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Thank you

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2003 International Residential Code Mechanical & Plumbing Application

○ **PRESENTED BY:**

- Department Of Public Safety
- Office Of Education And Data Management

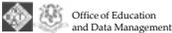


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Areas For Discussion & Application

- Combustion Air, Chimney & Venting
 - Oil
 - Chapters 17 & 18
 - Gas
 - Chapter 24
- Gas Piping
 - Methods
 - Longest Length Method, Branch Length Method, Hybrid Method
- Water Supply
 - Sizing of
 - Water service, Branches & Risers
 - Chapter 29



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Chapter 17
Combustion Air

- o Overview
 - **1701.1 Air Supply**
 - Liquid & solid fuel burning appliances
 - To have supply of air for fuel combustion, draft hood dilution & ventilation of space
 - **1701.1.1 Unusually Tight Construction**
 - Based upon infiltration rate of minimum
 - 50 cfm / 1000 Btu of input

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Infiltration Areas

Typical Sources of Air Leakage

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Exhaust - Ventilation Prohibited Sources

- o 1701.2 Exhaust & Ventilation System
 - Air requirements necessary for
 - Exhaust & ventilation fans, clothes dryers & fireplaces
 - Consider when determining adequacy of combustion air
- o 1701.4 Prohibited Sources
 - Prohibition for combustion air from
 - Sleeping rooms
 - Bathrooms
 - Toilet rooms

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Louvers

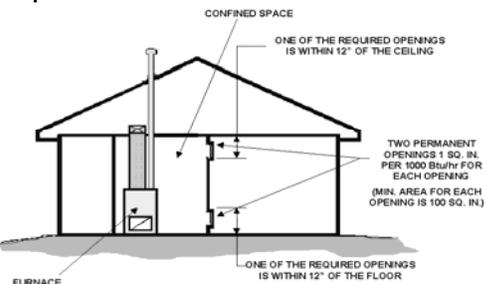
- o 1701.5 Opening Area
 - *Free opening area to be used*
 - Considered
 - 75% of Gross area for metal louvers
 - 25% of Gross area for wood louvers



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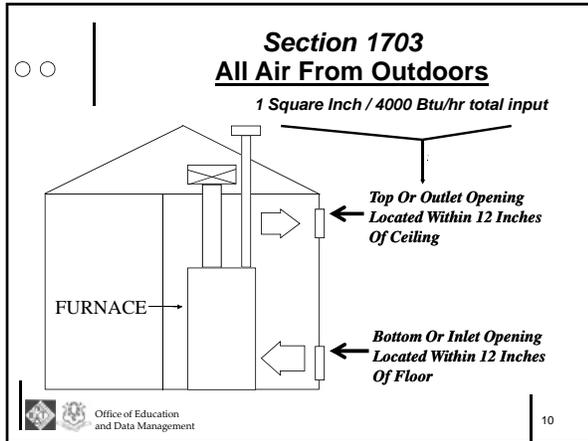
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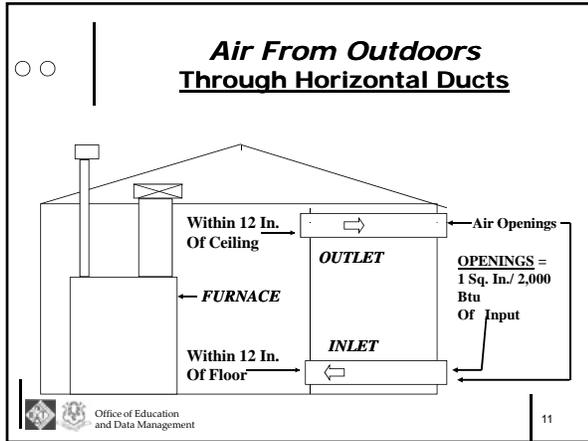
Section 1702
All Air From Inside The Building

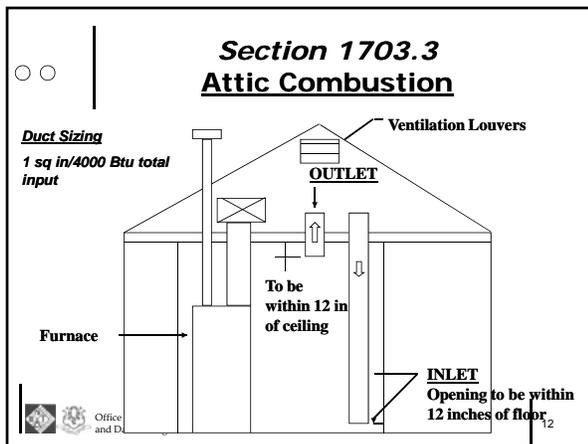


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Duct Within A Duct

Ventilation Rate
1 sq in / 4000 Btu/h

6 Inches
Within 12 Inches
Inlet
Outlet
Minimum 12 Inches
Furnace
Within 12 Inches

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Section 1703.4
Crawl Space Inlet Air, Attic Outlet Air

6 In. Above Insulation
Within 12 Inches Of Ceiling
Outlet
Furnace
Within 12 Inches Of Floor
CRAWL SPACE
Inlet
Louvers For Ventilation

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Chapter 18
Chimney And Vents

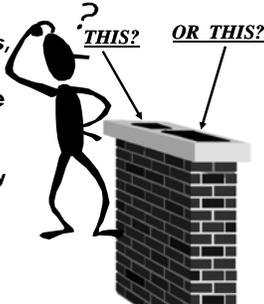
o **Section 1801.1 Venting Required**

- **Fuel burning appliances**
 - Shall be vented to the outdoors
 - As per MFG installation instructions
- **Gas fired appliances**
 - Shall be vented as
 - Per Chapter 24

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Section 1801.3
Existing Chimneys & Vents

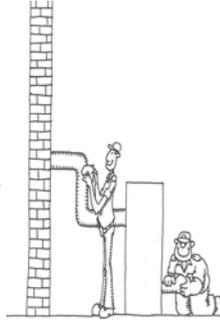
- o Existing are to comply with
 - *Size, Flue passageways, Cleanout, Clearances*
- o Section 1801.3.1 Size
 - *Resize as necessary to control condensation*
 - Oil fired units to masonry chimney
 - Use NFPA 31



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Section 1801.3.2
Flue Passageways

