

4TH EDITION



InVENTive TECHNOLOGY®



# ENGINEERED PRODUCTS MANUAL



# INDEX

---

## STUDOR ENGINEERED PRODUCTS TECHNICAL MANUAL

Index.....	1
Studor Overview.....	2
<b>Products</b>	
Redi-Vent.....	3
Ultra-Vent.....	4
Mini-Vent.....	5
Maxi-Vent.....	6
Maxi-Cap.....	6
Tec-Vent.....	7
Chem-Vent.....	8
P.A.P.A.....	9
Recess Box.....	10
Recess Box (Fire Rated).....	10
Maxi-Filtra.....	11
<b>Introduction to:</b>	
Air Admittance Valves (AAV's).....	12
Positive Air Pressure Attenuator (P.A.P.A.).....	13
<b>Installation</b>	
AAV'S (Air Admittance Valves).....	15
P.A.P.A. (Positive Air Pressure Attenuator).....	16
<b>Design Criteria</b>	
AAV'S (Air Admittance Valves).....	18
Drain Fixture Units.....	22
P.A.P.A. (Positive Air Pressure Attenuator).....	23
<b>Codes</b>	
IPC, IRC, UPC, NSPC and National Plumbing Code of Canada.....	25
Standards & Listings.....	28
<b>Materials Properties</b>	
Redi-Vent / Ultra-Vent / Mini-Vent / Maxi-Vent.....	29
Tec-Vent.....	30
Chem-Vent.....	31
<b>Product Specifications</b>	
(CSI-3).....	32
<b>Research</b>	
Dr. Gomely and Professor John Swaffield.....	40
Project Reference, Warranty.....	44

**THIS MANUAL WAS**  
**CRAFTED FOR THE 21<sup>ST</sup> CENTURY**  
**DESIGN PROFESSIONAL**

# STUDOR OVERVIEW

---

Air admittance valves (AAVs) are devices that were created to solve problems with the conventional open pipe venting design and can serve as a vent for drainage waste and vent (DWV) systems in lieu of open pipe vents. The STUDOR brand AAVs were invented by Sture Ericson and installed in Europe starting in the early 1970s; Ericson brought them into the USA in 1986. Since their introduction, millions of valves have been installed worldwide, and they are operating successfully.

STUDOR is the world recognized leader in innovative drain waste and vent products and designs. Greater efficiency and significant savings, make STUDOR products the # 1 choice worldwide. Studor, Inc., is the distributor of the STUDOR brand products in the USA, Canada, Mexico and Puerto Rico.

STUDOR worked with the American Society of Sanitary Engineering (ASSE) to create the nationally recognized consensus standards for these valves. In 1990 ASSE published the first performance standard for AAVs (ASSE 1051) for single fixture and branch devices, which was followed by ASSE 1050 for stack-type devices in 1991. The standards were revised in 2002 and are ANSI accredited. Today STUDOR works with the codes and code officials on national, regional, state and local levels to educate, gain approval and promote the understanding of the benefits of AAVs.

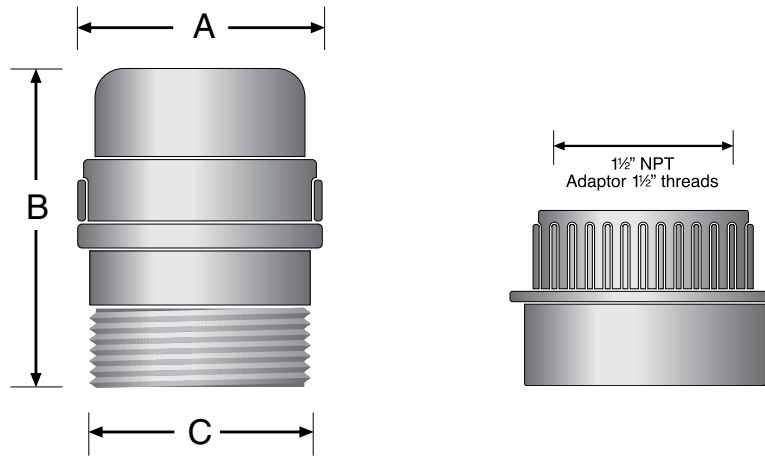
Because of STUDOR's much greater experience and exposure to a variety of different applications worldwide, we have been able to identify unique conditions present in commercial and industrial applications not found in the residential realm and have design products for the most demanding residential, commercial and industrial applications.

# REDI-VENT



- For Residential and Commercial use
- ANSI /ASSE 1051, NSF 14, Warnock Hersey
- For venting single fixtures such as island sinks or small bathroom groups up to 6 DFU
- Compact size
- Unique Patented ball valve sealing assembly
- Exclusive vermin protection system
- Can be installed in an IPS DU-ALL washer box to vent an automatic clothes washer
- Fits 1-1/2" or 2" pipe size
- Limited lifetime warranty

## DIMENSIONS



A	B	Nominal pipe size (C)
2"	2 5/8"	1 1/2" NPT

## DFU

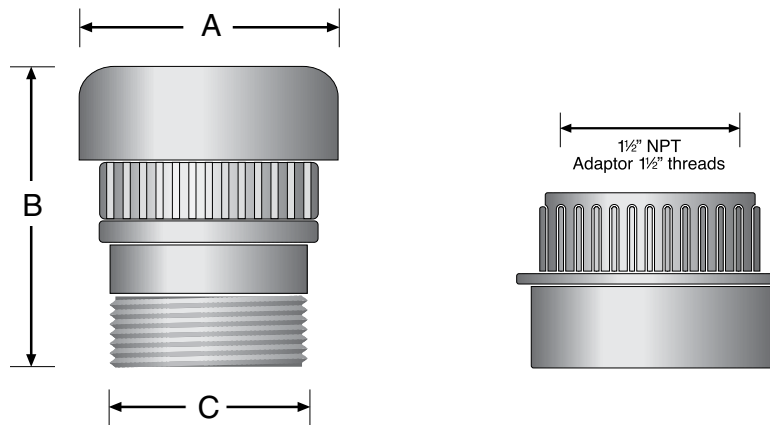
Horizontal Branch	Minimum Vent Pipe Size	Maximum DFU's on Branch
1 1/2"	1 1/4" - 1 1/2"	3
2"	1 1/4" - 2"	6
3"	1 1/2" - 3"	6
4"	2" - 4"	6

# ULTRA-VENT



- For Residential and Commercial use
- ANSI /ASSE 1051, NSF 14, Warnock Hersey
- For venting single fixture, bathroom groups including back-to-back applications up to 20 DFU
- Unique Patented ball valve sealing assembly
- Exclusive vermin protection system
- Expands architectural design limits
- Compact design for tight applications
- Fits 1 1/2" and 2" pipe sizes
- Limited lifetime warranty

## DIMENSIONS



A	B	Nominal pipe size (C)
2 1/2"	2 7/8"	1 1/2" NPT

## DFU

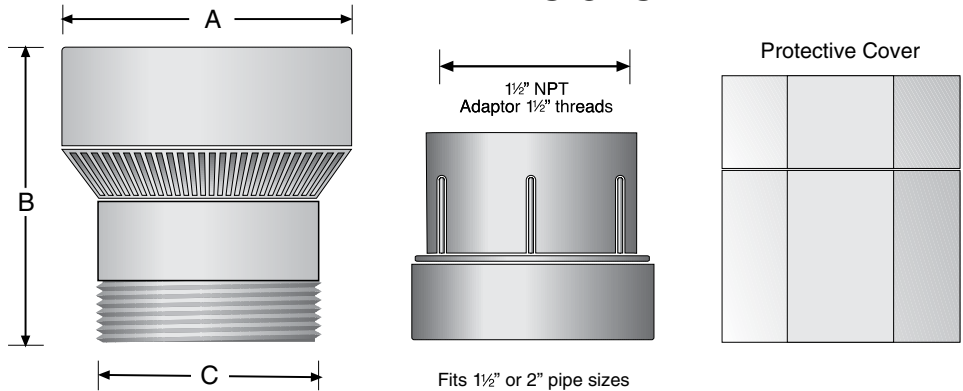
Horizontal Branch	Minimum Vent Pipe Size	Maximum DFU's on Branch
1 1/2"	1 1/4" - 1 1/2"	3
2"	1 1/4" - 2"	6
3"	1 1/2" - 3"	20
4"	2" - 4"	20

# MINI-VENT



- For Residential and Commercial use
- ANSI /ASSE 1051, ANSI /ASSE 1050, NSF 14, Warnock Hersey
- Can be used for a single fixture, individual branch, circuit vent or Stack Type application
- Will vent up to 160 DFU
- Protective cover for outdoor use
- Exclusive vermin protection system
- Fits 1 1/2" or 2" pipe size
- Limited lifetime warranty

## DIMENSIONS



A	B	Nominal pipe size (C)
2 5/8"	2 5/8"	1 1/2" NPT

## DFU

Horizontal Branch	Minimum Vent Pipe Size	Maximum DFU's on Branch
1 1/2"	1 1/4" - 1 1/2"	3
2"	1 1/4" - 2"	6
3"	1 1/2" - 3"	20
4"	2" - 4"	160

Stack Size	Maximum DFUs
1 1/2"	8
2"	24

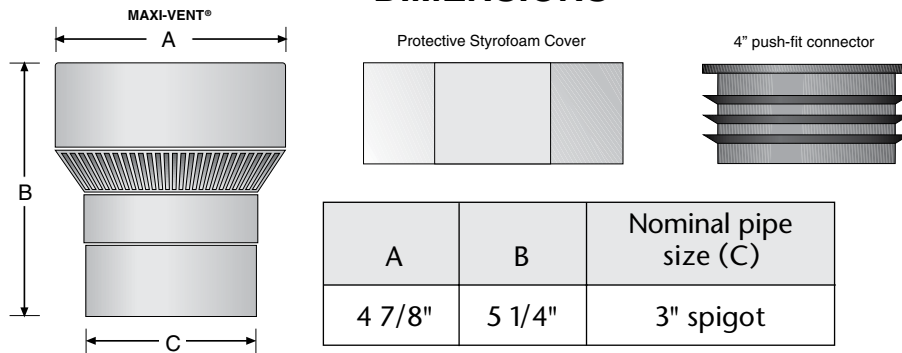


# MAXI-VENT



- For Residential and Commercial use
- ANSI /ASSE 1051, ANSI /ASSE 1050, NSF 14, Warnock Hersey
- Can be use on an Individual Branch, Circuit Vent or Stack type applications
- Will vent up to 500 DFU
- Exclusive vermin protection system
- Fits 3" or 4" Pipe sizes
- Limited lifetime warranty

## DIMENSIONS



## DFU

Horizontal Branch Size	Maximum DFU's
3"	20
4"	160
Stack Size	Maximum DFU's
3"	72
4"	500

# MAXI-CAP



### General Outside Use:

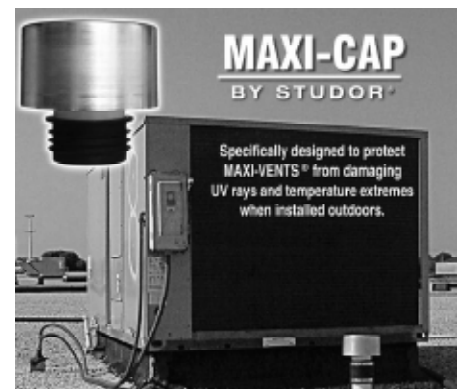
The MAXI-CAP can be installed on MAXI-VENTs® in outdoor installations to protect MAXI-VENTs® from damaging UV Rays and extreme temperatures.

### Installation:

Fits over the MAXI-VENT® and styrofoam cover.

- Install styrofoam cap to valve.
- Attach metal cap to styrofoam with double-sided adhesive.

Ensure that one open vent pipe is maintained. If desired, paint cap prior to installation.





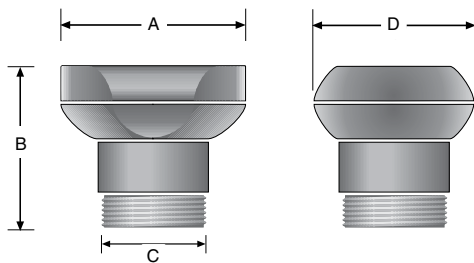
# TEC-VENT



- For Residential or Commercial use
- ANSI /ASSE 1051, ANSI /ASSE 1050, NSF 14, Warnock Hersey, UL2043
- Classified in accordance with UL2043 for installation in plenums when the system is designed by a design professional and approved by the local code official
- Manufactured from flame-retardant polycarbonate resin
- High tensile strength
- Will vent up to 160 DFUs
- UV Rated for outside installations
- Exclusive vermin protection system
- Fits 1 1/2" pipe size
- Limited lifetime warranty

The TEC-Vent features a material which is both flame retardant (self extinguishing) and possesses advanced flame properties. The Tec-Vent is ideal for any public constructions such as schools, hospitals, hotels, airports and many other applications.

## DIMENSIONS



A	B	Nominal pipe size (C)	D
3 3/4"	3"	1 1/2" NPT	2 3/4"

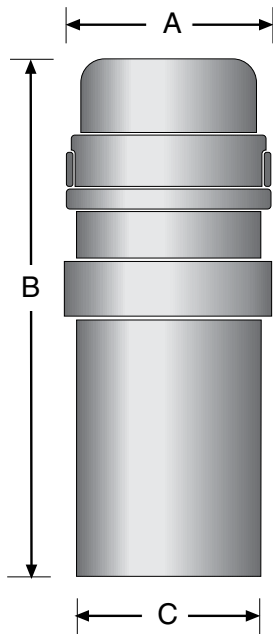
## DFU

Drain, Branch or Stack Size	Minimum Vent Pipe Size	Maximum DFU's on Branch
1 1/4"	1 1/4"	1
1 1/2"	1 1/4" - 1 1/2"	3
2"	1 1/4" - 2"	6
3"	1 1/2" - 3"	20
4"	2" - 4"	160

# CHEM-VENT



- For Commercial use
- NSF 14, (In Revision) ASSE 1049 Performance requirements for Individual and Branch Type Air Admittance Valves for Chemical Drainage Systems.
- For use on Chemical waste systems
- Manufactured from Flame Retardant Polypropylene conforming to D-41-01
- Unique ball valve sealing assembly with EPDM o-ring
- Exclusive vermin protection system
- Fits 1 1/2" pipe size
- Limited lifetime warranty



## DIMENSIONS

A	B	Nominal pipe size (C)
2 3/16"	6 3/16"	1 1/2" Sch 40 IPS

## DFU

Horizontal Branch	Minimum Vent Pipe Size	Maximum DFU's on Branch
1 1/2"	1 1/4" - 1 1/2"	3
2"	1 1/4" - 2"	6



**The extended leg schedule 40 connection allows direct mount on any acid waste system (MJ or Fusion) as well as CPVC, glass or Duriron system with an adaptor**

# Positive Air Pressure Attenuator (P.A.P.A.)



The P.A.P.A. device is the perfect compliment to STUDOR Air Admittance Valves. Together they form the **ENGINEERED STUDOR SYSTEM**, a total solution to building venting requirements. The Studor AAVs deal with negative pressure in the system while the P.A.P.A. effectively deals with the positive pressure transients. The combination of the two maintains the perfect system balance quickly and efficiently throughout the system preventing siphonage and blowing of traps.

