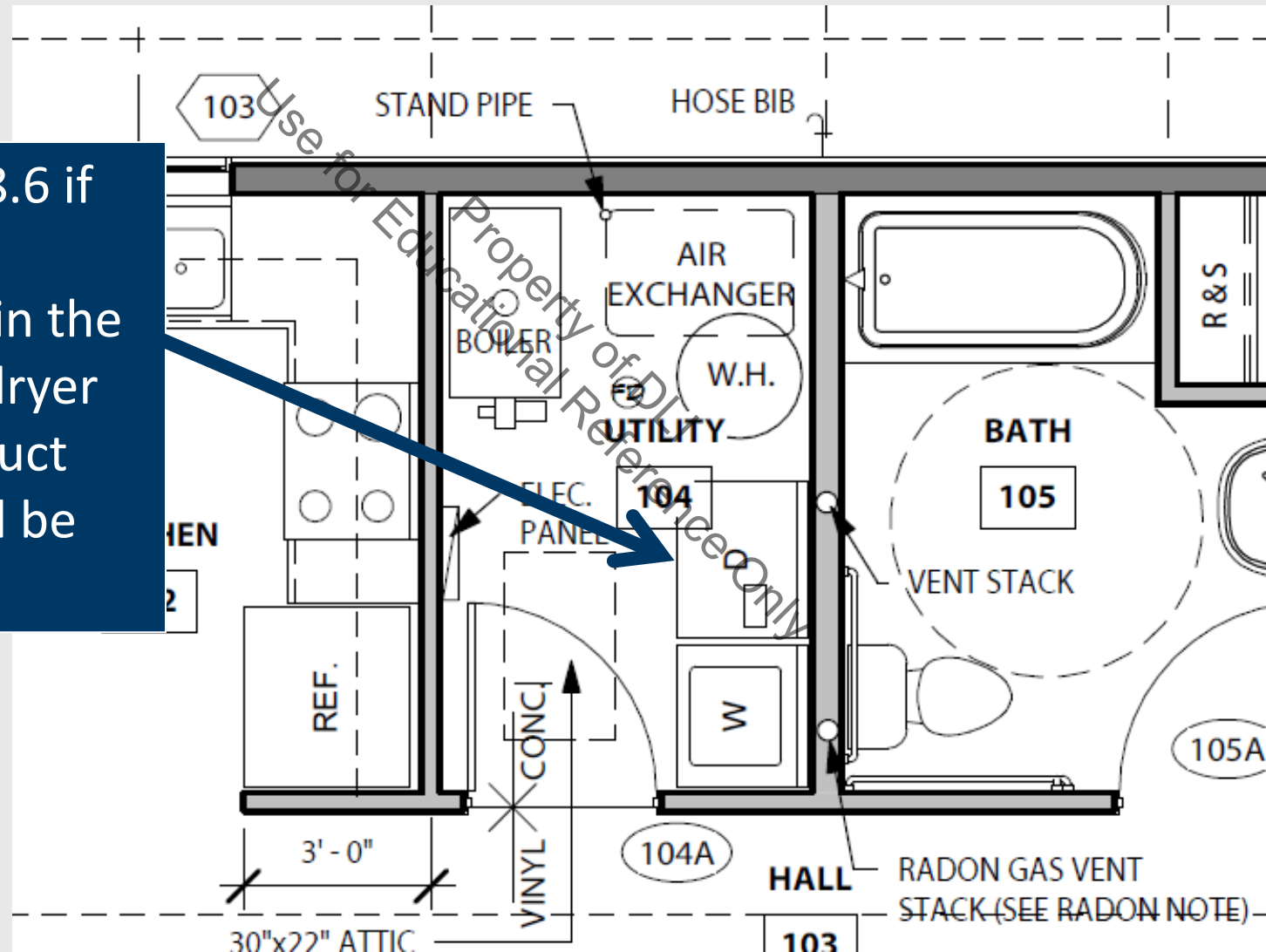
## 504.8.5 Length identification.

Where the exhaust duct is concealed within the building construction, the equivalent length of the exhaust duct shall be identified on a permanent label or tag. The label or tag shall be located within **6 feet** of the exhaust duct connection.

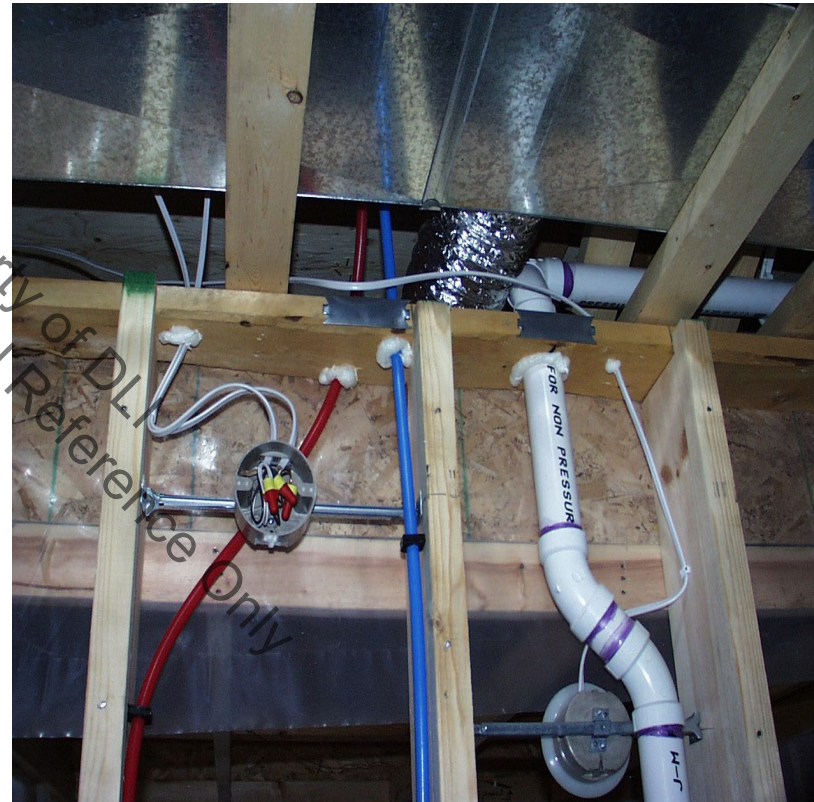


# Laundry exhaust rough in required when designated on the plan

IMC 504.8.6 if space is provided in the plan the dryer exhaust duct work shall be installed



- 504.7 Protection required.
- Protective shield plates shall be placed where nails or screws from finish or other work are likely to penetrate the clothes dryer exhaust duct. Shield plates shall be placed on the finished face of all framing members where there is less than **1-1/4 inches** between the duct and the finished face of the framing member. Protective shield plates shall be constructed of steel, have a thickness of **0.062 inch** and extend a minimum of **2 inches** above sole plates and below top plates.



- **514.1 General.**

**Energy recovery ventilation systems** shall be installed in accordance with this section. Where required for purposes of energy conservation, energy recovery ventilation systems shall also comply with the *International Energy Conservation Code*. Ducted heat recovery ventilators shall be listed and labeled in accordance with **UL 1812**.

# Energy Recovery Ventilation System

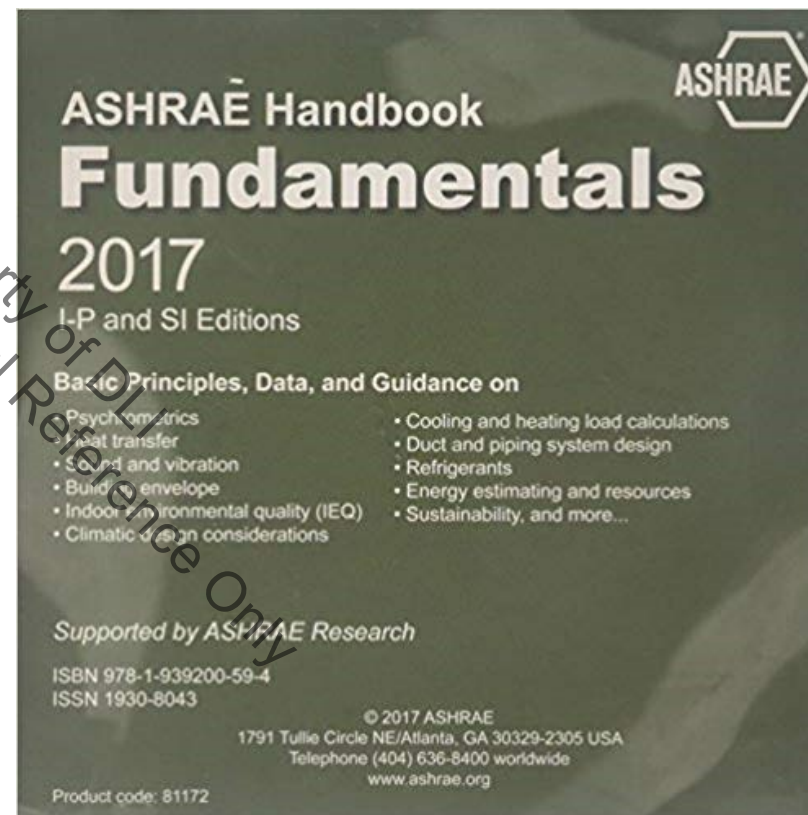
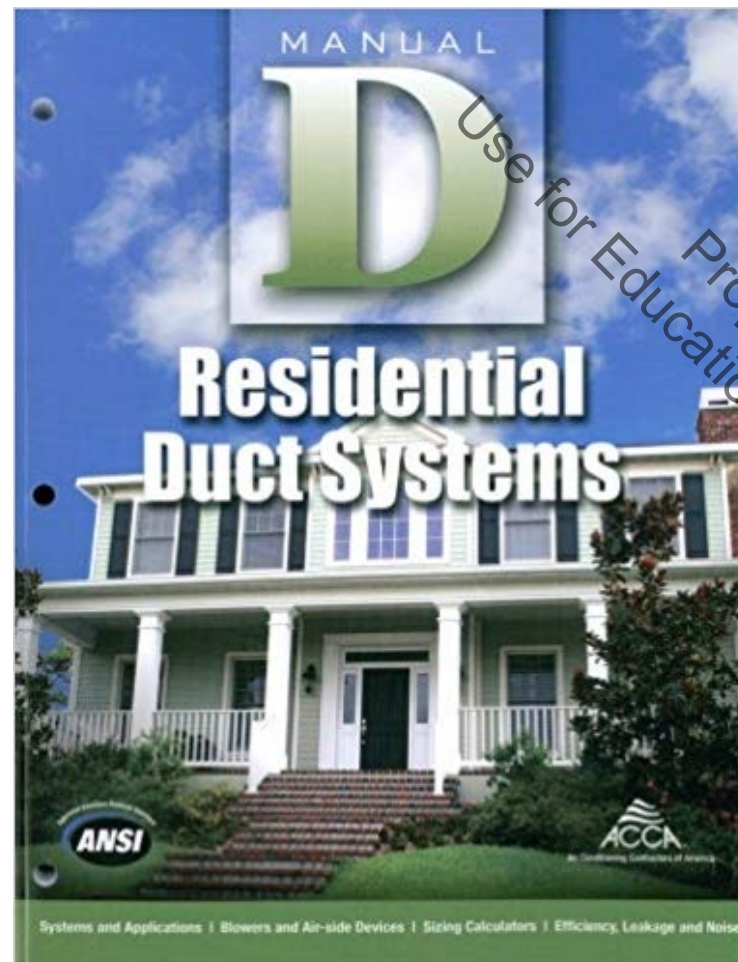




## Chapter 6 Duct Systems

- **603.2 Duct sizing.**  
Ducts installed within a home shall be sized in accordance with ACCA Manual D or other approved methods. Ducts installed within all other buildings shall be sized in accordance with the *ASHRAE Handbook of Fundamentals* or other equivalent computation procedure.