- o Passageway
 - *Free of*
 - *Obstructions & combustible deposits*
 - *To be cleaned*
 - *When previously used for solid or liquid fuel*
 - *Appliance or fireplace*



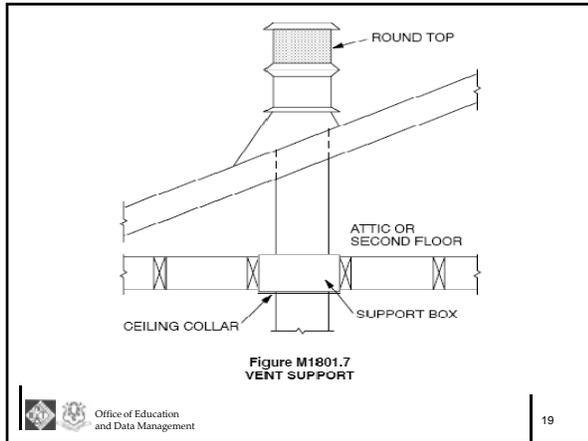
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Cleanouts & Clearances

- o Section 1801.3.3 Cleanout
 - *Cleanouts shall be provided*
 - For masonry chimneys
- o Section 1801.3.4 Clearances
 - *Air space clearance to combustibles must be provided*
 - In accordance with this code
 - **Exception:**
 - *Chimney Lining System (UL 1777)*



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Section 1801.11
Multiple Appliance Venting

- o Two or more listed and labeled appliances
 - Connected to a common
 - Natural draft venting system
 - On same floor
 - Offset
 - Connector under natural draft not connected to mechanical draft
 - Under positive pressure
- o Section 1801.12 Multiple Solid Fuel Prohibited
 - No venting connection allowed between appliances

Section 1802
Vent Components

o Section 1802.3 Draft Regulators

- Provide for oil fired appliances
 - In same room as appliance
- When provided for solid fuel
 - Install in accordance with the MFG installation instructions

Connector Size

CONNECTOR SIZE:
 * NOT SMALLER THAN FLUE COLLAR UNLESS STATED OTHERWISE BY MANUFACTURER AND LISTING
 * ENTIRE LENGTH IS SAME SIZE AS FLUE COLLAR

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Section 1803.3.4 Clearances To Combustibles

- **Clearance to combustibles**
 - See Table 1803.3.4
- **Installed connectors must also follow**
 - Table 1306.2 (fig 1306.1)
 - **For clearance reduction**

TYPE OF CONNECTOR	MINIMUM CLEARANCE (inches)
Single-wall metal pipe connectors: Oil and solid-fuel appliances	18
Oil appliances listed for use with Type L vents	9
Type L vent piping connectors: Oil and solid-fuel appliances	9
Oil appliances listed for use with Type L vents	3 ^b

For SI: 1 inch = 25.4 mm.

a. These minimum clearances apply to unlisted single-wall chimney and vent connectors. Reduction of required clearances is permitted as in Table M1306.2.

b. When listed Type L vent piping is used, the clearance shall be in accordance with the vent listing.

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Section 1803.4 Connection To Fireplace Flue

- o **Section 1803.4.1 Closure & Accessibility**
 - **Seal to be provided**
 - Below point of connection
- o **Section 1803.4.2 Connection To Factory Built Fireplace Flue**
 - **Not allowed**
 - Unless listed for installation
- o **Section 1803.4.3 Connection To Masonry Fireplace Flue**
 - **Flue gases must be conveyed**
 - Directly into flue

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Section 1804
Vents

o **Section 1804.1 Type Of Vent Required**

- Provide a listed & labeled venting system
- As per Table 1804.1

TYPE L OIL	PELLET VENTS
Oil-burning appliances listed and labeled for use with Type L vents.	Pellet fuel burning Pellet fuel-burning appliances listed and labeled for use with pellet vents

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TYPE L - VENT

For venting oil fired appliances approved with L-Vent, producing flue gas temperatures not in excess of 570° F (298° C). It can also be used on gas appliances approved with B-vent. For exterior installations, check with the authority having jurisdiction.



SIZES: 3" - 7"

CLEARANCE TO COMBUSTIBLES: 3"

MATERIALS: Case - Galvalume® AZ150
Liner - Type 304 SS or equivalent

LISTING: Tested by U.L.C. to standard S609
Tested by U.L.I. to standard UL641

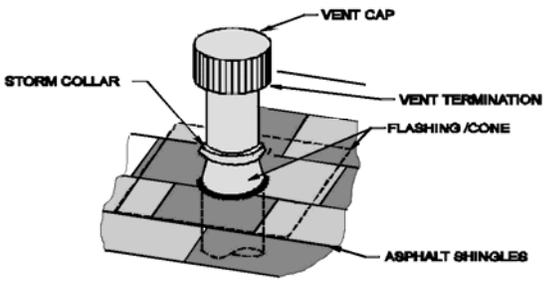
STANDARD PIECES:

Lengths	Tee / Y-Tee
Elbows	Rain Cap
Support Assy	Pipe Adaptor
Wall Bands	Firestop Spacer
Roof Flashing	Storm Collar
Tee with screens for horizontal venting of Radiant Heaters	

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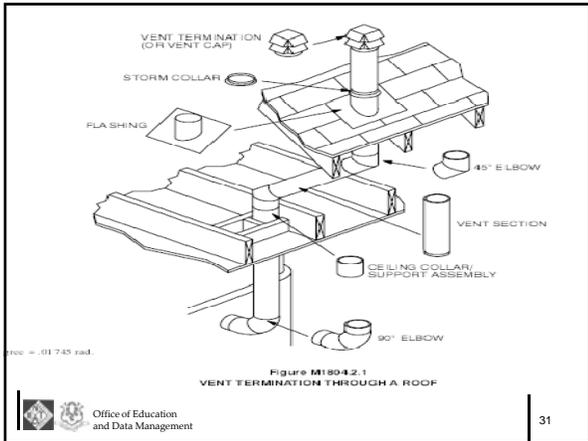
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Section 1804.2
Termination



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Venting Termination

o **Section 1804.2.2
Decorative Shrouds**

- **Must be**
 - Listed & labeled
- **Installation**
 - As per MFG installation instructions

Logos for Office of Education and Data Management are present.

