Venting for Plumbing Systems

One Hour Continuing Education
Venting

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Venting

This discussion on venting references the International Plumbing Code 2006 edition.
Chapter 9 Vents

And the Georgia State Amendments of 2007
Venting

The Drain Waste and Vent (DWV) system is perhaps the most important part of the total plumbing system in a building. The DWV system is for the removal of waste water and material from the building. Inspectors recognize this portion of the plumbing system as a major concern for not only the function of the plumbing but for the protection of the health of the building occupants.
Venting

When people first brought the well pump into the house, they would pump water into vessels for use. When they were finished with the water they would carry these vessels outside to dispose of the waste water. Human waste was handled at the old outhouse.

Then came the modern marvel of indoor plumbing. People began to use piping to remove waste water. The toilet was brought into the house, as well as all the aromas of the outhouse.
Venting

The first houses with indoor plumbing utilized a trap on the building drain pipe to provide a water seal for keeping the sewer gasses from coming back into the buildings. These traps were called “building traps” or “master traps”.

However there were still sewer gasses entering occupied spaces from the drain piping within the building. This was not only unpleasant to smell but was a great health concern.
Venting

The traps were then placed at each fixture to provide a barrier between the fixture and the drainage piping within the house. In order to ensure that these barriers continued to work, a system of piping was installed to provide a way for the plumbing system to “breath”.
Venting

This concept of the plumbing system breathing (while conceptually accurate) is somewhat confusing to a craftsperson when trying to understand specifically what the purpose of the vent system is. In section 901.2 of the 2006 IPC we are told specifically what the purpose of the vent system is.
Venting

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 pneumatic pressure differential of more than 1 inch of water column (249 Pa).

In this code section we are told that “The plumbing system shall be provided with a system of vent piping that will permit the admission or emission of air”. The plumbing system needs to breath.

The second half of this section tells us why the plumbing system needs to breath. “so that the seal of any fixture trap shall not be subjected to a pneumatic pressure differential of more than 1 inch of water column (249 Pa).” Here we are told that the protection of the seal is the reason for the vent, (the reason the system needs to breath).
Venting

The seal of any fixture trap shall not be subjected to a pneumatic pressure differential of more than 1 inch of water column (249 Pa).

12 inches of water column equals 0.433 psig. 1 inch of water column equals 0.036 psig. This also refers to half of the trap seal which shall be at least two inches.

With an atmospheric pressure of approximately 14.7 psi at sea level, there can be no more than plus or minus 0.036 psig difference present between both sides of the trap seal.
901.2.1 Venting required. Every trap and trapped fixture shall be vented in accordance with one of the venting methods specified in this chapter.

In this presentation we will look at the venting methods which are specified in chapter 9 of the International Plumbing Code 2006 edition. Also the 2007 Georgia State Amendments.
SECTION 903
OUTDOOR VENT EXTENSION

903.1 Required vent extension. The vent system serving each building drain shall have at least one vent pipe that extends to the outdoors.

903.1.1 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 913.

903.1.2 Size. The required vent shall be sized in accordance with Section 916.2 based on the required size of the building drain.
SECTION 904
VENT TERMINALS

• 904.1 Roof extension. All open vent pipes that extend through a roof shall be terminated at least [NUMBER] inches (mm) above the roof, except that where a roof is to be used for any purpose other than weather protection, the vent extensions shall be run at least 7 feet (2134 mm) above the roof.

The 2007 amendments tell us to insert the number 6 for [NUMBER] in this section.
SECTION 904
VENT TERMINALS

904.5 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 at least 2 feet (610 mm) above the top of such opening.
SECTION 904
VENT TERMINALS

904.6 Extension through the wall. Vent terminals extending through the wall shall terminate a minimum of 10 feet (3048 mm) from the lot line and 10 feet (3048 mm) above average ground level. Vent terminals shall not terminate under the overhang of a structure with soffit vents. Side wall vent terminals shall be protected to prevent birds or rodents from entering or blocking the vent opening.
VENT CONNECTIONS AND GRADES

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

Vent piping may either rise or fall as long as the pipe can drain back to the drainage piping by gravity. In other words air does not care whether it moves uphill or downhill.
SECTION 905
VENT CONNECTIONS AND GRADES

- **905.4 Vertical rise of vent.** Every dry vent shall rise vertically to a minimum of 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 least 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 at least 6 inches (152 mm) above the flood level rim of the highest fixture served.

