I. Construction Innovation Forum • NOVA Award Nomination

Instructions

Step 1 Enter a Descriptive Name for the Process/Method/Technique you are nominating on line A of this page.

2 Complete this page,
"I. Construction Innovation Forum • NOVA Award Nomination"
a. Be sure to provide original signatures in Section B and E on this page. Your nomination cannot be reviewed without them.
b. If you need additional space for names and addresses you may attach additional pages for names and address information. You may attach extra pages only for sheet I.

Step 3 "II - Innovation Description" — attach one (one only) 8-1/2" X 11" page that gives a succinct written description of the innovation. Put the name of the innovation at top of page. Tell us what you think is innovative about this. You should include:
- What the innovation is
- Why it is innovative
- What it changed or replaced
- Where and when it originated, has been used, and is expected to be used in the future
- If the nomination is for an innovative project, specifically identify its innovations.

Please type, with 1" margins, 10 characters per inch, 6 lines per inch.

Step 4 "III - Innovation Illustration" —attach one (one only) 8 1/2" X 11" page that contains one or more photographs, drawings, tables, graphs, clauses, etc., that visually describe the innovation. Do not submit more than one page of visuals. The jurors will see only one sheet for review. Put the name of the innovation at top of page.

Other You must submit 12 (twelve) sets of sheets I, II and III (a total of 36 pages)

Nominations are due September 15 mailed or delivered to:
The Construction Innovation Forum, 1000 Campus Drive, Suite 100, Ann Arbor, MI, USA 48104-6792, Phone: 313-995-1855, Fax: 313-975-5002

A. Name of Innovation: Venting of drainage systems with Air Admittance Valves

B. Person(s) and /or Organization(s) Primarily Responsible for the Innovation (Those to whom NOVA Award should be presented.)

Name: Sture Ericson
Title: Chairman
Affiliation: Studor Inc
Address: 2030 Main Street
Dunedin FL 34698
Phone: (813) 734-7750
Signature:

(Signature(s) indicate acceptance of the nomination and consent to have CIF research and make presentations on the innovation for the purpose of jurying and publicizing awards.)

C. Other Primary Sources of Information on the Innovation: (in addition to the persons nominated above.)

Name	Title	Affiliation	Address	Phone
Julius Ballanco	P.E.	J.B. Engineering	1661 Cardinal Dr. Munster IN 46321	(219) 922-6171
John Swaffield	Professor	Heriott Watt Univ.	Riccarton, Edinburgh EH 144 A5 U.K.	44-031-449-5111 X4643 FAX 031-451-3161
Karel DeKuyper	P.E.	WTCB	Ave. Pierre Holoffe 21 B-1342 Limelette BELGIUM	32-2-6538801

D. Independent Reference(s) familiar with the use of the Innovation

Name	Title	Affiliation	Address	Phone
Trefor Jones	Marketing Mgr	Wavin Bldg Prod.	Parsonage Way U.K. Chippenham, Wilts 3N15 5PN	44-249-654121
Warren Klugman	Manufacturers Rep	W.B. & Associates	P.O. Box 668588 Charlotte NC 28266	(704) 527-5550
Gary Kozan	Vice President	Ridgeway Plumbing Inc	640 E. Industrial Ave. Boynton Beach, FL 33426	(407) 732-3176

E. Person(s) making nomination:

Name: John R. Nussbaum
Title: Executive Director
Affiliation: Plumbing Heating Cooling Contractors Association of Southeastern Michigan
Address: 14801 West 8 Mile Rd.
Detroit MI 48235
Phone: 313) 345-3535
Signature: John R. Nussbaum

(Signature(s) indicate familiarity with the the innovation and signify that information contained in the nomination is correct to the best of one's knowledge.)

STUDOR® AIR ADMITTANCE VALVES (AAV) IN DRAINAGE SYSTEMS

Sture Ericson developed the air admittance valve in Sweden in the early 1970's. He introduced the valve to the United States in 1986 as the Studor® Air Admittance System, specifically the Mini-Vent® and the Maxi-Vent®. Modifications to the original concept have been made to readily adapt to the plumbing system in the United States.

The development of air admittance valves has led to a new and different way to vent a plumbing drainage system. Air admittance valves are an innovative way to replace the vent piping for a sanitary drainage system that extends through the roof to the outdoors.

The concept of venting fixtures has been a part of the plumbing industry since its inception. The purpose of the vent is to balance the pressure in the drainage system to maintain a water seal in the fixture trap. The water trap seal prevents the escape of sewer gas. Since a vent system relies on a series of pipes to extend to the outdoors, there have been many attempts to develop a system to replace the vent system.

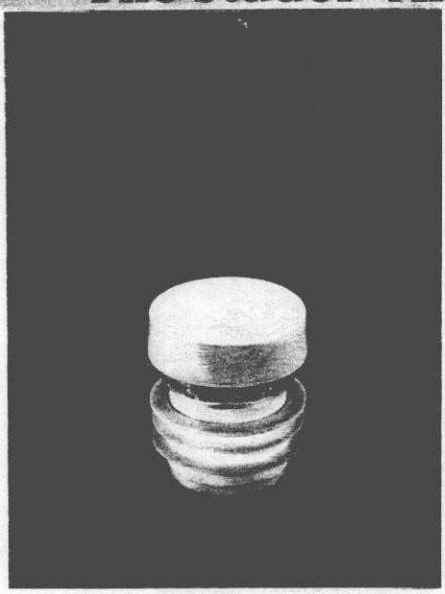
All attempts in the past have resulted in failure because of the lack of reliability or the inability to maintain a healthy and sanitary environment. The air admittance valve is the first device that functions in place of a piped vent system that has reliability, longevity, and maintains proper sanitation. The design of the system utilizes a reverse lift sealing member that relies on gravity to close the valve. There are no springs or levers that can fail and allow obnoxious gas to enter the building. The valve opens when a negative pressure occurs as the water falls in the drainage system and admits air. Once the air pressure is balanced, the valve closes.

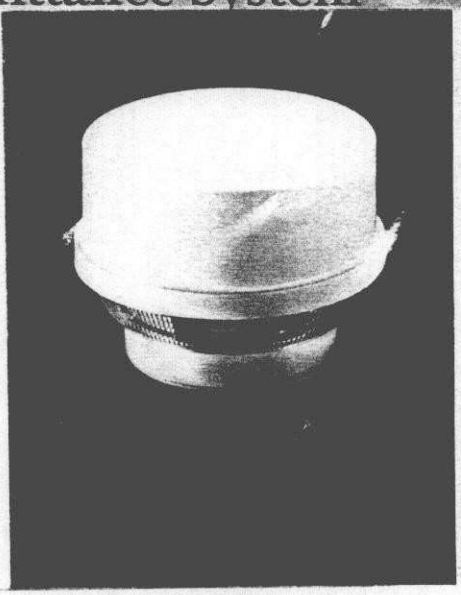
The use of AAVs has revolutionized the sanitary drainage system. The vent piping that is typically run to the outdoors through the roof can be completely or partly eliminated. Thus possible future leaks are avoided and the initially designed roofline is conserved. The AAVs can be installed under the fixture in the proximity of the trap. Other problems inherent to open stack venting, such as frost closure, trap losses due to high wind conditions and the "chimney effect" in the pipe when a fire occurs, are prevented by AAVs.

On a design of 10 Meijer's stores in Indiana, the use of AAVs accounted for savings of over $160,000.

Millions of valves have been installed worldwide. In the future, when fully implemented, the use of AAVs in building plumbing systems will create tremendous cost savings and contribute to a cleaner environment by keeping the sewer gases in the system.

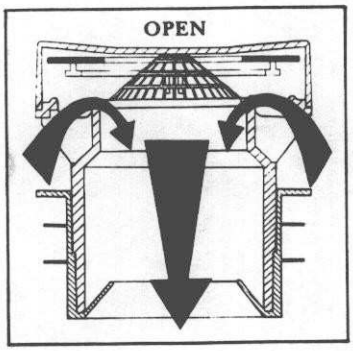
The Studor® Air Admittance System



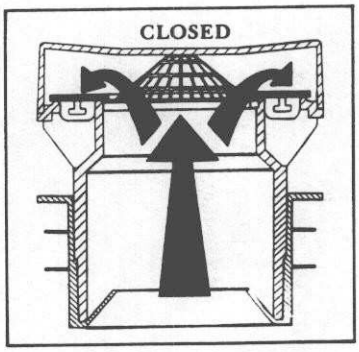


The Studor Mini-Vent® and Maxi-Vent®

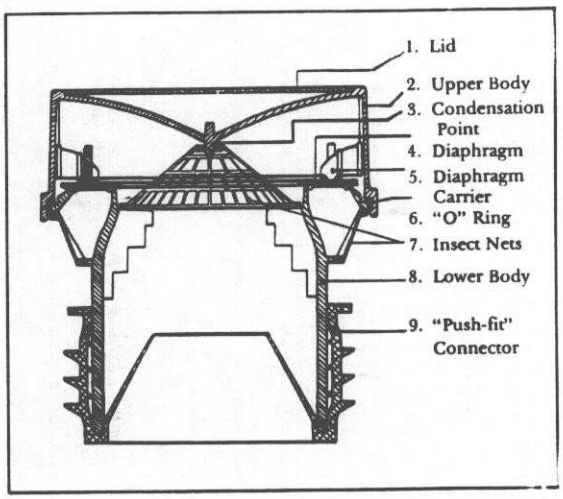
How Does It Work?



The Mini-Vent and Maxi-Vent open and admit fresh air when negative pressures occur from fixture discharge. This equalizes the pressure within the system and trap seals are protected.



Once this equalization is complete, the valve seals tight by gravity, preventing any transmission of foul air out through the device.



CROSS SECTION OF MINI-VENT

CROSS SECTION OF MAXI-VENT



AWARD MANAGER'S SUMMARY

AWARD MANAGER'S SUMMARY
Nomination 9415

STUDOR AIR ADMITTANCE VALVES (AAV) IN DRAINAGE SYSTEMS

The Innovation

The concept of sealing the drain of a plumbing fixture with a water trap and venting the plumbing line to maintain that seal has existed for many years. Ordinarily, such a vent system relies on a series of pipes that run from each fixture's trap and merge into a single pipe that extends to a high point outdoors where the end of that pipe can be left open to the air.