**Section 1804.2.3
Natural Draft Appliances**

Furnace →

12'-0" Minimum Top Of Vent To Bottom Of Furnace As Set Forth Within Section M1804.2.3

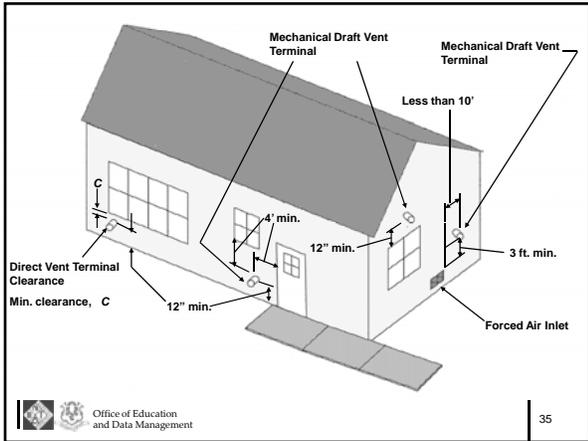
Logos for Office of Education and Data Management are present.

**Section 1804.2.4
Type L Vent**

- o **Type L venting system**
 - **Termination with listed and labeled cap**
 - As per MFG installation instructions
 - Not less than 2 feet above
 - *Roof or any portion of the building within 10 feet*

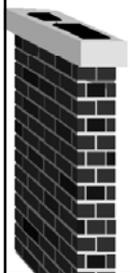


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**Section 1805
Masonry & Factory Built Chimneys**

- o **Section 1805.1 General**
 - **Masonry and factory-built chimneys**
 - Install per Sections 1001 & 1002
 - **Flue linings of masonry chimneys**
 - Install per Section 1001.8
- o **Section 1805.3 Size of Chimney Flues**
 - **Exception for Oil - NFPA 31**
- o **Section 1805.3.1 Size of Chimney Flue for Solid Fuel Appliance**
 - **Not less than flue collar**




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Chapter 24

Gas

○ **Section 2406 Appliance Location**

- **2406.2 Prohibited Locations**
 - Appliances shall not
 - *Be in or obtain combustion air from*
 - Sleeping rooms
 - Bathrooms
 - Toilet rooms
 - Storage closets
 - Note Exceptions

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Section 2407.5

Indoor Combustion Air

○ **Unlike Chapter 17**

- ***This chapter deals with the***
 - 50 cf of infiltration / 1000 Btu/h input rating
- ***But***
 - Allows for an additional means when the rate of infiltration is known to be less than
 - *0.40 air changes per hour*

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Section 2407.5.2

Known Air-Infiltration-Rate

○ **Equation 24-1**

- ***Appliances other than fan assisted***

$$RV_{other} \geq 21 \text{ cu ft/ACH} \times I_{other} / 1,000 \text{ Btu/h}$$

Note: Other = input all appliances other than fan assisted
 RV = required volume *other*
 ACH = Air Changes Per Hour

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Section 2407.5.2
Known Air-Infiltration-Rate

o **Equation 24-2**

- **Fan assisted appliances**

$RV_{fan} \geq 15 \text{ cu ft} / \text{ACH} \times I_{fan} / 1000 \text{ Btu/h}$

Note: RV_{fan} = required volume fan
 I_{fan} = fan assisted appliance input
 ACH = Air Changes Per Hour



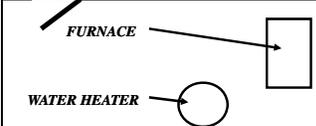
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Indoor Combustion Air Rates

o **Section 2407.5 Indoor Combustion Air**

- **Sets up the approach to be taken, for determination dependent upon:**
 - Total input of all appliances
 - Minimum required volume being
 - 50 Cubic Feet / 1000 Btu/h input
 - Air infiltration rating being less than
 - 0.40 Air Changes / hour

FURNACE = 100,000
WATER HEATER = 30,000
TOTAL INPUT = 130,000
Btu/HOUR




Section 2407.5.3
Indoor Opening Size & Location

o **Chapter 24 allows for the same methods as chapter 17**

- **With an addition**

o **Section 2407.5.3.2 Combining Spaces In Different Stories**

- **Communicating spaces between stories**
 - When connected by one or more openings
 - In doors or floors
 - Minimum free area of 2 square inches / 1000 Btu/h total input



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One Opening Placement

A = Direct Opening To Outside Within 12 Inches Of Ceiling

B = Horizontal Duct To Outside Within 12 Inches Of Ceiling

C = Vertical Duct To Attic Space Within 12 Inches Of Ceiling Terminates Minimum Of 6 Inches Above Attic Floor And Insulation

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Section 2407.7 Indoor & Outdoor Air

- o Unlike Chapter 17
 - Chapter 24 allows for the use of
 - Indoor & outdoor air together
- o Air Openings
 - Indoor openings 2407.7.1
 - To comply with 2407.5.3
 - Outdoor openings 2407.7.2
 - To comply with 2407.6

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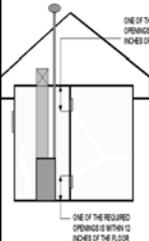
Use Of Indoor & Outdoor Air

- o Section 2407.7.3 Outdoor Opening(s) Size
 - Calculation of opening size
 - Interior ratio shall be
 - Available volume / Required volume
 - Outdoor size reduction factor
 - 1 minus ratio of interior space
 - Minimum outdoor opening size
 - Size as determined by section 2407.6
 - Times the reduction factor
 - NOTE: Minimum dimension not to be less than 3 inches

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Combination Of Indoor & Outdoor Combustion Air



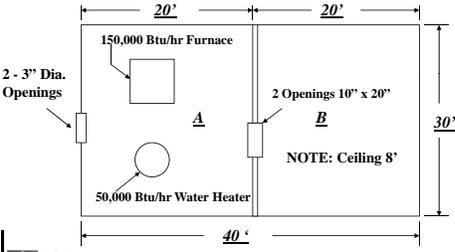
ONE OF THE REQUIRED OPENINGS IS WITHIN 12 INCHES OF THE CEILING

ONE OF THE REQUIRED OPENINGS IS WITHIN 12 INCHES OF THE FLOOR

- o **Section 2407.7**
 - **Interior Space Openings are to comply with**
 - 2407.5.3 Indoor opening size and location
 - **Exterior Openings Location are to comply with**
 - 2407.6 Outdoor combustion air

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Example Problem



2 - 3" Dia. Openings

150,000 Btu/hr Furnace

50,000 Btu/hr Water Heater

20' 20' 30' 40'

2 Openings 10" x 20"

NOTE: Ceiling 8'

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Do The Openings To The Outdoors, Combined With The Volumes Of A & B Meet Combustion Air Demand?