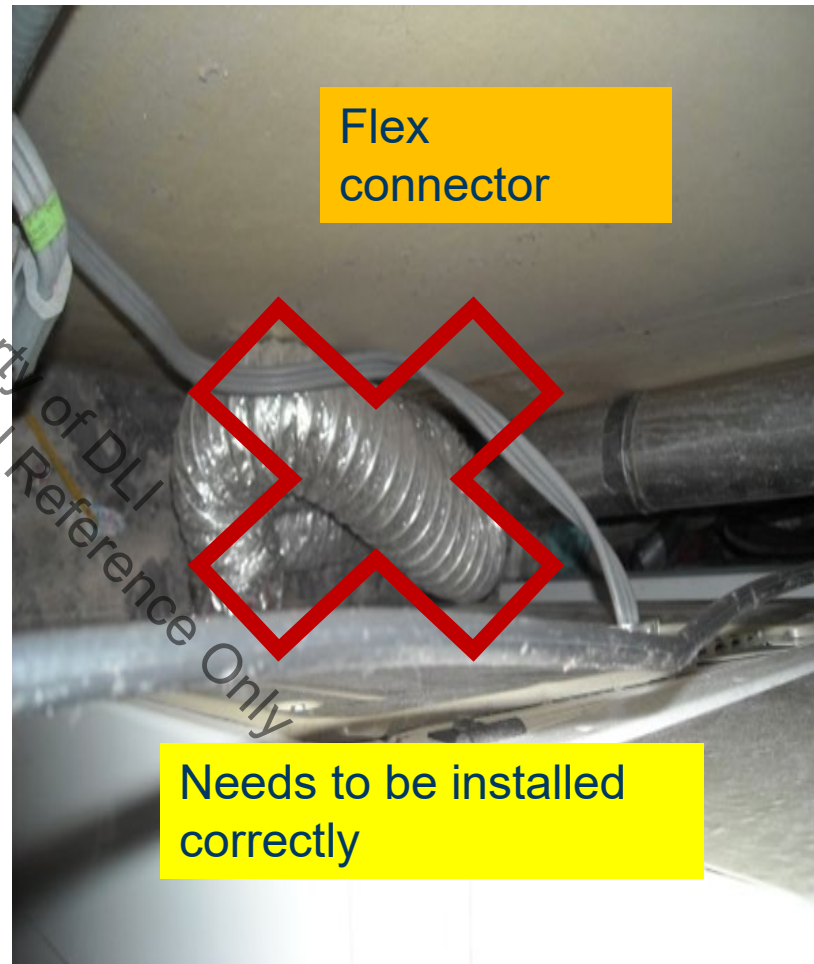
- **603.6.1 Flexible air ducts.**

Flexible air ducts, both metallic & nonmetallic, shall be UL 181 & *listed* and *labeled* as Class 0 or Class 1 flexible air ducts and shall be installed in accordance with Section 304.1. Flexible air ducts shall not be limited in length.

- **603.6.2 Flexible air connectors.**

Flexible air connectors, both metallic and nonmetallic, shall be UL 181 & be *listed* and *labeled* as Class 0 or Class 1 flexible air connectors and shall be installed in accordance with Section 304.1. Flexible air connectors shall be limited in length to 14 feet.





- **603.8 Underground ducts.**

Ducts shall be **approved** for underground. Metallic ducts not having a protective coating shall be encased in 2" concrete.

- **603.8.1 Slope.**

Ducts shall slope for drainage with access at each low point.

- **603.8.2 Sealing.**

Ducts shall be sealed, secured and tested prior to concrete encasement or direct burial. Duct shall be leak tested as required by section C403 of the International Energy Conservation Code.

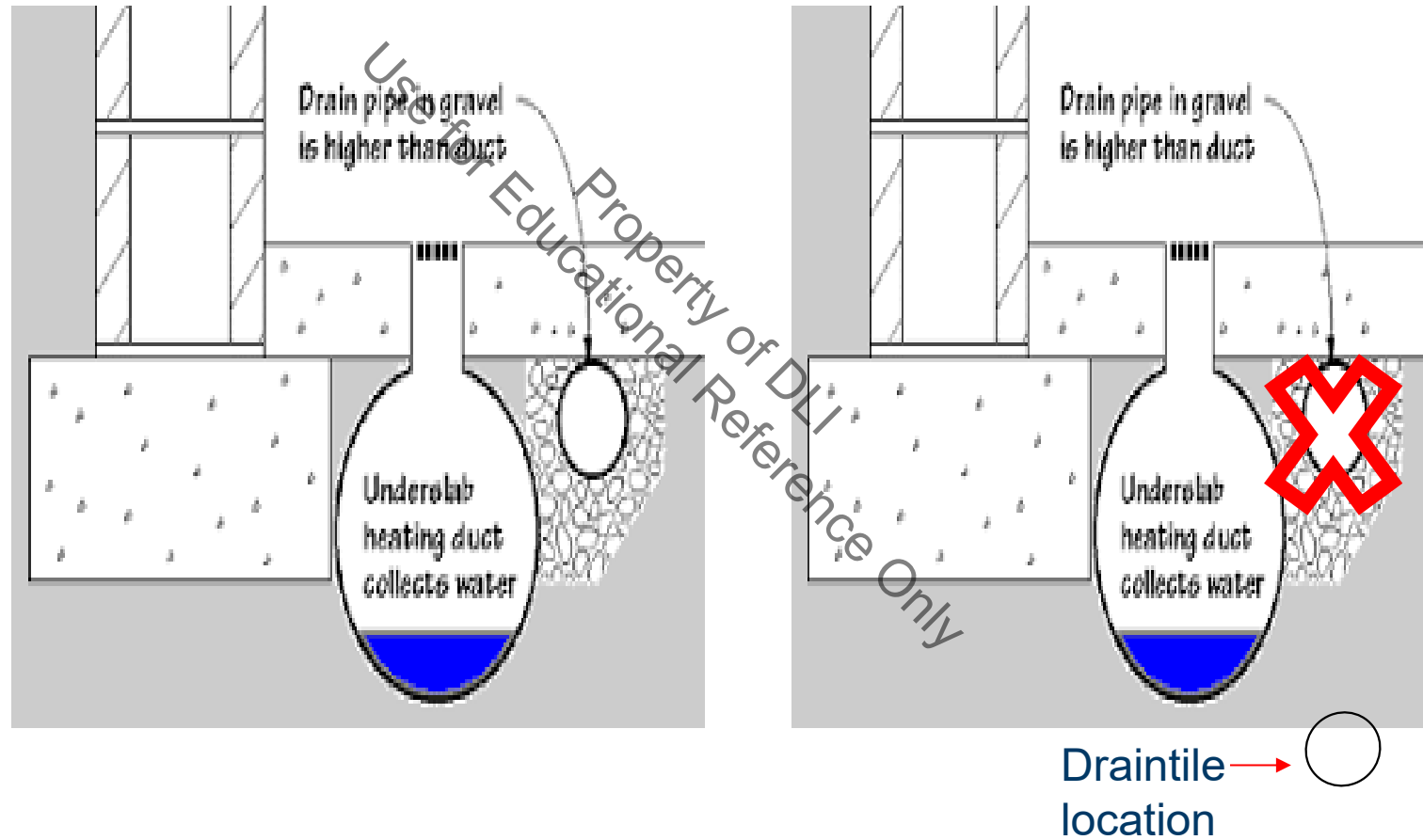


- **603.8.3 Plastic ducts and fittings.**

Plastic ducts shall be constructed of PVC or high-density poly in accordance with ASTM D2412. Plastic duct fittings shall be either PVC or high-density poly. Plastic duct & fittings underground shall be utilized in underground installations only.

- **603.8.4 Drainage and insulation.**

Underground ducts shall be insulated in accordance with amended IMC Section 604.1 and provided with drain tile around the perimeter of the duct system. The top of the drain tile shall be installed lower than the bottom of the underground duct system. The building official may *approve* an alternate drainage system if soil conditions are adequate.



- **604.1 General.**

Duct insulation shall conform to the requirements in Minnesota Rules, **Chapter 1322** ( residential) or **1323** (all other buildings), as applicable.

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# 2020 Minnesota Residential Energy Code MR 1322

TABLE R403.2.1 DUCT AND PLENUM  
INSULATION FOR DWELLING UNITS

DUCT TYPE/LOCATION	REQUIREMENTS
<u>Exterior of Building</u>	<u>R-8, V &amp; W</u>
<u>Attics, garages, crawl spaces</u>	<u>R-8 and V</u>
<u>Outdoor air intakes within conditioned spaces</u>	<u>R3.3 and V</u>
<u>Exhaust ducts within conditioned spaces</u>	<u>R3.3 and V</u>
<u>In cement slab or in ground</u>	<u>R3.5 and V</u>
<u>In conditioned spaces and basements with insulated walls</u>	<u>None Required</u>

$$= \frac{w}{2L} \mu_{\text{sat}} C_{\text{ox}} (V_{\text{G}} -$$

## Chapter 7 Combustion Air

- **701.1 Scope.**

Solid fuel-burning *appliances* shall be provided with *combustion air* in accordance with the appliance manufacturer's installation instructions. Oil-fired *appliances* shall be provided with *combustion air* in accordance with NFPA 31. The methods of providing *combustion air* in this chapter do not apply to fireplaces, fireplace stoves and direct-vent *appliances*. **The requirements for combustion and dilution air for gas-fired *appliances* shall be in accordance with the *International Fuel Gas Code*.**





## Chapter 8 Chimneys and Vents

- **801.1 Scope.**

This chapter shall govern the installation, maintenance, repair and approval of factory-built chimneys, *chimney* liners, vents and connectors. This chapter shall also govern the utilization of masonry chimneys. **Gas-fired *appliances* shall be vented in accordance with the *International Fuel Gas Code*.**





## Chapter 9 Specific Appliances

- **901.1 Scope.**

This chapter shall govern the approval, design, installation, construction, maintenance, *alteration* and repair of the appliances and *equipment* specifically identified herein and factory-built fireplaces. **The approval, design, installation, construction, maintenance, *alteration* and repair of gas-fired appliances shall be regulated by the *International Fuel Gas Code*.**

## 901.5 Unvented heaters and appliances.

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



- **902.1 General.**

Masonry fireplaces shall be constructed in accordance with the *International Building Code*. **IBC Section 2111**

- **903.1 General.**

Factory-built fireplaces shall be *listed* and *labeled* and shall be installed in accordance with the conditions of the listing. Factory-built fireplaces shall be tested in accordance with UL 127.

- **904.1 General.**

Pellet fuel-burning appliances shall be *listed* and *labeled* in accordance with ASTM E1509 and shall be installed in accordance with the terms of the listing.



- **905.1 General.**

Fireplace stoves and solid-fuel-type room heaters shall be *listed* and *labeled* and shall be installed in accordance with the conditions of the listing. Fireplace stoves shall be tested in accordance with **UL 737**. Solid-fuel-type room heaters shall be tested in accordance with **UL 1482**. Fireplace inserts intended for installation in fireplaces shall be *listed* and *labeled* in accordance with the requirements of **UL 1482** and shall be installed in accordance with the manufacturer's installation instructions. **(WOOD)**

- **917.1 Cooking appliances.**

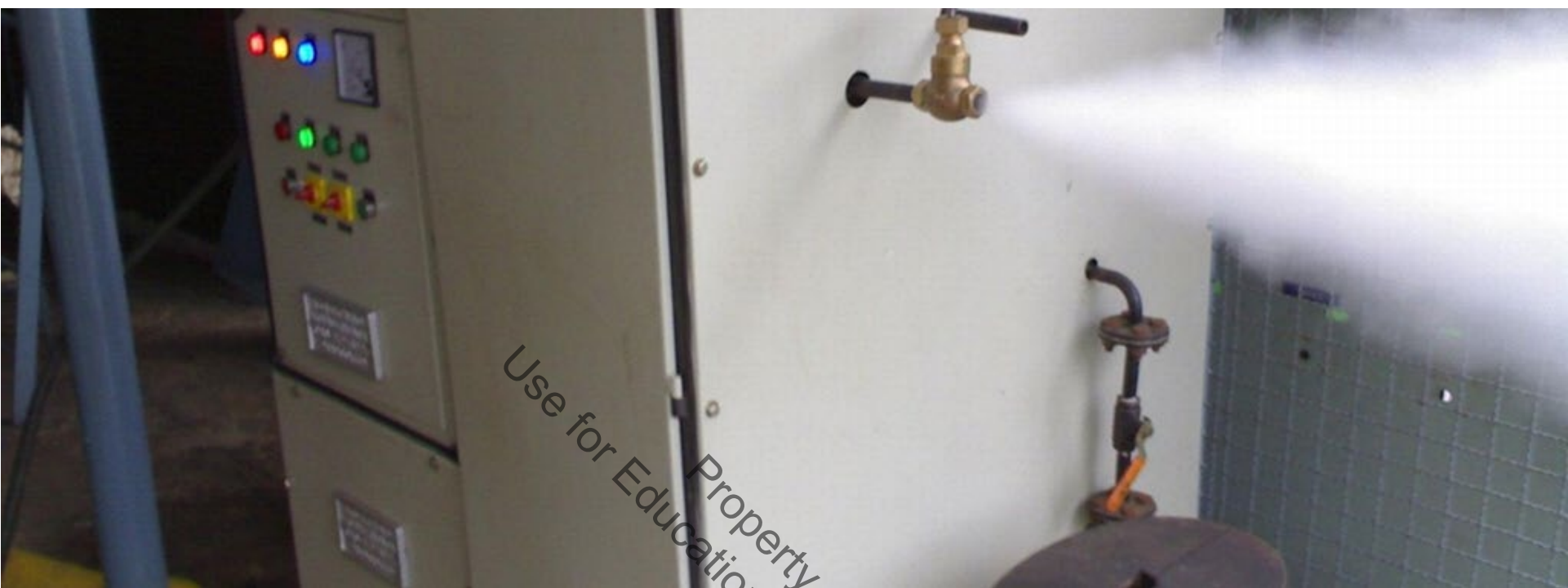
Household electric ranges shall be *listed* and *labeled* to UL 858. Microwave cooking appliances shall be *listed* and *labeled* to UL 923.