The water trap seal prevents sewer gas from escaping into habitable spaces and is necessary for safety and health of the buildings occupants. The purpose of the vent is to balance the pressures in the drainage system so that the water in the trap is neither sucked down the drain nor forced out into the fixture.

There have been many attempts to develop a system to replace the conventional vent system. Past attempts have resulted in failure because of the lack of reliability or the inability to maintain a healthy and sanitary environment.

The Studor Air Admittance Valve is a plastic device designed with sealing member, or diaphragm, that opens to admit air by lifting upward when a negative pressure occurs as the water falls in the drainage system. Once the air pressure in the system is balanced, it closes by gravity. There are no springs or levers that can fail. The diaphragms are made of synthetic rubber.

The Studor Valve has screens to prevent the admittance of vermin such as roaches or mice that can interfere with the operation of the diaphragm. The valve has an insulation cap of foamed plastic to prevent freezing and frost closure when used in a cold environment. The valve also prevents the "chimney effect" in the pipe that develops when a fire occurs, especially in plastic piping systems.

The nominators say that the air admittance valve is the first device that functions in place of a piped vent system and that has reliability and longevity while maintaining proper sanitation.

Background of Innovation

Mr. Sture Ericson, who has a background in air conditioning, was running a factory in Sweden that made prefabricated plumbing units. He was in contact with many contractors and knew of their plumbing installation problems.

In the early 1970s, one building contractor complained about not being able to get the roofer and the plumber on the job at

the same time when vents projected through the roof. The roofer would complete the roof and then the plumber would need to punch a hole for the vent. The roofer had to come back and reseal the roof.

From this experience, Mr. Ericson got the idea to use an air relief valve to prevent this common situation from occurring. Mr. Ericson developed the air admittance valve in Sweden in the early 1970s. The testing of the air valve was carried on in Italy and Sweden. Dr. Eskil Olson, now retired, was involved in the early testing. Professor John Swaffield, in Scotland, was also heavily involved in the research and development efforts. The Studor company now has research and testing stations in Belgium and France.

In 1973 the air admittance valve was put on the market. It was introduced to the United States in 1986 as the Studor Air Admittance System, specifically the Mini-Vent and the Maxi-Vent valves. Modifications to the original concept have been made to adapt to the plumbing system of the United States.

In 1986 Mr. Ericson sought approval of the air admittance system by the Building Officials Congress of America (BOCA). The idea met with considerable skepticism because similar schemes had failed in the past, most of which didn't work after about three to five years. A series of tests proposed by BOCA. Six months later, Mr. Ericson came back to BOCA with test results that went beyond what was anticipated. Accelerated longevity tests indicated the valves had a long life.

The main use of air admittance valves is in South and Southeastern parts of the United States, but it is being used in Indiana. The Building Officials Congress of America (BOCA) and the Southern Building Code Congress International (SBCCI) have approved the use of these valves and have adopted specifications for their use. On the 6th of December, the issue came before the Uniform Code's International Association of Plumbing and Mechanical Officials (IAPMO). The IAPMO covers the western United States.

There are about 10 manufacturers of the Studor valve. Plants are located in Finland, Sweden, France, Holland, Belgium, Austria, United Kingdom, and United States. The plant in the US is in Florida.

Competition

There apparently was an earlier device called PROVENT which was made of neoprene and operated with springs. These valves were originally designed for use in mobile homes and they began to be used in houses. There were a lot of failures. Also they were not approved by the Southern Building Conference Congress International. (SBCCI).

There is another brand of air admittance valves in direct competition with the Studor valve. The Durgo valve which is distributed in the United States by ENERJEE, Ltd. also has a Swedish origin and patent.

There is not enough documentation to determine whether the Studor or the Durgo valve was the first to be conceived. It is known that in the United States the issuance of a patent was first awarded to the Studor valves.

Application

The Studor Air Admittance Valve is installed either close to the water trap at a plumbing fixture or on top of the vent stack under the roof. Vent piping that is typically run to the outdoors through the roof can be completely or partly eliminated and possible future roof leaks can be avoided when air admittance valves are used.

Most plumbing codes that have certified the use of air admittance valves will not permit their exclusive use. They require a minimum of one open air stack for each building.

The Studor Valves have been installed on a major housing project in Vail, Colorado. Meijer Thrifty Acres stores have adopted the valves for use in all their new buildings. On 10 Meijer's stores in Indiana, the use of air admittance valves accounted for savings of over $160,000. Millions of the valves have been installed worldwide and it is expected that the numbers will increase in the future.

Notes on Nominated Persons

Mr. Sture Ericson

Mr. Sture Ericson is the designer of the Studor Air Admittance Valve. He is Chairman of Studor, Inc. of Dunedin, Florida. His company has locations in many European countries. Mr. Ericson was located in Belgium and was most helpful in providing information about the background of the Studor valve.

Opinions of Outside Persons

Mr. Julius A. Ballanco

Mr. Julius A. Ballanco is President of JB Engineering and Code Consulting, P.C. of Munster, Indiana. He has been doing consulting work for Mr. Ericson for about one year. He was on the American Society of Sanitary Engineering (ASSE) Standards Committee when the Committee wrote their specification for air admittance valves. Mr. Ballanco is reported to be probably the Nation's best authority on air vents.

Mr. Ballanco says that the use of air admittance valves is a major plumbing technique in Europe and has been used there for some time. He thinks its a "wave of the future." He knows of a project in Vail, Colorado, where these valves cut out about 80% on the venting costs for the project.

Mr. Ballanco says that Mr. Ericson got the idea from the use of diaphragms in vacuum breakers on the water supply side. Mr. Ericson then applied the concept to the waste side of the system. When the pressure in the pipe falls, the diaphragm lifts to let equalizing air into the pipe, and when the pressure is equalized, the diaphragm closes by gravity. In operation, the diaphragm movement is very small and the diaphragm flutters.

The valve helps out the drainage system because it allows only the necessary amount of air to enter. This results in better flow patterns for the water than with an open pipe. The valve operates without affecting the sealing trap and it prevents sewer gases from exiting the drainage system.

Mr. Ballanco keeps being impressed by the valves. He believes the Mr. Ericson has made a major contribution to the plumbing industry.

Mr. John Engelberger, P.E.

Mr. John Engelberger is President of ENERJEE Ltd. in Morrisville, Pennsylvania. He is Executive Agent for Durgo in the Western Hemisphere. He is the US distributor for the Durgo Air Admittance Valve. Durgo is a licensee of Bengt-Arne Persson who is the inventor of Durgo.

Mr. Engelberger says that Durgo is a competitor to Studor. The Durgo air admittance valve differs from the Studor valve in that the Durgo valve has guides for the diaphragm on a central spindle. The Studor valve has three guides on the outer ring for the Mini-Vent model, or six guides for the Maxi-Vent model. The Durgo sealing element is donut shaped and closes by gravity. It was developed in Sweden and is patented. Mr. Engelberger adds that the Durgo valve has more air capacity then the Studor valve, and that the single guide of the Durgo valve creates less friction.

Mr. Engelberger says that Durgo and Studor are very competitive. They are the sole makers of gravity sealed air admittance valves. Other valves made in the US are spring loaded.

Mr. Engelberger says that the Studor valve has a patented screen on the valve. The Durgo company doesn't feel this is necessary. In many uses the valve is installed in the attic of the house where insulation is blown in on the

attic floor. Loose fibers from this insulation could clog the Studor screen. Mr. Studor has succeeded in getting the screen requirement into codes as a standard.

Mr. Engelberger is not sure whether the Durgo or Studor valve is first.

Mr. Lawrence S. Galowin

Mr. Lawrence S. Galowin is Deputy to the Chief, National Voluntary Laboratory Accreditation Program of the National Institute of Standards and Technology in Gaithersburg, Maryland. He is a Member of the American Society of Sanitary Engineering (ASSE) which gives approval to the use of the ASSE logo on products of the plumbing industry.

Mr. Galowin says that the air admittance valve was developed in Europe, first in Sweden then in other countries. It has had a hard time being accepted in the USA.

Mr. Galowin, as a member of ASSE, opposed the acceptance of these valves because they do not allow for the relief of positive pressures. A range of + or - 1" water pressure is the generally accepted maximum value needed for approval. Mr. Galowin believes that such valves should relieve positive pressure.

Two or three years ago Studor came up with a clever arrangement for these check valves. Others use springs, but Studor's use of gravity to close the valve is very good. Their product is light weight and has a very small pressure drop, too.

Associate Professor Robert B. Keller

Professor Robert B. Keller is on the faculty of the Mechanical Engineering and Applied Mechanics Department of the University of Michigan. Professor Keller's specialties include automatic control systems, microprocessor control, and simulation and control of fluid systems.

Professor Keller says that he wouldn't trust such a valve. He would question its longevity. This would need to be proven.

Professor Keller says that check valves, and this is one, have been used in piping systems for a long time. This valve may be desirable for plumbers because of savings in cost, but it may not be in the best interest of the homeowner. There have been a number of devices developed for the plumbing field, but most wear out in a relatively short period and need to be replaced. Plastic pipe is one instance where the results have proven positive.

Professor Keller also wonders what happens if this valve fails. What if there is a plug in the line and the valve has failed in the open position? Then water from the sink would come out onto the floor. He also says that the diaphragm material may fail. He cites the toilet stopper, or ball, where the rubber deteriorates and must be replaced. He thinks the same thing could happen in this case.

Mr. Warren Klugman

Mr. Warren Klugman works for Studor, Inc. as the Manufacturers Representative for North and South Carolina. He is the Southeast Regional Manager for Studor Inc.

Mr. Klugman says that he has been involved with the Studor Air Admittance Valve almost since the beginning, but he was not involved with the physical product. During his association, sales of the Studor valve have gone from zero to very strong. The product is well received by plumbing contractors because of its ease of installation, and by builders because of its aesthetic character and its need for no roof penetrations.