- o **Volume Of "A":**
 - 4800 Cubic Feet
- o **Volume Of "B":**
 - 4800 Cubic Feet
- o **Area Of The 3" Diameter Opening:**
 - 7.07 Square Inches
- o **Area Of Each Opening Between A & B:**
 - 200 Square Inches

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Problem Continued

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- **TOTAL INPUT:**
 - 200,000 Btu/hr
- **Question**
 - Do "A" & "B" meet the volumetric requirements of 2407.5?
 - Required Volume =
 - 10,000 Cu.Ft.
 - Available Volume =
 - 9,600 Cu. Ft.

NO



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Problem Continued

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- **Question**
 - Do openings between "A" & "B" meet requirements of 2407.5.3
- **Required Area =**
 - 200 Square Inches
- **Actual Area =**
 - 200 Square Inches
 - For Each Opening

YES



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Problem Continued

○ ○

- **Determine The Required Area Of Each Outdoor Opening?**
 - Required Area =
 - $(200,000 / 4000) \times 1 \text{sq in} =$
 - 50 Sq in Required (as per G2407.6.1)
- **Determine If The 3 Inch Diameter Openings Along With the Interior Openings Comply?**
 - $[(1) - 9600 / 10000] \times 50 =$
 - $0.04 \times 50 = 2 \text{ sq. in.}$
 - (As per G2407.7.3)

OK



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Mechanical Air Supply



o **Section 2407.9 Mechanical Combustion Air Supply**

- **Minimum rate of 0.35 cubic feet per minute per 1,000 Btu/h total input rating**
- **Interlocks with all units must be provided**

Fan-in-a-Drum™

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Section 2413 Gas Pipe Sizing

o **Two Major Items To Keep In Mind**

- **Piping to supply a sufficient gas supply**
 - To meet maximum demand
 - Section 2413.1 General Considerations
- **Volume of gas to be provided**
 - Determined from mfg input rating
 - Section 2413.2 Maximum Gas Demand

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TABLE G2413.2 (402.2) APPROXIMATE GAS INPUT FOR TYPICAL APPLIANCES

APPLIANCE	INPUT BTU/H (Approx.)
Space Heating Units	
Hydronic boiler	
Single family	100,000
Multifamily, per unit	60,000
Warm-air furnace	
Single family	100,000
Multifamily, per unit	60,000
Space and Water Heating Units	
Hydronic boiler	
Single family	120,000
Multifamily, per unit	75,000
Water Heating Appliances	
Water heater, automatic instantaneous	35,000
Capacity at 2 gal/minute	50,000
Capacity at 4 gal/minute	
Capacity at 6 gal/minute	142,800
Water heater, automatic storage, 30- to 40-gal. tank	285,000
Water heater, automatic storage, 50-gal. tank	428,400
Water heater, domestic, circulating or side-arm	35,000
Cooking Appliances	
Built-in oven or broiler unit, domestic	65,000
Built-in top unit, domestic	25,000
Range, free-standing, domestic	40,000
Other Appliances	
Barbecue	3,000
Clothes dryer, Type 1 (domestic)	35,000
Gas fireplace, direct vent	40,000
Gas light	80,000
Gas log	40,000
Refrigerator	2,500

For SI: 1 British thermal unit per hour = 0.293 W, 1 gallon = 3.785 L, 1 gallon per minute = 3.785 L/min

Section 2413.4
Equation 24-3

1. Low-pressure gas equation [Less than 1.5 pounds per square inch (psi) (10.3 kPa)]:

$$D = \frac{Q^{0.381}}{19.17 \left(\frac{\Delta H}{C_r \times L} \right)^{0.206}} \quad \text{(Equation 24-3)}$$

where:

- D = Inside diameter of pipe, inches (mm).
- Q = Input rate appliance(s), cubic feet per hour at 60°F (16°C) and 30-inch mercury column
- P₁ = Upstream pressure, psia (P₁ + 14.7)
- P₂ = Downstream pressure, psia (P₂ + 14.7)
- L = Equivalent length of pipe, feet
- ΔH = Pressure drop, inch water column (27.7 inch water column = 1 psi)



Section 2413.4
Equation 24-4

2. High-pressure gas equation [1.5 psi (10.3 kPa) and above]:

$$D = \frac{Q^{0.381}}{18.93 \left(\frac{P_1^2 - P_2^2}{C_r \times L} \right)^{0.206}} \quad \text{(Equation 24-4)}$$

where:

- D = Inside diameter of pipe, inches (mm).
- Q = Input rate appliance(s), cubic feet per hour at 60°F (16°C) and 30-inch mercury column
- P₁ = Upstream pressure, psia (P₁ + 14.7)
- P₂ = Downstream pressure, psia (P₂ + 14.7)
- L = Equivalent length of pipe, feet
- ΔH = Pressure drop, inch water column (27.7 inch water column = 1 psi)



Additional Chart
For Equations 24-3 & 24-4

- o In Order To Use Either Equation
 - C sub r & Y must be known
 - Both are determined regarding the type of Gas Natural or Propane
 - Information is contained within Table 2413.4

TABLE G2413.4 (402.4)
C_r AND Y VALUES FOR NATURAL GAS AND UNDILUTED PROPANE AT STANDARD CONDITIONS

GAS	EQUATION FACTORS	
	C _r	Y
Natural gas	0.6094	0.9992
Undiluted propane	1.2462	0.9910

For SI: 1 cubic foot = 0.028 m³, 1 foot = 305 mm, 1 inch water column = 0.249 kPa, 1 pound per square inch = 6.895 kPa, 1 British thermal unit per hour = 0.293 W.