## DIMENSIONS

A	B	Nominal pipe size (C)
7 7/8"	29 1/2"	3" spigot



## CAPACITY

Series Assembly	
Maximum number of units: 4	
Air Capacity	US Gallons
1 unit	1
2 units	2
3 units	3
4 units	4

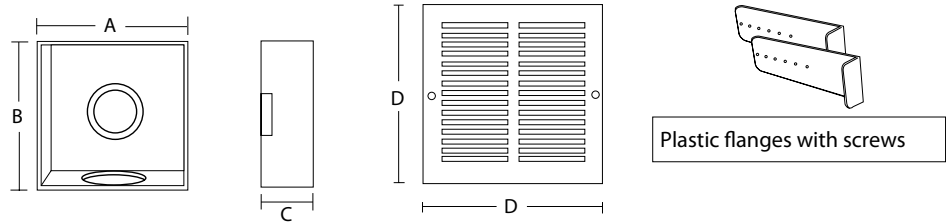
**The P.A.P.A. is rated for 5 PSI**

# In-Wall Access Box and Grill



STUDOR offers a recess box and grill ideally suited for in-wall installation of its Air Admittance Valves. Whether on individual fixtures or circuit installations it may be impractical or not possible to conceal the valve in an existing cabinet. In such installations and when concealment is desirable, the STUDOR recess box provides a safe as well as esthetically pleasing solution while providing code required accessibility to the valve. The box can also be used as the termination point for an open pipe side wall vent as an alternative to venting through the roof.

## DIMENSIONS



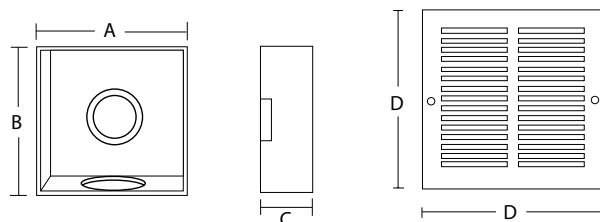
A	B	C	D
7 3/4"	7 3/4"	3 3/4"	9 1/2"



## "FR-12" Air admittance valve Recess Box

- Warnock Hersey Certified
- 1 hour and 2 hour Rated
- Made of High Temperature Resin
- U.L. Listed Intumescent Pad Attached to Back of Outlet Box

## DIMENSIONS



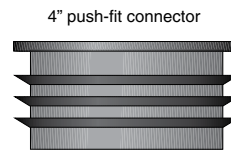
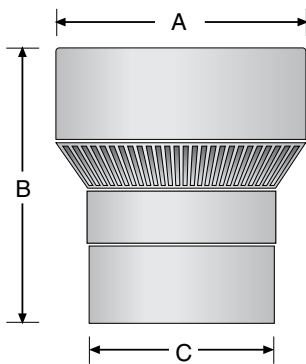
A	B	C	D
6"	6"	3 5/8"	9 1/2"

# Maxi-Filtra



- A two way vent , which filters air in both directions
- For outdoor use only
- Replaceable carbon filter to eliminate bad odors
- Designed for installation on septic tanks, lift stations
- UV Rated

Buildings connected to the main sewer can also benefit from the use of the MAXI-FILTRA but Studor technical department must be contacted so that installation feasibility can be determined. The MAXI-FILTRA, as part of the complete STUDOR System® eliminates sewer gases from entering buildings or polluting the surrounding areas. It can also be retro-fitted in existing plumbing system provided that all design and installation criteria are met.



## DIMENSIONS

A	B	Nominal pipe size (C)
4 7/8"	5 1/4"	3" spigot

**OUTDOOR USE ONLY**



**Maxi-Filtra**



**Adaptor**



**Replacement Cartridge**

## Introduction to Air Admittance Valves (AAVs)

### Dealing with Negative Air Pressure

The concept of venting fixtures has been a part of the plumbing industry since its conception. Balancing the pressure inside a DWV system, in order to equalize it with ambient pressure, is essential to maintain the water seal in the fixture trap. Loss of the water seal would allow the introduction of contaminants (sewer gasses and pathogens) into the living space.

Lacking the insight of modern science and the aid of modern technology, early designers devised a system comprised of a series of pipes extending to the outdoors. Although with updates and variation that very same cumbersome and often slow reacting system is still very much in use today around the world. It wasn't long however before the limitations of such a design were evident (e.g. roof penetrations and all related problems, excessive material use, space limitations, frost closure, trap loss due to high wind conditions, chimney effect in the pipe during fires, etc.)

Attempts were made to find more practical and effective solutions but lack of reliability and or the inability to maintain a healthy and sanitary environment doomed most of these efforts.

Studor Air Admittance Valves were the first devices to offer an alternative to open pipe vent systems. STUDOR's design utilizes a reverse lift sealing mechanism (membrane or ball) which opens (**fig. 1**) when even minimal vacuum conditions are present inside the system and closes (by gravity) when external and internal pressures are equalized. With the OPEN and CLOSE functions controlled entirely by pressure changes in the system and gravity, STUDOR AAVs have no springs (that can rust or lose memory), no gears (to jam or wear) and no stress components or dynamic seals (to fail). Additionally any positive pressure, like sewer gasses trying to escape, causes the valve to seal even tighter (**fig. 2**). The result is a valve which far exceeds the life of the system it serves to maintain proper sanitation.

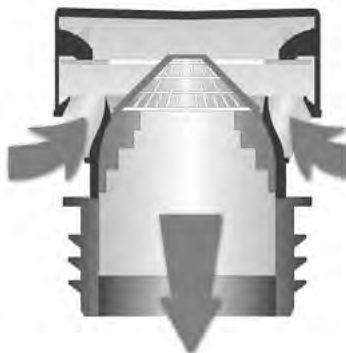


Fig. 1



Fig. 2

Besides working flawlessly, representing potential savings (by eliminating unnecessary vent piping and roof penetrations) and being the best solution for difficult to vent fixtures, STUDOR AAVs bring to a DWV system perhaps the most important of all features: greater efficiency.

Because AAVs are either at or very near the Point Of Need (PON) for air, and thanks to their reaction times, a system utilizing STUDOR AAVs is capable of balancing its internal pressure much more efficiently, without trap movement or depletion than open pipe vent systems. This is particularly true in large commercial applications where the air needed to balance the system after each occurrence is drawn from far away points and thus require substantial time to reach the Point of need (PON).

# Introduction to the Positive Air Pressure Attenuator (PAPA)

## Dealing with Positive Air Transients

We have seen how STUDOR AAVs are the technically preferable way of dealing with negative air pressure in a DWV system. We have also noted however how positive air pressure in the system will cause the valve to seal even tighter. This means that positive pressure in the system must be dealt with separately.

There are essentially three different types of positive pressure conditions in a DWV system:

Positive pressure from the main sewer (or septic tank) although positive pressure from the sewer or a septic tank is not a condition generated within your own system, it can certainly affect it in negative ways. For this reason it is important to have at least one open pipe vent per building drainage system. The drawings show two different layouts of a building complex. In the first example (**fig. 3**) the buildings only have one tie-in (thus requiring only one open vent) while the second example (**fig. 4**) shows two separate tie-ins (thus requiring two open vents in the building). Common sense dictates that the stack closer to the sewer tie-in is recommended to be the one to open atmosphere so the positive pressure can be relieved before it has much of a chance of entering the building's DWV system and unsettling its air balance.

## Positive pressure generated by a blockage or belly in the pipe

This is clearly a condition requiring attention. Unlike with other kinds of positive pressure there are no devices or designs to address a blockage or belly in the pipe, this problem is a failure of the system and it must be fixed.

It is however important to understand how AAVs and a system utilizing AAVs are affected by such a condition. The first thing is to make sure the AAVs used are ASSE and NSF certified. Among other things this will guarantee that the valve will be able to withstand up to 30" of water column. Such products can be installed under the flood rim level since even in the presence of positive pressure created by a blockage (**fig. 5**) the valve(s) will not leak. Non third-party certified valves may not be able to handle the pressure generated by a blockage and should not be used.

Positive pressure building at the valve will prevent it from opening thus preventing sewer gases from entering the building. If we consider however that the blockage is a problem that must be fixed, a poorly draining fixture in a system utilizing AAVs acts as an early warning sign of a drainage problem allowing the user to address it in a timely fashion.

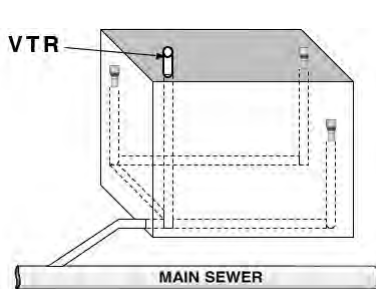


Fig. 3

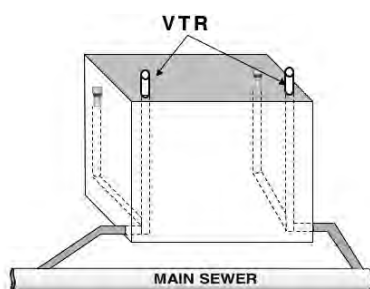


Fig. 4

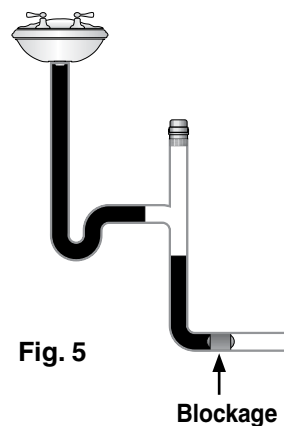


Fig. 5

Blockage



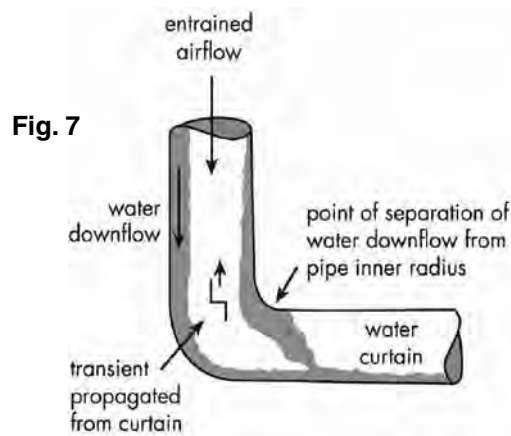
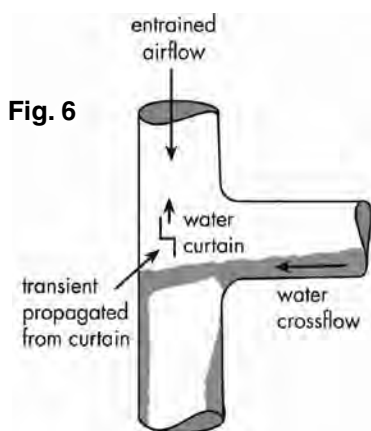
**Positive pressure created by a Hydraulic Jump** in multi-story buildings. This pressure referred to as positive transients) was believed to be the result of the hydraulic jump. Recent studies however have revealed a different scenario. When a WC is flushed or a bath or lavatory is emptied, the water flows in the horizontal part of the drainage system and carries with it solids from the WC or, perhaps solids which had deposited in the pipe from a previous flush. When this water reaches a vertical stack pipe, it pours in, in a curved fashion until it strikes the back wall of the vertical pipe. The water then swirls around the inner surface and falls down the pipe, under gravity, clinging to the pipe wall, this is called annular water flow (see figure 6). The water film on the inner surface of the pipe is surprisingly thin, even at high flow rates producing little more than ¼ inch film thickness. The solids fall, under gravity, in the core of the pipe. At the bottom of the stack the piping system makes the transition from vertical to horizontal through a sweep. As the flow goes through the sweep, centrifugal forces generated by the swirling action keep the fluid attached to its ID, much the same way it did while falling through the vertical stack. Towards the end of the sweep however the gravitational pull exceeds the centrifugal force and the fluid coating the inside of the sweep and upper half of the horizontal pipe falls to the bottom of the pipe forming a curtain of water. It is this curtain that the trapped air hits and bounces off creating the positive transient (see Figure 7).

Pressure transients are very simply the physical communication of a condition at one point in a system to another point. This means that if there is an event at point A then this information is communicated to point B some distance away by means of a pressure wave. The wave moves much faster than the air in which it travels and can move in any direction, not necessarily in the flow direction. In a pipe the speed at which an air pressure transient travels is the acoustic velocity, approx 1050 ft/sec.

Over the years the industry has relied on either designing dedicated passages (relief vents) for positive transients or complicated, limiting devices (aerator and de-aerator fittings) in order to prevent any discharge to ever reaching terminal velocity, no matter how tall the building is. As it was in the case of AAVs, STUDOR was first to research and bring to market a device which efficiently and cost-effectively removes the threat of positive transients.

The P.A.P.A. (Positive Air Pressure Attenuator) device acts like a water-hammer arrestor but for air. Unlike most water-hammer arrestors though, the P.A.P.A. device does not rely on compressed gas or springs for its operation. Naturally occurring conditions (positive pressure) are all that's needed to make the P.A.P.A work. For these reasons the P.A.P.A is a non-maintenance item guaranteed to last as long as the DWV system in service.

**How it works:** When the flow from a discharge (and following vacuum) goes by the branch-off fitting, the bladder inside the P.A.P.A is primed. After the air trapped by the flow, bounces off the water curtain and the positive transient is created, it begins its journey upward through the system. As the transient passes by the branch-off fitting some of it follows the alternative route and finds its way into the P.A.P.A. At that very moment the bladder begins to expand, a differential pressure is created at the branch-off point. This immediately makes the branch the path of least resistant (much like a short in an electrical loop) causing the vast majority of the transient to enter the P.A.P.A. The inflating bladder quickly (0.2 seconds) absorbs the energy of the transients thus reducing its speed to a harmless 40 ft per sec. The small volume of air is then released back into the system with no consequence.



## Installation of Studor Air Admittance Valves

1. STUDOR AAVs must be located a minimum of four (4") inches above the horizontal branch drain or fixture drain being vented.
2. STUDOR AAVs shall be accessible should replacement be required. For in wall installation use STUDOR recess box/grill combination.
3. STUDOR AAVs location must allow for adequate air to enter the valve. When located in a wall space or attic space lacking ventilation openings, openings shall be provided. Locating the valve in a sink or vanity cabinet is acceptable.
4. STUDOR AAVs must be installed in the vertical, upright position. A maximum deviation (in either direction) from plum of 15 degrees is allowed.
5. The vent shall connect to the drain vertically to maintain an unobstructed opening in the piping to the STUDOR AAVs.
6. A minimum of one vent pipe shall extended to the open atmosphere for each building drainage system for relief of positive pressure, the size of this vent is not specified because this single vent does not determine the total amount of aggregate cross sectional area of the vent system. The total amount of the cross sectional area of vents combined on the system has to equal the aggregate cross sectional area of the building drain. When properly installed an air admittance valve in the system is equivalent to an open vent pipe having the same cross sectional area as any other vent. Such open air vent is recommended to be located as close as possible to the connection between the building drain and building sewer.
7. The MAXI-VENT must be installed six (6") inches above the highest flood level rim of the fixtures being vented in stack applications.
8. STUDOR AAVs installed in attic area must be located a minimum of six (6") inches above the ceiling insulation.
9. The use of TEC-VENT in return air plenums or CHEM-VENT in acid/chemical waste applications shall be allowed only in engineered drainage systems designed by a design professional and approved by the local authority
10. The maximum height of drainage stack being vented by a MAXI-VENT must not exceed six (6) branch intervals.
11. When a horizontal branch connects to a stack more than four (4) branch intervals from the top of the stack. A relief vent shall be provided. The relief vent must be located between the connection of the branch to the stack and the first fixture connecting to the branch. The relief vent may also serve as a vent for the fixture. The relief vent must connect to the vent stack, stack vent or extend outdoors to the open air.
12. Only Teflon(r) tape can be used on the valves' threads. Use of primer, solvent cement or pipe dope will void STUDOR warranty.
13. The REDI-VENT, ULTRA-VENT, MINI-VENT, MAXI-VENT, TEC-VENT and CHEM-VENT must be installed at finish, after the system rough-in and pressure test.