Mr. Klugman believes that the Durgo valve came later than Studor valve. He said that the Studor valve has a better appearance, is smaller and therefore less intrusive, and has a vermin barrier. This barrier keeps out roaches and mice that would interfere with the valve operation. The Studor valve is easier to install because of its physical characteristics. It has screw threads, for instance. It is made in the US in the Studor plant.

Mr. Thomas Konen

Mr. Thomas Konen is the Director of the Building Technology Laboratory, Center for Environmental Engineering at the Stevens Institute in Hoboken, New jersey. His laboratory does testing for the American Society of Sanitary Engineering. He has tested the Durgo Valve and is a consultant to Mr. Engelberger of Durgo.

Mr. Konen says that the conception of air admittance valves needs to be investigated. He says that the air admittance valve is an extension of a mechanical vent that has been used in the mobile home industry, particularly by Lyons Industries.

Mr. Konen says that air admittance valves go back ten to fifteen years. The idea is not particularly new and the concept cannot be attributed to one individual. A competing product on the market is the Durgo valve. Mr. Konen is not sure which product came first. He says that Mr. Studor has been successful in getting air admittance valves included in US plumbing codes.

Mr. Gary Kozan

Mr. Gary Kozan is Vice President of Ridgeway Plumbing, Inc. of Boynton Beach, Florida. He is a plumbing contractor.

Mr. Kozan has used a lot of the air admittance valves since 1990 or 1991. His company was the first to use them in South Florida. They had obtained permission to use them, before they were permitted by the code, for a 1700 apartment complex that was completed about a year ago. There were no problems with them.

Mr. Kozan says the biggest problem is educating people about them and how they work. The plumbing industry is a conservative group and is reluctant to change. Mr. Kozan thinks air admittance valves are the greatest thing he has seen in 20 years. He's quite enthusiastic about them.

Most of the work of Mr. Kozan's company is single family housing and apartment buildings. He finds the valves to be very labor saving. In many current home designs there are vaulted ceilings and large window spaces. These features make it very difficult to find places to run conventional plumbing vents. The air admittance valve eliminates the need to have roof penetrations. There is no flashing so the roof is more waterproof. The valves can be kept very low. They only need to be 4 inches above the trap and be accessible. This allows installations under cabinets, in kitchen islands, bars, etc. and eliminates a lot of pipe.

Dr. John A. Swaffield

Dr. John Swaffield is Professor of Building Engineering and Surveying of the faculty of Heriott Watt University in Edinburgh, Scotland. Professor Swaffield has tested Sture Ericson's valves as a consultant and as an investigator on research projects funded by the government.

Professor Swaffield is currently testing Sture Ericson's valves to measure loss coefficients in a plumbing system. Also, he is doing a research project that involves developing computer models of venting systems. This requires that particular characteristics of certain valves by determined and entered in a database. The Ericson valve and about 4 or 5 others from different makers are being evaluated to build the model. doing a study on these valves for use on the London Underground.

Professor Swaffield says that air admittance valves have been around for a long time, so he couldn't say that Ericson invented it. Mr. Ericson is by no means the only one.

The Ericson design is in the forefront, but it provides no protection against overpressures that could blow the trap. The Ericson device does reduce the amount of air flow in the system.

There are a number of manufacturers of air admittance valves and Mr. Ericson has given the industry considerable impetus. Professor Swaffield says that the Ericson valve stands out as a very good product.

Mr. John R. Nussbaum

Mr. John R. Nussbaum is Executive Director of the Plumbing, Heating, Cooling Contractor's Association of Southeastern Michigan. He is the nominator for the Studor Valve.

Mr. Nussbaum was President of the American Society of Sanitary Engineering (ASSE) at the time their Seal Board approved the use of air admittance valves. He was part of the group that wrote the specifications for these valves.

Mr. Nussbaum understands that there are about two and three quarter million of these valves now in use. About one quarter of this number is in use in the United States. His understanding is that the failure rate of these valves is very low, being about 4/10 of one percent and ASSE is interested in maintaining that low rate or bettering it.

Mr. Nussbaum believes that most contractors favor the acceptance of air admittance valves by the building code bodies.

Award Managers' Comments

The Studor Air Admittance Valve permits plumbing drainage system to be vented in a new way. The valves appear to function well in balancing the negative pressures in the system. They do not balance positive pressures.

The use of air admittance valves saves in the amount of piping installed in a building, and reduces the number of vent stacks projecting through the roof. In turn, plumbing costs are lowered. The valves appear to be long lasting.

The Studor valve is being marketed in direct competition to the Durgo air admittance valve. The two products are essentially the same in concept, but the Studor valve seems to be a more sophisticated device. It is not clear which product was developed first, but patents in the US were issued to Studor first.

SELECTED INTERVIEW SUMMARIES

Phone Interviewer: Harris
Date: 11/23/93

#9415
No. 1

Name: Mr. John R. Nussbaum
Title: Executive Director
Affiliation: Plumbing, Heating, Cooling
Contractor's Association
of Southeastern Michigan
14801 West 8 Mile Road
Detroit, MI 48235

1. Mr. Nussbaum is not familiar with the engineering aspects of the air admittance valves. We should talk to Mr. Ballanco for that information.

2. Mr. Nussbaum was President of the American Society of Sanitary Engineering (ASSE) at the time that their Seal Board approved the use of air admittance valves. He was part of the group that wrote the specifications for these valves.

3. Mr. Nussbaum understands that there are about two and three quarter millions of these valves in use with about one quarter of them in the United States. His understanding is that the failure rate is very low, being about 4/10 of one percent. ASSE is interested in maintaining that low rate or bettering it.

4. Mr. Nussbaum believes that most contractors favor the use of acceptance of air admittance valves by the building code bodies. At present BOCA has accepted them as has the Southern Building Code. On the 6th of December, the isssue comes before the Uniform Code's International Association of Plumbing and Mechanical Officials (IAPMO). The IAPMO covers the western United States.

5. The valves have been installed in a large project of condominiums in the Denver area. It is also being used by Meijer Thrifty Acre stores in their buildings.

6. The major studies on the valves was done overseas. Mr. Ballanco can fill us in.

7. The air admittance valves cannot be used exclusively as there must be one major vent stack for each building.

8. Mr. Nussbaum believes that the acceptance of these valves would be improved if a NOVA award were granted.

9. Mr. Nussbaum says that there are three manufacturers making the air admittance valves. They are now made in Florida.

10. Mr. Nussbaum will see that the original nomination is signed by Mr. Ericson and send it back to me.

Phone Interviewer: Harris
Date: 11/23/93

#9415
No. 2

Name: Mr. Julius Ballanco
Title: Consultant
Affiliation: J.B. Engineering and Code Consulting, PC
1661 Cardinal Dr.
Munster, IN 46231

Mr. Ballanco has been doing consulting for Mr. Ericson for only about one year.

1. Mr. Ballanco worked for the Building Officials Congress of America (BOCA) and had his first contact with Mr. Ericson in 1986. Mr. Ericson was seeking approval for the air admittance valve by BOCA. Mr. Ballanco says that the idea met with considerable skepticism because similar schemes had failed in the past. Most didn't work after about three to five years. A series of tests of the air admittance valve was proposed by BOCA. Six months later, Mr. Ericson came back to BOCA with the results of the tests showing excellent results, results that went beyond what was anticipated.

2. Mr. Ballanco was also on the ASSE Standards Committee when they wrote their specification for the valves. He keeps being impressed by the valves. He believes the Mr. Ericson has made a major contribution to the plumbing industry.

3. Mr. Ballanco says that the concept has been used in Europe for some time. It is a major technique in Europe. Mr. Ballanco thinks its a "wave of the future." He knows of a project in Vail, Colorado, where these valves cut out about 80% on the venting costs for the project.

4. Mr. Ballanco says that Ericson got the idea from the use of diaphagms in vacuum breakers on the water supply side. Ericson then applied it to the waste side of the system. When the pressure in the pipe falls the diaphragm lifts to let equalizing air into the pipe. When the pressure is equalized, the diaphragm closes by gravity. In operation, the diaphragm movement is very small and the diaphragm flutters. Mr. Ballanco says that the valve helps the drainage system out in that it allows only the necessary air to enter. This results in better flow patterns than with an open pipe. The valve operates without affecting the sealing trap. It also prevents sewer gases from exiting the drainage system.

5. Mr. Ballanco says that the main use in the U.S. is in the South and Southeast. It is being used in Indiana. The BOCA and the Southern Building Code Congress have adopted specifications for the valve's use. The Western Building Code has not yet approved, but it is being considered by the IAPMO.

6. Mr. Ballanco says that Mr. Swaffield is the leading plumbing researcher throughout the world. Mr. Klugman is the Studor Sales

Representative. He believes that Mr. Kozan has had some plumbing problems when using these valves. He doesn't know of Mr. DeKuyper or Mr. Jones.

7. When asked about the tests for longevity, Mr. Ballanco said that the tests were accelerated and showed a long life. The diaphragms are made of synthetic rubber.

Phone Interviewer: Harris
Date: 12.08/93

#9415
No. 3

Name: Mr. Sture Ericson
Title: Chairman
Affiliation: Studor Inc.
2030 Main Street
Dunedin, FL 34698

1. Mr. Ericson said that he was running a factory in Sweden that made prefabricated plumbing units. His background is in Air Conditioning. Because of these associations, he was in contact with many contractors and knew of their problems in installing plumbing. In the early 1970s, one building contractor complained about not being able to get the roofer and the plumber on the job at the same time when vents projected through the roof. The roofer would complete the roof and then the plumber would need to punch a hole for the vent. The roofer had to come back and reseal the roof. Mr. Ericson got the idea to prevent this common situation. In 1973 the air admittance Valve was put on the market.

2. Mr. Ericson says that there are about 10 manufacturers of the valve. There are plants in Finland, Sweden, France, Holland, Belgium, Austria, United Kingdom, and United States.