It is important to note that the 2006 IPC has a definition of vertical pipe as any pipe which is 45° or greater from horizontal. The vent piping in this drawing is considered to be vertical pipe.
SECTION 906
FIXTURE VENTS

• 906.1 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 set forth in Table 906.1.

• 906.2 Venting of fixture drains. The total fall in a fixture drain due to pipe slope shall not exceed the diameter of the fixture drain, nor shall the vent connection to a fixture drain, except for water closets, be below the weir of the trap.

<table>
<thead>
<tr>
<th>SIZE OF TRAP (inches)</th>
<th>SLOPE (inch per foot)</th>
<th>DISTANCE FROM TRAP (feet)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 1/4</td>
<td>1/4</td>
<td>5</td>
</tr>
<tr>
<td>1 1/2</td>
<td>1/4</td>
<td>6</td>
</tr>
<tr>
<td>2</td>
<td>1/4</td>
<td>8</td>
</tr>
<tr>
<td>3</td>
<td>1/8</td>
<td>12</td>
</tr>
<tr>
<td>4</td>
<td>1/8</td>
<td>16</td>
</tr>
</tbody>
</table>

This drawing shows a combination wye and eighth bend which creates an “S” trap. This is not allowed because it places the connection of the waste arm with the vent below the hydraulic gradient.
SECTION 906
FIXTURE VENTS

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

This drawing shows the vent connected within two pipe diameters of the trap weir. This is a Crown Vent and is not permitted.
907.1 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 908
COMMON VENT

908.1 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.

908.2 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.
908.3 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 the vent for the lower fixture drain, and shall be sized in accordance with Table 908.3. The upper fixture shall not be a water closet.
• **909.1 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 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. 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.

The IPC does not limit the flow in a wet vent system with regards to major or minor fixtures.
909.1.1 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 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.
SECTION 910
WASTE STACK VENT

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

- **910.2 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. Every fixture drain shall connect separately to the waste stack. The stack shall not receive the discharge of water closets or urinals.

<table>
<thead>
<tr>
<th>STACK SIZE (Inches)</th>
<th>MAXIMUM NUMBER OF DRAINAGE FIXTURE UNITS (dfu)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Total discharge into one branch interval</td>
</tr>
<tr>
<td>1 1/2</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>2 1/2</td>
<td>No limit</td>
</tr>
<tr>
<td>3</td>
<td>No limit</td>
</tr>
<tr>
<td>4</td>
<td>No limit</td>
</tr>
<tr>
<td>5</td>
<td>No limit</td>
</tr>
<tr>
<td>6</td>
<td>No limit</td>
</tr>
</tbody>
</table>
SECTION 911
CIRCUIT VENTING

911.1 Circuit vent permitted. A maximum of 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.

911.2 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.
SECTION 911
CIRCUIT VENTING

911.1.1 Multiple circuit-vented branches. Circuit-vented horizontal branch drains are permitted to be connected together. Each group of a maximum of eight fixtures shall be considered a separate circuit vent and shall conform to the requirements of this section.
SECTION 911
CIRCUIT VENTING

Multiple circuit-vented branches
911.4 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.

911.4.1 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.

911.4.2 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.
SECTION 912
COMBINATION DRAIN AND VENT SYSTEM

• **912.1 Type of fixtures.** A combination drain and vent system shall not serve fixtures other than floor drains, sinks, lavatories and drinking fountains. Combination drain and vent systems shall not receive the discharge from a food waste grinder or clinical sink.

• **912.2 Installation.** The only vertical pipe of a combination drain and vent system shall be the connection between the fixture drain and the horizontal combination drain and vent pipe. The maximum vertical distance shall be 8 feet (2438 mm).
SECTION 912
COMBINATION DRAIN AND VENT SYSTEM

2007 amendment to revise section 912.2.2

912.2.2 Connection. The combination drain and vent system shall be provided with a dry vent connected at any point within the system or the system shall connect to a horizontal drain that is vented in accordance with one of the venting methods specified in this chapter. Combination drain and vent systems connecting to building drains or waste stacks shall be provided with a dry vent. The vent connection to the combination drain and vent pipe shall extend vertically a minimum of 6 inches (152 mm) above the flood level rim of the highest fixture being vented before offsetting horizontally.