- **917.2 Prohibited location.**

Cooking appliances designed, tested, *listed* and *labeled* for use in commercial occupancies shall **not** be installed within *dwelling units*.

- **917.3 Domestic appliances.**

Cooking appliances installed within *dwelling units* and within areas where domestic cooking operations occur shall be *listed* and *labeled* as household-type appliances for domestic use.



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## Chapter 10 Boilers

- **IMC 1001.1 Scope.**

This chapter shall govern the installation, *alteration*, and repair of boilers.

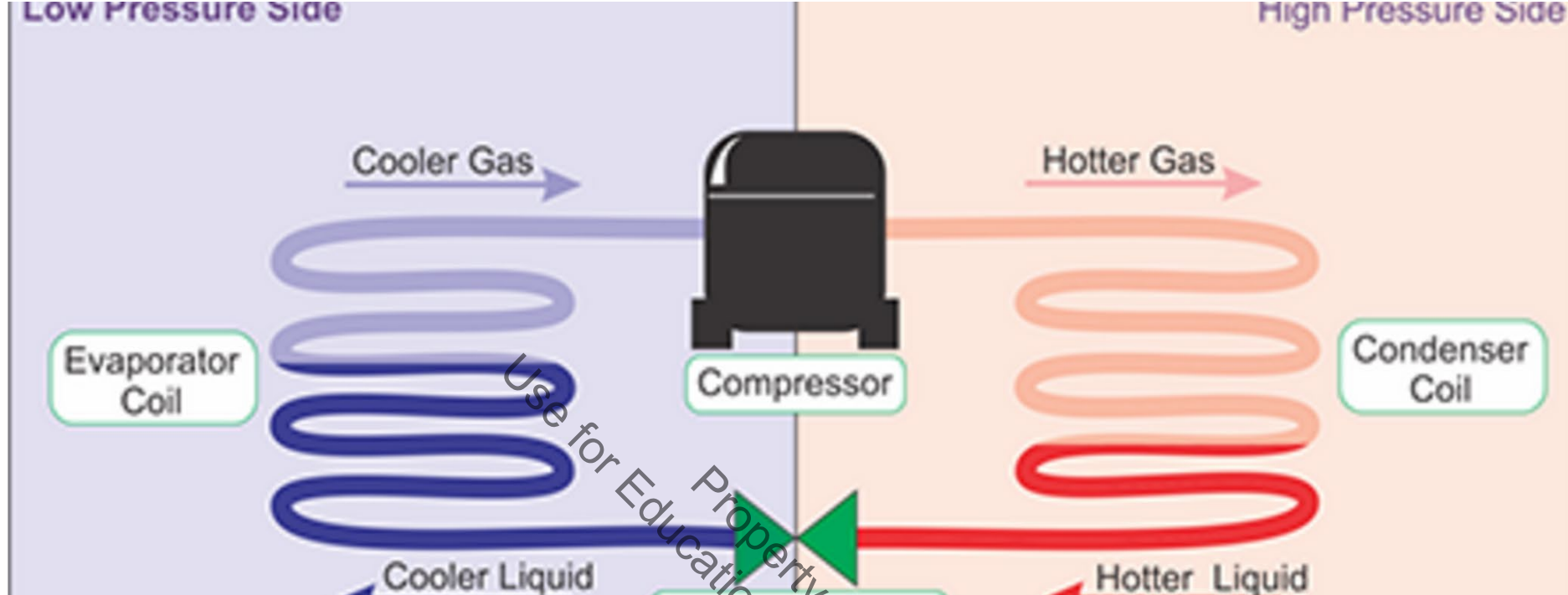
- **IFGC 631.1 Standards. (gas)**

Boilers shall be *listed* in accordance with the requirements of ANSI Z21.13/CSA 4.9 or UL 795.

- **IFGC 631.2 Installation. (gas)**

The installation of boilers shall be in accordance with the manufacturer's instructions and the *International Mechanical Code*. Operating instructions shall be attached to the boiler.





## Chapter 11 Refrigeration

# Chapter 11



- **1101.10 Locking access port caps.**

Refrigerant circuit access ports located outdoors shall be fitted with locking-type tamper-resistant caps or shall be otherwise secured to prevent unauthorized access.

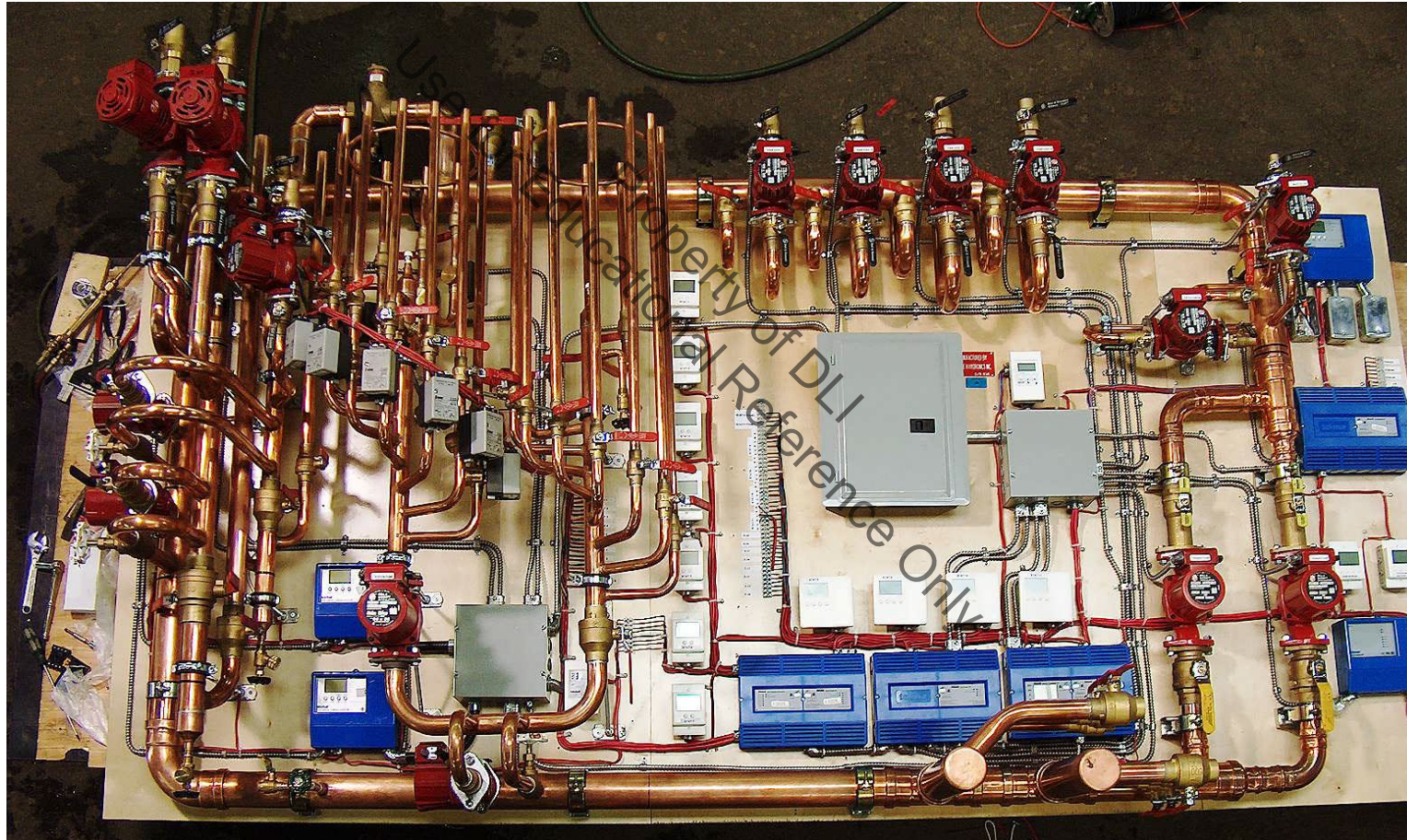




## Chapter 12 Hydronic Systems

### 1201.1 Scope.

The provisions of this chapter shall govern the construction, installation, *alteration* and repair of hydronic piping systems. This chapter shall apply to hydronic piping systems that are part of heating, ventilation and air-conditioning systems. Such piping systems shall include steam, hot water, chilled water, steam condensate and ground source heat pump loop systems. Potable cold and hot water distribution systems shall be installed in accordance with the Minnesota *Plumbing Code*.





## Chapter 13 Fuel Oil Piping and Storage

- **1301.1 Scope.**

This chapter shall govern the design, installation, construction and repair of fuel-oil storage and piping systems. The storage of fuel oil and flammable and combustible liquids shall be in accordance with Chapters 6 and 57 of the *International Fire Code*.





## Chapter 14 Solar Systems

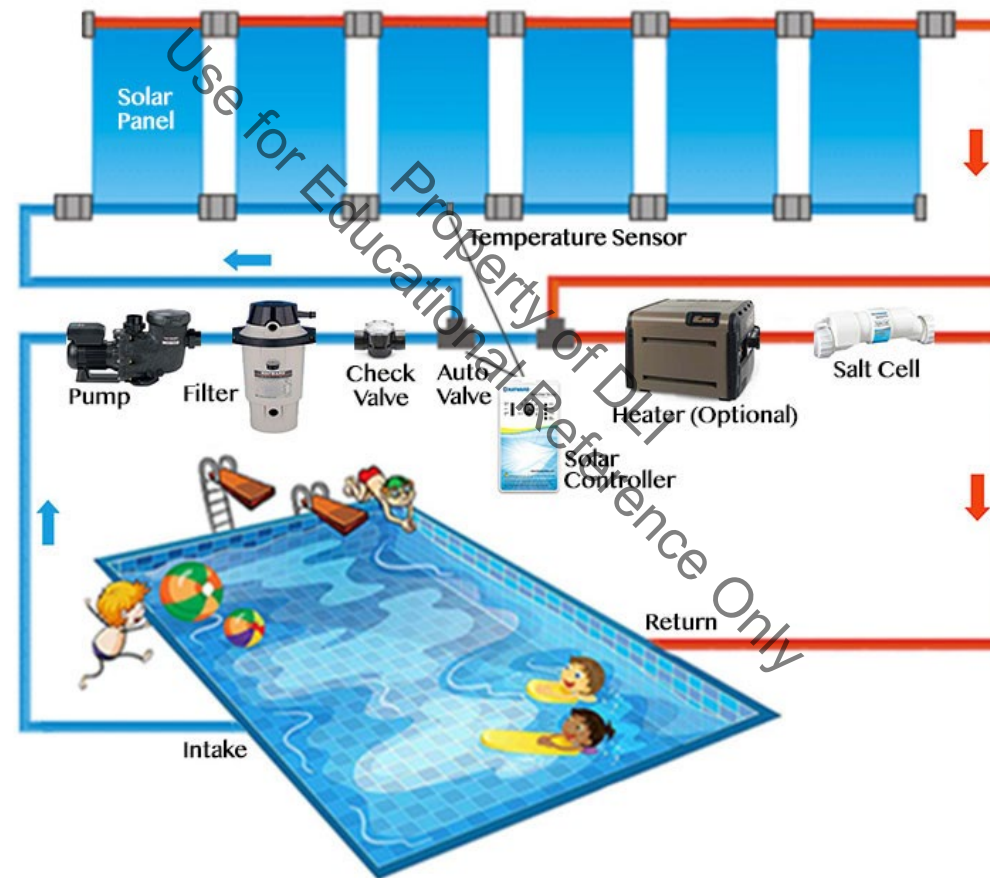
- **1401.1 Scope.**

This chapter shall govern the design, construction, installation, *alteration* and repair of systems, *equipment* and appliances intended to utilize solar energy for space heating or cooling, domestic hot water heating, swimming pool heating or process heating.