3. The testing of the air valve was carried on in Italy and Sweden. Dr. Eskil Olson, now retired, was involved in the early testing. The Studor company now has research and testing stations in Belgium and France. Professor John Swaffield, in Scotland, was also heavily involved in the research and development efforts.

4. I may talk to either Sharon or Rick in Florida to get printed literature.

5. Ericson will FAX a copy of the nomination form with his signature. He will send the original to me upon receipt of my address.

Phone Interviewer: Harris
Date: 12/08/93

#9415
No. 4

Name: Mr. Gary Kozan
Title: Vice President
Affiliation: Ridgeway Plumbing, Inc.
640 East Industrial Avenue
Boynton Beach, FL 33426

1. Mr. Kozan has used a lot of the air admittance valves (AAVs) since 1990 or 1991. His company was the first to use them in South Florida. They had obtained permission to use them, before they were permitted by the code, for a 1700 apartment complex that was completed about a year ago. There were no problems with them.

2. Mr. Kozan says the biggest problem is in educating people about them and how they work. The plumbing industry is a conservative group and is reluctant to change. Mr. Kozan thinks they are the greatest thing he has seen in 20 years. He's quite enthusiastic about them.

3. Most of the work of Mr. Kozan's company is single family housing and apartment buildings. He finds the AAVs to be very labor saving. In many current home designs there are vaulted ceilings and large window spaces. These features make it very difficult to find places to run conventional plumbing vents. The AAV eliminates the need to have roof penetrations. There is no flashing so the roof is more waterproof. The AAVs can be kept very low. They only need to be 4 inches above the trap and be accessibile. This allows installations under cabinets, in kitchen islands, bars, etc. and eliminates a lot of pipe.

4. There are two or three competitors. He could not name any as he uses Studor exclusively. He did know of an earlier device called PROVENT which was made of neoprene and operated with springs. These were originally designed for use in mobile homes but they began to be used in houses and there were a lot of failures. Also they were not approved by the Southern Building Conference Congress, International. (SBCCI). The Studor device is approved.

5. Mr. Kozan refered me to Mr. Ballanco who he believes is probably the Nation's best authority on air vents.

Phone Interviewer: Harris
Date: 12/09/93

#9415
No. 5

Name: Dr. John A. Swaffield
Title: Professor
Affiliation: Department of Building Engineering
and Surveying
Heriott Watt University
Riccarton, Edinburgh
Scotland EH 144 A5

1. Professor Swaffield has tested Ericson valves as a consultant and as part of research projects funded by the government. He says that air admittance valves have been around for a long time, so he couldn't say that Ericson invented it. Ericson is by no means the only one.

2. Professor Swaffield says that we should talk to Tom Konen at Stevens Institute in Hoboken, NJ and to John(?) Galowin at NIST in Gaithersberg. They could probably give more insight into the history and development of the AAVs. They are more knowledgable about American codes than he is.

3. Swaffield says that the Ericson design is in the forefront, but it provides no protection against overpressures that could blow the trap. (If a stoppage occurs in the system, the pressure builds up and will force the water out of the trap.) The Ericson device does reduce the amount of air flow in the system.

4. There are a number of manufacturers of air admittance valves. Mr. Ericson has given the industry considerable impetus.

5. Professor Swaffield is currently testing Ericson's valves. He is now engeged in tests to measure the loss coefficients in the system. He is also doing a research project that involves developing computer models of venting systems. This requires that certain characteristics by determined and entered in a data base. The Ericson valve along with about 4 or 5 others from different makers are being evaluated for building the model.

6. Professor Swaffield says that the Ericson valve stands out as a very good product.

Phone Interviewer: Harris
Date: 12/09/93

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Phone Interviewer: Harris
Date: 12/09/93

#9415
No. 6

Name: Mr. Warren Klugman
Title: Manufacturers Representative
Affiliation: W.B. & Associates, Inc.
P.O. Box 668588
Charlotte, NC 28266

Mr. Klugman works for Studor, Inc. as the Manufacturers Representative for North and South Carolina. He is the Southeast Regional Manager for Studor Inc.

1. Mr. Klugman says that he has been involved with the Studor Air Admittance Valve almost since the beginning, but he was not involved with the physical product. During his association, sales of the Studor valve have gone from zero to very strong. The product is well received by plumbing contractors because of its ease of installation, and by builders because of its aesthetic character and its need for no roof penetrations.

2. Mr. Klugman was asked about competition for the product. He said that there is a valve made by Durgo that has a Swedish patent. Mr. Klugman believes that it came later than Studor. There may be others.

3. Asked about differences betweeen the Studor valve and the Durgo valve, he said that the Studor valve has a better appearance, is small and therefore less intrusive, and has a vermine barrier that other valves lack. This barrier keeps out roaches and mice that would interfer with the valve operation. The Studor valve is easier to install because of its physical characteristics. It has screw threads, for instance. It is made in the US in the Studor plant.

4. Mr. Klugman says that it is rumored that code bodies oppose any product that is labor saving. The Studor valve is labor saving. The UPC, Universal Product Code, is an investigating body that makes recommendations to IAPMO.

#9415
No. 7

Phone Interviewer: Harris
Date: 12/10/93

Name: Robert B. Keller
Title: Associate Professor
Affiliation: Department of Mechanical Engineering
and Applied Mechanics
The University of Michigan.
Ann Arbor, MI 48109-2125

Professor Keller's specialties include automatic control systems, microprocessor control, and simulation and control of fluid systems.

1. Professor Keller says that he wouldn't trust such a valve. He would question its longevity. This would need to be proven.

2. Professor Keller says that check valves, and this is one, have been used in piping systems for a long time. This valve may be desireable for plumbers because of savings in cost, but it may not be in the best interest of the homeowner. There have been a number of devices developed for the plumbing field, but most wear out in a relatively short period and need to be replaced. Plastic pipe is one instance where the results have proven positive.

3. Professor Keller also wonders what happens if this valve fails. What if there is a plug in the line and the valve has failed in the open position? Then water from the sink would come out onto the floor.

4. He also says that the diaphragm material may fail. He cites the toilet stopper, or ball, where the rubber deteriorates and must be replaced. He thinks the same thing could happen in this case.

#9415
No. 8

Phone Interviewer: Harris
Date: 12/10/93

Name: Mr. Lawrence S. Galowin
Title: Deputy to the Chief
Affiliation: National Voluntary Laboratory
Accreditation Program
National Institute of Standards
and Technology
Gaithersburg, MD 20899
Phone: 301-975-4022

1. Mr. Galowin says that the Air Admittance Valve was developed in Europe, first in Sweden then in other countries. It has had a hard time to be accepted in the USA. It has been accepted by two code writing bodies, but these acceptances may be conditional.

2. Mr. Galowin, as a member of American Society of Sanitary Engineering (ASSE), opposed the acceptance of these valves because they do not allow for the relief of positive pressures. A level of + or - 1" water pressure is the generally accepted range. Mr. Galowin believes that they should relieve positive pressure.

3. Mr. Galowin says that the device meets the requirements of suction systems in mobile homes. There they need a cap on the vent to prevent the intrusion of birds, etc.

4. Mr. Galowin says that he has heard of the requirement for the need for one open stack per building. He has some reservations about this. Some installations don't need to worry about positive pressure.

5. Two or three years ago Studor came up with a clever arrangement. Other check valves used springs, but Studor's use of gravity to close the valve is very good. Their product is light weight and has a very small pressure drop, too.

6. Professor Swaffield is doing a study on these valves for use on the London Underground.

7. If more is needed about the acceptance of these valves, call Pat Higgins, 3013-694-6607. Pat is a national plumbing consultant.

Phone Interviewer: Harris
Date: 12/10/93

#9415
No. 9

Name: Mr. Thomas Konen
Title: Director of Building Technology Laboratory
Affiliation: Center for Environmental Engineering
Stevens Institute
Hoboken, NJ 07030
Phone: 201-216-5000

1. Mr. Konen says that air admittance valves go back ten to fifteen years. The idea is not particularly new and the concept cannot be attributed to one individual. A competing product on the market is the Durgo valve. Mr. Konen is not sure which product came first.

2. Mr. Konen says that the conception of air admittance valves needs to be investigated. Mr. Studor has been successful in getting air admittance valves included in US plumbing codes.

3. Mr. Konen says that the air admittance valve is an extension of a mechanical vent that has been used in the mobile home industry, particularly by Lyons Industries.

4. Mr. Konen refers to Mr. John Engelberger, the repressentative of Durgo in the US. His phone is 215-295-0557.

Note:
Mr. Konen seems very knowledgeable. He is a consultant to Mr. Engelberger.

Phone Interviewer: Harris
Date: 12/13/93

#9415
No.10

Name: Mr. John Engelberger, P.E.
Title: President
Affiliation: ENERJEE Ltd.
32 South Lafayette Ave.
Morrisville, PA 19067
Phone: 215-295-0557

Mr. Engelberger is Executive Agent for Durgo in the Western Hemisphere. He is the US distributor. Durgo is a licensee of Bengt-Arne Persson who is the inventor of Durgo.

1. Mr. Engelberger says that Durgo is a competitor to Studor. The Durgo air admittance valve fiffers from Studor in that the Durgo valve has guides for the diaphragm on a central spindle. The Studor valve has three guides on the outer ring, or six guides for the maxi-model. The Durgo sealing element is donut shaped and closes by gravity. It was developed in Sweden and is patented.

2. Mr. Engelberger adds that the Durgo valve has more air capacity then the Studor valve. The single guide of the Durgo product creates less friction.

3. Mr. Engelberger says that Durgo and Studor are very competitive. They are the sole makers of gravity sealed air admittance valves. Other valves made in the US are spring loaded.

4. Mr. Engelberger says that Studor has a screen on the valve and have patents on this. The Durgo company doesn't feel this is necessary. In many uses the valve is installed in the attic of the house where insullation is blown in on the attic floor. Loose fibers from this insullation could clog the Studor screen. Studor has succeeded in getting the screen requirement into codes as a standard. Durgo does not have a patented screen.