(Effective January 1, 2007)
**SECTION 912**

**COMBINATION DRAIN AND VENT SYSTEM**

*Add new Section 912.4 ‘Appendix reference’ as follows:

**912.4 Appendix reference.** Additional provisions for safe waste systems are contained in Appendix H ‘Section 912: Combination Drain and Vent System’.

(Effective January 1, 2007)

*Add new Appendix H ‘Section 912: Combination Drain and Vent System’. See pages 18 through 20.

(Effective January 1, 2007)

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**APPENDIX H**

**SECTION 912: COMBINATION DRAIN AND VENT SYSTEM**

**SAFE WASTE SYSTEM.** A horizontal waste system composed of a main waste line, branch waste lines, auxiliary vents and a master trap with a fresh air vent

**912.4.7 Master trap venting.** The master trap shall be vented with two vents. A fresh air vent no less than the trap size shall extend from the house side of the trap to the outside of the building, by either (a) extending through the roof independent of any sanitary vent; (b) extending through the outside wall, 12 inches (305 mm) above the flood rim of any connected fixture and terminating with a perforated or bar grate cover or (c) connecting to a fresh air auxiliary vent. A 2-inch (51 mm) sanitary vent shall extend from the sewer side of the master trap through the roof or connect with a dry sanitary vent, in accordance with Chapter 9.

**912.4.8 Auxiliary vent.** The auxiliary vent shall be the same size as the master trap and extend from the main waste line through the roof independent of any sanitary vent or may terminate through an outside wall using an acceptable bar grate. When safe waste systems are located on two or more floors of a building, the fresh air and auxiliary vents may be connected together and extend to the outside of the building independent of any sanitary vent.
SAFE WASTE SYSTEM

- 2” Sanitary Vent thru roof or connect To building sanitary dry vent.
- Alternate Fresh Air Vent Branch Location
- Alternate Sanitary Vent Branch Location
- Master Trap
- To Sanitary Sewer
- Fresh Air Vent Thru Roof or Wall
- Fresh Air Auxiliary Vent
- Full Size of Main
- 48” Max Vertical rise
- Full size fresh air Relief vent off main At 45° angle or greater
SECTION 913
ISLAND FIXTURE VENTING

- **913.1 Limitation.** Island fixture venting shall not be permitted for fixtures other than sinks and lavatories. Residential kitchen sinks with a dishwasher waste connection, a food waste grinder, or both, in combination with the kitchen sink waste, shall be permitted to be vented in accordance with this section.

- **913.2 Vent connection.** The island fixture vent shall connect to the fixture drain as required for an individual or common vent. The vent shall rise vertically to above the drainage outlet of the fixture being vented before offsetting horizontally or vertically downward. The vent or branch vent for multiple island fixture vents shall extend to a minimum of 6 inches (152 mm) above the highest island fixture being vented before connecting to the outside vent terminal.

- **913.3 Vent installation below the fixture flood level rim.** The vent located below the flood level rim of the fixture being vented shall be installed as required for drainage piping in accordance with Chapter 7, except for sizing. The vent shall be sized in accordance with Section 916.2. The lowest point of the island fixture vent shall connect full size to the drainage system. The connection shall be to a vertical drain pipe or to the top half of a horizontal drain pipe. Cleanouts shall be provided in the island fixture vent to permit rodding of all vent piping located below the flood level rim of the fixtures. Rodding in both directions shall be permitted through a cleanout.
SECTION 913
ISLAND FIXTURE VENTING

Cleanout for Vent

Low point Vent Connection
SECTION 914
RELIEF VENTS—STACKS OF MORE THAN
10 BRANCH INTERVALS

914.1 Where required. Soil and waste stacks in buildings having more than 10 branch intervals shall be provided with a relief vent at each tenth interval installed, beginning with the top floor.

914.2 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 916
VENT PIPE SIZING

916.1 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 916.1, 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).

916.2 Vents other than stack vents or vent stacks. The diameter of individual vents, branch vents, circuit vents and relief vents shall be at least 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 not be 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 914.2.
SECTION 916
VENT PIPE SIZING

916.3 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.

Add the measurements along the centerline through the fittings.