# Installing the P.A.P.A. Device

## The P.A.P.A. device can be installed in the Vertical or Horizontal position



Fig. 8

When mounting the P.A.P.A. device vertically the P.A.P.A. device should be independently supported by an anchor connected to its housing as shown in (fig. 8). The anchor's metal hoop around the P.A.P.A. housing unit should allow for expansion and contraction and be rubber lined to prevent damage. Alternately the P.A.P.A. should be connected to the pipe with the use of a Fernco type coupling or no-hub band.

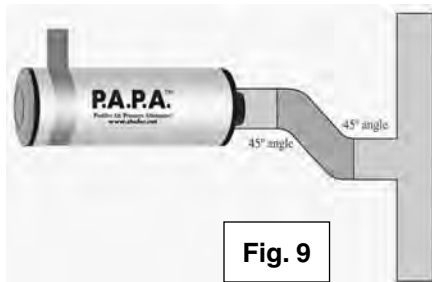


Fig. 9

When mounting horizontally (it is advisable to maintain a minimum of a few degrees of slope so as to induce self draining) or at any angle up to 90 degrees, the P.A.P.A. device should be supported or anchored as shown in (fig. 9). The portion of the support or anchor in contact with the device housing should allow for expansion and contraction and be rubber lined to prevent damage.



Fig. 10

Up to a maximum of four (4) P.A.P.A. units can be joined in series to provide additional capacity and protection. This solution is recommended at the base of the stack or at any point in application where heavy use is expected as shown in (fig. 10).

3" Spigot



Use a Fernco type coupling or no-hub band to connect to 3" pipe size

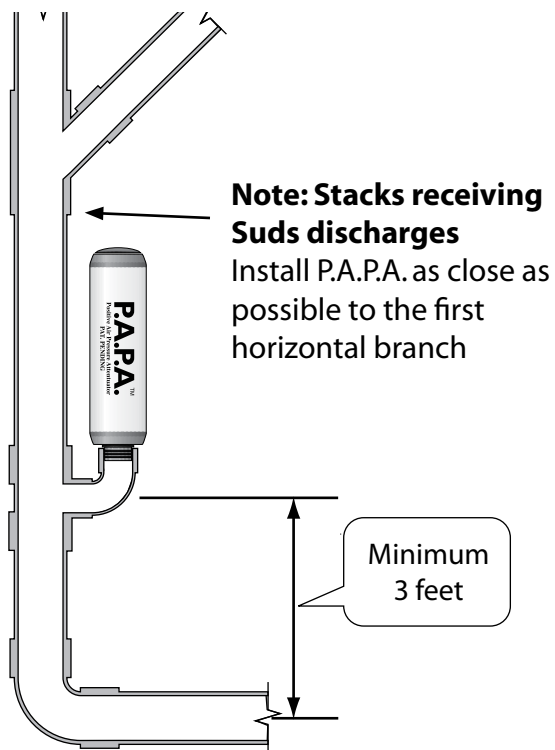
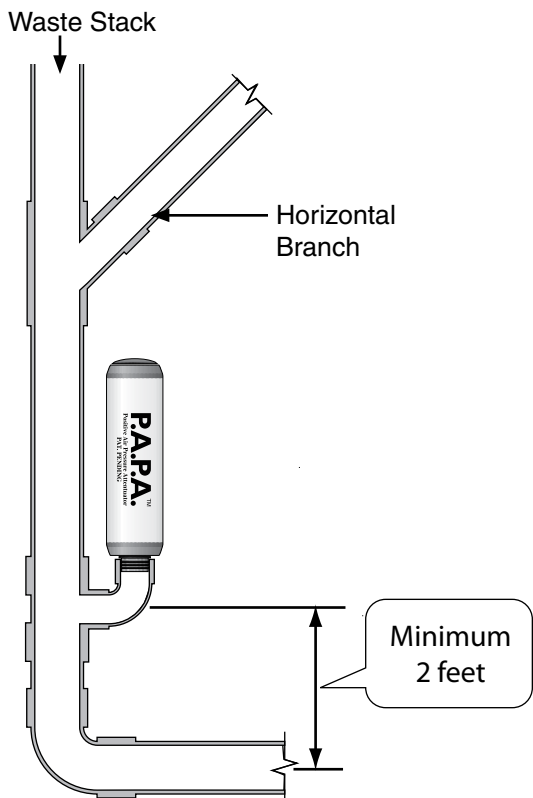
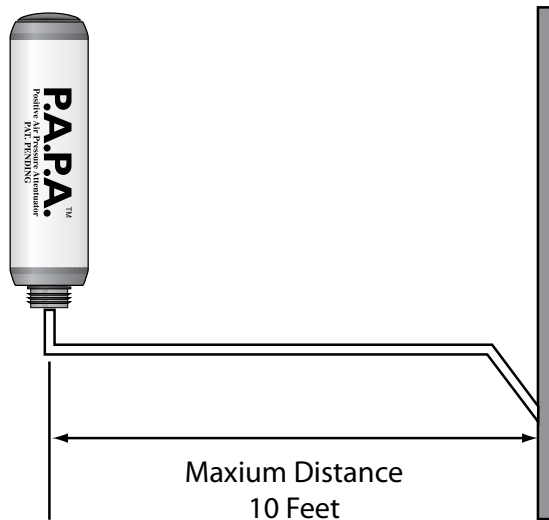
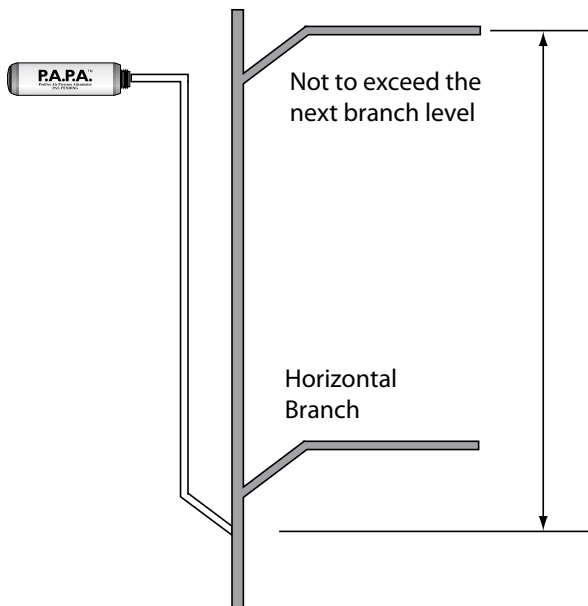
**Threaded adaptor is included and can be cemented to the spigot**



**THE P.A.P.A. MUST BE INSTALLED AFTER THE SYSTEM'S PRESSURE TEST AND MUST BE ACCESSIBLE**

**Note:**

Accessible; in regard to the P.A.P.A. device is defined as noting the location of the P.A.P.A. device on the final plans for the building. The P.A.P.A. may be located behind any sheetrock wall or ceiling, without an access panel. If the P.A.P.A. is located behind a concrete wall or block wall an access panel is required.



Stack extending no more than 5 floors above the base of the stack or offset should be a minimum of 2 feet

Stack extending more than 5 floors above the base of the stack or offset should be a minimum of 3 feet

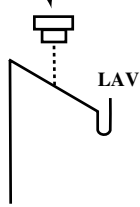
**Minimum distance shall be measured from center to center**

# Air Admittance Systems Design Criteria

There are many designs that can utilize Studor's Air Admittance Valves. Various layouts of acceptable designs are shown in the following diagrams. These isometric drawings are intended to show some of the acceptable designs; however several additional designs are also acceptable.

## INDIVIDUAL VENT

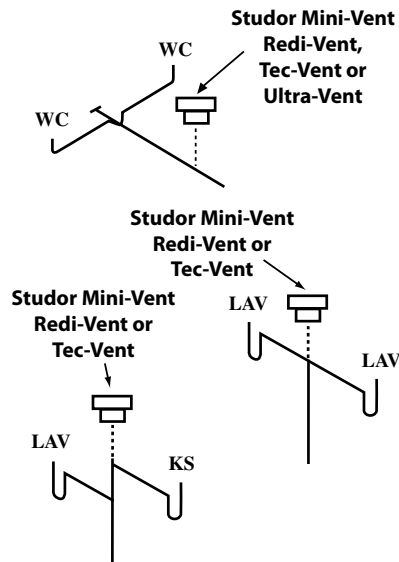
Studor Mini-Vent, Redi-Vent, Tec-Vent or Ultra-Vent



**Figure 1**

The simplest form of venting is an individual vent. The individual vent with the Studor vent as the vent terminal is an effective method of venting island fixtures or fixture located in a remote location.

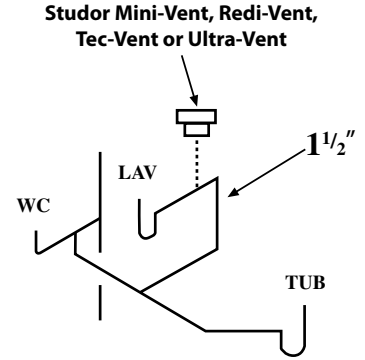
## COMMON VENT



**Figure 2**

The common vent is similar to an individual vent. The vent serves two or three fixtures. The Studor vent can be located in the close proximity to the fixture being vented.

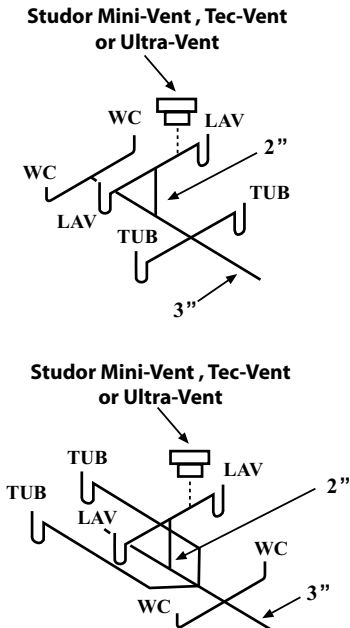
## WET VENT



**Figure 3**

A wet vent is a single vent for one or two bathroom groups. There are different layouts for achieving the same venting concept. A single bathroom group wet vent can terminate to a Studor Vent.

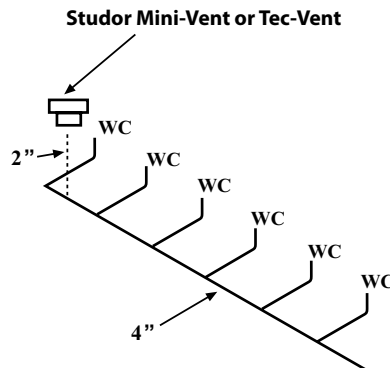
## WET VENT



**Figure 4**

A double bathroom group, back to back, can be wet vented with a single Studor vent connecting as the vent.

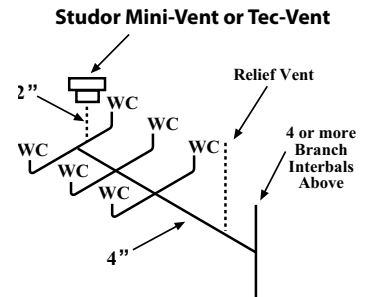
## CIRCUIT VENT



**Figure 5**

A single vent serves as the vent for three to eight fixtures. The Studor vent serves as the circuit vent.

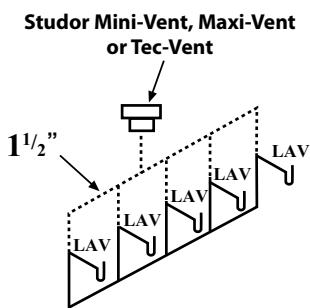
## CIRCUIT VENT



**Figure 6**

When the horizontal drainage branch connects to a stack having more than 4 branch intervals located above the branch, a relief vent is required. The relief vent must connect to the vent stack, stack vent, or extend to the outdoor air.

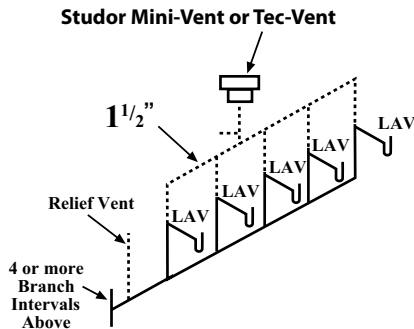
**BRANCH VENT**



**Figure 7**

When various vents connect to a branch vent a Studor vent can serve as the vent for the branch

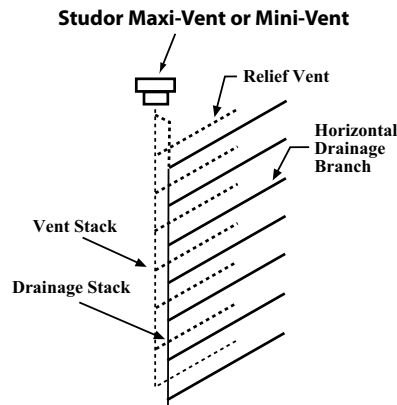
**BRANCH VENT**



**Figure 8**

More than one Studor vent can be installed within a horizontal branch to vent various fixtures. A relief vent is required when more than 4 branch intervals are located above the branch connection.

**VENT STACK - STACK VENT**

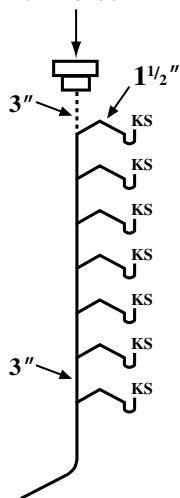


**Figure 9**

The stack type air admittance valve, Studor vent can serve as the vent for a vent stack or stack vent. The maximum height of the drainage stack that is vented with an air admittance valve is six branch intervals

**WASTE STACK VENT**

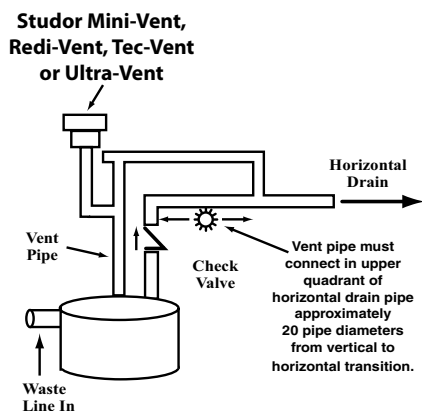
Studor Maxi-Vent or Mini-Vent



**Figure 10**

The Studor vent can serve as the vent for a waste stack vent. The maximum height of the waste stack vent with an air admittance valve is six branch intervals

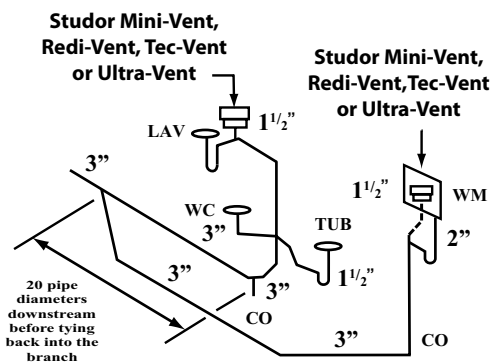
**SEWER EJECTOR**



**NOTE**

When using an air admittance valve on a sewer ejector you must get approval from the local authority

**WASHING MACHINE**



**Figure 11**

The trap and fixture drain for an automatic clothes washer standpipe shall be a minimum of 2" in diameter. The automatic clothes washer fixture drain shall connect to a branch drain or drainage stack a minimum of 3" in diameter



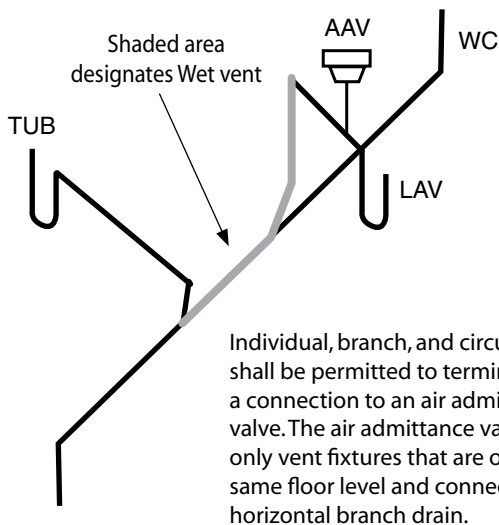
# Air Admittance Systems Design Criteria *(cont.)*

Any combination of fixtures within two bathroom groups located on the same floor level are permitted to be vented by a wet vent.