5. Mr. Engelberger says that Durgo has a whole family of plumbing products. Durgo has been involved with similar products for more than 50 years.

6. Mr. Engelberger knows Mr. Sture Ericson. He last saw him in New Orleans earlier in the year.

7. Mr. Engelberger is not sure whether the Durgo or Studor valve is first.

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Limited
Parsonage Way
Chippenham
Wiltshire SN15 5PN
Telephone (0249) 654121
Telex 444171

TGJ JIC OCTpc
3 October 1988

TO WHOM IT MAY CONCERN

OSMAVENT AIR ADMITTANCE VALVES

Air Admittance Valves were first used in the United Kingdom in the late 1970's, but it was some years before they were sold in any significant numbers.

We introduced the two Studor Valves in late 1984, marketing them under the names OsmaVent 40 for the Mini-Studor and OsmaVent 110 for the Maxi-Studor.

Prior to selecting the Studor Valves we had evaluated three other competing products, all of which were available to us. We opted for the Studor Valve not because it was the cheapest, but because we felt it was technically superior to the other models and represented the best value for money.

As market leaders in the plastics sanitary plumbing market in this country we could not afford to risk our good reputation on a poor or unreliable product.

Subsequent events have indicated our decision. Sales have grown from 16,000 units in 1985 to just under 50,000 this year. To date our total sales are 112,000 units, and of this number we have had less than 30 complaints, all of which were due to dust in the mechanism or to bad handling.

During this period the Building Regulations were changed to permit Air Admittance Valves to be generally used, provided that they had been assessed by the British Board of Agrement and were covered by a British Board of Agrement Certificate. Prior to change in Regulations, special application had to be made to the local Building Control Officer for permission to install them.

Continued growth in the use of Air Admittance Valves seems assured. The cost-savings to be gained both in terms of labour and materials are often considerable and the aesthetic consideration of maintaining a smooth roof line are also important to the private housebuilder.

Yours faithfully

TREFOR G JONES
MARKETING DIRECTOR

BBA BRITISH BOARD OF AGRÉMENT
ASSESSMENT OF PRODUCTS FOR CONSTRUCTION

Tel: 0923 670844 Telex: 94010145 (BBAG G) Fax: 0923 662[illegible]

UK Member of the UEAtc (European Union of Agrément)

Your ref: **S1/20485** Our ref: **BCC/BC**

Date: **22nd June 1989**

Mr S Ericson
Studor Trading Ltd
Prins Boudewijnlaan 48
2230 Schilde
Belgium

Dear Mr Ericson

Re: Air Admittance Valves

The British Board of Agrément have certificated Air Admittance Valves for more than 10 years and have received very few complaints regarding failures or problems. During this period many hundreds of thousands of valves have been installed in this country. These facts suggest that the Air Admittance Valves have satisfactory durability and long term performance.

The BBA has recently reviewed 3 air admittance valve Certificates including the Studor AAV, part of which involved carrying out a survey of the opinion of users, specifiers and installers of the valves.

The only problems that have been reported can be traced back to poor installation not carried out in accordance with the Certificate e.g. where valves have been dismantled and reassembled incorrectly or where they have been installed prior to blown fibreglass insulation in loft spaces.

Yours sincerely

B. C. Chamberlain

B C Chamberlain
Section Head

ericsbc.ltr

Members of Council
W J W Courtney, CBE, Chairman
P C Hewlett, PhD, BSc, CChem, FRSC, HonFComm, APRI, Director
D I Cappell
A M Cooper, MCIOB
I W Davis, MBE, FIBC
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A C Pomeroy, CBE, BSc, FEng, FICE, FIMechE, FIStructE
A J Peach, MInstM, JP
D W Quinion, BSc, FICE, FIStructE
J A Roberts, MA, PhD, CBIM
J W Turner, CBE, FCIOB
C Wilson, MA, DA(Manc.) Dip Arch, RIBA, MRTPI

British Board of Agrément, a non profit distributing company limited by guarantee and registered in England No 878293

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The Building Research Station,
Buchanan Lane, Garston, Watford, Herts

Scottish Office
W A Riddell, 13 Mauricewood Bank,
Penicuik, Midlothian EH26 0BS
Telephone No: 0968 74634

Secretary
R A Cust, FCCA

NAMAS
ACCN No 0133(B)
ACCN No 0357(N)

Design Guild Homes

To Whom It May Concern:

Design Guild Homes has used the Studor Air Admittance valves in our home construction since 1991, and we have been very satisfied with these products.

We have found that by using the Mini vent and Maxi Vent our plumbers save time as well as money. Because we no longer have to vent the plumbing through the roof, we do not have to be concerned with coordinating the arrival of the roofer and the plumber. An added plus is the fact that there is no possibility of future roof leakage with the Studor system. The Studor vents are easy to install and problem free; one Mini Vent will handle an entire kitchen or bathroom with ease.

We highly recommend these superior quality products to anyone in the building industry.

Sincerely,

Rick Finn
Design Guild Homes

Harbour Watch
1548 Riverside Drive
Tarpon Springs, FL 34689
(813) 934-3155

Eagle Watch
at Boot Ranch
1000 East Lake Road
Palm Harbor, FL 34685
(813) 789-9281

Pointe Alexis
1 N. Pointe Alexis Drive
Tarpon Springs, FL 34689
(813) 934-3155

RIDGEWAY PLUMBING, Inc.

640 East Industrial Avenue
Boynton Beach, Florida 33426

407-732-3176 (Palm Bch)
305-481-3550 (Broward)
407-369-0118 (Fax)

February 23, 1993

Palm Beach County Building Department
3400 Belvedere Road
West Palm Beach, FL 33406

ATTN: Robert Palchanis, Chief Building Official

RE: Air Admittance Valves

Dear Bob:

I am requesting a review of the current County policy regarding the use of air admittance valves (AAV's), such as the Studor "Mini-Vent" and "Maxi-Vent", in residential and commercial plumbing systems.

As I understand it, the County's policy has been to permit the free use of these AAV's only in installations where there is no other means of getting a vent stack through the roof (i.e. "true" island situations). Use of these devices in any other situations must be noted on the plans, or have a letter from the architect or engineer.

The 1991 Standard Plumbing Code, Sections 1402 and 1403, permits the use of air admittance valves as a vent terminal. The Studor AAV's comply with ASSE Standard 1051, and SBCCI Compliance Report #9062. The installation instructions and limitations listed in that report are clear and easy to understand. Use of these devices should not be restricted beyond the limitations of the code and the SBCCI report. Incidentally, the Countywide Amendments to the Plumbing Code make no mention restricting the use of these devices.

Since the AAV's inclusion into the plumbing code, our company has installed "mini-vents" in Boynton, Delray, and Boca Raton. In fact, one project in Boynton has more than 1500 mini-vents installed. Imagine dozens of 2-story, 12-unit buildings with 43 mini-vents (installed under sinks and vanities), and only 1 vent through the roof! We have experienced zero callbacks pertaining to their operation.

Bob, I can certainly understand the skepticism and concern regarding these devices. Non-traditional methods and new technologies have always gained slow acceptance, particularly in the plumbing trade. And make no mistake about it, the air

admittance valve is certainly a revolutionary product. But I share in the confidence that SBCCI has shown for the product, and feel that the only obstacle that remains is to educate the plumbers, contractors, and inspectors in its proper use.

I believe it is time for the County to review and modify its policy regarding AAV's, so as not to present any unnecessary or unwarranted roadblocks to their use. I would be pleased to discuss this situation with you or your department at any time.

Respectfully yours,

RIDGEWAY PLUMBING, INC.

Gary W. Kozan
Vice President

REPRINTED WITH PERMISSION
June 1993 issue
PLUMBING ENGINEER MAGAZINE



Code Update

By Julius Ballanco, P.E., JB Engineering, Munster, IN

The Acceptance of Air Admittance Valves

Many plumbing engineers have inquired about the use and limitations of air admittance valves since reporting their acceptance by three of the model codes. The three model codes that directly mention the acceptance of air admittance valves are the BOCA National Plumbing Code, CABO One and Two Family Dwelling Code, and SBCCI Standard Plumbing Code. These valves can be used as an alternative material or device under the IAPMO Uniform Plumbing Code and NAPHCC National Standard Plumbing Code.

Air admittance valves can be considered a one-way valve that permits air to enter the drainage system, yet prevents air and sewer gas from escaping into the building. They are designed to balance the negative (or lower) pressure in a DWV system and prevent siphonage of the trap seal.

Air admittance valves are regulated by two ASSE standards—1050 and 1051. ASSE 1050 regulates stack-type air admittance valves, while ASSE 1051 regulates individual and branch-type air admittance valves. The difference between the two valves is that the 1050 valves are designed for venting fixtures on multiple floor levels. Valves conforming to ASSE 1051 are designed to vent fixtures on a single floor level.

The model codes make direct reference to only ASSE 1051 since ASSE 1050 was not a completed document at the time the changes were submitted to the codes. However, the plumbing engineer will find that the same air admittance valve conforms to both ASSE 1050 and 1051. Thus, the air admittance valve can be used for either stack applications or individual and branch applications.

The BOCA National Plumbing Code stipulates that air admittance valves must be part of an engineered plumbing system (designed by a plumbing engineer), in Section P-1808.0. The SBCCI Standard Plumbing Code regulates the use of air admittance valves in Section 504.8. The CABO One and Two Family Dwelling Code regulates the use of the valves in Section P-2207.5.

Section 12.2 of the NAPHCC National Standard Plumbing Code would permit a plumbing engineer to install an air admittance valve as an "other design" for venting. The valves can be considered only an alternate method by Section 201 (b) of the IAPMO Uniform Plumbing Code.

Air admittance valves are often mistaken as being the vent for a given fixture. To maintain the proper perspective, plumbing engineers should only classify air admittance valves as the vent terminal. Rather than extending a vent to the outdoors, the vent terminates with an air admittance valve.

There is no change to the venting arrangement of the plumbing fixtures when an air admittance valve is installed. The fixtures are vented by an individual vent, common vent, circuit vent, wet vent, or other type of venting system. The vent just extends to an air admittance valve.

