

CHAPTER 9

VENTS

User note:

About this chapter: Chapter 9 regulates connection locations, various venting system arrangements and the sizing of piping for vent systems. The proper operation of a gravity flow drainage system (Chapter 7) depends on maintaining an air path throughout the system to prevent waste and odor “blow back” into fixtures and siphoning of the trap seal in fixture traps (Chapter 10).

SECTION 901 GENERAL

901.1 Scope. The provisions of this chapter shall govern the materials, design, construction and installation of vent systems.

901.2 Trap seal protection. The plumbing system shall be provided with a system of vent piping that will permit the admission or emission of air so that the seal of any fixture trap shall not be subjected to a pressure differential of more than 1 inch of water column (249 Pa).

901.2.1 Venting required. Traps and trapped fixtures shall be vented in accordance with one of the venting methods specified in this chapter.

901.3 Chemical waste vent systems. The vent system for a chemical waste system shall be independent of the sanitary vent system and shall terminate separately through the roof to the outdoors or to an air admittance valve that complies with ASSE 1049. Air admittance valves for chemical waste systems shall be constructed of materials *approved* in accordance with Section 702.6 and shall be tested for chemical resistance in accordance with ASTM F1412.

901.4 Use limitations. The plumbing vent system shall not be utilized for purposes other than the venting of the plumbing system.

901.5 Tests. The vent system shall be tested in accordance with Section 312.

901.6 Engineered systems. Engineered venting systems shall conform to the provisions of Section 919.

SECTION 902 MATERIALS

902.1 Vents. The materials and methods utilized for the construction and installation of venting systems shall comply with the applicable provisions of Section 702.

902.2 Sheet copper. Sheet copper for vent pipe flashings shall conform to ASTM B152 and shall weigh not less than 8 ounces per square foot (2.5 kg/m²).

902.3 Sheet lead. Sheet lead for vent pipe flashings shall weigh not less than 3 pounds per square foot (15 kg/m²) for field-constructed flashings and not less than 2½ pounds per square foot (12 kg/m²) for prefabricated flashings.

SECTION 903 VENT TERMINALS

903.1 Roof extension. All open vent pipes that extend through a roof shall be terminated at least 1 foot (305 mm) above the roof, except that if a roof is to be used for any purpose other than weather protection, then the vent extensions shall be run not less than 7 feet (2134 mm) above the roof.

R 408.30753a

903.1.1 Roof extension unprotected. Open vent pipes that extend through a roof shall be terminated not less than 12 inches, 304.8 mm above the roof.

R 408.30753b

903.1.2 Roof used for recreational or assembly purposes. Where a roof is to be used as a promenade, restaurant, bar, or sunbathing deck, as an observation deck, or for similar purposes, open vent pipes shall terminate not less than 7 feet (2134 mm) above the roof.

903.1.3 Protected vent terminal. Where an open vent pipe terminates above a sloped roof and is covered by either a roof-mounted panel (such as a solar collector or photovoltaic panel mounted over the vent opening) or a roof element (such as an architectural feature or a decorative shroud), the vent pipe shall terminate not less than 2 inches (51 mm) above the roof surface. Such roof elements shall be designed to prevent the adverse effects of snow accumulation and wind on the function of the vent. The placement of a panel over a vent pipe and the design of a roof element covering the vent pipe shall provide for an open area for the vent pipe to the outdoors that is not less than the area of the pipe, as calculated from the inside diameter of the pipe. Such vent terminals shall be protected by a method that prevents birds and rodents from entering or blocking the vent pipe opening.

903.1.4 Sidewall vent terminal. Vent terminals extending through the wall shall terminate not less than 10 feet (3048 mm) from the lot line and 10 feet (3048 mm) above the highest adjacent grade within 10 feet (3048 mm) horizontally of the vent terminal. Vent terminals shall not terminate under the overhang of a structure with soffit vents. Sidewall vent terminals shall be protected to prevent birds and rodents from entering or blocking the vent opening.