Equation 24-3
Example

Natural Gas
 Specific gravity: 0.60
 Heating Value: 1000 Btu/cf
 Allowable pressure drop: 0.5" WC
 Total Input Rating: 45,000
 Length of Pipe: 80 ft

$$D = \frac{Q^{0.381}}{19.17 \left(\frac{\Delta H}{C_p \times L} \right)^{0.206}} \quad \text{(Equation 24-3)}$$

$D = (45)^{0.381} / 19.17 [(1/2) / (0.609 \times 80)]^{0.206} = 0.574$

½ inch

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Section 2413.4
Sizing Tables

o Three Methods Of Sizing

- **Section 2413.4.1 Longest Length Method**
 - Longest length measurement from point of delivery to most remote location
- **Section 2413.4.2 Branch Length Method**
 - Sized by determining length of piping from point of delivery to each load
- **Section 2413.4.3 Hybrid Pressure**
 - Sized from point of high pressure delivery to most remote pressure regulator
 - Low pressure from regulator to the most remote outlet

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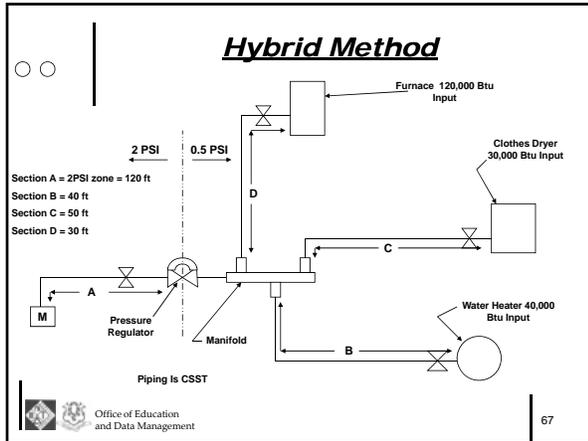
TABLE G2413.4(1) (402.4(2))
SCHEDULE 40 METALLIC PIPE

Nominal Arch'd ID	PIPE SIZE (In.)					
	½	¾	1	1 ¼	1 ½	1 ¾
	0.364	0.493	0.622	0.824	1.049	1.389
Length (ft)	Maximum Capacity in Cubic Feet of Gas per Hour					
10	43	95	175	300	460	1,000
20	29	65	120	200	405	950
30	24	52	97	160	375	770
40	20	45	82	170	320	660
50	18	40	73	151	285	580
60	16	36	66	138	260	550
70	15	33	61	125	240	490
80	14	31	57	118	220	460
90	13	29	53	110	205	430
100	12	27	50	103	195	400
115	11	24	44	93	175	360
130	10	22	40	84	160	320

For 80: 1 inch=25.4 mm, 1 foot=304.8 mm, 1 cubic foot per hour = 0.0283 m³/h, 1 pound per square inch = 6.895 kPa, 1 inch water column = 0.2488 kPa.

Tables 2413.4(1) – 2413.4(6)
 Set up by: Type of piping, Type of gas, Inlet pressure, Pressure Drop, Specific gravity

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**Section 2425
General**

- o Section 2425.1 Scope
 - Section governs
 - Installation, maintenance of
 - Factory built & masonry chimneys for gas appliances
- o Section 2425.4 Minimum Size Of Chimney or Vent
 - To be sized per section 2427

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**Section 2425
Continued**

- o Section G2425.5 Abandoned Inlet Openings
 - Shall be closed by an approved means

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Section 2425.7
Connection to Fireplace

- o Section 2425.7.1 Closure & Access
 - *Non-combustible seal to be provided*
 - Below point of connection
- o Section 2425.7.2 Connection to Factory-Built Fireplace flue
 - *Shall not connect to factory-built fireplace flue*
 - Unless listed for installation
- o Section 2425.7.3 Connection to Masonry Fireplace
 - *Connector to extend from appliance to the flue*

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Section 2425.8
Equipment Not Required to be Vented

Ranges



Domestic Cook Tops
Hot Plates & Laundry Stoves
Counter Appliances

Type I Clothes Dryer



Refrigerators



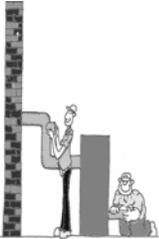
Unvented Room Heaters



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Section 2425.15
Existing Chimneys & Vents

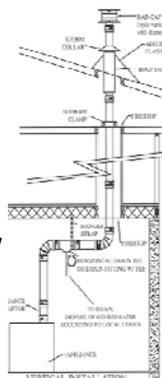
- o Section 2425.15.1 Size
 - *Resize as necessary*
- o Section 2425.15.2 Flue Passageways
 - *Flue liner to be continuous*
 - Free of cracks or damage
- o Section 2425.15.3 Cleanouts
 - *To have a minimum height of*
 - 6 inches



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Vents

- Section G2426.1 General
 - All vents shall be listed and labeled Type B, BW or L
- Section G2426.4 Insulation Shield
 - When passing through an insulated assembly minimum shield of 26 gauge sheet metal
 - Between vent and insulation material
 - If passing through attic space
 - Termination to be minimum of 2 inches above insulation material



VERTICAL INSTALLATION

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Section 2427 Venting Of Equipment

- Section 2427.1 General
 - Venting materials and methods dependent upon operating characteristics
 - Positive or negative pressure
 - Flue gases and condensation problems
- Section 2427.3 Design & Construction
 - System shall develop a positive flow for flue gas removal

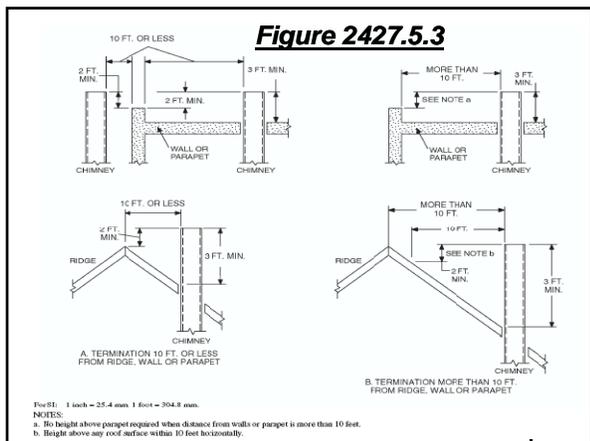


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TABLE G2427.4 (503.4)
TYPE OF VENTING SYSTEM TO BE USED