Both the codes and standards regulate the installation of air admittance valves to ensure that they will perform as intended. The valves must be accessible since they are a mechanical device that could eventually require repair or replacement. They must be located in an area that permits air to enter the valve.

For island fixture venting or locating the valve under the fixture, air admittance valves are required to be a minimum of 4 inches above the weir of the trap. For stack installations, valves must be located a minimum of 6 inches above the highest fixture's flood level rim.

Since these valves are designed to relieve only negative pressure, they are limited to installations where a positive pressure in the DWV system will not occur. The stack valve is limited to stacks that are a maximum height of 6 branch intervals. Individual and branch-type air admittance valves can be installed on branch drains that are located within four branch intervals of the top of the stack. If individual or branch-type air admittance valves are used on lower floors, the branch must have a relief vent between the stack and the fixture that extends to the outdoors.

The two manufacturers of air admittance valves that have indicated conformance to the ASSE standards are Studor, Inc. and Enerjee Ltd. (product name is "Durgo"). These manufacturers will provide plumbing engineers with additional information and engineering reports identifying the use of their product.

After seeing some of the cost savings on the redesign of plumbing systems using air admittance valves, it would be extremely beneficial for every plumbing engineer to further investigate the concept. It is possible that air admittance valves can result in a major change in the design of venting systems as we currently know them. □□

An analysis of the effect of Air Admittance Valve installation on the dynamic response of building drainage and vent systems, with particular reference to trap seal retention.

By

Professor J.A.Swaffield and Dr D.P.Campbell

Department of Building Engineering and Surveying
Heriot-Watt University,
Riccarton,
Edinburgh, EH14 4AS,
Scotland.

May 1993.

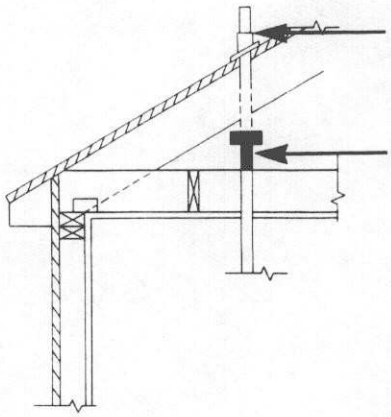
Summary

The normal operating conditions of a building drainage and vent system involves the establishment of an induced air flow within the system vertical stacks by the unsteady water downflow generated by appliance discharge. In order to protect against odour and contamination ingress to habitable space each appliance is normally protected by a water trap seal. Variations in the water downflow within the network generates transient air pressures that are often capable of depleting these trap seals either by induced siphonage or as a result of back pressures following air path closures by water surcharge.

The introduction of Air Admittance Valves offers the system designer the possibility of avoiding the necessity to vent the network outside the building envelope as the AAV only opens in response to sub-atmospheric pressure in the pipework. However AAVs have hitherto been considered problematic in conditions where positive transients, generating back pressures, were an operational possibility.

This report, summarising a substantial body of data developed within a consultancy undertaken on behalf of Studor Ltd, introduces a dynamic analysis based on a method of characteristics mathematical network simulation to assess the role of multiple AAV installations under conditions of both positive and negative pressure transient propagation.

The results of the simulation indicates that the introduction of multiple AAVs on a vertical stack can, due to the provision of alternative air flow paths, control the effects of both negative and positive pressure transients. It is shown that the introduction of a multiple AAV installation has no adverse effect on the normal running of the network, however the modification to the induced air flow in the vertical stack leads to quantifiable benefits in terms of trap seal retention under all the transient conditions simulated.



Conventional Vent Pipe through the Roof, and flashing, is Eliminated

DURGO Air Vent in Attic Space

DURGO Air Admittance Valve APPROVALS
ASSE 1050 - Stack Type Devices
ASSE 1051 - Fixture & Branch Devices
BOCA National Plumbing Code/1993
Section P-1808.0 Air Admittance Valves
SBCCI Standard Plumbing Code-92/93 Rev
Section 504.8 Air Admittance Valves
CABO 1&2FDC, P-2207.5.6 Vent in Attic

DON'T run the vent pipe through the roof!

DURGO Air Vents for Indoor Drain Pipes

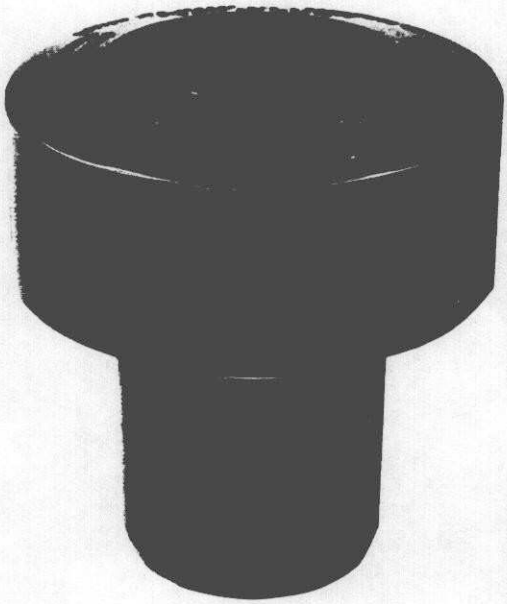
Plumbing vents allow air to enter the drainage system to neutralize the negative pressure which sometimes develops when water is flowing through drain pipes. This low pressure might otherwise suck out the water seal in the drain and allow odors to enter the room.

The ***DURGO Air Vent*** allows air to enter the pipe freely, but achieves this without costly roof penetrations. In addition, the ***DURGO Air Vent*** prevents the discharge of foul odors by sealing off the vent terminal when positive pressure develops.

The ***DURGO Air Vent*** was developed in Sweden, over 10 years ago, and there are now in excess of one million units in service worldwide. Extensive testing* demonstrated that the ***DURGO Air Vent*** is suitable for typical U.S. residential plumbing systems connected to a vented sewer.

Drainage systems in buildings must have some direct connection with outside air, even when ***DURGO Vents*** are used. Usually the branch located nearest the sewer connection is vented through the roof. A home with a septic tank may well be vented with ***DURGO Air Vents***, provided the system is satisfactorily connected to the atmosphere.

Durgo



The CABO ONE and TWO FAMILY DWELLING CODE, 1989 EDITION includes the the following section:

> ***Section P-2207.5.6—Vent Terminals in Attic Spaces.*** Vent terminals equipped with approved vacuum breaker air valves may be located in accessible attic spaces where the building drainage system connects to a vented sewer.

Note: CABO is an umbrella organization, developed by the Model Building Code organizations; BOCA, SBCCI, and ICBO.

* Report No. 145, Dept.of Civil Engineering, Stevens Institute of Technology, Hoboken, NJ.

ENERJEE INTL
32 S. Lafayette Ave.
Morrisville, PA. 19067
215-295-0557

AMERICAN SOCIETY OF SANITARY ENGINEERING

For Plumbing and [redacted] Sanitary Research

This certifies that Enerjee is authorized to display the A.S.S.E. Seal on its

Air Admittance Valves for Plbg Drainage Systems Stack Type Device
DURGO Model BA 90-74 3 inch & DURGO Model BA 50-74 1-1/2inch

in the manner and under the conditions stated herein and any supplemental description sheets,

in accordance with A.S.S.E. Standard Number 1050 - 1991

Tested: Stevens Institute of Technology

This authorization is issued for one (1) year from date hereon and is renewable annually for a period of five (5) years subject to the conditions printed on the reverse side of this certificate.

The SEAL displayed on a product indicates that the product has been tested for compliance with an appropriate and accepted A.S.S.E. Standard for performance in a system of plumbing.

The American Society of Sanitary Engineering has created the SEAL program to encourage improvements in plumbing products and systems in the interests of greater protection of public health and safety.

DATE April 23, 1993 CHAIRMAN Richard Lanzo
A.S.S.E. SEAL BOARD

AMERICAN SOCIETY OF SANITARY ENGINEERING

For Plumbing and [redacted] Sanitary Research

This certifies that Enerjee, Ltd. is authorized to display the A.S.S.E. Seal on its

Air Admittance Valve BA 90 74 3 inch and BA 50 74 1-1/2 inch

in the manner and under the conditions stated herein and any supplemental description sheets,

in accordance with A.S.S.E. Standard Number 1051 - 1991

Tested: Stevens Institute of Technology

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The American Society of Sanitary Engineering has created the SEAL program to encourage improvements in plumbing products and systems in the interests of greater protection of public health and safety.

DATE May 12, 1993 CHAIRMAN Richard Lanzo
A.S.S.E. SEAL BOARD

ENERJEE
32 S. Lafayette Ave.
Morrisville, PA. 19067
215-295-0557

SIZING OF DURGO AIR ADMITTANCE VALVES

The sizing of Air Admittance Valves may be accomplished by first calculating the water flow rate for a given stack diameter and fixture unit load and thereby determining the corresponding air flow rate. Given the required air flow rate, the AAV is selected such that the pressure loss does not exceed an established value, i.e., 0.3 inches of water. On this basis, the DURGO 50US, size 1-1/2" will satisfy stack sizes through 6 inch nominal diameter.

FIXTURE DFU	WATER QTY GPM	STACK DIA IN	r = Q/Q	AIR QTY CFM	RECOMMENDED DURGO AAV
25	38	3	0.207977	2.411877	1.5
50	50	3	0.245204	2.565202	1.5
75	59.6	3	0.272454	2.652547	1.5
100	67.5	3	0.29358	2.706999	1.5
100	67.5	4	0.185279	4.946938	1.5
200	90	4	0.220185	5.312442	1.5
300	108	4	0.245639	5.527829	1.5
400	127	4	0.270723	5.701903	1.5
200	90	5	0.154075	8.235513	1.5
400	127	5	0.189439	9.056682	1.5
600	156.6	5	0.214814	9.540064	1.5
800	183.2	5	0.236016	9.883621	1.5
1000	208	5	0.254698	10.14424	1.5
1000	208	6	0.190254	14.75454	1.5
2000	325	6	0.248672	16.36571	1.5
3000	433	6	0.295386	17.21466	1.5

NOTE: AAV size based on maximum pressure drop of 0.3" water.