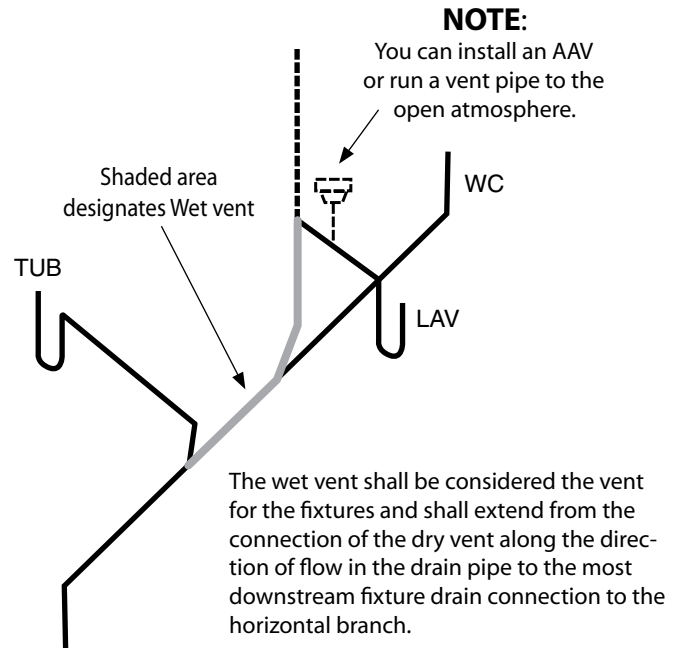
A bathroom group is defined as a group of fixtures consisting of a water closet, lavatory, bathroom or shower, including or excluding a bidet, an emergency floor drain or both and such fixtures are located together on the same floor.

The piping arrangement in the wet vent system permits the designer and installer the versatility to combine the fixtures with a single vent pipe connection.

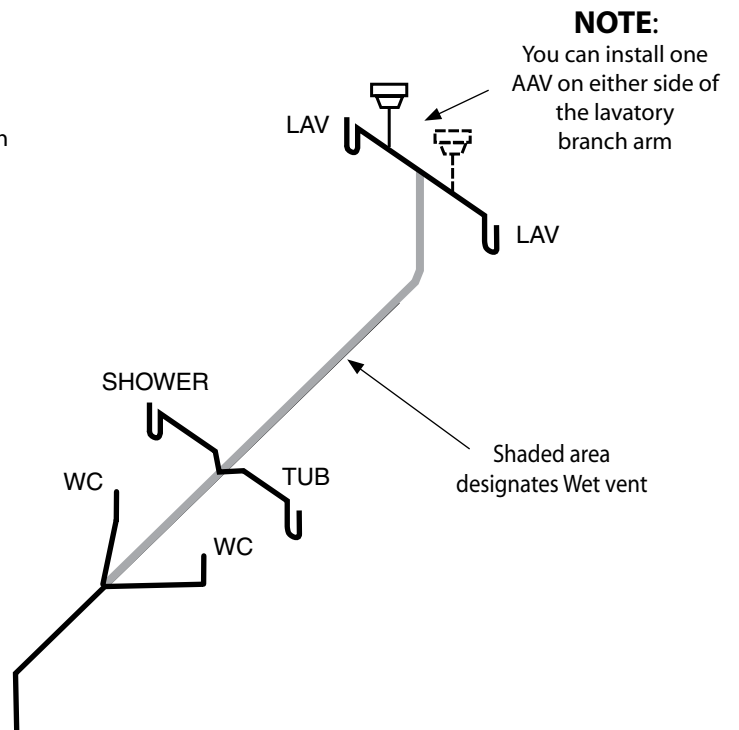
## Horizontal Wet Vent



## Horizontal Wet Vent



## Double Bathroom Group

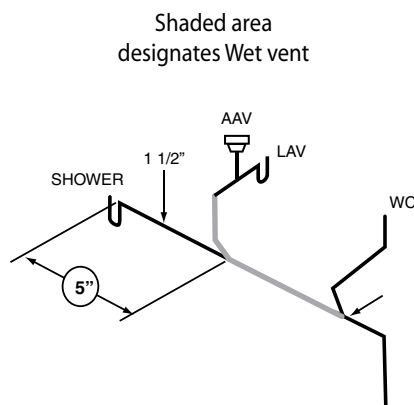




**Maximum Distance of Fixture Trap from Vent**

Size of Trap (inches)	Size of Trap Drain (inches)	Slope (inch per foot)	Distance From Trap
1-1/4	1-1/4	1/4	3-1/2
1-1/4	1-1/2	1/4	5
1-1/2	1-1/2	1/4	5
1-1/2	2	1/4	6
2	2	1/4	6
3	3	1/8	10
4	4	1/8	12

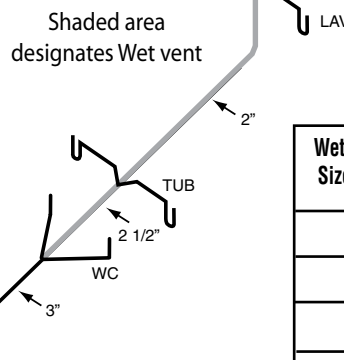
IPC Table 905.1 Maximum distance of trap from vent



**Sizing the wet vent and the dry vent**

**NOTE:**

You can install one AAV or either side of the lavatory branch arm



Wet Vent Pipe Size (inches)	Drainage Fixture Unit load (dfu's)
1-1/2	1
2	4
2-1/2	6
3	12

IPC Table 909.3 Sizing the wet vent

**Horizontal Wet Venting**

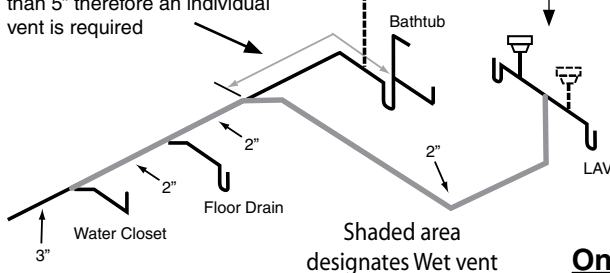
**NOTE:**

You can install an AAV or run a vent pipe to the open atmosphere

The distance from the vent to the trap weir of the bathtub is longer than 5" therefore an individual vent is required

**NOTE:**

You can install one AAV or either side of the lavatory branch arm

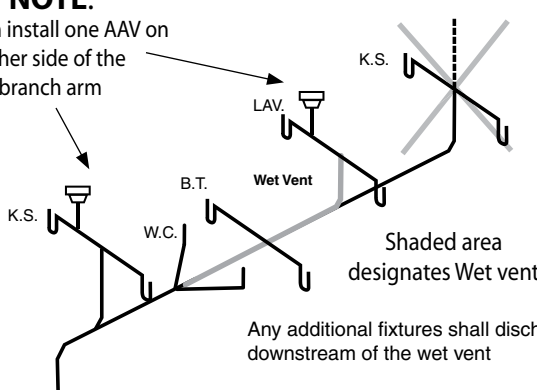


**Only the fixtures within the bathroom group shall connect to the wet vented horizontal branch drain**

**NOTE:**

You can install one AAV on either side of the branch arm

Not Allowed



Any additional fixtures shall discharge downstream of the wet vent

# Drainage Fixture Units (DFU)

Drainage Fixture Unit is a value that is directly related to the sizing and selection of both your drainage piping and your Air Admittance Valves. Specifically when it comes to selecting the right Studor air admittance valve a capacity range which can vary substantially (e.g. from 1 DFUs to 500 DFUs). It is important to notice that this capacity range is not at all a function of the valve size but rather of the size of the branch serviced by the valve. The table below shows how DFUs values are assigned to different fixtures.

## DRAINAGE FIXTURE UNITS FOR FIXTURES AND GROUPS

FIXTURE TYPE	DRAINAGE FIXTURE UNIT VALUE AS LOAD FACTORS	MINIMUM SIZE OF TRAP (Inches)
Automatic clothes washers, commercial <sup>a</sup>	3	2
Automatic clothes washers, residential	2	2
Bathroom group as defined in Section 202 (1.6 gpf water closet) <sup>e</sup>	5	—
Bathroom group as defined in Section 202 (water closet flushing greater than 1.6 gpf) <sup>e</sup>	6	—
Bathtub <sup>b</sup> (with or without overhead shower or whirlpool attachments)	2	1 1/2
Bidet	1	1 1/4
Combination sink and tray	2	1 1/2
Dental lavatory	1	1 1/4
Dental unit or cuspidor	1	1 1/4
Dishwashing machine, domestic	2	2 1/2
Drinking fountain	1/2	1 1/4
Emergency floor drain	0	2
Floor drains	2	2
Kitchen sink, domestic	2	1 1/2
Kitchen sink, domestic with food waste grinder and/or dishwasher	2	1 1/2
Laundry tray (1 or 2 compartments)	2	1 1/2
Lavatory	1	1 1/4
Shower	2	1 1/2
Sink	2	1 1/2
Urinal	4	Footnote c
Urinal, 1 gallon per flush or less	2 <sup>d</sup>	Footnote c
Wash sink (circular or multiple) each set of faucets	2	1 1/2
Water closet, flushometer tank, public or private	4 <sup>d</sup>	Footnote c
Water closet, private (1.6 gpf)	3 <sup>d</sup>	Footnote c
Water closet, private (flushing greater than 1.6 gpf)	4 <sup>d</sup>	Footnote c
Water closet, public (1.6 gpf)	4 <sup>d</sup>	Footnote c
Water closet, public (flushing greater than 1.6 gpf)	6 <sup>d</sup>	Footnote c

- For traps, up to 3 inches.
- A showerhead over a bathtub or whirlpool bathtub attachment does not increase the drainage fixture unit value.
- Trap size shall be consistent with the fixture outlet size.
- For the purpose of computing loads on building drains and sewers, water closets or urinals shall not be rated at a lower drainage fixture unit unless the lower values are confirmed by testing.
- For fixtures added to a dwelling unit bathroom group, add the DFU value of those additional fixtures to the bedroom group fixture count.

# P.A.P.A. Design Criteria

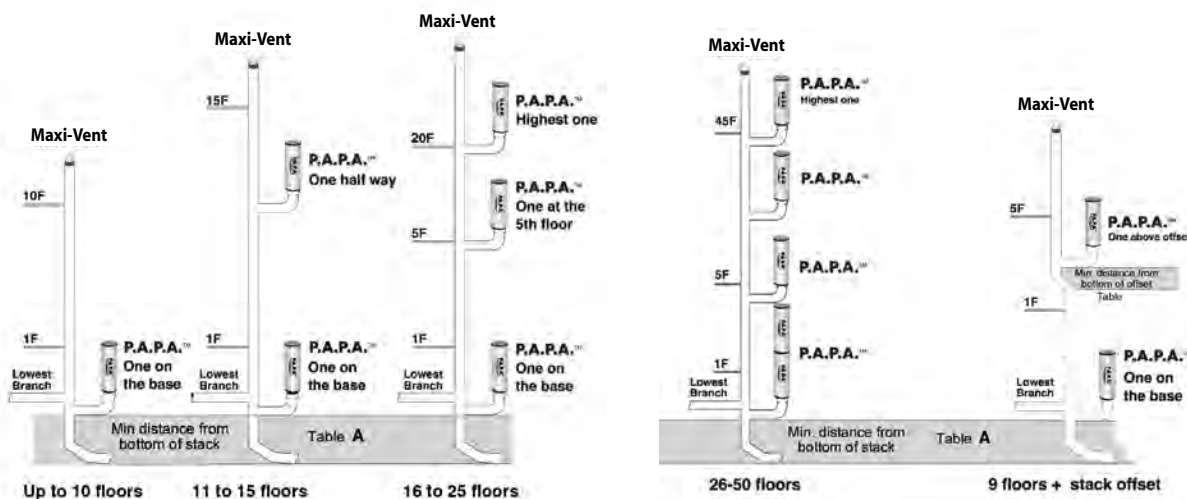
There are several issues to be recognized as the drainage and vent system respond to positive transients propagation:

- The pressure profile is constantly changing
- The area of risk to trap water seals is dynamic and constantly changing
- The volume of extra air in the system will depend on airflow rate, closure times of blockage and the AAVs pipe period of the system; all of which are not constant

To deal with these certainties, the P.A.P.A. device should be distributed throughout the system. The following is only a guide line of how many P.A.P.A. devices would be required per stack. This would vary depending on the plumbing design. **Please consult Studor, Inc. with any questions regarding the design of the system**

Pressure Attenuators should be installed in the following locations:

- before the very first branch connected to the stack
- before the first branch connected to stack after a offset
- at intervals on the stack



**Table A. MINIMUM DISTANCE**

Stack extending no more than 5 floors above the base of the stack or offset:	<b>2 ft</b>
Stack extending more than 5 floors above the base of the stack or offset:	<b>3 ft</b>
Stack receiving suds discharges:	As close as possible to the first horizontal branch

*Minimum distance shall be measured from center to center*

Height of stack above base or offset number of floor levels	Location of additional P.A.P.A. devices
Up to 10 .....	1 P.A.P.A. at the base
11 – 15 .....	1 at base, 1 at mid level
16 – 25 .....	1 at base and at intervals not exceeding 5 floors
26 – 50 .....	2 P.A.P.A. in series at base and at intervals not exceeding 5 floors up to level 25 and at interval not exceeding 10 floors above level 25
51 or more.....	Studor must be consulted

## **P.A.P.A. DESIGN CRITERIA** *(cont.)*

---

With the **P.A.P.A.** devices installed throughout the system, the protection against positive transients would never be more than 10 floors away. Therefore the transient is dealt with before it can affect the whole system. It is essential to recognize that to be effective, a pressure transient attenuator must be placed between the source of the transient and the appliance to be protected.

The **P.A.P.A.** device is a maintenance free product and we recommend that it is accessible. Fluids and suds entering the device will not restrict the device's ability to neutralize the negative effects of pressure transients nor will they compromise the life expectancy of the unit.

Note: The **P.A.P.A.** does not solve the problem of a slow buildup of pressure, a sustained positive pressure originating from deposits blocking the pipes, the blockage of a public sewer, an overloaded septic tank, etc. This is an inherent problem that must be resolved with or without the installation of **P.A.P.A.** devices or AAVs.

### **The P.A.P.A. device may be utilized in conjunction with a conventional System**

**STUDOR offers a full planning service for designs of drainage venting systems incorporating the STUDOR products.**

**Use of the STUDOR P.A.P.A. devices in conjunction with non-STUDOR brand air admittance valves will void any and all warranties on the P.A.P.A. unit(s) as well as any other STUDOR components used on the the project.**

# CODES

Currently there are several plumbing codes used in the USA; the International Plumbing Code (IPC), the Residential Plumbing Code (IRC), the Uniform Plumbing Code (UPC) and the National Standard Plumbing Code (NSPC). There are also many state and local codes as well as variations of these model codes.

## INTERNATIONAL PLUMBING CODE (IPC) 2006 SECTION 917-AIR ADMITTANCE VALVES

**917.1 General.** Vent systems utilizing air admittance valves shall comply with this section. Individual and branch-type air admittance valves shall conform to ASSE 1051.