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903.2 Frost closure. To prevent frost closure, every vent extension through a roof shall be a minimum of 3 inches (76 mm) in diameter. Any increase in the size of the vent shall be made inside the building a minimum of 1 foot (305 mm) below the roof or inside the wall.

R 408.30754a

903.3 Flashings. The juncture of each vent pipe with the roof line shall be made watertight by an *approved* flashing.

903.4 Prohibited use. A vent terminal shall not be used for any purpose other than a vent terminal.

903.5 Location of vent terminal. An open vent terminal from a drainage system shall not be located directly beneath any door, openable window, or other air intake opening of the building or of an adjacent building, and any such vent terminal shall not be within 10 feet (3048 mm) horizontally of such an opening unless it is 3 feet (914 mm) or more above the top of such opening.

903.6 Extension outside a structure. In climates where the 97.5-percent value for outside design temperature is less than 0°F (-18°C), vent pipes installed on the exterior of the structure shall be protected against freezing by insulation, heat or both.

903.7 Extensions outside a structure. Vent pipes installed on the exterior of the structure shall be protected against freezing by insulation or heat, or both.

R 408.30754b

SECTION 904 OUTDOOR VENT EXTENSIONS

904.1 Required vent extension. The vent system serving each *building drain* shall have not less than one vent pipe that extends to the outdoors.

904.1.1 Installation. The required vent shall be a dry vent that connects to the *building drain* or an extension of a drain that connects to the *building drain*. Such vent shall not be an island fixture vent as allowed by Section 916.

904.1.2 Size. The required vent shall be sized in accordance with Section 906.2 based on the required size of the *building drain*.

904.2 Vent stack required. A vent *stack* shall be required for every drainage *stack* that has five *branch intervals* or more.

Exception: Drainage *stacks* installed in accordance with Section 913.

904.3 Vent termination. Vent *stacks* or *stack vents* shall terminate outdoors to the open air or to a stack-type air admittance valve in accordance with Section 918.

904.4 Vent connection at base. Vent *stacks* shall connect to the base of the drainage *stack*. The vent *stack* shall connect at or below the lowest horizontal *branch*. Where the vent *stack* connects to the *building drain*, the connection shall be

located downstream of the drainage *stack* and within a distance of 10 times the diameter of the drainage *stack*.

904.5 Vent headers. *Stack vents* and vent stacks connected into a common vent header at the top of the *stacks* and extending to the open air at one point shall be sized in accordance with the requirements of Section 906.1. The number of fixture units shall be the sum of all fixture units on all *stacks* connected thereto, and the *developed length* shall be the longest vent length from the intersection at the base of the most distant *stack* to the vent terminal in the open air, as a direct extension of one *stack*.

SECTION 905 VENT CONNECTIONS AND GRADES

905.1 Connection. Individual, *branch* and circuit vents shall connect to a vent *stack*, *stack vent*, air admittance valve or extend to the open air.

905.2 Grade. Vent and *branch vent* pipes shall be so graded and connected as to drain back to the drainage pipe by gravity.

905.3 Vent connection to drainage system. Every dry vent connecting to a horizontal drain shall connect above the centerline of the horizontal drain pipe.

905.4 Vertical rise of vent. Every dry vent shall rise vertically to a point not less than 6 inches (152 mm) above the *flood level rim* of the highest trap or trapped fixture being vented.

Exception: Vents for interceptors located outdoors.

905.5 Height above fixtures. A connection between a vent pipe and a vent *stack* or *stack vent* shall be made at not less than 6 inches (152 mm) above the *flood level rim* of the highest fixture served by the vent. Horizontal vent pipes forming *branch vents*, relief vents or loop vents shall be located not less than 6 inches (152 mm) above the *flood level rim* of the highest fixture served.

905.6 Vent for future fixtures. Where the drainage piping has been roughed-in for future fixtures, a rough-in connection for a vent shall be installed. The vent size shall be not less than one-half the diameter of the rough-in drain to be served. The vent rough-in shall connect to the vent system, or shall be vented by other means as provided for in this chapter. The connection shall be identified to indicate that it is a vent.