The above data was developed by Thomas P. Konen, PE, Director of the Plumbing Laboratory at Stevens Institute of Technology, Department of Civil, Environmental and Costal Engineering, at Hoboken, New Jersey. This data is based on experimental data and measurements of the performance of the DURGO Air Admittance Valve which were also conducted at Stevens under the direction of Mr. Konen.

Issued 07/06/93

SECONDARY EXHIBITS

JB ENGINEERING AND CODE CONSULTING, P.C.
1661 Cardinal Drive • Munster, IN 46321
Phone: 219-922-6171
Fax: 219-922-6172

JULIUS A. BALLANCO, P.E.
President

ENGINEERING REPORT ON STUDOR AIR ADMITTANCE VALVES

December 15, 1992

Prepared for: Studor, Inc.
2030 Main Street
Dunedin, FL 34698
(813) 734-7750

Product Manufactured: Air Admittance Valves

Product Trade Name: Studor Mini-Vents, Studor Maxi-Vents

Purpose: The purpose of this engineering report is to identify the acceptable uses of Studor's air admittance valves to function as part of the vent for a sanitary drainage, waste, and vent (DWV) system.

Abstract: To prevent sewer gases from emanating into a building, every plumbing fixture connected to the sanitary drainage system is protected with a water trap seal. The fixture trap seal must be protected against pressure differentials in the drainage system that can cause the loss of the trap seal.

The common method of protecting the trap seal is the installation of a vent system that provides an open pipe connection to the outdoor air. The vent system is designed to protect the trap seal from both low pressure and high pressure conditions.

While the open piped vent system is the most widely accepted method of protecting a trap seal, other methods have also been developed. The air admittance valve is one such method that provides protection of the trap seal. When used properly, an air admittance valve system is equivalent to an open piped vent system.

Product Standard: The standards regulating air admittance valves are ASSE 1050 and ASSE 1051. ASSE 1051 is the standard regulating individual and branch type air admittance valves. ASSE 1050 is the standard regulating stack type air admittance valves. The standards were developed under the consensus process in accordance with ANSI procedures.

Product Description: The Studor Mini-Vent is an air admittance valve that conforms to both ASSE 1051 and ASSE 1050. The Studor Mini-Vent is designed for pipe sizes 1-1/4 inch through 2 inch. The Studor Maxi-Vent is an air admittance valve that conforms to both ASSE 1051 and ASSE 1050. The Studor Maxi-Vent is designed for pipe sizes 2 inch through 4 inch.

A full description of the Studor Mini-Vent and Maxi-Vent is contained in the manufacturer's technical literature.

Listings and Test Reports:

1. U.S. Testing Company, Tulsa, OK - Report No. EN91-0612, dated January 6, 1992
2. U.S. Testing Company, TUlsa, OK - Report No. EN90-0337, dated May 31, 1990
3. National Swedish Institute for Building Research, Project No. 52902100-8, dated September 8, 1980
4. French Government's Scientific Center for Building Construction, Test No. 19592, dated January 24, 1984
5. BOCA Research Report No. 86-61
6. SBCCI Compliance Report No. 9062
7. ASSE Seal of Studor Maxi-Vent and Mini-Vent to ASSE 1051, dated September 28, 1990

Technical Application: An air admittance valve is designed to permit air to enter the drainage system when the pressure within the piping system drops below atmospheric pressure. The valve thus prevents the fixture trap seal from being siphoned.

While an open piped vent system is designed to protect against both siphonage and high pressure conditions, the main concern is siphonage in a drainage system. High pressure, or back pressure, only occurs as a result of certain designs or conditions. The designs that result in a high pressure occurrence include flow in a drainage stack that is five (5) to eight (8) branch intervals or more in height and flow into a closed vessel, such as a sewage sump. The condition that results in high pressure is the power sewer cleaning equipment that uses high pressure to clean the public sewers. The equipment can cause a high pressure condition in the building sanitary drainage system.

The Studor Mini-Vent and Maxi-Vent air admittance valves are intended to be installed to protect the trap seal in areas where a high pressure, or back pressure, condition does not create an adverse effect. The limitations of use, therefore, restrict the Studor Mini-Vents and Studor Maxi-Vents to systems subject to siphonage conditions and minimal pressure conditions of plus one (1) inch of a water column or less.

Each building must also have a minimum of one (1) vent open to the outdoor air. However, the vent to the outdoors may be eliminated when an engineer determines the building's location is not subject to a high pressure condition from the public sewer cleaning equipment.

When a sanitary drainage system connects to a private sewage disposal system, the design of the private sewage disposal system must also be taken into consideration. Soil scientists require the first chamber of a septic tank to be open vented to the atmosphere.

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This is accomplished by either venting the private sewage disposal system, or through an open piped vent in the sanitary drainage system.

The air admittance valve can serve as a vent terminal for an individual vent, common vent, wet vent, circuit vent or branch vent for fixtures located on the same floor. The Studor Mini-Vent can be installed as the individual or branch vent terminal air admittance valve for any vent size, 1-1/4 inch, 1-1/2 inch, or 2 inch. The Studor Maxi-Vent can, likewise, be installed for vent sizes 2 inch, 3 inch, or 4 inch.

When a horizontal branch connects to a drainage stack more than four (4) branch intervals below the top of the stack, a relief vent is required on the horizontal branch. The relief vent must be located between the air admittance valve and the branch connection to the stack. The relief vent must connect to the vent stack and may serve as the vent for other fixtures. The relief vent is designed to relieve the pressure resulting from the flow in the drainage stack to maintain a pressure differential of plus or minus one (1) inch of a water column.

Both the Studor Mini-Vent and Maxi-Vent can be used as the vent terminal for a vent stack since they comply with ASSE 1050. The maximum height of the drainage stack permitted to be vented by an air admittance valve is six (6) branch intervals.

The stack type air admittance valve can also be used as the vent terminal for a single stack venting system. The maximum height permitted for a single stack venting system having an air admittance valve is also six (6) branch intervals.

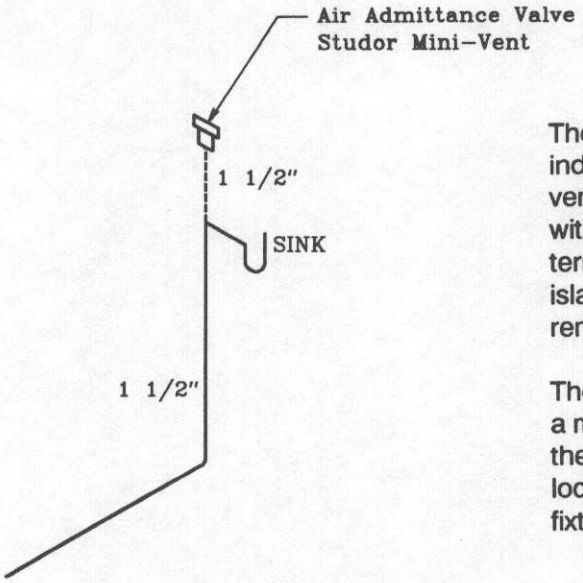
Acceptable Designs:

There are many designs that can utilize the Studor Mini-Vent and the Studor Maxi-Vent. Various layouts of acceptable designs are shown in diagrams on the following pages. The layouts are shown based on the type of venting system.

The size of the Studor Mini-Vent or Maxi-Vent is determined based on the pipe size required for the vent. The vent pipe size is based on being a minimum of one half the size of the required drainage pipe. For example, a 4 inch circuit vented horizontal branch would have a 2 inch circuit vent with a 2 inch Studor Mini-Vent as the vent terminal.

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Individual Vent

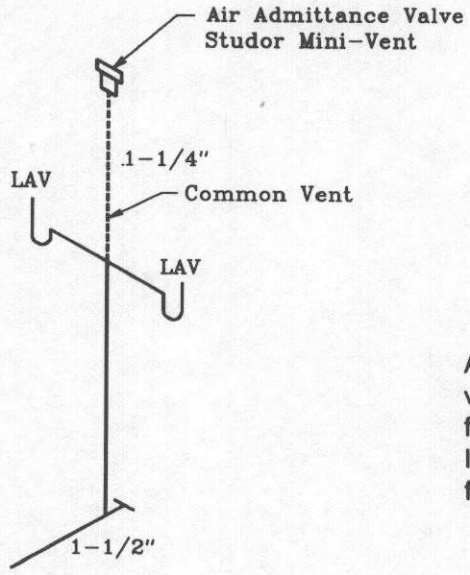


The simplest form of venting is an individual vent. A Studor Mini-Vent would vent the fixture trap. The individual vent with a Studor Mini-Vent as the vent terminal is an effective method of venting island fixtures or fixtures located in a remote location.

The air admittance valve must be located a minimum of 4 inches above the weir of the trap. However, the valve may be located below the flood level rim of the fixture being vented.

Figure 1

Common Vent

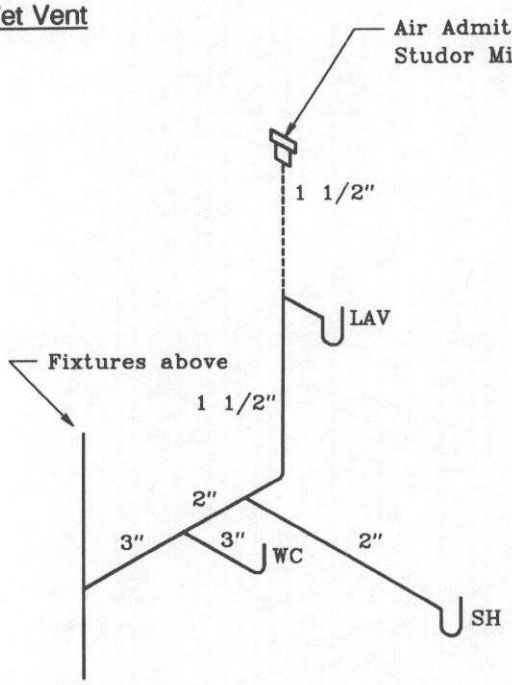


A common vent is similar to an individual vent. The vent serves two (2) or three (3) fixtures. The Studor Mini-Vent can be located in the close proximity to the fixtures being vented.