- **1401.2 Potable water supply.**

Potable water supplies to solar systems shall be protected against contamination in accordance with the Minnesota *Plumbing Code*.





"Analytical methods are the foundation for acquiring product knowledge. It is critical to develop and qualify a series of methods useful for characterizing product attributes such as structure, purity, chemical modifications and biological activity. Early in development, it is unlikely that a recognized reference standard already exists, so an in-house primary reference must be made and fully characterized through the development of analytical methods and tools."

#### **Q6A 2.11 Reference Standard**

*A reference standard, or reference material, is a substance prepared for use as the standard in an assay, identification, or purity test. It should have a quality appropriate to its use. It is often characterized and evaluated for its intended purpose by additional procedures other than those used in routine testing. For new drug substance reference standards*

## Chapter 15 Reference Standards

# IMC Chapter 15 Reference Standards

- This chapter lists the standards that are referenced in various sections of this document. The standards are listed herein by the promulgating agency of the standard, the standard identification, the effective date and title, and the section or sections of this document that reference the standard. The application of the referenced standards shall be as specified in Section 102.8.
- **Supplemental standards.** The standards listed in this part shall supplement the list of referenced standards in Chapter 15 of the 2012 IMC. The standards referenced in this rule shall be considered part of the requirements of this rule to the extent prescribed in each rule or reference.

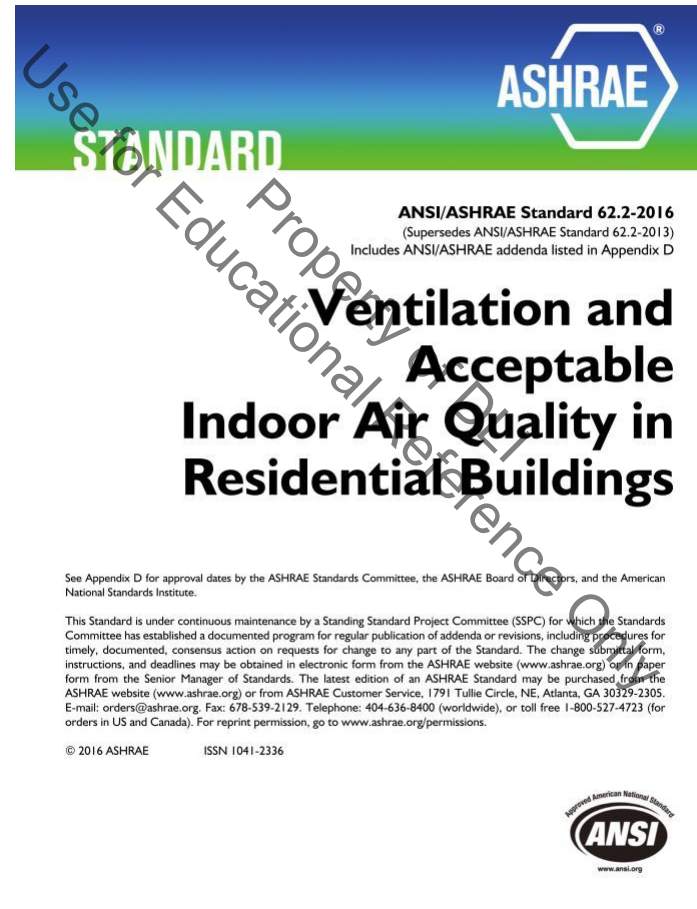


## Chapter 16 Installation & Testing Oil or Liquid Equipment

- **1601.1 General.**

Chapter 16 governs the installation, testing, or repair of: **oil** or **liquid fuel burners**, oil or liquid fuel burning systems, oil or liquid fuel burning *equipment*, and the oil or liquid fuel piping systems installed within, or in conjunction with, buildings or structures

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





## ASHRAE 154-2011



**ANSI/ASHRAE Standard 154-2016**  
(Supersedes ANSI/ASHRAE Standard 154-2011)

## **Ventilation for Commercial Cooking Operations**



- **BTU.** Abbreviation for British thermal unit, which is the quantity of heat required to raise the temperature of 1 pound of water 1°F.
- **DECORATIVE APPLIANCE, VENTED.** A vented *appliance* wherein the primary function lies in the aesthetic effect of the flames.
- **DIRECT-VENT APPLIANCES.** Appliances that are constructed and installed so that all air for combustion is derived directly from the outside atmosphere and all flue gases are discharged directly to the outside atmosphere.

- **FUEL GAS.** A natural gas, manufactured gas, liquefied petroleum gas or mixtures of these gases.
- **LIQUEFIED PETROLEUM GAS or LPG (LP-GAS).** Liquefied petroleum gas composed predominately of propane, propylene, butanes or butylene, is gaseous under normal atmospheric conditions, but is capable of being liquefied under moderate pressure at normal temperatures.
- **POWER VENT APPLIANCE.** An *appliance* with a venting system that uses a fan or other mechanical means to cause the removal of flue or vent gases under positive static vent pressure.

- **READY ACCESS (TO).** That which enables a device, *appliance* or *equipment* to be directly reached, without requiring the removal or movement of any panel, door or similar obstruction.
- **REGULATOR.** A device for controlling and maintaining a uniform supply pressure, either pounds-to-inches water column (MP regulator) or inches-to-inches water column (*appliance* regulator).
- **WATER HEATER.** Any heating *appliance* or *equipment* that heats **potable** water and supplies such water to the potable hot water distribution system.

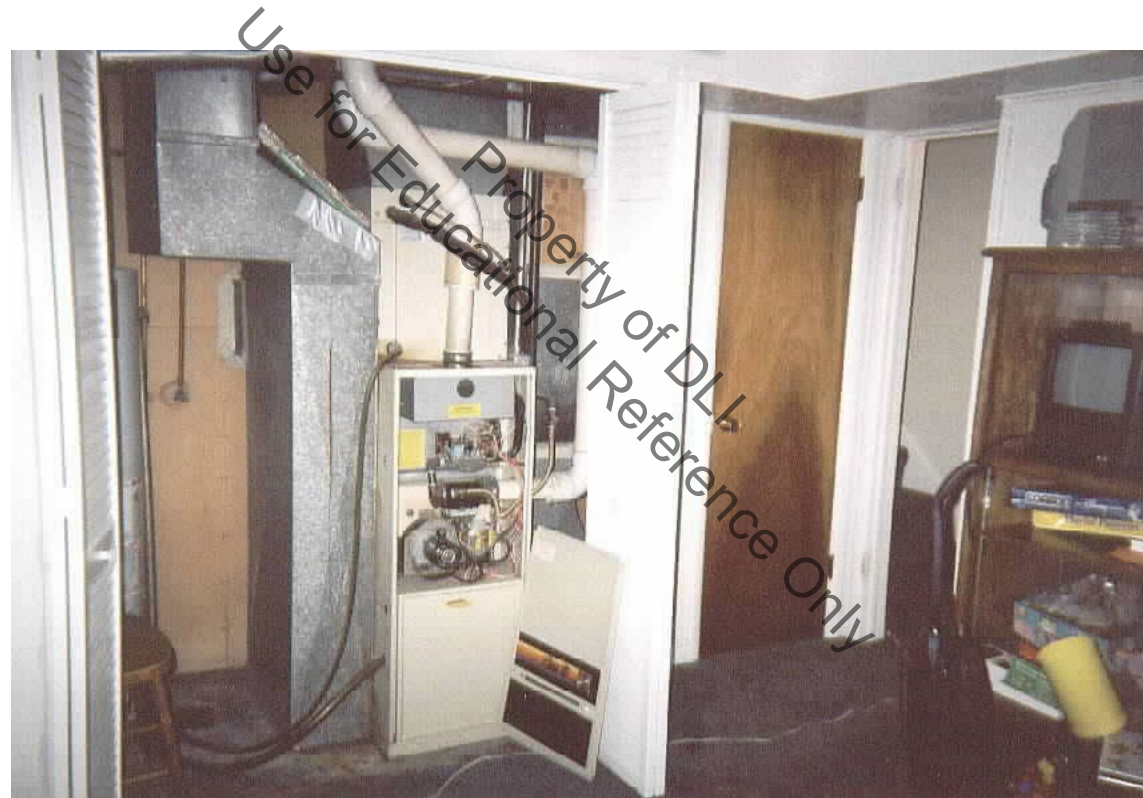
# Regulation

## Chapter 3 General Regulations

- **IFGC 303.3 Prohibited locations.**

Appliances shall **not** be located in sleeping rooms, bathrooms, toilet rooms, or in a space that opens only into such rooms or spaces, except where the installation complies with one of the following:

1. The *appliance* is a direct-vent *appliance*.
2. **Vented** room heaters, wall furnaces, decorative appliances, gas fireplaces, gas fireplace heaters & decorative appliances for installation in vented solid fuel-burning fireplaces are installed in rooms that meet the volume criteria of Section 304.5.
5. The *appliance* is installed in a room that opens only into a bedroom or bathroom, & such room and is provided with a solid weather-stripped door with an *approved* self-closing device. All *combustion air* shall be taken directly from the outdoors.

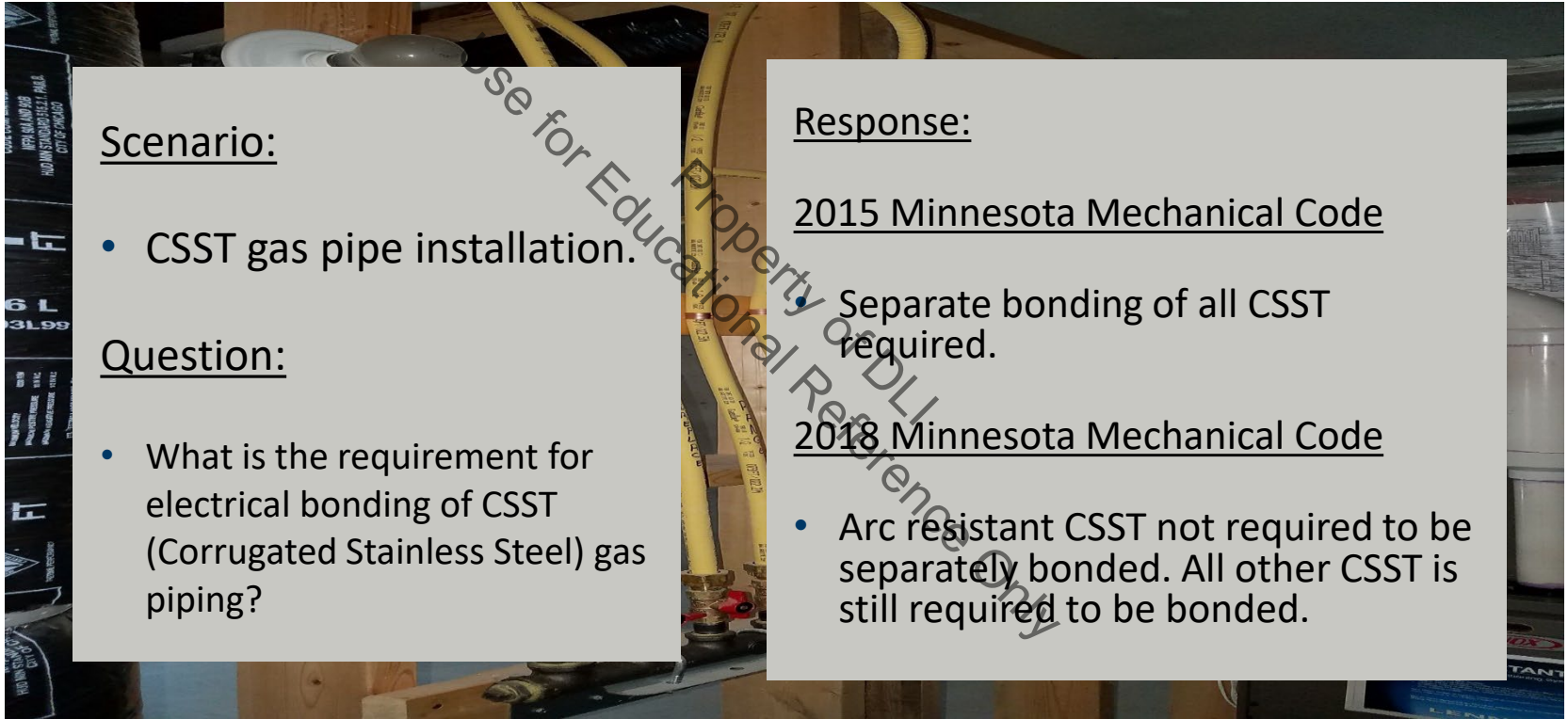


**310.3 Arc-resistant CSST.** This section applies to corrugated stainless steel tubing (CSST) that is listed with an arc-resistant jacket or coating system in accordance with ANSI LC 1/CSA 6.26. The CSST shall be electrically continuous and bonded to an effective ground fault current path.