SECTION 906 VENT PIPE SIZING

906.1 Size of stack vents and vent stacks. The minimum required diameter of *stack vents* and vent *stacks* shall be determined from the *developed length* and the total of *drainage fixture units* connected thereto in accordance with Table 906.1, but in no case shall the diameter be less than one-half the diameter of the drain served or less than 1¹/₄ inches (32 mm).

**TABLE 906.1
SIZE AND DEVELOPED LENGTH OF STACK VENTS AND VENT STACKS**

DIAMETER OF SOIL OR WASTE STACK (inches)	TOTAL FIXTURE UNITS BEING VENTED (dfu)	MAXIMUM DEVELOPED LENGTH OF VENT (feet) ^a DIAMETER OF VENT (inches)										
		1 ¹ / ₄	1 ¹ / ₂	2	2 ¹ / ₂	3	4	5	6	8	10	12
1 ¹ / ₄	2	30	—									
1 ¹ / ₂	8	50	150	—	—	—	—	—	—	—	—	—
1 ¹ / ₂	10	30	100									
2	12	—	75	200	—	—	—	—	—	—	—	—
2	20	30	50	150	—	—	—	—	—	—	—	—
2 ¹ / ₂	42	26	30	100	300							
3	10		42	150	360	1,040						
3	21	—	32	110	270	810	—	—	—	—	—	—
3	53		27	94	230	680						
3	102		25	86	210	620	—	—	—	—	—	—
4	43	—	—	35	85	250	980	—	—	—	—	—
4	140		—	27	65	200	750					
4	320			23	55	170	640	—	—	—	—	—
4	540	—	—	21	50	150	580	—	—	—	—	—
5	190			—	28	82	320	990				
5	490				21	63	250	760				
5	940	—	—	—	18	53	210	670	—	—	—	—
5	1,400				16	49	190	590				
6	500					33	130	400	1,000			
6	1,100	—	—	—	—	26	100	310	780	—	—	—
6	2,000					22	84	260	660			
6	2,900					20	77	240	600	—	—	—
8	1,800	—	—	—	—	—	31	95	240	940	—	—
8	3,400					—	24	73	190	729		
8	5,600						20	62	160	610	—	—
8	7,600	—	—	—	—	—	18	56	140	560	—	—
10	4,000						—	31	78	310	960	—
10	7,200							24	60	240	740	—
10	11,000	—	—	—	—	—	—	20	51	200	630	—
10	15,000							18	46	180	571	
12	7,300								31	120	380	940
12	13,000	—	—	—	—	—	—	—	24	94	300	720
12	20,000								20	79	250	610
12	26,000								18	72	230	500
15	15,000	—	—	—	—	—	—	—	—	40	130	310
15	25,000								—	31	96	240
15	38,000	—	—	—	—	—	—	—	—	26	81	200
15	50,000								—	24	74	180

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

a. The developed length shall be measured from the vent connection to the open air.

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906.2 Vents other than stack vents or vent stacks. The diameter of individual vents, *branch vents*, circuit vents and relief vents shall be not less than one-half the required diameter of the drain served. The required size of the drain shall be determined in accordance with Table 710.1(2). Vent pipes shall be not less than 1¹/₄ inches (32 mm) in diameter. Vents exceeding 40 feet (12 192 mm) in *developed length* shall be increased by one nominal pipe size for the entire *developed length* of the vent pipe. Relief vents for soil and waste *stacks* in buildings having more than 10 *branch intervals* shall be sized in accordance with Section 908.2.

906.3 Developed length. The *developed length* of individual, *branch*, circuit and relief vents shall be measured from the farthest point of vent connection to the drainage system to the point of connection to the vent *stack*, *stack vent* or termination outside of the building.

906.4 Multiple branch vents. Where multiple *branch vents* are connected to a common *branch vent*, the common *branch vent* shall be sized in accordance with this section based on the size of the common horizontal drainage *branch* that is or would be required to serve the total *drainage fixture unit* load being vented.