**917.2 Installation.** The valves shall be installed in accordance with the requirements of this section and the manufacturer's installation instructions. Air admittance valves shall be installed after the DWV testing required by Section 312.2 or 312.3 has been performed.

**917.3 Where Permitted.** Individual, branch and circuit vents shall be permitted to terminate with a connection to an air admittance valve. The air admittance valve shall only vent fixtures that are on the same floor level and connect to a horizontal branch drain. The horizontal branch drain shall conform to Section 917.3.1 or Section 917.3.2.

**917.3.1 Location of branch.** The horizontal branch drain shall connect to the drainage stack or building drain a maximum of four branch intervals from the top of the stack.

**917.3.2 Relief vent.** The horizontal branch shall be provided with a relief vent that shall connect to a vent stack, or stack vent, or extend outdoors to the open air. The relief vent shall connect to the horizontal branch drain between the stack or building drain and the most downstream fixture drain connected to the horizontal branch drain. The relief vent shall be sized in accordance with Section 916.2 and installed in accordance with Section 905. The relief vent shall be permitted to serve as the vent for other fixtures.

**917.4 Location.** The air admittance valve shall be located a minimum of 4 inches (102mm) above the horizontal branch drain or fixture drain being vented. The air admittance valve shall be located within the maximum developed length permitted for the vent. The air admittance valve shall be installed a minimum of 6 inches (152mm) above insulation materials.

**917.5 Access and ventilation.** Access shall be provided to all air admittance valves. The valve shall be located within a ventilated space that allows air to enter the valve.

**917.6 Size.** The air admittance valve shall be rated for the size of the vent to which the valve is connected.

**917.7 Vent required.** Within each plumbing system, a minimum of one stack vent or vent stack shall extend outdoors to the open air. **917.8**

**Prohibited installations.** Air admittance valves shall not be installed in non-neutralized special waste systems as described in Chapter 8. Valves shall not be located in spaces unitized as supply or return air plenums.

## SECTION 303 MATERIALS

**303.1 Identification.** Each length of pipe and pipe fitting, trap, fixture, material and device utilized in a plumbing system shall bear the identification of the manufacturer.

**303.2 Installation of materials.** All materials used shall be installed in strict accordance with the standards under which the materials are accepted and approved. In the absence of such installation procedures, the manufacturer's installation instructions shall be followed. Where the requirements of referenced standards or manufacturer's installation instructions do not conform to minimum provisions of this code, the provisions of this code shall apply.

**303.3 Plastic pipe, fittings and components.** All plastic pipe, fittings and components shall be third-party certified as conforming to NSF 14.

## Section 406 Automatic Clothes

**406.3 Waste Connection.** The waste from an automatic clothes washer shall discharge through an air break into a standpipe in accordance with Section 802.4 or into a laundry sink. The trap and fixture drain for an automatic clothes washer standpipe shall be a minimum of 2 inches (51mm) in diameter. The automatic clothes washer fixture drain shall connect to a branch drain or drainage stack a minimum of 3 inches (76mm) in diameter.

## 2006 INTERNATIONAL RESIDENTIAL CODE (IRC)

**P3114.1 General.** Vent systems utilizing air admittance valves shall comply with this section. Individual-and-branch-type air admittance valves shall conform to ASSE 1051. Stack type air admittance valves shall conform to ASSE 1050.

**3114.2 Installation.** The valves shall be installed in accordance with the requirements of this section and the manufacturer's installation instructions. Air admittance valves shall be installed after the DWV testing required by Section P2503.5.1 or P 2503.5.2 has been performed.

**3114.3 Where permitted.** Individual vents, branch vents, circuit vents and stack vents shall be permitted to terminate with a connection to an air admittance valve.

**3114.4 Location.** Individual and branch air admittance valves shall be located a minimum of 4 inches (102 mm) above the horizontal branch drain or fixture drain being vented. Stack-type air admittance valves shall be located a minimum of 6 inches (152 mm) above the flood level rim of the highest fixture being vented. The air admittance valve shall be located within the maximum developed length permitted for the vent. The air admittance valve shall be installed a minimum of 6 inches (152 mm) above insulation materials installed in attics.

**3114.5 Access and Ventilation.** Access shall be provided to all air admittance valves. The valve shall be located within a ventilated space that allows air to enter the valve.

**3114.6 Size.** The air admittance valve shall be rated in accordance with the standard for the size of the vent to which the valve is connected.

**3114.7 Vent required.** Within each plumbing system, a minimum of one stack vent or vent stack shall extend outdoors to the open air.

## 2006 UNIFORM PLUMBING CODE

### 301.2 Alternate Materials and Methods of Construction Equivalency

Nothing in this code is intended to prevent the use of systems, methods, or devices of equivalent or superior quality, strength, fire resistance, effectiveness, durability, and safety over those prescribed by this code. Technical documentation shall be submitted to the Authority Having Jurisdiction to demonstrate equivalency. The Authority Having Jurisdiction shall approve the system method or device when determined to be equivalent or superior. However, the exercise of this discretionary approval by the Authority Having Jurisdiction shall have no effect beyond the jurisdictional boundaries of said Authority Having Jurisdiction. Any alternate material or method of construction so approved shall not be considered as conforming to the requirements and/or intent of this code for any purpose other than that granted by the Authority Having Jurisdiction when the submitted date does not prove equivalency.

#### 301.2.1 Testing

The Authority Having Jurisdiction shall have the authority to require tests, as proof of equivalency.

##### 301.2.1.1

Tests shall be made in accordance with approved standards, by an approved testing agency at the expense of the applicant. In the absence of such standards, the Authority Having Jurisdiction shall have the authority specify the test procedure.

##### 301.2.1.2

The Authority Having Jurisdiction shall have the authority to require tests to be made or repeated if, at any time, there is reason to believe that any material or device no longer conforms to the requirements on which its approval was based.

## NATIONAL STANDARD PLUMBING CODE (NSPC)

**NOTE:** Following sections of the code cover the special design requirements that apply to all of the systems in Appendix E.

### E.1 GENERAL REQUIREMENTS

**E.1.1** Special design plumbing systems shall include all systems that vary in detail from the requirements of this Code.

**E.1.2** The provisions of this Appendix shall control the design, installation, and inspection of special design plumbing systems.

**E.1.3** Special design plumbing systems shall conform to the Basic Principles of this Code.

**E.1.4** Special design plumbing systems shall be designed by a registered design professional who is licensed to practice in the particular jurisdiction.

### E.2 Plans, Specifications, and Computations

**E.2.1** Plans, specifications, computations, and other related data for special design plumbing systems, prepared by the registered design professional, shall be submitted to the Authority Having Jurisdiction for review and approval prior to installation.

**E.2.2** The design plans shall indicate that the plumbing system (or portions thereof) is a special design system.

### E.3 Installation of Special Design Plumbing Systems

**E.3.1** Special design plumbing systems shall be installed according to established, tested and approved criteria, including manufacturer's instructions.

**E.3.2** The installation shall comply with Chapter 2 – General Regulations and other applicable requirements of this Code.

### E.4 Certification of Compliance

**E.4.1** Inspection shall be made by the Authority Having Jurisdiction to ensure conformance with data submitted for approval and the applicable requirements of this Code.

**E.4.2** The complete installation and performance of the special design plumbing system shall be certified by the registered design professional as complying with the requirements of the special design.

#### NOTE:

Final code considerations It must be noted that even in the IPC, where AAVs are specifically approved it is stated that Air admittance valves shall not be installed in non-neutralized special waste systems and shall not be located in spaces unitized as supply or return air plenums. These limitations, reasonable and appropriate, at the time the latest code revisions were written do not take into account the latest products from Studor Engineered Systems.

Some STUDOR products were specifically designed for applications such as chemical / acid waste or for use in the supply and return plenum. These valves, as shown in this manual utilize special materials exhibiting all the mechanical, chemical, thermal and fire related properties needed to perform in specialized applications. When utilizing these specialty valves in a system, the system must be designed by a design professional and approved by the local authority.

---

## CANADIAN NATIONAL PLUMBING CODE

### DIVISION A

#### 1.4.1.2. Definition

Air admittance valve means a one-way valve designed to allow air to enter the drainage system when the pressure in the plumbing system is less than the atmospheric pressure.

(See Appendix Note A-2.2.10.16.(1) of Division B.)

### DIVISION B

#### 2.2.10.16. Air admittance valves

- 1) Air admittance valves shall conform to ASSE 1051, "Individual and Branch Type Air Admittance Valves for Sanitary Drainage Systems." (See Appendix A.)

#### 2.5.9. Air Admittance Valves

(See A-2.2.10.16.(1) in Appendix A.)

##### 2.5.9.1. Air Admittance Valve as a Vent Terminal

- 1) Individual vents may terminate with a connection to an air admittance valve as provided in Articles 2.5.9.2. and 2.5.9.3. (See also Sentence 2.2.10.16.(1).)

##### 2.5.9.2. Air Admittance Valves

- 1) Air admittance valves shall only be used to vent
  - a) fixtures located in island counters,
  - b) fixtures that may be affected by frost closure of the vent due to local climatic conditions,
  - c) fixtures in one and two-family dwellings undergoing renovation, or
  - d) installations where connection to a vent may not be practical.
- 2) Air admittance valves shall be located
  - a) not less than 100mm above the horizontal branch drain or fixture drain being vented,
  - b) within the maximum developed length permitted for the vent, and
  - c) not less than 150mm above insulation materials.

##### 2.5.9.3. Installation Conditions

- 1) Air admittance valves shall not be installed in supply or return air plenums, or in locations where they may be exposed to freezing temperatures.
- 2) Air admittance valves shall be installed in accordance with the manufacturer's installation instructions.
- 3) Air admittance valves shall be rated for the size of vent pipe to which they are connected.
- 4) Installed air admittance valves shall be
  - a) accessible, and
  - b) located in a space that allows air to enter the valve.
- 5) Every drainage system shall have one vent that terminates to the outdoors in conformance with Sentence 2.5.6.2.(1).



# Standards & Listings

AIR ADMITTANCE VALVES Standards are the industry's benchmark for any given product. A standard will identify the minimum performance criteria of a product. Being the inventor of the Air Admittance Valve's exclusive technology, STUDOR was also instrumental, working closely with ASSE, in the development of today's applicable standards.

All STUDOR Air Admittance Valves are tested to and conform to the following standards:

- ANSI/ASSE 1051 (2002 revision) Single Fixture and Branch-Type AAVs
- ANSI/ASSE 1050 (2002 revision) Stack-Type AAVs
- ASSE Seal of Approval
- NSF Standard 14 (Plastic Pipe, Fittings and Components)

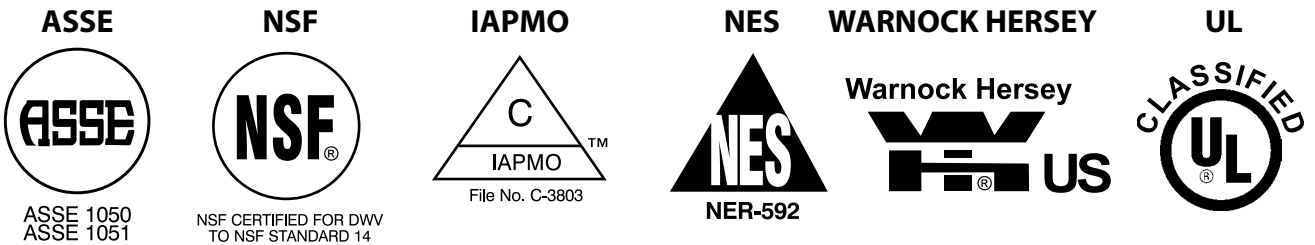
The fundamental technical parameter of ASSE 1051 and 1050 as they relate to the performance of AAVs as follows:

- Min. Opening pressure..... **0.30 inches H<sub>2</sub>O**
- Tightness ..... **Tight at 0 differential pressure or higher**
- Max pressure rating ..... **30" H<sub>2</sub>O**
- Endurance ..... **500,000 cycles**
- Operating temperature range ..... **-40F to +150F**  
Chem-Vent ..... **-40F to +210F**
- Temperature test ..... **8 hrs @+150F**  
..... **8 hrs @ -40F**

It is important to note that all STUDOR valves not only meet all but also exceed one or more of the above parameters. At 1,500,000 cycles all our valves far exceed the cycle life testing and some (like the Chem-Vent) undergo a much more stringent temperature test (8 hrs @210F) because of the potential of exothermic reaction in acid waste systems.

Product listings are also a fundamental part of a product makeup. Without listing there would be no independent third party certification that a given product actually conforms to the relevant standard(s).

**All STUDOR Air Admittance Valves are listed and certified by one or more of the following:**



## Following is NSF14 schedule for testing of STUDOR AAVs.

### Air admittance valve test frequency

Test	Stack Type Devices	Fixture and Branch Devices
Capacity Test	annually	annually
Low pressure test of complete device	weekly	—
Pressure test of complete device	—	weekly
Temperature range test	annually	annually
Thread length	weekly	weekly
Product Standards	ASSE 1050	ASSE 1051

# Materials Properties

**Product:** MAXI-VENT – MINI-VENT – ULTRA-VENT – REDI-VENT

Material of construction: Acrylonitrile Butadiene Styrene (ABS)

## MECHANICAL

Property	Typical Data	Unit	Method
Tensile Modulus c73 F, 2.0 in/mm	5500	psi	ASTM D 638
Elongation at Break @73 F	45	%	ASTM D 638
Modulus of Elasticity@73 F	240,000	psi	ASTM D 790
Modulus of Elasticity@176 F	185,000	psi	ASTM D 790
Compressive Strength	6150	psi	ASTM D 695
Flexural Strength	13,000	psi	ASTM D 790

## IMPACT

Property	Typical Data	Unit	Method
Izod Impact, notched	8.5	ft-lb/in	ASTM D 256

## PHYSICAL

Property	Typical Data	Unit	Method
Specific Gravity, solid	1.04	—	ASTM D 792
Water Absorption 24 hrs.	0.01	%	ASTM D 570

## THERMAL

Property	Typical Data	Unit	Method
Coefficient of Linear Expansion	5.0x10-5	in/in/F	ASTM D 696
Heat Deflection Temp. @ 66psi load	200	F	ASTM D 648
Heat Deflection Temp. @ 264psi load	180	F	ASTM D 648
Thermal Conductivity	1.31-2.32	Btu/in/ft <sup>2</sup> F/hr	ASTM C 177

# MATERIALS PROPERTIES *(cont.)*

**Product:** TEC-VENT

Material of construction: Polycarbonate (Lexan)

## MECHANICAL

Property	Typical Data	Unit	Method
Tensile Str, yld, Type I, 2.0 in/mm	8500	psi	ASTM D 638
Tensile Elong, brk, Type I, 2.0 in/mm	130.0	%	ASTM D 63
Tensile Modulus, 2.0 in/mm	305000	psi	ASTM D 638
Flex Stress, yld, 0.05 in/mm, 2" span	12900	psi	ASTM D 790
Flex Mod, 0.05 in/mm, 2" span	300000	psi	ASTM D 790
Hardness, H358/30	90	MPa	ISO 2039/1

## IMPACT

Property	Typical Data	Unit	Method
Izod Impact, notched, 73F	15.0	ft-lb/in	ASTM D 256
Izod Impact, notched, 22F	12.7	ftlb/in	ASTM D 256

## THERMAL

Property	Typical Data	Unit	Method
Vicat Softening Temp, Rate B	299 deg	F	ASTM D 1525
Relative Temp Index, Elec	125 deg	C	UL 7468
Relative Temp Index, Mech w/impact	115 deg	C	UL 746B
Relative Temp Index, Mech w/o impact	120 deg	C	UL 746B