12’ 4”
5’ 2 11/32”
3’ 8 11/16”
8’ 2 11/32”
D L 29’ 5 3/8”
Sizing a Wet Vent

<table>
<thead>
<tr>
<th>Section</th>
<th>Lav Source Of Wet Vent</th>
<th>Shower Source Of Wet Vent</th>
</tr>
</thead>
<tbody>
<tr>
<td>A-B</td>
<td>1 ½”</td>
<td>1 ¼”</td>
</tr>
<tr>
<td>B-D</td>
<td>2”</td>
<td>2”</td>
</tr>
<tr>
<td>C-F</td>
<td>1 ½”</td>
<td>1 ½”</td>
</tr>
<tr>
<td>B-F</td>
<td>1 ½”</td>
<td>2’</td>
</tr>
<tr>
<td>A-E</td>
<td>1 ½”</td>
<td>1 ¼”</td>
</tr>
<tr>
<td>E-F</td>
<td>1 ¼”</td>
<td>1 ½”</td>
</tr>
</tbody>
</table>

**TABLE 909.3 WET VENT SIZE**

<table>
<thead>
<tr>
<th>WET VENT PIPE SIZE (inches)</th>
<th>DRAINAGE FIXTURE UNIT LOAD (dfu)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 ½”</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>2 ½”</td>
<td>6</td>
</tr>
<tr>
<td>3</td>
<td>12</td>
</tr>
</tbody>
</table>
Vent Sizing

The slides that follow show this system divided into sections. Listed are the vent type and sizes.
The wet vent is the pipe between the lavatory waste arm connection to the water closet drain pipe. Sized according to the table for 1 DFU is 1 ½” wet vent.

The vent size is determined by the size of the largest drain pipe served by the vent.

<table>
<thead>
<tr>
<th>WET VENT PIPE SIZE (inches)</th>
<th>DRAINAGE FIXTURE UNIT LOAD (dfu)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 1/2</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>2 1/2</td>
<td>6</td>
</tr>
<tr>
<td>3</td>
<td>12</td>
</tr>
</tbody>
</table>
Wet Vent

The wet vent is the pipe between the lavatory waste arm connection to the water closet drain pipe. Sized according to the table for 1 DFU is 1 ½” wet vent.

The vent size is determined by the size of the largest drain pipe served by the vent.

<table>
<thead>
<tr>
<th>WET VENT PIPE SIZE (Inches)</th>
<th>DRAINAGE FIXTURE UNIT LOAD (dfu)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1½</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>2½</td>
<td>6</td>
</tr>
<tr>
<td>3</td>
<td>12</td>
</tr>
</tbody>
</table>
The minimum waste for a sink is 1 ½”.

The vent shall be one half the size the drain is serves but shall not be smaller than 1 ¼”.

This vent is serving only the drain for the sink, it does not serve any portion of the building drain.
The wet vent is the pipe between the lavatory waste arm connection to the water closet drain pipe. Sized according to the table for 1 DFU is 1 ½” wet vent.

The vent size is determined by the size of the largest drain pipe served by the vent.

### TABLE 909.3 WET VENT SIZE

<table>
<thead>
<tr>
<th>WET VENT PIPE SIZE (inches)</th>
<th>DRAINAGE FIXTURE UNIT LOAD (dfu)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 ½</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>2 ½</td>
<td>6</td>
</tr>
<tr>
<td>3</td>
<td>12</td>
</tr>
</tbody>
</table>
This portion for the vent system is considered a common vent.

The vent size is determined by the size of the largest drain pipe served by the vent.

The portion of the pipe which serves as the drain for the upper fixture and the vent for the lower fixture is sized as a wet vent.

The branch drain is three inch based on section 406.3 as amended in 2007

<table>
<thead>
<tr>
<th>PIPE SIZE (Inches)</th>
<th>MAXIMUM DISCHARGE FROM UPPER FIXTURE DRAIN (dfu)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 1/2</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>2 1/2 to 3</td>
<td>6</td>
</tr>
</tbody>
</table>
Conclusion

The code gives us specific application for various ways to vent the plumbing system in a building. Some of these we may be unfamiliar with. However all the methods in the IPC 2006 will allow the plumbing in a building to adequately breath. This is important, because this breathing is what protects the seal of the trap. Protecting the trap seal is important in helping protect occupants of a building from hazards associated with the gasses present in the plumbing system.

Becoming familiar with types of vents and proper sizing may help us save money, maybe not. Proper sizing and knowing the options available will provide opportunity for solving problematic situations we face on a regular basis.