906.5 Sump vents. Sump vent sizes shall be determined in accordance with Sections 906.5.1 and 906.5.2.

906.5.1 Sewage pumps and sewage ejectors other than pneumatic. Drainage piping below *sewer* level shall be vented in the same manner as that of a gravity system. Building sump vent sizes for sumps with sewage pumps or sewage ejectors, other than pneumatic, shall be determined in accordance with Table 906.5.1.

906.5.2 Pneumatic sewage ejectors. The air pressure relief pipe from a pneumatic sewage ejector shall be

connected to an independent vent *stack* terminating as required for vent extensions through the roof. The relief pipe shall be sized to relieve air pressure inside the ejector to atmospheric pressure, but shall be not less than 1¹/₄ inches (32 mm) in size.

SECTION 907 VENTS FOR STACK OFFSETS

907.1 Vent for horizontal offset of drainage stack. Horizontal offsets of drainage *stacks* shall be vented where five or more *branch intervals* are located above the offset. The offset shall be vented by venting the upper section of the drainage *stack* and the lower section of the drainage *stack*.

907.2 Upper section. The upper section of the drainage *stack* shall be vented as a separate *stack* with a vent *stack* connection installed in accordance with Section 904.4. The offset shall be considered to be the base of the *stack*.

907.3 Lower section. The lower section of the drainage *stack* shall be vented by a yoke vent connecting between the offset and the next lower horizontal *branch*. The yoke vent connection shall be permitted to be a vertical extension of the drainage *stack*. The size of the yoke vent and connection shall be not less than the size required for the vent *stack* of the drainage *stack*.

SECTION 908 RELIEF VENTS—STACKS OF MORE THAN 10 BRANCH INTERVALS

908.1 Where required. Soil and waste *stacks* in buildings having more than 10 *branch intervals* shall be provided with

TABLE 906.5.1
SIZE AND LENGTH OF SUMP VENTS

DISCHARGE CAPACITY OF PUMP (gpm)	MAXIMUM DEVELOPED LENGTH OF VENT (feet) ^a					
	Diameter of vent (inches)					
	1 ¹ / ₄	1 ¹ / ₂	2	2 ¹ / ₂	3	4
10	No limit ^b	No limit	No limit	No limit	No limit	No limit
20	270	No limit	No limit	No limit	No limit	No limit
40	72	160	No limit	No limit	No limit	No limit
60	31	75	270	No limit	No limit	No limit
80	16	41	150	380	No limit	No limit
100	10 ^c	25	97	250	No limit	No limit
150	Not permitted	10 ^c	44	110	370	No limit
200	Not permitted	Not permitted	20	60	210	No limit
250	Not permitted	Not permitted	10	36	132	No limit
300	Not permitted	Not permitted	10 ^c	22	88	380
400	Not permitted	Not permitted	Not permitted	10 ^c	44	210
500	Not permitted	Not permitted	Not permitted	Not permitted	24	130

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 gallon per minute = 3.785 L/m.

a. Developed length plus an appropriate allowance for entrance losses and friction due to fittings, changes in direction and diameter. Suggested allowances shall be obtained from NBS Monograph 31 or other approved sources. An allowance of 50 percent of the developed length shall be assumed if a more precise value is not available.

b. Actual values greater than 500 feet.

c. Less than 10 feet.

a relief vent at each tenth interval installed, beginning with the top floor.

908.2 Size and connection. The size of the relief vent shall be equal to the size of the vent *stack* to which it connects. The lower end of each relief vent shall connect to the soil or waste *stack* through a wye below the horizontal *branch* serving the floor, and the upper end shall connect to the vent *stack* through a wye not less than 3 feet (914 mm) above the floor.

**SECTION 909
FIXTURE VENTS**

909.1 Distance of trap from vent. Each fixture trap shall have a protecting vent located so that the slope and the developed length in the fixture drain from the trap weir to the vent fitting are within the requirements in Table 909.1.

R 408.30723

**TABLE 909.1
MAXIMUM DISTANCE OF FIXTURE TRAP FROM VENT**

SIZE OF TRAP (inches)	SLOPE (inch per foot)	DISTANCE FROM TRAP (feet)
1 ¹ / ₄	1 ¹ / ₄	5
1 ¹ / ₂	1 ¹ / ₄	6
2	1 ¹ / ₄	8
3	1 ¹ / ₈	12
4	1 ¹ / ₈	16

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 inch per foot = 83.3 mm/m.