Where

any CSST component of a piping system does not have an arc-resistant jacket or coating system, the bonding requirements of Section 310.2 shall apply. Arc-resistant-jacketed CSST shall be considered to be bonded where it is connected to an appliance that is connected to the appliance grounding conductor of the circuit that supplies that appliance.

# CSST Regulations



## Scenario:

- CSST gas pipe installation.

## Question:

- What is the requirement for electrical bonding of CSST (Corrugated Stainless Steel) gas piping?

## Response:

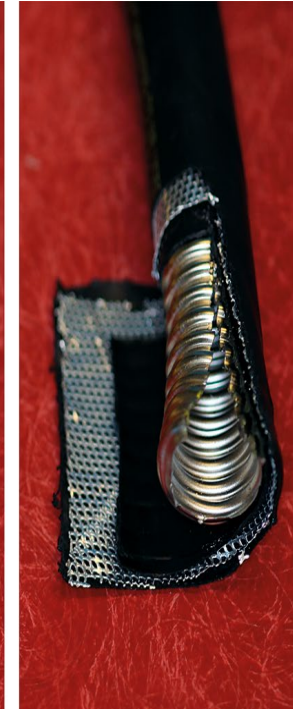
### 2015 Minnesota Mechanical Code

- Separate bonding of all CSST required.

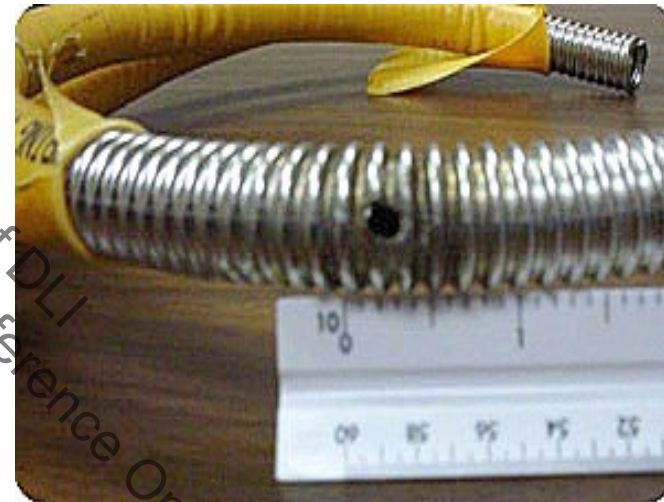
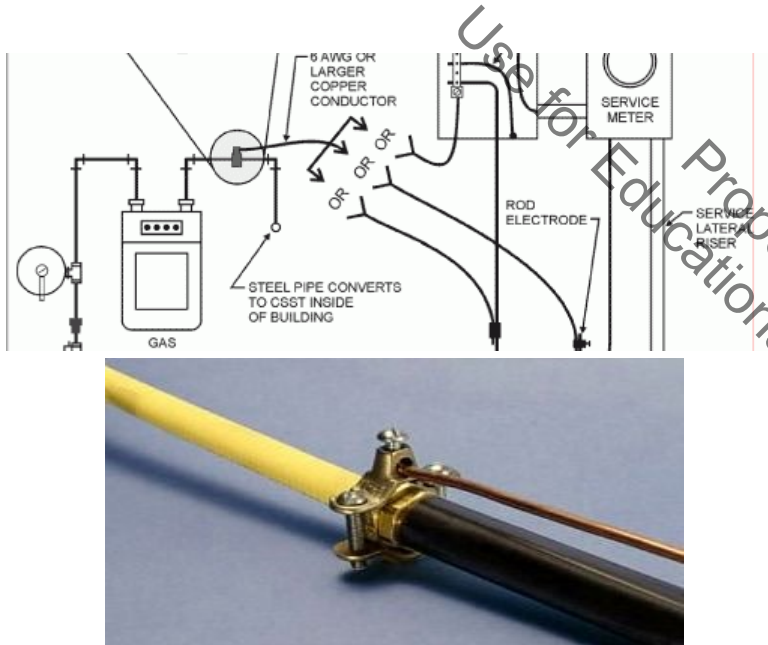
### 2018 Minnesota Mechanical Code

- Arc resistant CSST not required to be separately bonded. All other CSST is still required to be bonded.

# What is CSST?



# What is electrical Bonding?





## Chapter 4 Gas Pipe Installations

- **401.1 Scope.**

This chapter shall govern the design, installation, modification and maintenance of *pip*ing systems. The applicability of this code to *pip*ing systems extends from the *point of delivery* to the connections with the *appliances* and includes the design, materials, components, fabrication, assembly, installation, testing, inspection, operation and maintenance of such *pip*ing systems.

## SIZING GAS

### 402.4.1 Longest length method.

1. Total BTU load (assume all working at the same time)
2. Total length of longest run (from supply to most remote)
3. Use the correct table and length column (stay in that column for sizing every line)
4. Start at most remote and work back to point of delivery

**402.4.1 Longest length method.**

150,000 (fur) + 30,000 (wh) + 30,000 + 25,000 (ref) + 35,000 (ra) =

270,000 BTU total

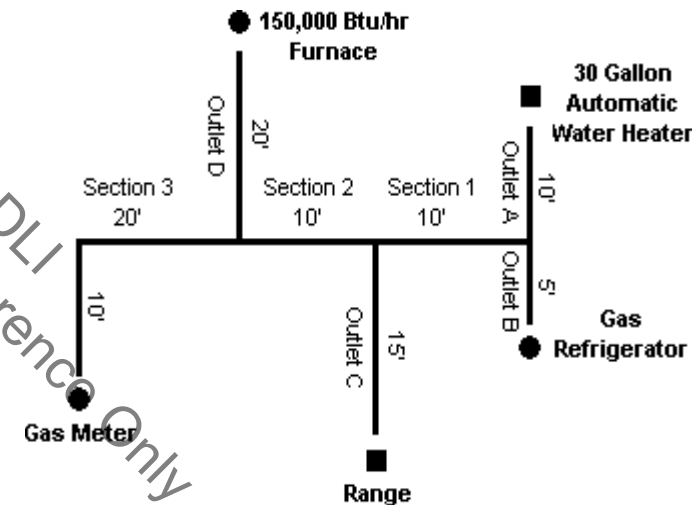
Meter to WH = 60ft

Less than 2 PSI (402.4(10))

A-30=3/8", B-25=3/8", 1-55=1/2"

C-35=1/2", 2-90=5/8", D-150=3/4"

3-270=1"



# IFGC TABLE 402.4(10) SEMIRIGID COPPER TUBING

## SIZING BETWEEN HOUSE LINE REGULATOR AND THE APPLIANCE TUBE SIZE (INCH)

Gas Natural

Inlet Pressure **Less than 2 psi**

Pressure Drop 1.0 in. w.c.

Specific Gravity 0.60

INTENDED USE: SIZING BETWEEN HOUSE LINE REGULATOR AND THE APPLIANCE										
TUBE SIZE (inch)										
Nominal	K & L	1/4	3/8	1/2	5/8	3/4	1	1 1/4	1 1/2	2
	ACR	3/8	1/2	5/8	3/4	7/8	1 1/8	1 3/8	—	—
Length (ft)		Capacity in Cubic Feet of Gas Per Hour								
50		16	33	68	119	168	359	647	1,020	2,130
60		15	30	61	107	152	326	586	925	1,930

**402.4.2 Branch length method.** Pipe shall be sized as follows:

1. Pipe size of each section of the longest pipe run from the *point of delivery* to the most remote *outlet* shall be determined using the longest run of *piping* and the load of the section.
2. The pipe size of each section of branch *piping* not previously sized shall be determined using the length of *piping* from the *point of delivery* to the most remote *outlet* in each branch and the load of the section.

## 402.4.2 Branch length method.

150,000 (fur) + 30,000 (wh) + 30,000 + 25,000 (ref) + 35,000 (ra) =

270,000 BTU total

Meter to WH = 60ft

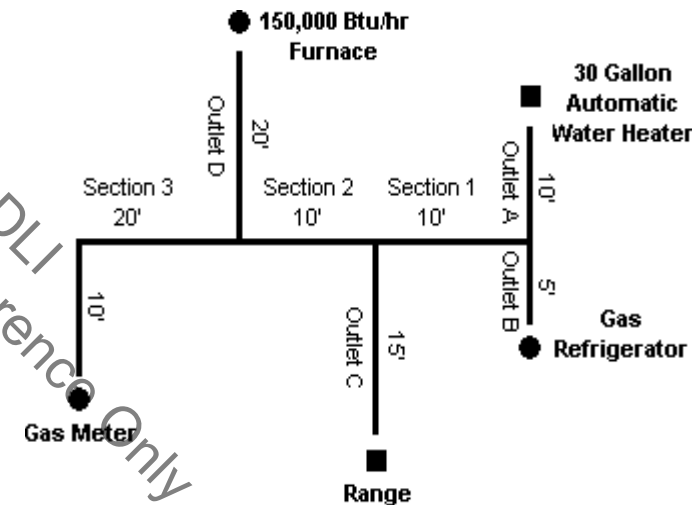
Less than 2 PSI (402.4(10))

A-60'-30=3/8", B-55'-25=3/8"

1-60'-55=1/2"

C-55'-35=1/2", 2-60'-90=5/8", D-50'-150=3/4"

3-60'-270=1"



# IFGC TABLE 402.4(10) SEMIRIGID COPPER TUBING

## SIZING BETWEEN HOUSE LINE REGULATOR AND THE APPLIANCE TUBE SIZE (INCH)

Gas Natural

Inlet Pressure **Less than 2 psi**

Pressure Drop 1.0 in. w.c.

Specific Gravity 0.60

INTENDED USE: SIZING BETWEEN HOUSE LINE REGULATOR AND THE APPLIANCE										
TUBE SIZE (inch)										
Nominal	K & L	1/4	3/8	1/2	5/8	3/4	1	1 1/4	1 1/2	2
	ACR	3/8	1/2	5/8	3/4	7/8	1 1/8	1 3/8	—	—
Length (ft)		Capacity in Cubic Feet of Gas Per Hour								
50		16	33	68	119	168	359	647	1,020	2,130
60		15	30	61	107	152	326	586	925	1,930

# IFGC TABLE 402.4(12) SEMIRIGID COPPER TUBING

Gas  
Inlet Pressure  
Pressure Drop  
Specific Gravity

Natural  
**2.0 psi**  
1.0 psi  
0.60

Nominal	K & L	1/4	3/8	1/2	5/8	3/4	1	1 1/4	1 1/2	2
	ACR	3/8	1/2	5/8	3/4	7/8	1 1/8	1 3/8	—	—
Length (ft)		Capacity in Cubic Feet of Gas Per Hour								
10		245	506	1,030	1,800	2,550	5,450	9,820	15,500	32,200
20		169	348	708	1,240	1,760	3,750	6,750	10,600	22,200
30		135	279	568	993	1,410	3,010	5,420	8,550	17,800
40		116	239	486	850	1,210	2,580	4,640	7,310	15,200
50		103	212	431	754	1,070	2,280	4,110	6,480	13,500
60		93	192	391	683	969	2,070	3,730	5,870	12,200

- **403.4.1 Cast iron.**  
Cast-iron pipe shall not be used.
- **403.4.2 Steel.**  
Steel and wrought-iron pipe shall be at least of standard weight (Schedule 40)
- **403.4.3 Copper and copper alloy.**
- **403.4.4 Aluminum.**  
Aluminum-alloy pipe shall comply with ASTM
- **403.5.1 Steel tubing.**  
Steel tubing shall comply with ASTM A254.

- **403.5.2 Copper and brass tubing..**
- **403.5.3 Aluminum tubing.**  
Aluminum-alloy tubing shall comply with ASTM B210 or ASTM B241.
- **403.5.4 Corrugated stainless steel tubing.**  
Corrugated stainless steel tubing shall be *listed* in accordance with ANSI LC 1/CSA 6.26.
- **403.6 Plastic pipe, tubing and fittings.**  
Polyethylene plastic pipe, tubing and fittings used to supply fuel gas shall be marked “Gas” and “ASTM D2513.”