## PHYSICAL

Property	Typical Data	Unit	Method
Specific Gravity, solid	1.18	—	ASTM D 792
Melt Flow Rate, 300C/1.2 kgf (0)	10.0	g/10 mm	ASTM D 1238
Density	1.19	g/cm <sup>3</sup>	ISO 118

## ELECTRICAL

Property	Typical Data	Unit	Method
Dielectric Constant, 1 MHz	2.90	—	ASTM D 150
Dissipation Factor, 1 MHz	0.0085	—	ASTM D 150

## FLAME CHARACTERISTICS

Property	Typical Data	Unit	Method
UL File Number, USA	E121562	—	—
V0 Rated (tested thickness)	0.059	inch	UL 94
5VA Rating (tested thickness)	0.118	inch	UL 94
Oxygen Index (LOI)	35	%	ISO 4589

**Product: CHEM-VENT**

Material of construction Flame retardant Polypropylene  
 O-ring material Ethylene Propylene Diene Monomer

**MECHANICAL**

Property	Typical Data	Unit	Method
Tensile Modulus, 2.0 in/mm	4400	psi	ASTM D 638
Flexural Modulus	215,000	psi	ASTM D 790
Hardness, Rockwell R	100	—	ASTM D 1706

**IMPACT**

Property	Typical Data	Unit	Method
Izod Impact, notched,	1.0	ftlb/in	ASTM D 256

**PHYSICAL**

Property	Typical Data	Unit	Method
Specific Gravity, solid	0.94	—	ASTM D 1505
Water Absorption 24 hrs.	0.01	%	ASTM D 570

**THERMAL**

Property	Typical Data	Unit	Method
Coefficient of Linear Expansion	6x10 <sup>-5</sup>	in/in/F	ASTM D 696
Heat Deflection Temperature@66psi load	220-240	F	ASTM D 648
Heat Deflection Temperature@264psi load	195	F	ASTM D 648

**FLAME CHARACTERISTICS**

Property	Typical Data	Unit	Method
Time of Burning	< 5	sec	ASTM D 635
Extent of Burning	< 5	mm	—
Burning Class	V2	—	UL 94
Maximum Smoke Density	62.0	—	ASTM D 2843
Smoke Density Rating	40.1	—	—
Oxygen Index	28	%	ASTM D 2863

# Product Specifications

The following specification text has been prepared following the CSI-3 Part Specifications format. Its purpose, to assist design professionals in the preparation of a specification incorporating Redi-Vent, Ultra-Vent, Mini-Vent, Maxi-Vent, Tec-Vent, Chem-Vent air admittance valves, P.A.P.A. positive air pressure attenuator or Maxi-Filtra by Studor, Inc. Utilize these paragraphs to insert text into Specification Section 15150 – Sanitary Waste and Vent Piping, or similarly titled section governing this work.

Editing notes to assist in the proper editing of the specifications are included as grey text. Delete these notes from the final specification.

Websites listed in the editing notes are hypertext links: While connected to the internet, simple click on the underline text to go to the applicable web page.

For assistance on the use of the products in this section, **contact Studor, Inc. Phone: 1-800-447-4721, Email: info@studor.com or visit: www.studor.com**

## REDI-VENT

### PART 1 - GENERAL

Insert the following under "References." Edit to include only those standards used elsewhere in the specification.

#### 1.X REFERENCES

- A. American Society of Sanitary Engineering (ASSE): Standard 1051 - Performance Requirements for Individual and Branch Type Air Admittance Valves for Sanitary Drainage Systems.
- B. International Association of Plumbing and Mechanical Officials (IAPMO) - Uniform Plumbing Code (UPC), 2006 Edition.
- C. International Code Council (ICC) - International Plumbing Code (IPC), 2006 Edition.
- D. International Code Council (ICC) - International Residential Code (IRC), 2006 Edition.
- E. NSF International/American National Standards Institute (NSF/ANSI) Standard 14 - Plastics Piping Systems Components and Related Materials.

If shop drawings, product data, or samples are desired, insert the following under "Submittals." Edit to include only those submittals actually required.

#### 1.X SUBMITTALS

- A. Shop Drawings: Indicate valve locations, valve sizes, drain fixture units per branch size, and required clear dimensions in spaces to receive valves.
- B. Product Data: Include product description, drain fixture unit chart, and installation instructions.
- C. Samples: Full size sample of air admittance valve.

Insert the following under "Quality Assurance."

#### 1.X QUALITY ASSURANCE

- A. Air Admittance Valves:

Edit the following to indicate applicable building or plumbing code.

1. Approved for use under [IPC, Section 917.] [IRC, Section P3114.] [UPC, Section 301.2 - Alternate Materials and Methods.]
2. Certified by NSF to NSF/ANSI Standard 14; bear NSF certification marking.
3. Certified to ASSE Standards 1051; bear ASSE Seal of Approval.
4. Certified by National Evaluation Services, Inc.; National Evaluation Report NER-592.
5. Bear Warnock Hersey (Intertek Testing Services, Inc.) Certification Mark.

Insert the following under "Warranties."

#### 1.X WARRANTIES

- A. Provide manufacturer's limited lifetime warranty providing coverage for replacement of defective air admittance valves.

### PART 2 - PRODUCTS

Insert the following under "Materials."

#### 2.X MATERIALS

- A. Air Admittance Valves:
  1. Source: REDI-VENT by Studor, Inc.
  2. Components:
    - a. ABS valve body.
    - b. PP ball style shutter.
    - c. Buna-N seat
    - d. ABS or PVC female adapter (specifier to select one).
  3. Features:
    - a. Screening inside and outside of valve to protect sealing membrane from insects and debris.
    - b. Spinning, self cleaning ball shutter.
    - c. Compact design.
    - d. Operating temperature: Minus 40 to plus 150 degrees F.

Edit the following to suit project requirements.

4. Connection size: [1-1/2 inches.] [2 inches.] [As indicated on Drawings.]

### PART 3 - EXECUTION

Insert the following under "Installation."

#### 3.X INSTALLATION OF AIR ADMITTANCE VALVES

- A. Install valves after drainage and waste system has been roughed in and tested.
- B. Locate valves minimum 4 inches above horizontal branch drain or fixture drain being vented.
- C. Install valves in accessible locations.
- D. Connect valves to piping in accordance with manufacturer's instructions.
- E. Install valves in upright position, within 15 degrees of true vertical.
- F. Extend minimum of one vent to open atmosphere for each building drainage system.
- G. In attics, install valves minimum 6 inches above attic insulation.
- H. Do not install valves on chemical waste systems or in supply and return air plenums.

## ULTRA-VENT

### PART 1 - GENERAL

Insert the following under "References." Edit to include only those standards used elsewhere in the specification.

#### 1.X REFERENCES

- A. American Society of Sanitary Engineering (ASSE): Standard 1051 - Performance Requirements for Individual and Branch Type Air Admittance Valves for Sanitary Drainage Systems.
- B. International Association of Plumbing and Mechanical Officials (IAPMO) - Uniform Plumbing Code (UPC), 2006 Edition.
- C. International Code Council (ICC) - International Plumbing Code (IPC), 2006 Edition.
- D. International Code Council (ICC) - International Residential Code (IRC), 2006 Edition.
- E. NSF International/American National Standards Institute (NSF/ANSI) Standard 14 - Plastics Piping Systems Components and Related Materials.

If shop drawings, product data, or samples are desired, insert the following under "Submittals." Edit to include only those submittals actually required.

#### 1.X SUBMITTALS

- A. Shop Drawings: Indicate valve locations, valve sizes, drain fixture units per branch size, and required clear dimensions in spaces to receive valves.
- B. Product Data: Include product description, drain fixture unit chart, and installation instructions.
- C. Samples: Full size sample of air admittance valve.

Insert the following under "Quality Assurance."

#### 1.X QUALITY ASSURANCE

- A. Air Admittance Valves:

Edit the following to indicate applicable building or plumbing code.

1. Approved for use under [IPC, Section 917.] [IRC, Section P3114.] [UPC, Section 301.2 - Alternate Materials and Methods.]
2. Certified by NSF to NSF/ANSI Standard 14; bear NSF certification marking.
3. Certified to ASSE Standards 1051; bear ASSE Seal of Approval.
4. Certified by National Evaluation Services, Inc.; National Evaluation Report NER-592.
5. Bear Warnock Hersey (Intertek Testing Services, Inc.) Certification Mark.

Insert the following under "Warranties."

#### 1.X WARRANTIES

- A. Provide manufacturer's limited lifetime warranty providing coverage for replacement of defective air admittance valves.

### PART 2 - PRODUCTS

Insert the following under "Materials."

#### 2.X MATERIALS

- A. Air Admittance Valves:
  1. Source: ULTRA-VENT by Studor, Inc.
  2. Components:
    - a. ABS valve body.
    - b. PP ball style shutter.
    - c. Buna-N seat
    - d. ABS or PVC female adapter (specifier to select one).
  3. Features:
    - a. Screening inside and outside of valve to protect sealing membrane from insects and debris.
    - b. Spinning, self cleaning ball shutter.
    - c. Compact design.
    - d. Operating temperature: Minus 40 to plus 150 degrees F.

Edit the following to suit project requirements.

4. Connection size: [1 1/2 inches.] [2 inches.] [As indicated on Drawings.]

### PART 3 - EXECUTION

Insert the following under "Installation."

#### 3.X INSTALLATION OF AIR ADMITTANCE VALVES

- A. Install valves after drainage and waste system has been roughed in and tested.
- B. Locate valves minimum 4 inches above horizontal branch drain or fixture drain being vented.
- C. Install valves in accessible locations.
- D. Connect valves to piping in accordance with manufacturer's instructions.
- E. Install valves in upright position, within 15 degrees of true vertical.
- F. Extend minimum of one vent to open atmosphere for each building drainage system.
- G. In attics, install valves minimum 6 inches above attic insulation.
- H. Do not install valves on chemical waste systems or in supply and return air plenums.

# Product Specifications (cont.)

## MINI-VENT

### PART 1 - GENERAL

Insert the following under "References." Edit to include only those standards used elsewhere in the specification.

#### 1.X REFERENCES

- A. American Society of Sanitary Engineering (ASSE):
  - 1. Standard 1050 - Performance Requirements for Stack Air Admittance Valves for Sanitary Drainage Systems.
  - 2. Standard 1051 - Performance Requirements for Individual and Branch Type Air Admittance Valves for Sanitary Drainage Systems.
- B. International Association of Plumbing and Mechanical Officials (IAPMO) - Uniform Plumbing Code (UPC), 2006 Edition.
- C. International Code Council (ICC) - International Plumbing Code (IPC), 2006 Edition.
- D. International Code Council (ICC) - International Residential Code (IRC), 2006 Edition.
- E. NSF International/American National Standards Institute (NSF/ANSI) Standard 14 - Plastics Piping Systems Components and Related Materials.

If shop drawings, product data, or samples are desired, insert the following under "Submittals." Edit to include only those submittals actually required.

#### 1.X SUBMITTALS

- A. Shop Drawings: Indicate valve locations, valve sizes, drain fixture units per branch size, and required clear dimensions in spaces to receive valves.
- B. Product Data: Include product description, drain fixture unit chart, and installation instructions.
- C. Samples: Full size sample of air admittance valve.

Insert the following under "Quality Assurance."

#### 1.X QUALITY ASSURANCE

- A. Air Admittance Valves:

Edit the following to indicate applicable building or plumbing code.

- 1. Approved for use under [IPC, Section 917.] [IRC, Section P3114.] [UPC, Section 301.2 - Alternate Materials and Methods.]
- 2. Certified by NSF to NSF/ANSI Standard 14; bear NSF certification marking.
- 3. Certified to ASSE Standards 1050 and 1051; bear ASSE Seal of Approval.
- 4. Certified by National Evaluation Services, Inc.; National Evaluation Report NER-592.
- 5. Bear Warnock Hersey (Intertek Testing Services, Inc.) Certification Mark.

Insert the following under "Warranties."

#### 1.X WARRANTIES

- A. Provide manufacturer's limited lifetime warranty providing coverage for replacement of defective air admittance valves.

### PART 2 - PRODUCTS

Insert the following under "Materials."

#### 2.X MATERIALS

- A. Air Admittance Valves:
  - 1. Source: MINI-VENT by Studor, Inc.
  - 2. Components:
    - a. ABS valve with elastomeric membrane.
    - b. ABS or PVC female adapter (specifier to select one).
    - c. ABS protection cover.
  - 3. Features:
    - a. Screening inside and outside of valve to protect sealing membrane from insects and debris.
- B. Static seal design.
  - c. Protective cover against extreme temperatures, dirt and UV exposure.
  - d. Channels to divert condensation away from sealing membrane.
  - e. Operating temperature: Minus 40 to plus 150 degrees F, without protective cover.

Edit the following to suit project requirements.

- 4. Connection size: [1 1/2 inches.] [2 inches.] [As indicated on Drawings.]

### PART 3 - EXECUTION

Insert the following under "Installation."

#### 3.X INSTALLATION OF AIR ADMITTANCE VALVES

- A. Install valves after drainage and waste system has been roughed in and tested.
- B. Locate valves minimum 4 inches above horizontal branch drain or fixture drain being vented and minimum 6 inches above flood level of highest fixture being vented for stack applications.
- C. Install valves in accessible locations.
- D. Connect valves to piping in accordance with manufacturer's instructions.
- E. Install valves in upright position, within 15 degrees of true vertical.
- F. Extend minimum of one vent to open atmosphere for each building drainage system.
- G. In attics, install valves minimum 6 inches above attic insulation.
- H. Do not install valves on chemical waste systems or in supply and return air plenums.



## MAXI-VENT

### PART 1 - GENERAL

Insert the following under "References." Edit to include only those standards used elsewhere in the specification.

#### 1.X REFERENCES

- A. American Society of Sanitary Engineering (ASSE):
  1. Standard 1050 - Performance Requirements for Stack Air Admittance Valves for Sanitary Drainage Systems.
  2. Standard 1051 - Performance Requirements for Individual and Branch Type Air Admittance Valves for Sanitary Drainage Systems.
- B. International Association of Plumbing and Mechanical Officials (IAPMO) - Uniform Plumbing Code (UPC), 2006 Edition.
- C. International Code Council (ICC) - International Plumbing Code (IPC), 2006 Edition.
- D. International Code Council (ICC) - International Residential Code (IRC), 2006 Edition.
- E. NSF International/American National Standards Institute (NSF/ANSI) Standard 14 - Plastics Piping Systems Components and Related Materials.

If shop drawings, product data, or samples are desired, insert the following under "Submittals." Edit to include only those submittals actually required.

#### 1.X SUBMITTALS

- A. Shop Drawings: Indicate valve locations, valve sizes, drain fixture units per branch size, and required clear dimensions in spaces to receive valves.
- B. Product Data: Include product description, drain fixture unit chart, and installation instructions.
- C. Samples: Full size sample of air admittance valve.

Insert the following under "Quality Assurance."

#### 1.X QUALITY ASSURANCE

- A. Air Admittance Valves:

Edit the following to indicate applicable building or plumbing code.

1. Approved for use under [IPC, Section 917.] [IRC, Section P3114.] [UPC, Section 301.2 - Alternate Materials and Methods.]
2. Certified by NSF to NSF/ANSI Standard 14; bear NSF certification marking.
3. Certified to ASSE Standards 1050 and 1051; bear ASSE Seal of Approval.
4. Certified by National Evaluation Services, Inc.; National Evaluation Report NER-592.
5. Bear Warnock Hersey (Intertek Testing Services, Inc.) Certification Mark.

Insert the following under "Warranties."

#### 1.X WARRANTIES

- A. Provide manufacturer's limited lifetime warranty providing coverage for replacement of defective air admittance valves.