909.2 Venting of fixture drains. The vent for a fixture drain, except where serving a fixture with integral traps, such as water closets, shall connect above the weir of the fixture trap being vented. The total slope shall not exceed the diameter of the fixture drain.

R 408.30725c

909.3 Crown vent. A vent shall not be installed within two pipe diameters of the trap weir.

**SECTION 910
INDIVIDUAL VENT**

910.1 Individual vent permitted. Each trap and trapped fixture is permitted to be provided with an individual vent. The individual vent shall connect to the *fixture drain* of the trap or trapped fixture being vented.

**SECTION 911
COMMON VENT**

911.1 Individual vent as common vent. An individual vent is permitted to vent two traps or trapped fixtures as a common vent. The traps or trapped fixtures being common vented shall be located on the same floor level.

911.2 Connection at the same level. Where the *fixture drains* being common vented connect at the same level, the vent connection shall be at the interconnection of the *fixture drains* or downstream of the interconnection.

911.3 Connection at different levels. Where the *fixture drains* connect at different levels, the vent shall connect as a vertical extension of the vertical drain. The vertical drain pipe connecting the two *fixture drains* shall be considered to be the vent for the lower *fixture drain*, and shall be sized in accordance with Table 911.3. The upper fixture shall not be a water closet.

**TABLE 911.3
COMMON VENT SIZES**

PIPE SIZE (inches)	MAXIMUM DISCHARGE FROM UPPER FIXTURE DRAIN (dfu)
1 ¹ / ₂	1
2	4
2 ¹ / ₂ to 3	6

For SI: 1 inch = 25.4 mm.

**SECTION 912
WET VENTING**

912.1 Horizontal wet vent permitted. Any combination of fixtures within two *bathroom groups* located on the same floor level is permitted to be vented by a horizontal wet vent. The wet vent shall be considered to be the vent for the fixtures and shall extend from the connection of the dry vent along the direction of the flow in the drain pipe to the most downstream *fixture drain* connection to the *horizontal branch drain*. Each wet-vented *fixture drain* shall connect independently to the horizontal wet vent. Only the fixtures within the *bathroom groups* shall connect to the wet-vented *horizontal branch drain*. Any additional fixtures shall discharge downstream of the horizontal wet vent.

912.1.1 Vertical wet vent permitted. Any combination of fixtures within two *bathroom groups* located on the same floor level is permitted to be vented by a vertical wet vent. The vertical wet vent shall be considered to be the vent for the fixtures and shall extend from the connection of the dry vent down to the lowest *fixture drain* connection. Each wet-vented fixture shall connect independently to the vertical wet vent. Water closet drains shall connect at the same elevation. Other *fixture drains* shall connect above or at the same elevation as the water closet *fixture drains*. The dry-vent connection to the vertical wet vent shall be an individual or common vent serving one or two fixtures.

912.2 Dry vent connection. The required dry-vent connection for wet-vented systems shall comply with Sections 912.2.1 and 912.2.2.

912.2.1 Horizontal wet vent. The dry-vent connection for a horizontal wet-vent system shall be an individual vent or a common vent for any *bathroom group* fixture, except an *emergency floor drain*. Where the dry-vent connects to a water closet *fixture drain*, the drain shall connect horizontally to the horizontal wet-vent system. Not more than one wet-vented *fixture drain* shall discharge upstream of the dry-vented *fixture drain* connection.

912.2.2 Vertical wet vent. The dry-vent connection for a vertical wet-vent system shall be an individual vent or common vent for the most upstream *fixture drain*.

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912.3 Size. The dry vent serving the wet vent shall be sized based on the largest required diameter of pipe within the wet-vent system served by the dry vent. The wet vent shall be of a size not less than that specified in Table 912.3, based on the fixture unit discharge to the wet vent.

**TABLE 912.3
WET VENT SIZE**

WET VENT PIPE SIZE (inches)	DRAINAGE FIXTURE UNIT LOAD (dfu)
1½	1
2	4
2½	6
3	12

For SI: 1 inch = 25.4 mm.