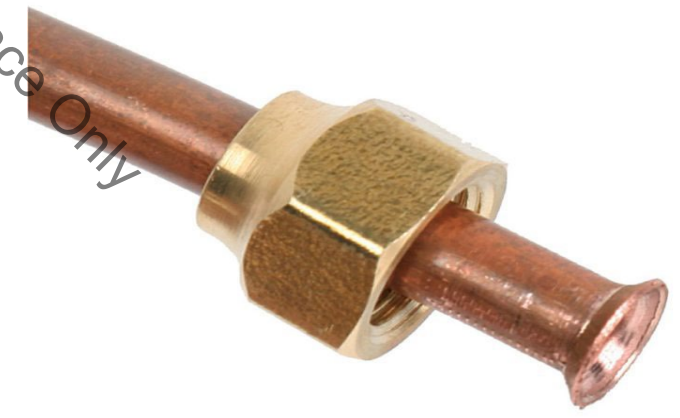
# Gas pipe materials



- **404.5 Fittings in concealed locations.**

Fittings installed in concealed locations shall be limited to the following types:

1. Threaded elbows, tees and couplings.
2. Brazed fittings.
3. Welded fittings.
4. Fittings listed to ANSI LC-1/CSA 6.26 or ANSI LC-4.



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- **404.6 Underground penetrations prohibited.**

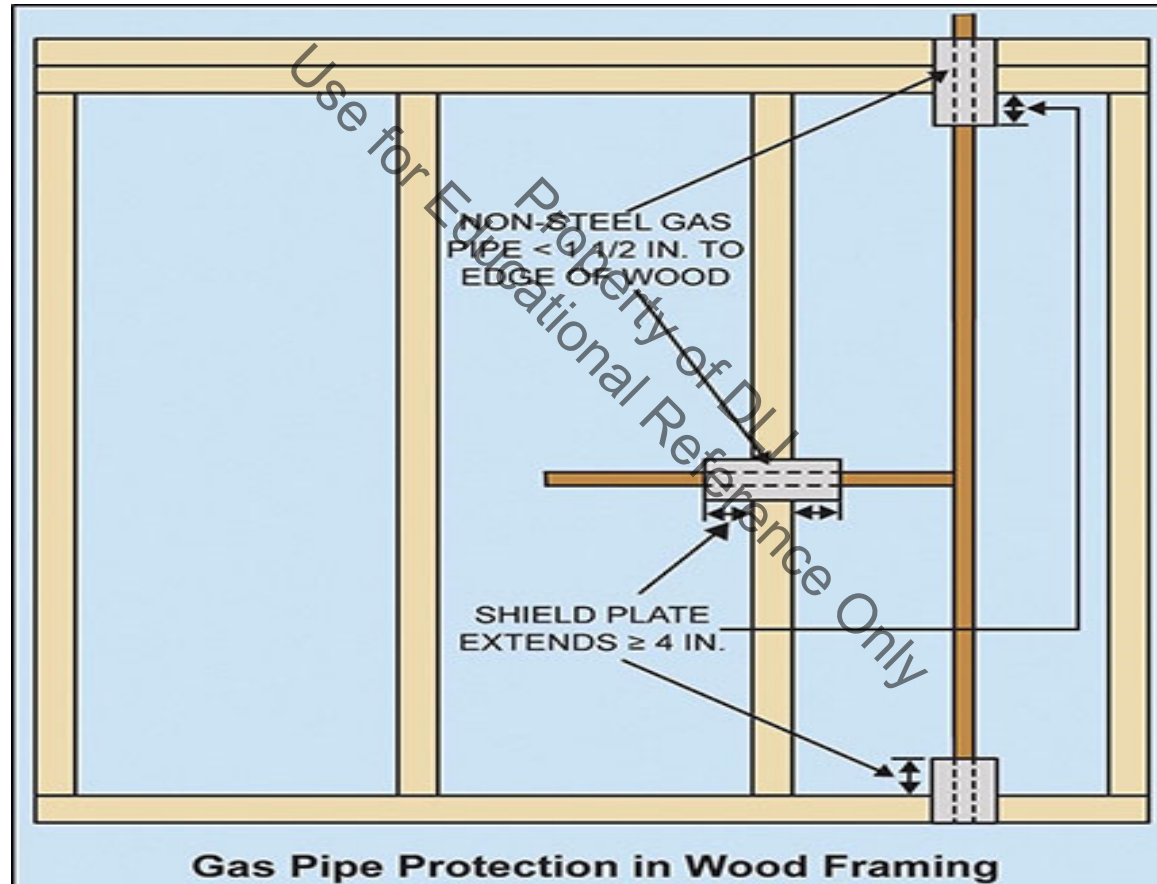
Gas *pip*ing shall **not** penetrate building foundation walls at any point below grade. Gas *pip*ing shall enter and exit a building at a point above grade and the annular space between the pipe and the wall shall be sealed. If necessary due to structural conditions, underground *pip*ing may be installed with prior approval from the building official.





- **404.7 Protection against physical damage.**

In concealed locations, where *piping* other than black or galvanized steel is installed through holes or notches in wood studs, joists, rafters or similar members less than **1<sup>1</sup>/<sub>2</sub> inches** from the nearest edge of the member, the pipe shall be protected by shield plates. Protective steel shield plates having a minimum thickness of **0.0575 inch** shall cover the area of the pipe where the member is notched or bored and shall extend a **minimum of 4 inches** above sole plates, below top plates and to each side of a stud, joist or rafter.



- **404.9 Above-ground outdoor piping.**

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



- **404.12 Minimum burial depth.**

Underground *piping* systems shall be installed a minimum depth of **12 inches** below grade, except as provided for in Section 404.12.1.

- **404.12.1 Individual outside appliances.**

Individual lines to outside lights, grills or other *appliances* shall be installed a minimum of **8 inches** below finished grade, provided that such installation is *approved* and is installed in locations not susceptible to physical damage.



- **406.4 Test pressure measurement.**

Gauges used shall have a range such that the highest end of the scale is not greater than five times the test pressure.

- **406.4.1 Test pressure.**

The test pressure to be used shall be no less than **25 psig**.

- **406.4.2 Test duration.**

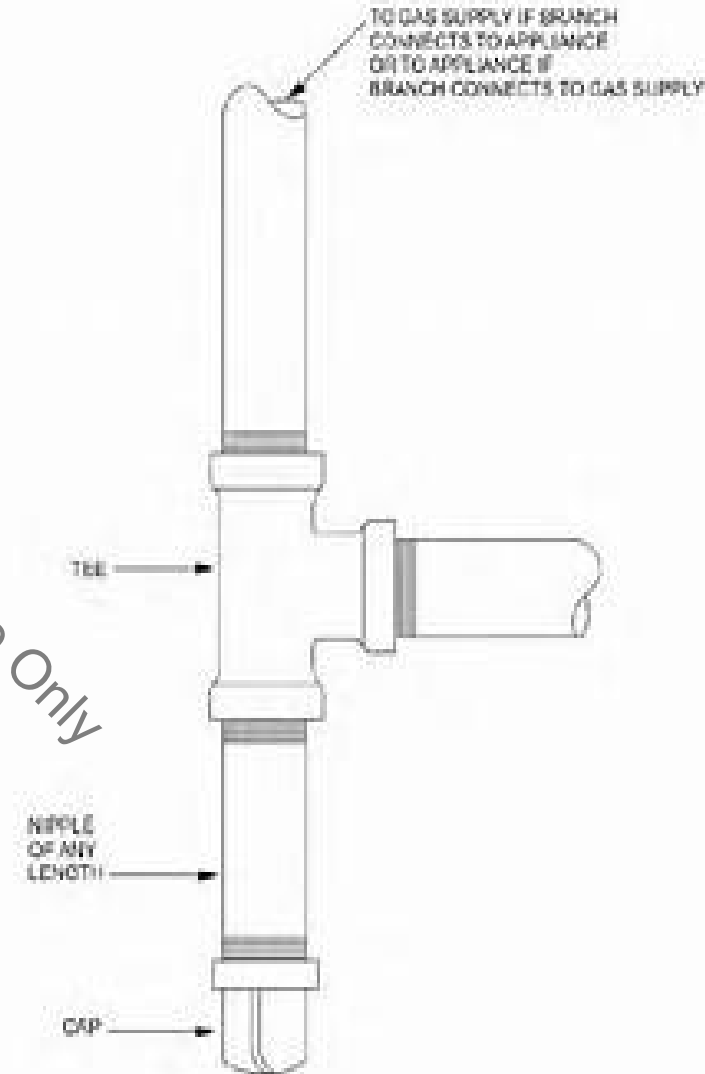
Test duration shall be not less than one-half hour. When testing a system in a single-family dwelling, the test duration shall be permitted to be reduced to **10 minutes** with prior *approval* from the building official.

- **406.4.3 Test gauges.**

The test pressure shall be within the middle 50 percent of the test gauge pressure range.



**408.4 Sediment trap.** Where a sediment trap is not incorporated as part of the appliance, a sediment trap shall be installed downstream of the appliance shutoff valve as close to the inlet of the appliance as practical. The sediment trap shall be either a tee fitting having a capped nipple of **any length** installed vertically in the bottommost opening of the tee as illustrated in Figure 408.4 or other device approved as an effective sediment trap. Illuminating appliances, ranges, cloths dryers, vented decorative appliances for installation in vented fireplaces, gas fireplaces and outdoor grills need not be so equipped.



- **409.1 General.**

*Piping* systems shall be provided with shutoff valves in accordance with this section.

- **409.1.2 Prohibited locations.**

Shutoff valves shall be prohibited in concealed locations and *furnace plenums*.

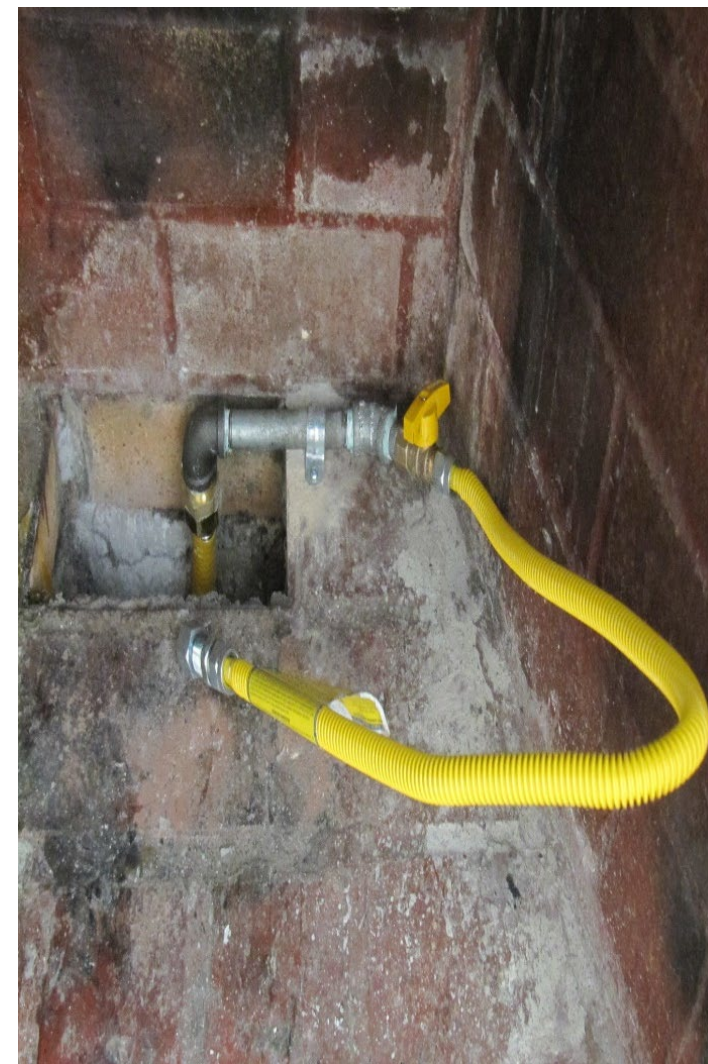
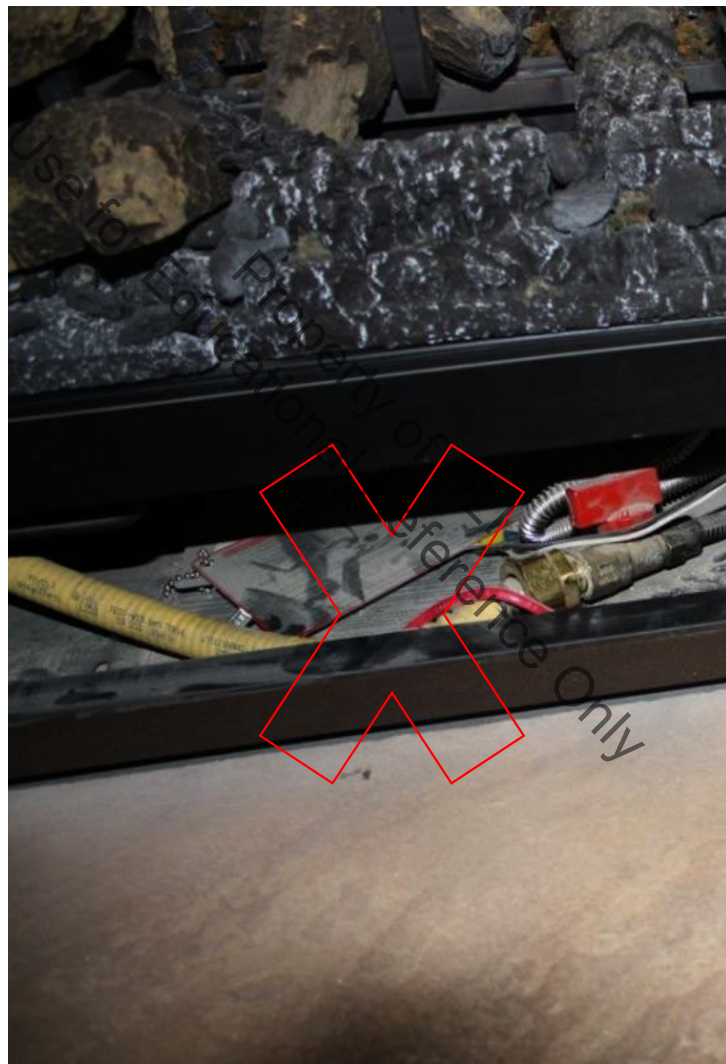
- **409.1.4 Main shutoff valve.** Piping systems shall have an approved main shutoff valve before the first branch line. The valve shall be installed in the first available location inside the building 5 feet or less above the floor that provides ready access and shall have a permanently attached handle.