### PART 2 - PRODUCTS

Insert the following under "Materials."

#### 2.X MATERIALS

- A. Air Admittance Valves:
  1. Source: MAXI-VENT by Studor, Inc.
  2. Components:
    - a. ABS valve with elastomeric membrane.
    - b. Styrofoam protective cover.
    - c. Rubber connector.
  3. Features:
    - a. Screening inside and outside of valve to protect sealing membrane from insects and debris.
    - b. Protective cover and insulation against extreme temperatures.
    - c. Channels to divert condensation away from sealing membrane.
    - d. Operating temperature: Minus 40 to plus 150 degrees F, without protective cover.

Edit the following to suit project requirements.

4. Connection size: [3 inches.] [4 inches.] [As indicated on Drawings.]

### PART 3 - EXECUTION

Insert the following under "Installation."

#### 3.X INSTALLATION OF AIR ADMITTANCE VALVES

- A. Install valves after drainage and waste system has been roughed in and tested.
- B. Locate valves minimum 4 inches above horizontal branch drain or fixture drain being vented and minimum 6 inches above flood level of highest fixture being vented for stack applications.
- C. Install valves in accessible locations.
- D. Connect valves to piping in accordance with manufacturer's instructions.
- E. Install valves in upright position, within 15 degrees of true vertical.
- F. Extend minimum of one vent to open atmosphere for each building drainage system.
- G. In attics, install valves minimum 6 inches above attic insulation.
- H. Do not install valves on chemical waste systems or in supply and return air plenums.

# Product Specifications (cont.)

## TEC-VENT

### PART 1 - GENERAL

Insert the following under "References." Edit to include only those standards used elsewhere in the specification.

#### 1.X REFERENCES

- A. American Society of Sanitary Engineering (ASSE):
  - 1. Standard 1051 - Performance Requirements for Individual and Branch Type Air Admittance Valves for Sanitary Drainage Systems.
- B. International Association of Plumbing and Mechanical Officials (IAPMO) - Uniform Plumbing Code (UPC), 2006 Edition.
- C. International Code Council (ICC) - International Plumbing Code (IPC), 2006 Edition.
- D. International Code Council (ICC) - International Residential Code (IRC), 2006 Edition.
- E. NSF International/American National Standards Institute (NSF/ANSI) Standard 14 - Plastics Piping Systems Components and Related Materials.
- F. Underwriters Laboratories (UL) 2043 - Fire Test for Heat and Visible Smoke Release for Discrete Products and Their Accessories Installed in Air-Handling Spaces.

If shop drawings, product data, or samples are desired, insert the following under "Submittals." Edit to include only those submittals actually required.

#### 1.X SUBMITTALS

- A. Shop Drawings: Indicate valve locations, valve sizes, drain fixture units per branch size, and required clear dimensions in spaces to receive valves.
- B. Product Data: Include product description, drain fixture unit chart, and installation instructions.
- C. Samples: Full size sample of air admittance valve.

Insert the following under "Quality Assurance."

#### 1.X QUALITY ASSURANCE

- A. Air Admittance Valves:

Edit the following to indicate applicable building or plumbing code.

- 1. Approved for use under [IPC, Section 917.] [IRC, Section P3114.] [UPC, Section 301.2 - Alternate Materials and Methods.]
- 2. Certified by NSF to NSF/ANSI Standard 14; bear NSF certification marking.
- 3. Certified to ASSE Standards 1051; bear ASSE Seal of Approval.
- 4. Certified by Underwriters Laboratories to UL 2043; bear UL Classification Mark.

Insert the following under "Warranties."

#### 1.X WARRANTIES

- A. Provide manufacturer's limited lifetime warranty providing coverage for replacement of defective air admittance valves.

### PART 2 - PRODUCTS

Insert the following under "Materials."

#### 2.X MATERIALS

- A. Air Admittance Valves:
  - 1. Source: TEC-VENT by Studor, Inc.
  - 2. Components:
    - a. Flame retardant polycarbonate valve with elastomeric membrane.
    - b. Channels to divert condensation away from sealing membrane.
    - c. Rated for exposure to ultraviolet.
  - 3. Features:
    - a. Screening inside and outside of valve to protect sealing membrane from insects and debris.
    - b. Operating temperature: Minus 40 to plus 150 degrees F.
    - c. Suitable for use on sewer ejectors and in supply and return air plenums if approved by local administrative authorities.
  - 4. Connection size: 1-1/2 NPT.

#### 3.X INSTALLATION OF AIR ADMITTANCE VALVES

- A. Install valves after drainage and waste system has been roughed in and tested.
- B. Locate valves minimum 4 inches above horizontal branch drain or fixture drain being vented and minimum 6 inches above flood level of highest fixture being vented for stack applications.
- C. Install valves in accessible locations.
- D. Connect valves to piping in accordance with manufacturer's instructions.
- E. Install valves in upright position, within 15 degrees of true vertical.
- F. Extend minimum of one vent to open atmosphere for each building drainage system.
- G. In attics, install valves minimum 6 inches above attic insulation.
- H. Do not install valves on chemical waste systems.

## CHEM-VENT

### PART 1 - GENERAL

Insert the following under "References." Edit to include only those standards used elsewhere in the specification.

#### 1.X REFERENCES

- A. American Society of Sanitary Engineering (ASSE) Standard 1051 - Performance Requirements for Individual and Branch Type Air Admittance Valves for Sanitary Drainage Systems.
- B. International Association of Plumbing and Mechanical Officials (IAPMO) - Uniform Plumbing Code., 2006 edition.
- C. International Code Council (ICC) - International Plumbing Code (IPC), 2006 Edition.
- D. NSF International/American National Standards Institute (NSF/ANSI) Standard 14 - Plastics Piping Systems Components and Related Materials.

If shop drawings, product data, or samples are desired, insert the following under "Submittals." Edit to include only those submittals actually required.

#### 1.X SUBMITTALS

- A. Shop Drawings: Indicate valve locations, valve sizes, drain fixture units per branch size, and required clear dimensions in spaces to receive valves.
- B. Product Data: Include product description, drain fixture unit chart, and installation instructions.
- C. Samples: Full size sample of air admittance valve.

Insert the following under "Quality Assurance."

#### 1.X QUALITY ASSURANCE

- A. Air Admittance Valves:
  1. Certified by NSF to NSF/ANSI Standard 14; bear NSF certification marking.
  2. Approved for use under [IPC, Section 917.] [IRC, Section P3114.]
  3. Approved for use in specialized chemical waste systems as an Engineered Product or part of an Engineered System under IPC, Section 301.2 - Alternate Materials and Methods, or IPC, Section 300.
  4. (In Revision) ASSE 1049 Performance requirements for Individual and Branch Type Air Admittance Valves for Chemical Drainage Systems.

Insert the following under "Warranties."

#### 1.X WARRANTIES

- A. Provide manufacturer's limited lifetime warranty providing coverage for replacement of defective air admittance valves.

### PART 2 - PRODUCTS

Insert the following under "Materials."

#### 2.X MATERIALS

- A. Admittance Valves:
  1. Source: CHEM-VENT by Studor, Inc.
  2. Components:
    - a. Flame retardant polypropylene body and ball sealing assembly.
    - b. EPDM O-ring seal.
  3. Features:
    - a. Screening inside and outside of valve to protect sealing membrane from solids.
    - b. Operating temperature: Minus 40 to plus 210 degrees F.
    - c. Suitable for use in non-neutralized chemical waste systems when system is designed by a design professional.

Edit the following to suit project requirements.

4. Connection size: [1-1/2 inch extended leg Schedule 40.] [As indicated on Drawings.]

### PART 3 - EXECUTION

Insert the following under "Installation."

#### 3.X INSTALLATION OF AIR ADMITTANCE VALVES

- A. Install valves after drainage and waste system has been roughed in.
- B. Locate valves minimum 4 inches above horizontal branch drain or fixture drain being vented.
- C. Install valves in accessible locations.
- D. Connect valves to piping in accordance with manufacturer's instructions.
- E. Install valves in upright position, within 15 degrees of true vertical.
- F. Extend minimum of one vent to open atmosphere for each building drainage system.
- G. Do not install valves in supply and return air plenums.

# Product Specifications (cont.)

## P.A.P.A.

### PART 1 - GENERAL

Insert the following under "References." Edit to include only those standards used elsewhere in the specification.

#### 1.X REFERENCES

- A. International Association of Plumbing and Mechanical Officials (IAPMO) - Uniform Plumbing Code (UPC), 2006 Edition.
- B. International Code Council (ICC) - International Plumbing Code (IPC), 2006 Edition.

If shop drawings, product data, or samples are desired, insert the following under "Submittals." Edit to include only those submittals actually required.

#### 1.X SUBMITTALS

- A. Shop Drawings: Indicate air attenuator locations and required clear dimensions in spaces to receive air attenuators.
- B. Product Data: Include product description and installation instructions.
- C. Samples: Full size sample of air attenuator.

Insert the following under "Quality Assurance."

#### 1.X QUALITY ASSURANCE

- A. Positive Air Pressure Attenuators: Approved for use as an Engineered Product or as part of an Engineered System under UPC, Section 301.2 - Alternate Materials and Methods or IPC, Section 300.
- B. (In development) ASSE 1030 Performance Requirements for Positive Air Pressure Attenuators for Sanitary Drainage Systems.

Insert the following under "Warranties."

#### 1.X WARRANTIES

- A. Provide manufacturer's limited lifetime warranty providing coverage for replacement of defective air attenuators.

### PART 2 - PRODUCTS

Insert the following under "Materials."

#### 2.X MATERIALS

- A. Positive Air Pressure Attenuators:
  - 1. Source: P.A.P.A. by Studor, Inc.
  - 2. Components:
    - a. PVC housing.
    - b. Butylene bag.
  - 3. Features:
    - a. One gallon capacity.
    - b. Expandable capacity up to four gallons, series assembly.
    - c. Separator tubes.
    - d. Operating temperature: Minus 40 to plus 150 degrees F.

### PART 3 - EXECUTION

Insert the following under "Installation."

#### 3.X INSTALLATION OF POSITIVE TRANSIENT ATTENUATORS

Edit the following to suit project requirements. The P.A.P.A. may be installed horizontally or vertically and may also be installed in series for additional protection.

- A. Install P.A.P.A. after drainage and waste system has been roughed in and pressure tested.
- B. Install P.A.P.A. in accessible locations.
- C. Stack Installation: Connect units onto stack [vertically using one 90 degree or two 45 degree bends.] [horizontally using two 45 degree bends.]
- D. Branch Installation: Connect units onto branch [vertically using one 90 degree or two 45 degree bends.] [horizontally using two 45 degree bends.]
- E. Connect air attenuators to piping in accordance with manufacturer's instructions.

## MAXI-FILTRA

The following specification text has been prepared to assist design professionals in the preparation of a specification incorporating MAXI-FILTRA carbon filter by Studor, Inc. Utilize these paragraphs to insert text into Specification Section 15150 - Sanitary Waste and Vent Piping, or similarly titled section governing this work.

Editing notes to assist in the proper editing of the specifications are included as blue text. Delete these notes from the final specification.

Websites listed in the editing notes are hypertext links; while connected to the Internet, simply click on the underlined text to go to the applicable web page.

For assistance on the use of the products in this section, contact Studor, Inc. by calling 800-447-4721, by email at [info@studor.com](mailto:info@studor.com), or visit their website at [www.studor.com](http://www.studor.com).

### PART 1 - GENERAL

If shop drawings, product data, or samples are desired, insert the following under "Submittals." Edit to include only those submittals actually required.

#### 1.X SUBMITTALS

- A. Shop Drawings: Indicate filter locations and filter sizes.
- B. Product Data: Include product description, required maintenance, and installation instructions.
- C. Samples: Full size sample of filter.

Insert the following under "Warranties."

#### 1.X WARRANTIES

- A. Provide manufacturer's limited lifetime warranty providing coverage for replacement of defective filter.

### PART 2 - PRODUCTS

Insert the following under "Materials."

#### 2.X MATERIALS

- A. Carbon Filter:
  - 1. Source: MAXI-FILTRA by Studor, Inc.
  - 2. Components:
    - a. ABS body.
    - b. Active Charcoal Filter replaceable cartridge
    - c. Rubber connector.
  - 3. Features:
    - a. UV inhibitor in resin compounds for exposure to sunlight.

Edit the following to suit project requirements.

- 4. Connection size: [3 inches.] [4 inches.] [As indicated on Drawings.]

### PART 3 - EXECUTION

Insert the following under "Installation."

#### 3.X INSTALLATION OF CARBON FILTER

- A. Install filter after drainage and waste system has been roughed in and tested.
- B. Install valves in accessible locations to allow for filter cartridge replacement.
- C. Connect valves to piping in accordance with manufacturer's instructions.
- D. Do not install valves on chemical waste systems or in supply and return air plenums.
- E. For Outdoor Installation Only.

# Research

---

## **Building Drainage Waste and Vent Systems: Active Pressure Control Devices**

There are few real mysteries remaining about the mechanisms at play in building drainage and vent systems. This has been well understood from the beginning of modern sanitary engineering, which dates back to the end of the 19th Century. The description of building drainage and vent system operation is best understood in the context of engineering science in general and fluid mechanics.

At the center of the drainage system's integrity is the water trap seal, which stops sewer gas from entering a habitable space from the sewer. The water trap seal is usually 2 inches in depth depending on the fixture it is protecting.

It comes as a surprise to many that the flow of air is as important, if not more important, than the flow of water, to the safe operation of the drainage system. This air flow is 'induced' or 'entrained' by the flow of water. The unsteady nature of the water flows causes pressure fluctuations (known as pressure transients) which can compromise water trap seals and provide a path for sewer gases to enter the habitable space.

Transients can be dealt with by a combination of careful design and the introduction of pressure control devices as close to the area of concern as possible. Long vent pipes can be an inefficient way of providing relief due to friction in the pipe. Distributing air supply inlets using air admittance valves (AAVs) around a building provides an efficient means of venting by allowing air to enter the system, and they also reduce the risk of positive transient generation. AAVs do not cause positive pressure transients, they merely respond to them by closing, and hence reflect a reduced amplitude wave.

The introduction of a positive air pressure transient alleviation device known as the Positive Air Pressure Attenuator (PAPA) provides a means to 'blow off' pressure surges as close to their source, thereby protecting water traps. Attenuation of up to 90% of the incident wave can be achieved, thus protecting the entire system. It should be noted that there is little that can be done for a system experiencing a total blockage, generating excessive static positive pressures in the drainage system. In such circumstances the lowest water trap seal will 'blow' providing relief for the whole system. This will occur regardless of the method of venting employed.

In validated test simulations AAVs have been shown to provide at least as good protection for water trap seals as a system, completely vented with piping to the outdoors, and in tall buildings in some circumstances, even better. The fully engineered designed active control system utilizing AAVs for negative pressure relief and PAPAs for positive transient relief is shown to be an effective method for balancing the need for safety and efficiency while maintaining functionality invisible to the user.

### **What are pressure transients?**

A negative pressure transient communicates a need for more air and represents a suction force while a positive pressure transient communicates the need to reduce the air flowing and represents a pushing force. A negative transient can be caused by air leaving the system (hence the need for more air) and a positive transient can be caused by the air reaching a closed end (stopping the air where there is no escape route).

A negative transient will attempt to suck water out of a water trap seal. The pressure differential may not be sufficient to completely evacuate the water the first time, but the effect can be cumulative. Positive air pressure transients cause air to be forced through the water seal from the sewer side to the habitable space inside.