SECTION 913 WASTE STACK VENT

913.1 Waste stack vent permitted. A waste *stack* shall be considered to be a vent for all of the fixtures discharging to the *stack* where installed in accordance with the requirements of this section.

913.2 Stack installation. The waste *stack* shall be vertical, and both horizontal and vertical offsets shall be prohibited between the lowest *fixture drain* connection and the highest *fixture drain* connection. *Fixture drains* shall connect separately to the waste *stack*. The *stack* shall not receive the discharge of water closets or urinals.

913.3 Stack vent. A *stack vent* shall be provided for the waste *stack*. The size of the *stack vent* shall be not less than the size of the waste *stack*. Offsets shall be permitted in the *stack vent*, shall be located not less than 6 inches (152 mm) above the flood level of the highest fixture and shall be in accordance with Section 905.2. The *stack vent* shall be permitted to connect with other *stack vents* and vent *stacks* in accordance with Section 904.5.

913.4 Waste stack size. The waste *stack* shall be sized based on the total discharge to the *stack* and the discharge within a *branch interval* in accordance with Table 913.4. The waste *stack* shall be the same size throughout its length.

**TABLE 913.4
WASTE STACK VENT SIZE**

STACK SIZE (inches)	MAXIMUM NUMBER OF DRAINAGE FIXTURE UNITS (dfu)	
	Total discharge into one branch interval	Total discharge for stack
1½	1	2
2	2	4
2½	No limit	8
3	No limit	24
4	No limit	50
5	No limit	75
6	No limit	100

For SI: 1 inch = 25.4 mm.

SECTION 914 CIRCUIT VENTING

914.1 Circuit vent permitted. Not more than eight fixtures connected to a *horizontal branch drain* shall be permitted to be circuit vented. Each *fixture drain* shall connect horizontally to the horizontal *branch* being circuit vented. The *horizontal branch drain* shall be classified as a vent from the most downstream *fixture drain* connection to the most upstream *fixture drain* connection to the horizontal *branch*.

914.1.1 Multiple circuit-vented branches. Circuit-vented *horizontal branch drains* are permitted to be connected together. Each group of not more than eight fixtures shall be considered to be a separate circuit vent and shall conform to the requirements of this section.

914.2 Vent connection. The circuit vent connection shall be located between the two most upstream *fixture drains*. The vent shall connect to the horizontal *branch* and shall be installed in accordance with Section 905. The circuit vent pipe shall not receive the discharge of any soil or waste.

914.3 Slope and size of horizontal branch. The slope of the vent section of the *horizontal branch drain* shall be not greater than one unit vertical in 12 units horizontal (8.3-percent slope). The entire length of the vent section of the *horizontal branch drain* shall be sized for the total drainage discharge to the *branch*.

914.3.1 Size of multiple circuit vent. Each separate circuit-vented horizontal *branch* that is interconnected shall be sized independently in accordance with Section 914.3. The downstream circuit-vented horizontal *branch* shall be sized for the total discharge into the *branch*, including the upstream *branches* and the fixtures within the *branch*.

914.4 Relief vent. A relief vent shall be provided for circuit-vented horizontal *branches* receiving the discharge of four or more water closets and connecting to a drainage *stack* that receives the discharge of soil or waste from upper horizontal *branches*.

914.4.1 Connection and installation. The relief vent shall connect to the *horizontal branch drain* between the *stack* and the most downstream *fixture drain* of the circuit vent. The relief vent shall be installed in accordance with Section 905.

914.4.2 Fixture drain or branch. The relief vent is permitted to be a *fixture drain* or *fixture branch* for fixtures located within the same *branch interval* as the circuit-vented horizontal *branch*. The maximum discharge to a relief vent shall be four fixture units.

914.5 Additional fixtures. Fixtures, other than the circuit-vented fixtures, are permitted to discharge to the *horizontal branch drain*. Such fixtures shall be located on the same floor as the circuit-vented fixtures and shall be either individually or common vented.