GAS UTILIZATION EQUIPMENT	TYPE OF VENTING SYSTEM
Listed Category I equipment	Type B gas vent (G2427.6)
Listed equipment equipped with draft hood	Chimney (G2427.5)
Equipment listed for use with Type B gas vent	Single-wall metal pipe (G2427.7) Listed chimney lining system for gas venting (G2427.5.3). Special gas vent listed for this equipment (G2427.4.2)
Listed vented wall furnaces	Type B-W gas vent (G2427.6, G2435)
Category II equipment	As specified or furnished by manufacturers of listed equipment (G2427.4.1, G2427.4.2)
Category III equipment	As specified or furnished by manufacturers of listed equipment (G2427.4.1, G2427.4.2)
Category IV equipment	As specified or furnished by manufacturers of listed equipment (G2427.4.1, G2427.4.2)
Unlisted equipment	Chimney (see G2427.2.1)
Decorative appliance in vented fireplace	Chimney (see G2427.2.2)
Direct-vent equipment	See G2427.2.1
Equipment with integral vent	See G2427.2.4

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Chimneys

Serving Multiple Fuels

- o Section 2427.5.6.1 Solid Fuel-burning Appliances
 - Gas utilization equipment **NOT** to connect to flue
 - Serving a separate solid fuel appliance
- o Section 2427.5.6.2 Liquid Fuel-burning Appliances
 - Gas & liquid fuel equipment to be connected to
 - Separate openings
 - Or through a single opening by a suitable fitting

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Lining Or Vent

- o Section 2427.5.9 Space Surrounding Lining Or Vent
 - Space surrounding liner, vent or plastic piping
 - Shall not be used to vent another appliance
 - Nor is it to be used for
 - Combustion air

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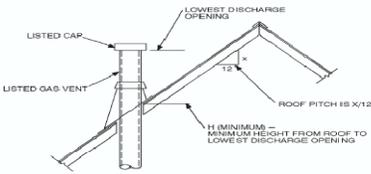
**—TYPE B GAS VENT—
MODEL BV
WWW.ENERGYVENT.COM**

**the Venting
Solution for
Gas appliances**





Gas Vent Termination



ROOF PITCH	H (minimum) ft	m
Flat to $\frac{1}{4}$ "	1.0	0.30
Over $\frac{1}{4}$ " to $\frac{1}{2}$ "	1.25	0.38
Over $\frac{1}{2}$ " to $\frac{3}{4}$ "	1.5	0.46
Over $\frac{3}{4}$ " to 1 "	2.0	0.61
Over 1 " to $1\frac{1}{4}$ "	2.5	0.76
Over $1\frac{1}{4}$ " to $1\frac{1}{2}$ "	3.25	0.99
Over $1\frac{1}{2}$ " to $1\frac{3}{4}$ "	4.0	1.22
Over $1\frac{3}{4}$ " to 2 "	5.0	1.52
Over 2 " to $2\frac{1}{4}$ "	6.0	1.83
Over $2\frac{1}{4}$ " to $2\frac{1}{2}$ "	7.0	2.13
Over $2\frac{1}{2}$ " to $2\frac{3}{4}$ "	7.5	2.27
Over $2\frac{3}{4}$ " to 3 "	8.0	2.44

FIGURE G2427.5.5 (503.6.6)
GAS VENT TERMINATION LOCATIONS FOR LISTED CAPS: 12 INCHES

**When Extensive Use
Of Solid & Liquid Fuels**

- o Gas Vents Shall Be
 - *Permanently identified by a label*
 - **Label to read:**
 - "This gas vent is for appliances that burn gas. Do not connect to solid or liquid fuel-burning appliances or incinerators."


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**Section 2427.7
Single Wall Metal Pipe**

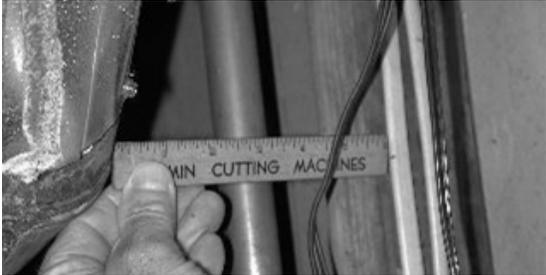


o **Section 2427.7.3 Termination**

- **Minimum 5 ft termination vertically**
 - Above highest connected draft hood outlet
- **Minimum of 2 ft above**
 - Highest point passing through roof
- **Minimum 2 ft higher than**
 - Building within 10 ft horizontal

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**Clearance To Combustibles
See Table 2427.7.7**



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**Clearances To Combustible
Table 2427.7.7**

Equipment	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 equipment with draft hoods & equipment listed for use with Type B gas vents	as listed	as listed	6 inches	as listed
Residential boilers and furnaces with listed gas conversion burner and with draft hood	6 inches	6 inches	9 inches	as listed
Residential and low heat equipment other than those above	not permitted	9 inches	18 inches	as listed

NOTE: Slide is representative of Table 2427.7.7

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Section 2427.8
Venting System Termination Location

APPENDIX C
EXIT TERMINALS OF MECHANICAL DRAFT AND DIRECT-VENT SYSTEMS

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Section 2428
Sizing of Category I Appliance Venting Systems

- o **Section 2428.2 Application of Single Appliance Vent Tables**
 - **Section 2428.2.2 Minimum Size**
 - If tables determine smaller size than draft hood or flue collar
 - *Smaller size permitted when all requirements are met*
 - **Section 2428.2.3 Vent Offsets**
 - 0 – lateral lengths = **NO OFFSETS**
 - Lateral lengths in tables
 - 2 - 90 degree turns allowed

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System Sizing

- o **Section G2428.2 Application of Single Appliance Vent Tables**
 - **For application of Type B double wall gas vent**
 - Use Tables G2428.2 (1) & G2428.2 (2)
- o **Section G2428.3 Application of Multiple Appliance Vent Tables**
 - **For application of Type B double wall gas vent**
 - Use Tables G2428.3 (1) through G2428.3 (2)
 - **For application of Masonry Chimney**
 - Use Tables G2428.3 (3) through G2428.3 (4)