The need to communicate an increase or decrease in the air flow and the finite time that this takes is central to the requirements of providing a safely engineered drainage system. The absolute key to maintaining a state of equilibrium in a drainage system is to provide pressure relief as close to where it will occur as possible. If negative pressure transients are a call for more air then positive pressure transients are a call to stop sending air.

### **Modeling flows in drainage networks**

Research and analysis of real building drainage systems is complicated by the difficulty in obtaining data from 'live' buildings. Most areas of engineering employ some form of modeling technique in research and development in their 'look and see' approach to development. In DWV research there are few models capable of dealing with the complex time dependent transient flows. The computer model AIRNET, developed by Professor John Swaffield, Heriot-Watt University (Scotland), is such a model capable of such a complex task. At the heart of the AIRNET model is the mathematical technique known as the method of characteristics. The technique allows the propagation of waves to be

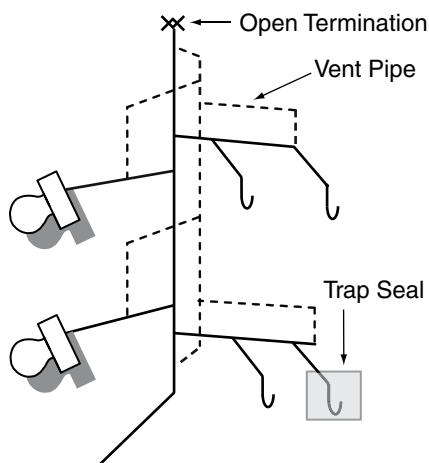
predicted along the length of a pipe at different time steps. This is a very powerful and unique way to 'look and see' what is actually going on inside a building drainage system. The simulations in this study were carried out using AIRNET.

### Two story building

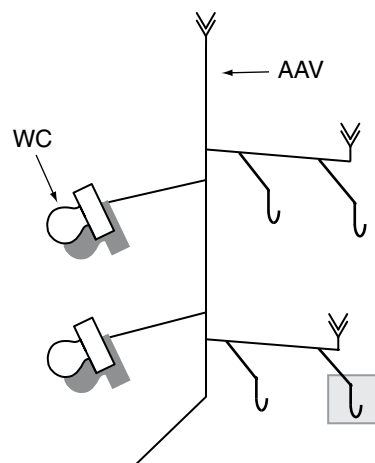
A two story building drainage system can operate sufficiently well with minimal additional ventilation as long as it is designed and installed properly. This is borne out by reference to the installation shown in Figures 1 and 2. The building represents a fairly common house with a number of bathrooms and a group branch in a kitchen / laundry area. The simulation was run in two different scenarios.

1. System with an open pipe vent
2. System with AAVs

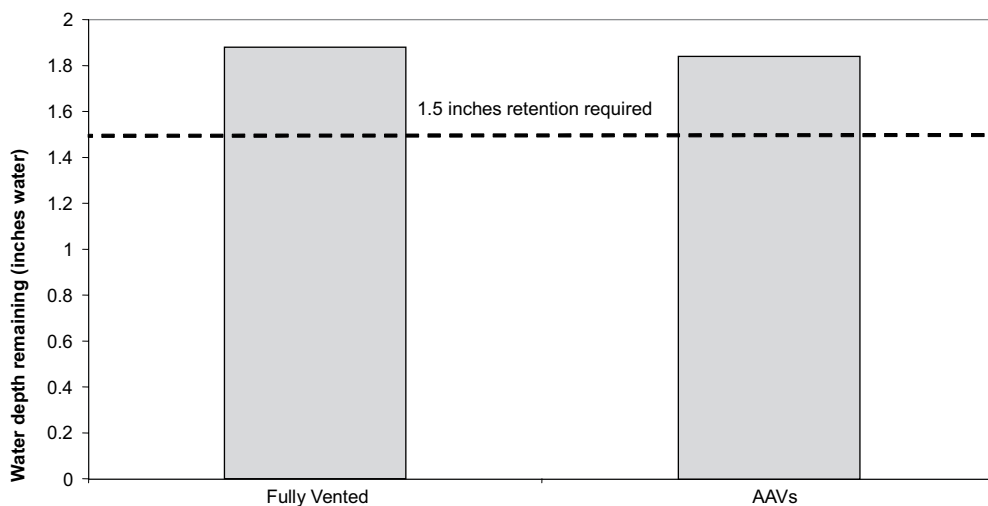
A discharge flow rate was simulated from the top floor consisting of a combined flow from a WC and a bath. This discharge was simulated from the upper floor and the effect on the water trap indicated by shading was recorded from the output data. It can be seen from the bar graph shown in Figure 3 that little water has been lost as a result of the operation of system devices in either scenario.



**Figure 1.** Fully vented system with open top and parallel vent pipe

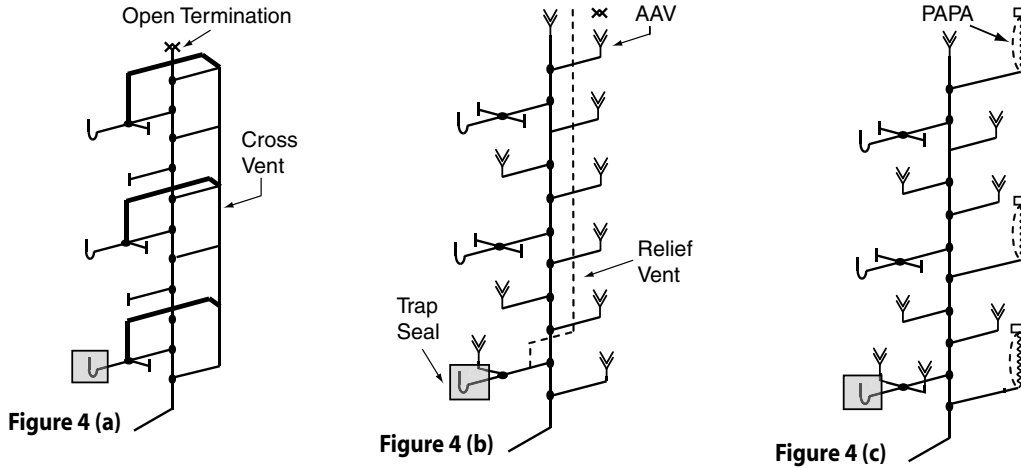


**Figure 2.** Two story house with AAVs on branches and an AAV termination at the top of the stack



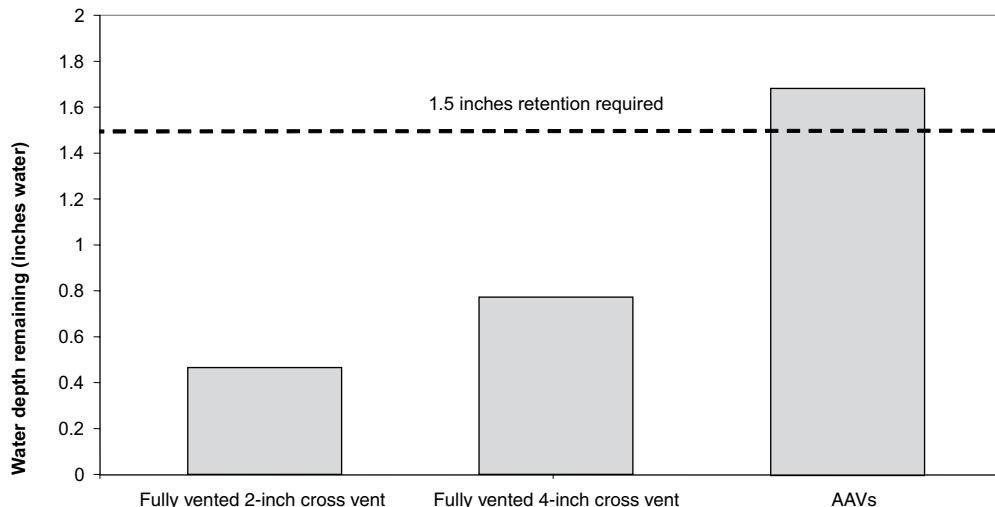
**Figure 3.** Comparison of water retained in the ground floor trap indicated (shaded on schematic)

The 10 story building scenario is shown in Figure 4 below. There are basically three installation types being simulated here; the fully vented system Figure 4 (a) and a one pipe system with distributed venting and an AAV on the top of the stack, Figure 4 (b). This system also includes a relief vent. Figure 4 (c) is the one pipe system with distributed AAVs and PAPAs subjected to a positive air pressure transient simulated to replicate the occurrence of a surcharge in the sewer. In each of the scenarios a representative water trap is shown on three floors up the building



The flow rate used in this simulation represents a maximum for the 4" vertical stack in question (80 gpm). This flow rate is unlikely to be observed in practice as the simultaneous discharges required are a probabilistic impossibility (Hunter 1940). The flow rate is therefore indicative of a 'worst case scenario' in order to push the drainage vent system to its limits, and therefore show comparisons between the options investigated. The discharges making up the flow rate are distributed evenly along the stack to simulate a number of simultaneous discharges (approximated 16 gpm from 5 different floors).

The bar graph shown in Figure 5 illustrates the water depth retained in the shaded water trap in Figure 4 following this event. It can be seen that under these conditions the system with AAVs installed (Figure 4b) has retained more water than the open pipe system (Figure 4a). Why is this? Well, the main reason is that the flow in the vertical stack induces a negative pressure transient as it calls for more air. This negative transient propagates to all parts of the system "looking for air". The negative transient represents a suction force which will try to draw water out of the trap seal. If the negative transient is too great it will suck water out of the trap. To stop this happening, air must be provided from somewhere else. The methods shown in Figure 4(a) and Figure 4(b) show two different methods. In figure 4(a) the air must travel from the top of the stack, approximately 100 feet away (but only after the negative transient

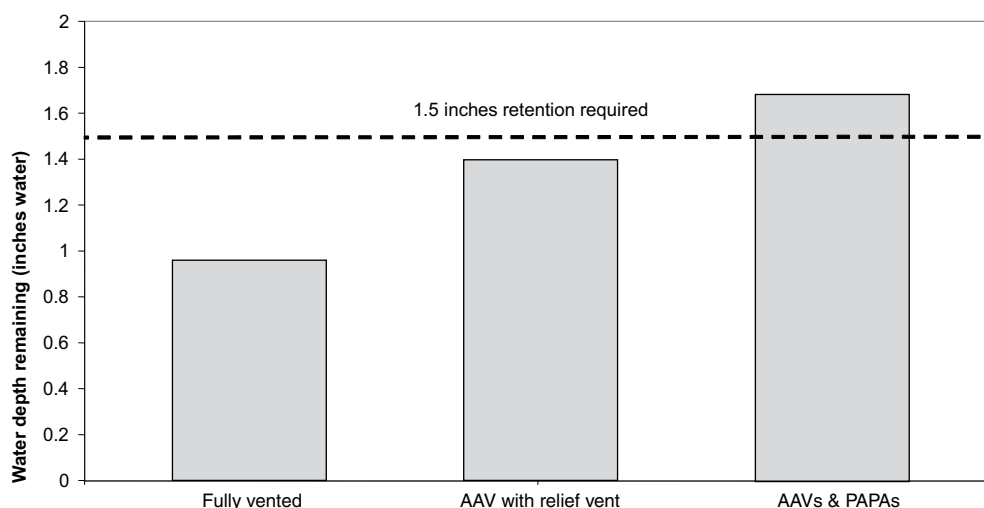


**Figure 5. Comparison of water retained in the lowest water trap (shaded on schematic) conditions based on negative transient**



has propagated to the top of the stack first so the round trip is approximately 200 feet). Alternatively, air can be provided locally by the provision of an AAV (Figure 4(b)). In this case the round trip is only a matter of 10 feet. This means that the air can be provided quicker than the fully vented system.

Figure 6 shows the trap retention on the same trap as the result of a positive pressure transient in the system. The positive transient was generated by simulating a surcharge in the sewer, causing the airflow through the stack to be stopped. Again two methods of dealing with this scenario; the fully vented system shown in Figure 4(a) and the 'active control' option utilizing AAVs and PAPAs as shown in Figure 4(c). The bar graph of trap retention clearly shows that the active control system protects against this sort of event, and that the AAV system with a relief vent shown in Figure 4(b) provides better protection than the fully vented system in Figure 4(a). The reasons for active control being better are two-fold; firstly, the distribution of the air inlets reduces the maximum positive pressure possible in the first place and secondly, the PAPA presents a volume which can consume the positive pressure wave, attenuate it and destroy it, rendering it harmless. This is borne out by the amount of water displaced by the positive pressure wave.



**Figure 6. Comparison of water retained in the ground floor trap indicated (shaded on schematic) conditions based on positive transient**

### Conclusion

This article has considered the implications for venting in building drainage systems. It has concentrated on the fundamental fluid mechanics which so readily describe the unsteady flows resulting from plumbing fixture discharges. The description of the workings of a drainage and vent system in these terms is not new, since many early innovators were well aware of this. However many codes and regulations worldwide seem to avoid the engineering imperative of a description based on fluid mechanics in favor of a prescriptive legalistic approach based on the evolution of the industry rather than the science.

Air admittance valves (AAVs) have been installed worldwide since the early 1970s and in North America since 1989. Millions of valves have been installed; they have been field tested and are operating successfully. The Positive Air Pressure Attenuator (PAPA), which was invented by Professor John Swaffield and Dr. David Campbell of Heriot-Watt University, Scotland, was introduced in North America in 2004. Since their introduction, five major high-rise buildings (with AAVs and PAPAs installed) have been completed, and there are six more projects under construction in which AAVs and PAPAs have been specified. Design professionals have realized that these "active pressure control devices" are a viable option to open pipe venting and solvent systems.

**Note:** This article is mainly comprised of excerpts from a recent study prepared by Professor John Swaffield and Dr. Michael Gormley of Heriot-Watt University in Scotland entitled Building Drainage Waste and Vent Systems: Options for Efficient Pressure Control. Copies of this study can be obtained at [www.studor.com](http://www.studor.com) under the news section or by contacting Studor, Inc. at 1-800-447-4721

## Product References

---

STUDOR is the world recognized leader in innovative DWV venting products and designs, and our valves are designed for many different applications. For over 35 years Studor air admittance valve technology has been installed in various buildings such as Airports, Stadiums, Hotels, Hospitals, Residential houses, Condominiums, Townhouses, Apartments, Institutional facilities, Governmental facilities, Multi-story buildings and the Marine industry.

For a complete list of USA & International projects please visit [www.studor.com](http://www.studor.com) under **Reference Projects**

### WARRANTY

All STUDOR products carry a **limited lifetime warranty** which guarantees against defects resulting from faulty workmanship or materials. If any such product is found to be defective by reason of faulty workmanship or material, upon written notice and return of the product(s), the defective product will be replaced by STUDOR free of charge, including shipping charges for the replacement product(s). Claims for labor costs and other expenses required to replace such defective product(s) or to repair any damage resulting from the use thereof will not be allowed by STUDOR. Our liability is limited to the price paid for the defective product(s). STUDOR will not be bound by any warranty other than above set forth, unless such warranty is in writing.

---

**Use of the STUDOR P.A.P.A. devices in conjunction with non-STUDOR brand air admittance valves will void any and all warranties on the P.A.P.A. unit(s) as well as any other Studor components used on the project.**

---



This literature is published in good faith and is believed to be reliable. However STUDOR does not represent and/or warrant in any manner the information and suggestions contained in this manual. Data presented is the result of laboratory tests and field experiences.

STUDOR maintains a policy of ongoing product improvement. This may result in modification of features, dimensions and/or specifications without notice.



**IPS**  
CORPORATION<sup>®</sup>

500 Distribution Parkway  
Collierville, TN 38017  
[www.studor.com](http://www.studor.com)  
1-800-888-8312  
Fax: 1-901-853-5008  
Email: [info@studor.com](mailto:info@studor.com)