**409.5.1 Located within same room.** The shutoff valve shall be located in the same room as the appliance. The shutoff valve shall be within 6 feet of the appliance, and shall be installed upstream of the union, connector or quick disconnect device it serves. Such shutoff valves shall be provided with access. Shutoff valves serving movable appliances, such as cooking appliances and clothes dryers, shall be considered to be provided with access where installed behind such appliances. Appliance shutoff valves located in the firebox of a fireplace shall be installed in accordance with the appliance manufacturer's instructions.

- **409.5.2 Vented decorative appliances and room heaters.**

Shutoff valves for vented decorative appliances, room heaters and decorative appliances for installation in vented *fireplaces* shall be permitted to be installed in an area remote from the appliances where such valves are provided with ready *access*. Such valves shall be permanently identified and shall serve no other *appliance*. The *pipng* from the shutoff valve to within **6 feet** of the *appliance* shall be designed, sized and installed in accordance with Sections 401 through 408.

- **409.7 Shutoff valves in tubing systems.** Shutoff valves installed in tubing systems shall be rigidly and securely supported independently of the tubing.



- **409.5.3 Located at manifold.**

Where the *appliance* shutoff valve is installed at a manifold, such shutoff valve shall be located within **50 feet** of the *appliance* served and shall be readily accessible and permanently identified. The *pipng* from the manifold to within **6 feet** of the *appliance* shall be designed, sized and installed in accordance with Sections 401 through 408.

- **411.1 Connecting appliances.**

1. Rigid metallic pipe and fittings.
2. Corrugated stainless steel tubing (CSST) where installed in accordance with the manufacturer's instructions.
3. Semirigid metallic tubing and metallic fittings. Lengths shall not exceed 6 feet and shall be located entirely in the same room as the *appliance*. Semirigid metallic tubing shall not enter a motor-operated *appliance* through an unprotected knockout opening.

- **411.1 Connecting appliances.**

4. *Listed & labeled* connectors in compliance with ANSI Z21.24/CSA 6.27 and installed in accordance with the manufacturer's instructions and located in the same room as the *appliance*.

5. *Listed* and *labeled* quick-disconnect devices used in conjunction with *listed* and *labeled* *appliance* connectors.

7. *Listed* and *labeled* outdoor *appliance* connectors in compliance with ANSI Z21.75/CSA 6.27 and installed in accordance with the manufacturer's instructions.

# IFGC 415.1 Interval of support

**TABLE 415.1  
SUPPORT OF PIPING**

STEEL PIPE, NOMINAL SIZE OF PIPE (inches)	SPACING OF SUPPORTS (feet)	NOMINAL SIZE OF TUBING (SMOOTH-WALL) (inch O.D.)	SPACING OF SUPPORTS (feet)
$\frac{1}{2}$	6	$\frac{1}{2}$	4
$\frac{3}{4}$ or 1	8	$\frac{5}{8}$ or $\frac{3}{4}$	6
$1\frac{1}{4}$ or larger (horizontal)	10	$\frac{7}{8}$ or 1 (horizontal)	8
$1\frac{1}{4}$ or larger (vertical)	Every floor level	1 or larger (vertical)	Every floor level

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm.



## Chapter 5 Chimneys and Vents

- **501.1 Scope.**

This chapter shall govern the installation, maintenance, repair & approval of factory-built chimneys, chimney liners, vents and connectors & the utilization of masonry chimneys serving gas-fired appliances. The requirements for the installation, maintenance, repair & approval of factory-built chimneys, chimney liners, vents and connectors serving appliances burning fuels other than fuel gas shall be regulated by the *International Mechanical Code*. The construction, repair, maintenance & approval of masonry chimneys shall be regulated by the *International Building Code*.

- **503.6.5 Gas vent terminations.**

A gas vent shall terminate in accordance with one of the following:

1. Gas vents that are **12 inches or less** in size and located not less than **8 feet** from a vertical wall or similar obstruction shall terminate above the roof in accordance with Figure 503.6.5.
2. Gas vents that are **over 12 inches** in size or are located less than **8 feet** from a vertical wall or similar obstruction shall terminate not less than **2 feet** above the highest point where they pass through the roof and not less than **2 feet** above any portion of a building within **10 feet** horizontally.

- **503.6.7 Roof terminations.**

Gas vents shall extend through the roof flashing, roof jack or roof thimble and terminate with a *listed* cap or *listed* roof assembly.

- **503.6.8 Forced air inlets.**

Gas vents shall terminate not less than **3 feet** above any forced air inlet located within **10 feet**.

## Category I appliance

- Operates with a positive vent static pressure
- Gas vent temperature that avoid's condensation

Read manufactures venting requirements  
Or follow prescriptive in the 2018 IFGC chapter 4

Examples of classification for gas burning appliances and backdrafting

# Example of classification for gas burning appliances and backdrafting

## INSTALLATION INSTRUCTIONS

90+ Two--Stage & Two--Stage, Variable

**Category IV, Gas Furnace**

- **Should be on the appliance**

## PRODUCT DESIGN

**Category I Venting (Vertical Venting)**

(80% Furnaces Only)

### WARNING

TO PREVENT POSSIBLE PERSONAL INJURY OR DEATH DUE TO ASPHYXIATION, NON-CONDENSING GAS FIRED WARM AIR FURNACES MUST BE CATEGORY I VENTED. DO NOT VENT ANY OF THESE FURNACES USING CATEGORY III VENTING.

Category I Venting is venting at a non-positive pressure. A furnace vented as Category I is considered a fan-assisted appliance and does not have to be "gas tight." NOTE: Single-Stage and Two-Stage gas furnaces with induced draft blowers draw products of combustion through a heat exchanger allowing in some instances common venting with natural draft appliances (i.e. water heaters).

# Example of classification for gas burning appliances and backdrafting

- **Induced-draft.** These have a small fan added for energy performance, not to overcome house depressurization. These can typically tolerate 5 to 15 Pa of negative pressure.

## Category I appliance

- vent temperatures between 300 – 400 °F
- The heat exchanger is under a negative
- Can be connected with other natural draft appliances



# Example of classification for gas burning appliances and backdrafting

- Category II appliances
  - Category II products are no longer manufactured. Negative pressure vents with combustion gases at or below the dew point. Heavy gases at the dew point are not buoyant enough to vent with a negative pressure flue.

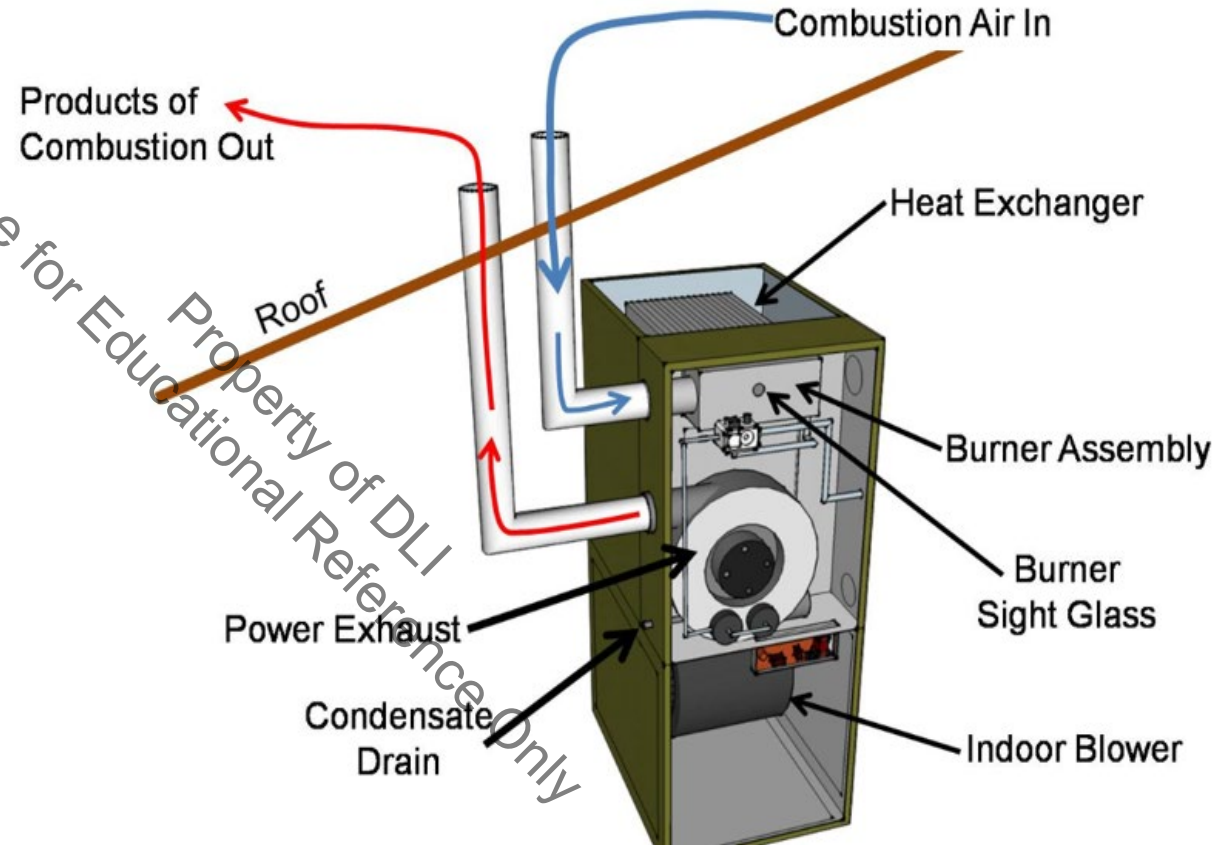
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# Example of classification for gas burning appliances and backdrafting

Category III products are direct sidewall vented without additional apparatus. Positive pressure requires joints in flue material to be sealed. Because these 80 percent appliance flue gases are close to the dew point, and the vent material is single wall, corrosion resistant materials must be used. Drains are typically incorporated to remove flue condensation before it enters the heat exchanger. Category III has been used to solve installation problems where no appropriate flue is available.

# Example of classification for gas burning appliances

- **Sealed-combustion.** Also called “direct vent,” these appliances draw all combustion and dilution air from outside. These can typically tolerate negative pressures in the range from 25 to 50 Pa.