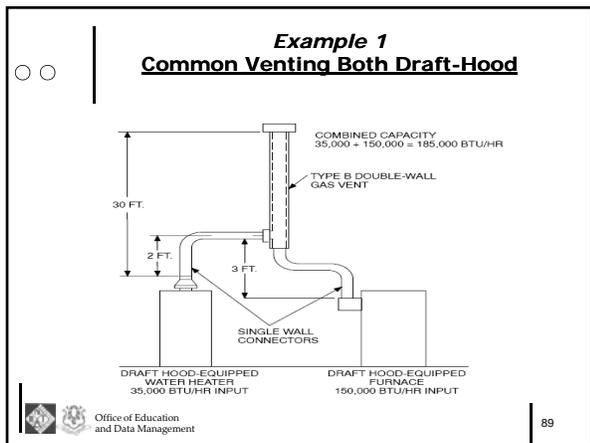
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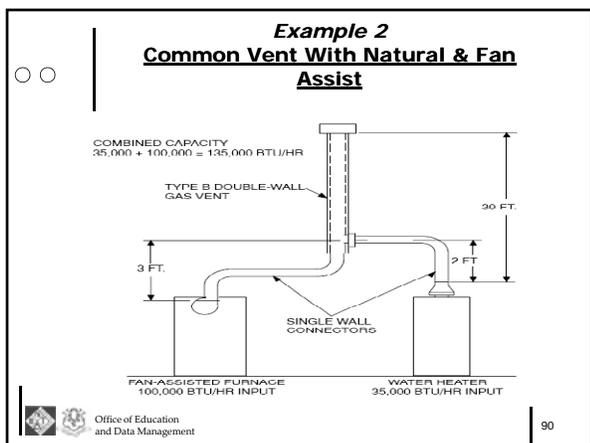
**TABLE G2428.3.2
MAXIMUM VENT CONNECTOR LENGTH**

CONNECTOR DIAMETER	CONNECTOR HORIZONTAL
Maximum (inches)	Length (feet)
3	4.5
4	6
5	7.5
6	9
7	10.5
8	12
9	13.5

NOTE: Slide is representative of Table G2428.3.2

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Water Supply & Distribution

What Are The Minimum Pipe Sizes For This Diagram?

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Water Distribution System Includes

Areas For Consideration

- o **Section 2901.1 Potable Water Required**
 - *Potable water to be supplied*
 - To dwelling units
- o **Section 2903.1 Water Supply System Design Criteria**
 - *Design and size selection*
 - Minimum flow under peak load conditions

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Section 2903.7
Water Service & Branch Mains

- **Determined by this section or other design methods**
 - *Conforming to acceptable engineering practice*
- **Sizing**
 - **Four steps**
 - Obtain minimum daily static service pressure
 - Maximum developed length of water pipe
 - Size of water service pipe & main distribution pipe
 - Size of each water distribution pipe

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Procedure
Minimum Daily Static Service Pressure

- **Pressure Available @ Meter**
 - *Determined by local water authority*
 - Adjust for
 - *Elevation difference*
 - *Water pressure reducing valve*
 - *Pressure losses for special equipment*
 - *Pressure in excess of 8 psi due to*
 - Special plumbing fixtures



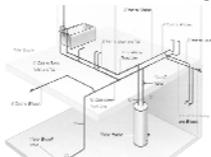
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Procedure
Maximum Developed Length

- **Water Piping**
 - *Maximum developed length*
 - From source of supply to most remote fixture
 - **Including**
 - Hot or cold water branches
 - *Times a factor of 1.2*



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Procedure
Size of Water Service Pipe

- o Determine Water Service Size
 - **Meter & main distribution pipe**
 - From appropriate table
 - **Using**
 - Minimum available pressure
 - Maximum developed length
 - Follow to wfsu
 - = too or greater than


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Example

Pressure Range—50 to 60 psi

METER AND SERVICE PIPE (inches)	DISTRIBUTION PIPE (inches)	MAXIMUM DEVELOPMENT LENGTH (feet)									
		40	60	80	100	150	200	250	300	400	500
3/4	1/2	3	3	2.5	2	1.5	1	1	1	.5	.5
3/4	3/4	9.5	9.5	9.5	8.5	6.5	5	4.5	4	3	2.5
3/4	1	32	32	32	32	25	18.5	14.5	12	9.5	8
1	1	32	32	32	32	30	22	16.5	13	10	8
3/4	1 1/4	32	32	32	32	32	32	32	32	29	24
1	1 1/4	80	80	80	80	80	68	57	48	35	28
1 1/2	1 1/4	80	80	80	80	80	75	63	53	39	29
1	1 1/2	87	87	87	87	87	87	87	87	82	70
1 1/2	1 1/2	151	151	151	151	151	151	139	120	94	79

Procedure
Each Water Distribution Pipe

- o Start At Most Remote Outlet
 - **Add wfsu passing through each segment**
 - Hot & Cold
 - **Apply demand and size**
 - From same corresponding section of
 - Table 2903.7


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Manifold Sizing



- o **Minimum Size**
 - **Minimum of 3/8 inch distribution line**
 - Minimum sizing may be larger when specified by MFG
 - **When feeding a water heater from the end of a cold water manifold**
 - Manifold is to be one size larger than the water heater feed
- o **Manifold Sizing**
 - **Sizing is to be in accordance with Table P2903.8.1**

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Section 2903.8.1 Sizing of Manifolds

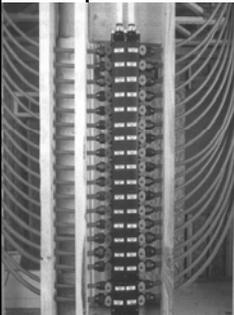
TABLE P2903.8.1
MANIFOLD SIZING

PLASTIC		METALLIC	
Nominal Size ID (inches)	Maximum ^a gpm	Nominal Size ID (inches)	Maximum ^a gpm
3/4	17	3/4	11
1	29	1	20
1 1/4	46	1 1/4	31
1 1/2	66	1 1/2	44

For SI: 1 inch = 25.4 mm, 1 gallon per minute = 3.785 L/min, 1 foot per second = 0.3048 m/s.
NOTE: See Table P2903.6 for w.s.f.u and Table 2903.6(1) for gallon-per-minute (gpm) flow rates.
a. Based on velocity limitations: plastic—12 fps; metal—8 fps.