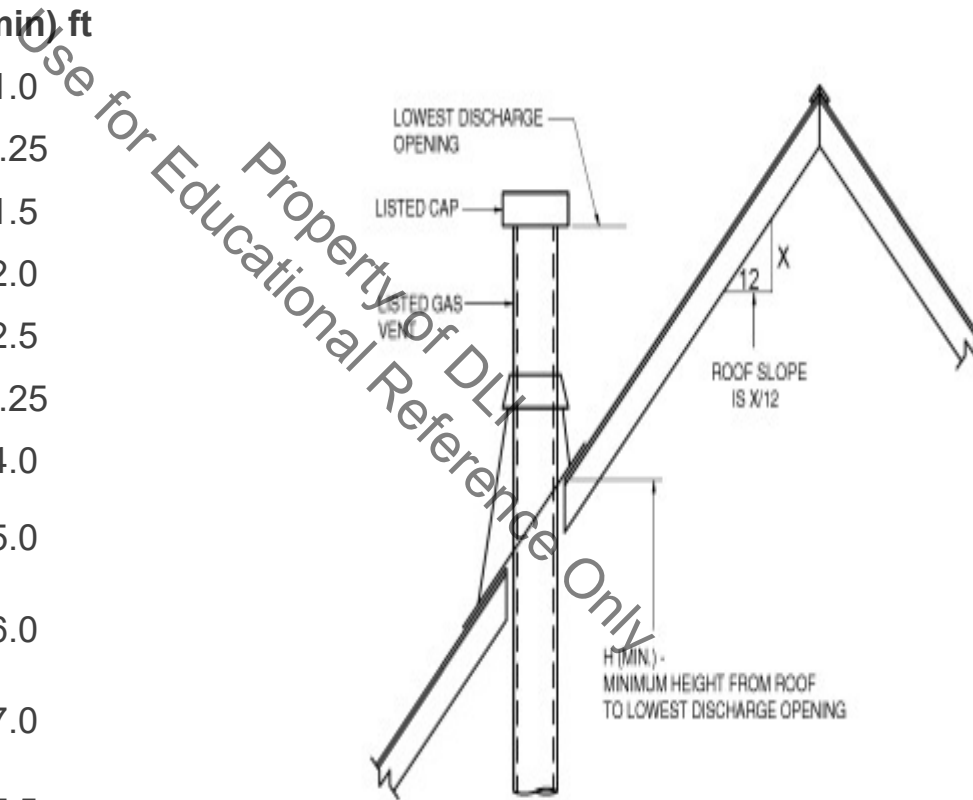


## Category IV appliance

- Positive vent pressure
- Vent gas temp typically around 120 degrees
- Condensing appliance

## B-vent termination

ROOF SLOPE	H (min) - ft
Flat to 6/12	1.0
Over 6/12 to 7/12	1.25
Over 7/12 to 8/12	1.5
Over 8/12 to 9/12	2.0
Over 9/12 to 10/12	2.5
Over 10/12 to 11/12	3.25
Over 11/12 to 12/12	4.0
Over 12/12 to 14/12	5.0
Over 14/12 to 16/12	6.0
Over 16/12 to 18/12	7.0
Over 18/12 to 20/12	7.5
Over 20/12 to 21/12	8.0



- **503.6.10.2 Vent offsets.**

Type B and L vents sized in accordance with Item 2 or 3 of Section 503.6.9.1 shall extend in a generally vertical direction with offsets not exceeding 45 degrees, except that a vent system having not more than one 60-degree (1.04 rad) *offset* shall be permitted. Any angle **greater** than **45 degrees** from the vertical is considered horizontal. The total horizontal distance of a vent plus the horizontal vent connector serving draft hood-equipped appliances shall be not greater than **75 percent** of the vertical height of the vent.

- **503.10 Vent connectors for Category I appliances.**

- **503.10.4 Two or more appliances connected to a single vent or chimney.**

Where two or more vent connectors enter a common vent, chimney flue or single-wall metal pipe, the smaller connector shall enter at the highest level consistent with the available headroom or *clearance to combustible material*.

Vent connectors serving Category I appliances shall not be connected to any portion of a mechanical draft system operating under positive static pressure, such as those serving Category III or IV appliances.

# Natural draft and fan assist venting application



2018 IFGC section 503.10.4

- when two or more appliances connected to a common vent
- The smaller connector shall enter at the highest level

- **503.10.5 Clearance.**

Minimum clearances from **vent connectors** to *combustible material* shall be in accordance with Table 503.10.5.

APPLIANCE	MINIMUM DISTANCE FROM COMBUSTIBLE MATERIAL			
	Listed Type B gas vent material	Listed Type L vent material	Single-wall metal pipe	Factory-built chimney sections
Listed appliances with draft hoods and appliances listed for use with <u>Type B gas vents</u>	As listed	As listed	<b>6 inches</b>	As listed
Residential and low-heat appliances other than above	Not permitted	9 inches	<b>18 inches</b>	As listed

- **503.10.6 Joints.**

Joints between sections of connector *pip*ing and connections to flue collars and draft hood outlets shall be fastened by either:

1. Sheet metal screws.
2. Vent connectors of *listed* vent material assembled and connected to flue collars or draft hood outlets in accordance with the manufacturers' instructions.

- **503.10.7 Slope.**

A vent connector shall be installed without dips or sags & shall slope upward toward the vent or chimney at least  **$\frac{1}{4}$  inch per foot.**

- **SECTION 504 (IFGS)**  
**SIZING OF CATEGORY I APPLIANCE**  
**VENTING SYSTEMS**
- **504.2 Application of single-appliance vent Tables 504.2(1) through 504.2(6).**  
The application of Tables 504.2(1) through 504.2(6) shall be subject to the requirements of Sections 504.2.1 through 504.2.17.

- **504.3.2 Connector length limit.**

The vent connector shall be routed to the vent utilizing the shortest possible route. Except as provided in Section 504.3.3, the maximum vent connector horizontal length shall be **1<sup>1</sup>/<sub>2</sub> feet for each inch** of connector diameter as shown in Table 504.3.2.

## Table 504.3.2 Maximum Vent Connector Length

CONNECTOR DIAMETER (inches)	CONNECTOR MAXIMUM HORIZONTAL LENGTH (feet)
3	4½
4	6
5	7½
6	9
7	10½
8	12
9	13½
10	15
12	18
14	21
16	24
18	27
20	30
22	33
24	36



## Chapter 6 Specific Appliances

- **601.1 Scope.**

This chapter shall govern the approval, design, installation, construction, maintenance, *alteration* and repair of the appliances and *equipment* specifically identified herein.

- **602.1 General.**

Decorative appliances for installation in **approved solid fuel-burning fireplaces** shall be tested in accordance with ANSI Z21.60/CSA 6.26 and shall be installed in accordance with the manufacturer's installation instructions. Manually lighted natural gas decorative appliances shall be tested in accordance with ANSI Z21.84.

- **604.1 General.**

Vented gas fireplaces shall be tested in accordance with ANSI Z21.50/CSA 2.22, shall be installed in accordance with the manufacturer's installation instructions and shall be designed and equipped as specified in Section 602.2.

- **605.1 General.**

Vented gas fireplace heaters shall be installed in accordance with the manufacturer's installation instructions, shall be tested in accordance with ANSI Z21.88/CSA 2.33 and shall be designed and equipped as specified in Section 602.2.

**IFGC 614 IFGC (gas clothes dryers) copies section IMC 504 (electric clothes dryers.)**



- **615.1 General.**

Sauna heaters shall be installed in accordance with the manufacturer's installation instructions.

- **617.1 General.**

Pool and spa heaters shall be tested in accordance with ANSI Z21.56/CSA 4.7 and shall be installed in accordance with the manufacturer's installation instructions.

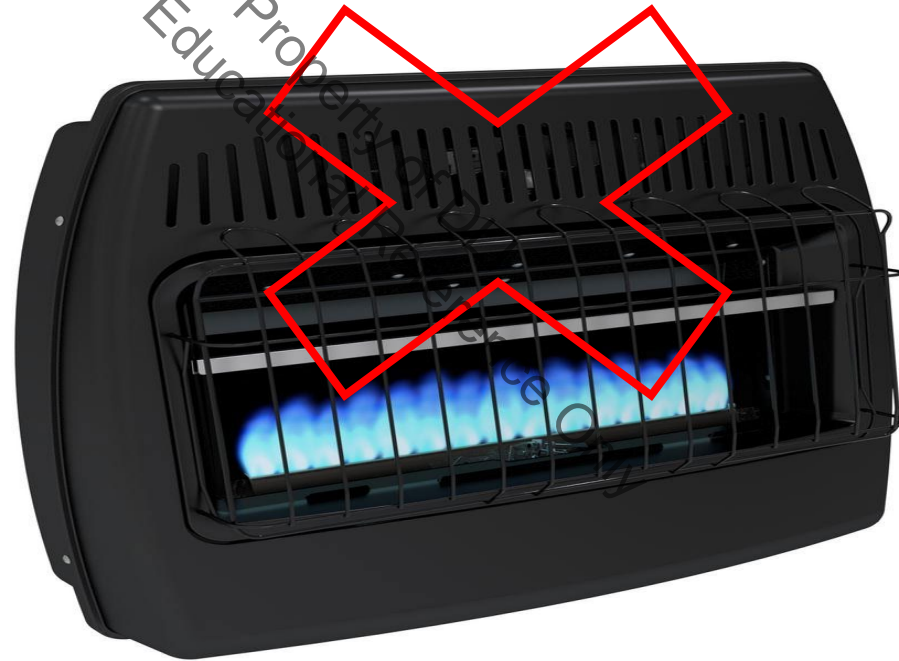
- **618.1 General.**

Forced-air warm-air furnaces shall be tested in accordance with ANSI Z21.47/CSA 2.3 or UL 795 and shall be installed in accordance with the manufacturer's installation instructions.

- **620.1 General.**

Unit heaters shall be tested in accordance with ANSI Z83.8/CSA 2.6 and shall be installed in accordance with the manufacturer's installation instructions.

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



- **623.1 Cooking appliances.**

Cooking appliances that are designed for permanent installation, including ranges, ovens, stoves, broilers, grills, fryers, griddles, hot plates and barbecues, shall be tested in accordance with ANSI Z21.1, ANSI Z21.58/CSA 1.6 or ANSI Z83.11/CSA 1.8 and shall be installed in accordance with the manufacturer's installation instructions.

- **623.2 Prohibited location.**

Cooking appliances designed, tested, *listed* and *labeled* for use in commercial occupancies shall not be installed within dwelling units or within any area where domestic cooking operations occur.

- **623.3 Domestic appliances.**

Cooking appliances installed within dwelling units and within areas where domestic cooking operations occur shall be *listed* and *labeled* as **household-type** appliances for domestic use.

- **623.4 Domestic range installation.**

Domestic ranges installed on combustible floors shall be set on their own bases or legs and shall be installed with clearances of not less than that shown on the label.

- **623.7 (IFGS) Vertical clearance above cooking top.**

Household cooking appliances shall have vertical clearance above the cooking top of at least 30" to *combustibles* and metal cabinets. A minimum *clearance* of 24" where one of the following is installed:

The underside of the *combustible material* or metal cabinet above the cooking top is protected with not less than  $\frac{1}{4}$ " insulating millboard covered with sheet metal not less than 0.0122" thick or a metal ventilating hood sheet metal not less than 0.0122" is installed above the cooking top with clearance of not less than  $\frac{1}{4}$ " between the hood and the underside of the *combustible material* or metal cabinet or a listed cooking *appliance* or **microwave oven** is installed over a listed cooking *appliance* and compliant with the terms of the manufacturer's installation instructions for the upper appliance.



- **624.1 General.**

Water heaters shall be tested per ANSI Z21.10.1/CSA 4.1 and ANSI Z21.10.3/CSA 4.3 & shall be installed in accordance with the manufacturer's installation instructions.

- **624.1.1 Installation requirements.**

The requirements for water heaters relative to sizing, relief valves, drain pans and scald protection shall be in accordance with the *MSPC*.

- **624.2 Water heaters utilized for space heating.**

Water heaters utilized both to supply potable hot water and provide hot water for space-heating applications shall be *listed* and *labeled* for such applications by the manufacturer and shall be installed in accordance with the manufacturer's installation instructions and the *MSPC*.

- **631.1 Standards.**

Boilers shall be *listed* in accordance with the requirements of ANSI Z21.13/CSA 4.9 or UL 795. If applicable, the boiler shall be designed and constructed in accordance with the requirements of ASME CSD-1 and as applicable, the *ASME Boiler and Pressure Vessel Code*, Sections I, II, IV, V and IX and NFPA 85.

- **631.2 Installation.**

In addition to the requirements of this code, the installation of boilers shall be in accordance with the manufacturer's instructions and the *International Mechanical Code*

- **636.1 General.**

Permanently fixed-in-place outdoor decorative appliances shall be tested in accordance with ANSI Z21.97 and shall be installed in accordance with the manufacturer's instructions.





## Chapter 7 Gaseous Hydrogen Systems

# REFERENCE STANDARDS

## TESTING STANDARDS & WORKING STANDARDS

### Chapter 8 Reference Standards



## Chapter 9 Installation & Testing Fuel Gas Appliances



## Chapter 10 Manufactured Home Fuel Gas Appliances

Question

**THANK YOU FOR YOUR ATTENTION**