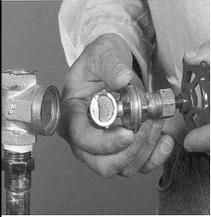
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Manifold Piping Distribution



- o **Section 2903.8.2 Minimum Size**
 - **Minimum size to be 3/8"**
 - **Exceptions:**
 - When specified by MFG to be larger
 - Cold water manifold to water heater to be one size larger

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Service Valve

- o Each Dwelling Unit
 - *To be provided with an accessible main shutoff*
 - Fullway type
 - *Additional valving at curb or property line*
 - In accordance with local requirements



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Valving



- o Valve Requirements
 - *All valves serving fixtures, appliances, risers & branches*
 - Will be accessible
 - *Individual shutoff valves are required on each plumbing fixture*
 - Except Bathtubs & Showers

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Water Service & Distribution Summation

- o Section 2904.4 Water Service Pipe
 - *Conform to NSF 61*
 - *Material and installation*
 - To follow Section & Table 2904.4.1
- o Section 2904.5 Water Distribution Pipe
 - *To conform to NSF 61*
 - *Material to meet standards of*
 - Table 2904.5

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DWV Sizing

- o DWV Sizing
 - *Determined by the DFU load*
- o Section 3004.1 DWV System Load
 - *Computed in terms of (dfu) drainage fixture units*
 - DFU determined from
 - *Table 3004.1*

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TABLE 3004.1
DRAINAGE FIXTURE UNIT (d.f.u.) VALUES FOR VARIOUS PLUMBING FIXTURES

TYPE OF FIXTURE OR GROUP OF FIXTURES	DRAINAGE FIXTURE UNIT VALUE
Basin	1
Bedroom (with or without shower head and/or whirlpool attachments)	2
Bidet	1
Clothes washer standpipe	2
Dishwasher	2
Floor drain ^a	0
Kitchen sink	2
Lavatory	1
Laundry tub	2
Shower stall	2
Water closet (1.6 gallons per flush)	3
Water closet (greater than 1.6 gallons per flush)	4
Full-bath group with bathtub (with 1.6 gallon per flush water closet, and with or without shower head and/or whirlpool attachment on the bathtub or shower stall)	5
Full-bath group with bathtub (water closet greater than 1.6 gallon per flush, and with or without shower head and/or whirlpool attachment on the bathtub or shower stall)	6
Half-bath group (1.6 gallon per flush water closet plus lavatory)	4
Half-bath group (water closet greater than 1.6 gallon per flush plus lavatory)	5
Kitchen group (dishwasher and sink with or without garbage grinder)	2
Laundry group (clothes washer standpipe and laundry tub)	3
Multiple-bath groups ^b	
1.5 baths	7
2 baths	8
2.5 baths	9
3 baths	10
3.5 baths	11

^a For 5L (1 gallon = 3.785 L).
^b For a continuous or semi-continuous flow into a drainage system, such as from a pump or similar device, 1.5 fixture units shall be allowed per group of flow. For a fixture not listed, use the highest d.f.u. value for a similar listed fixture.
^c A floor drain shall take only 1/2 d.f.u. However, when used as a receptor, the fixture unit value of the fixture discharging into the receptor shall be applicable.
^d Add 2 d.f.u. for each additional full bath.

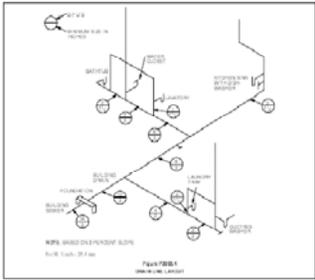
**Section 3005.4
Drain Pipe Sizing**

- o Sizing according to d.f.u. loads
 - *Draw an isometric layout*
 - *Riser diagram and fixture layout*
 - *Assign d.f.u. values to fixture groups*
 - Use Table 3004.1
 - *Work from most remote, top most floor*
 - *Toward building drain, accumulating*
 - *Size branches, stacks by d.f.u. value*
 - Table 3005.4.1
 - *Pipe diameter & slope*
 - Using Table 3005.4.2

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Drain Pipe Sizing Procedure

- Draw an isometric layout or riser diagram
 - Denoting fixtures on the layout



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Drain Pipe Sizing Procedure

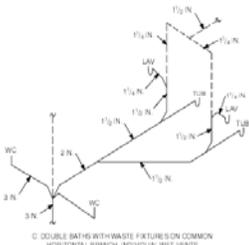
- Assign (dfu) values
 - To each fixture or fixture group
 - From Table 3004.1
- 2 bath groups = 8
- 1 laundry group = 3
 - Total dfu = 11

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Drain Pipe Sizing Procedure

- Starting From
 - Most remote fixture & top floor
 - Work downstream toward building drain
 - Accumulating dfu for fixture groups & fixtures



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Installation Inspection Problem 2:

A large dwelling has five bathrooms. The kitchen has two sinks and two dishwashers. Additionally the dwelling has a full laundry room and two 1/2 baths.

What is the minimum size sewer pipe and allowable slope?

ANSWERS:

1. *Minimum Line Size = 3"*
2. *Minimum Slope = 1/8"*



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1

Vent Terminals

o **Vent Terminal Locations**

- **Minimum of 4 feet**
 - Beneath door , operable window, air intake
- **Minimum of 10 feet**
 - Horizontally of the above openings
 - *Unless terminal is 2 feet above such openings*





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2

Section 3113 Vent Pipe Sizing

o **Section 3113.1 Size of Vents**

- **Minimum required diameter for**
 - Individual, branch, circuit, stack vents & vent stacks
 - *1/2 required diameter of drain served*
 - *Minimum of 1 1/2 in. Diameter*

o **Section 3113.2 Developed Length**

- **Individual & circuit vents**
 - **Measured farthest point of connection to vent stack or stack vent or termination**



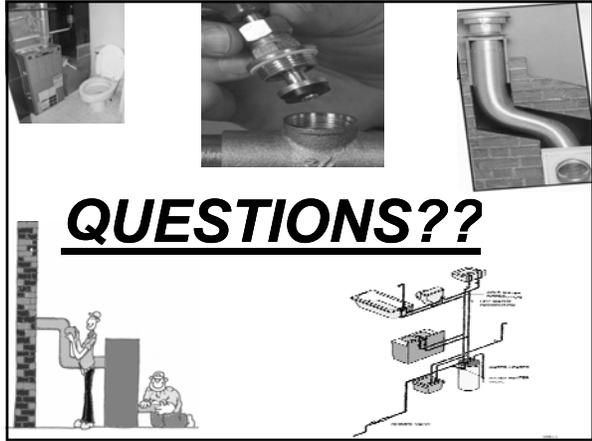
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Air Admittance Valves

- o **Installation**
 - *Install per manufacturer instructions*
 - **Not to be installed until after DWV test**
- o **Where Permitted**
 - *Individual, Branch, Circuit and Stack vents*

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QUESTIONS??