Figure 2

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Wet Vent



A wet vent is a single vent for one (1) or two (2) bathroom groups. There are different layouts for achieving the same venting concept.

A single bathroom group wet vent can be vented with a single Studor Mini-Vent.

Figure 3

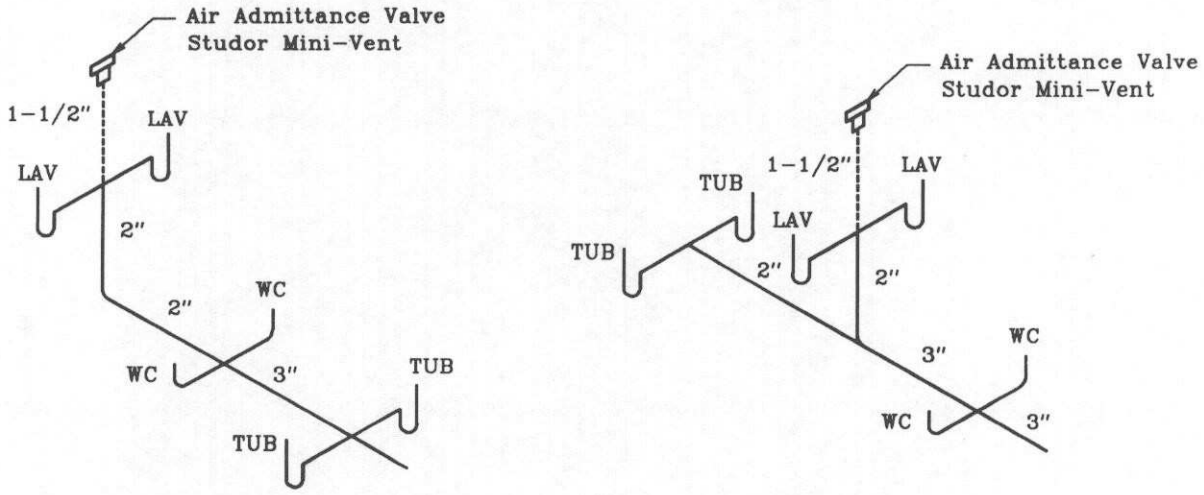


Figure 4

A double bathroom group, back-to-back, can be wet vented with a single Studor Mini-Vent connecting as the vent terminal. The diagram on the left shows a wet vent system acceptable by the BOCA® National Plumbing Code and the CABO One and Two Family Dwelling Code. The diagram on the right shows a wet vent system permitted by BOCA®, CABO, and SBCCI Standard Plumbing Code.

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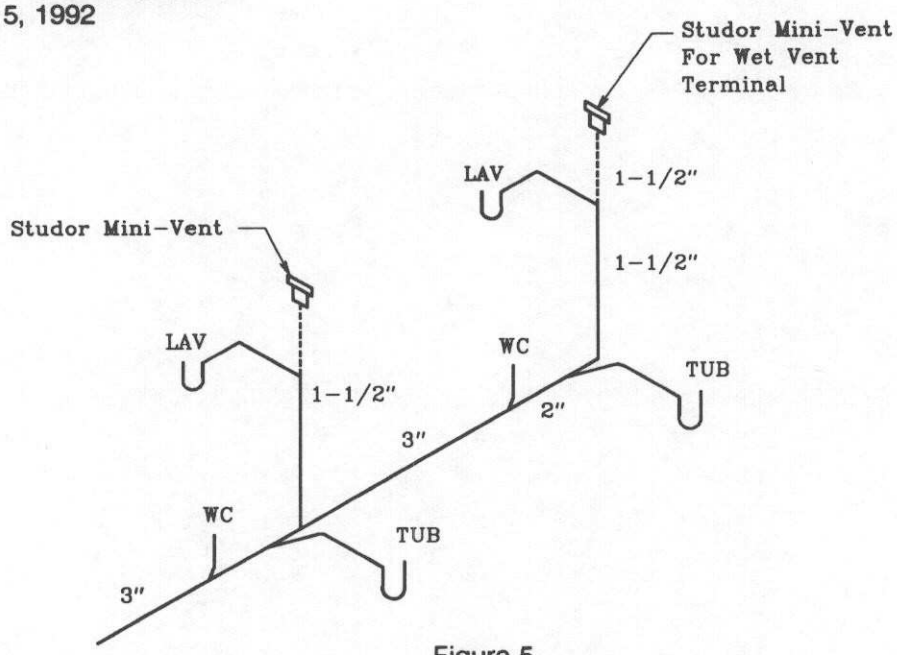
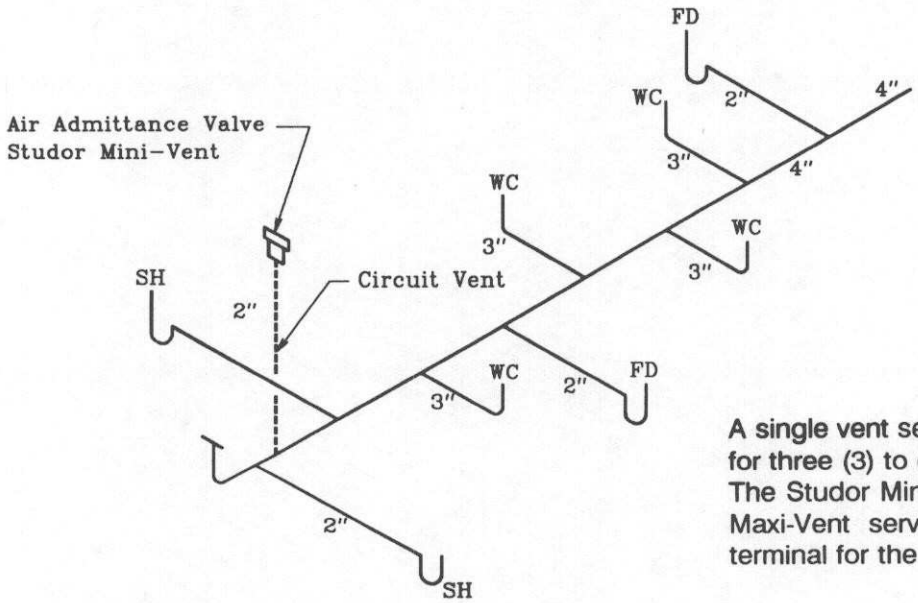


Figure 5

When the piping arrangement for two bathroom groups results in two (2) vent connections; two (2) Studor Mini-Vents can serve as vent terminals.

Circuit Vent



A single vent serves as the vent for three (3) to eight (8) fixtures. The Studor Mini-Vent or Studor Maxi-Vent serves as the vent terminal for the circuit vent.

Figure 6

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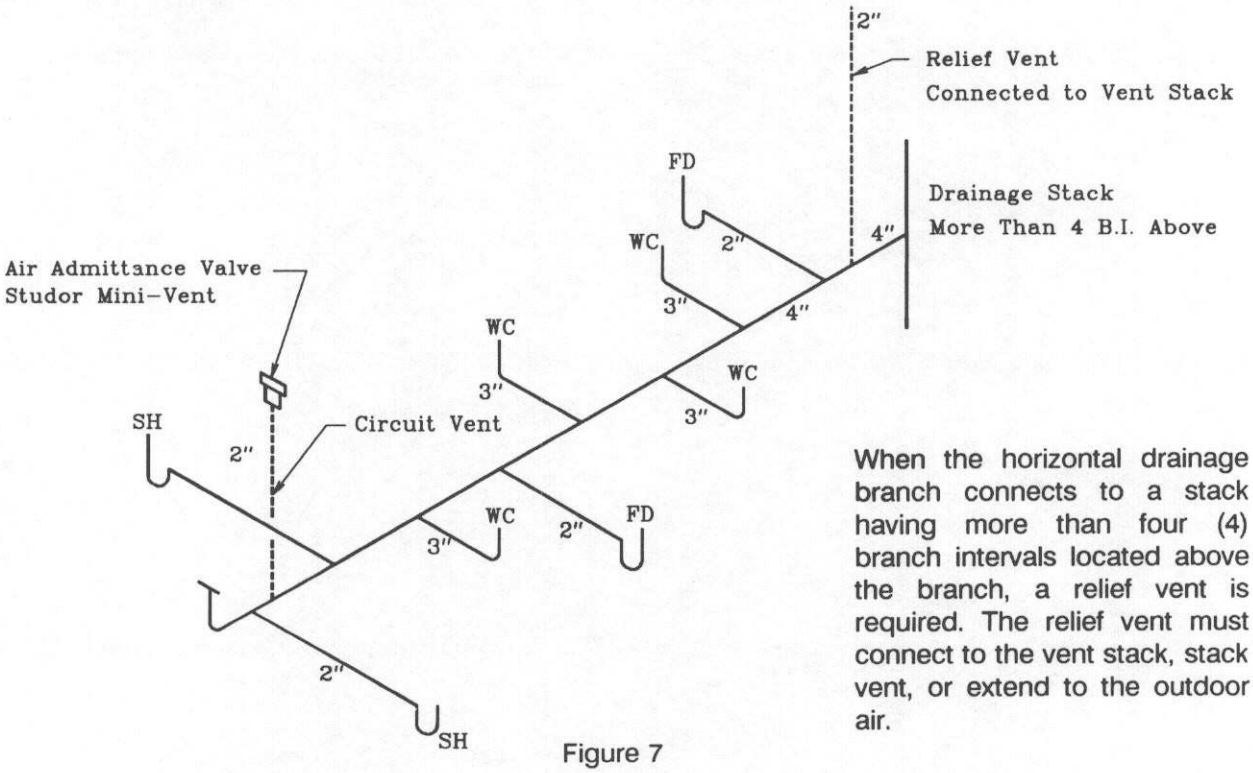
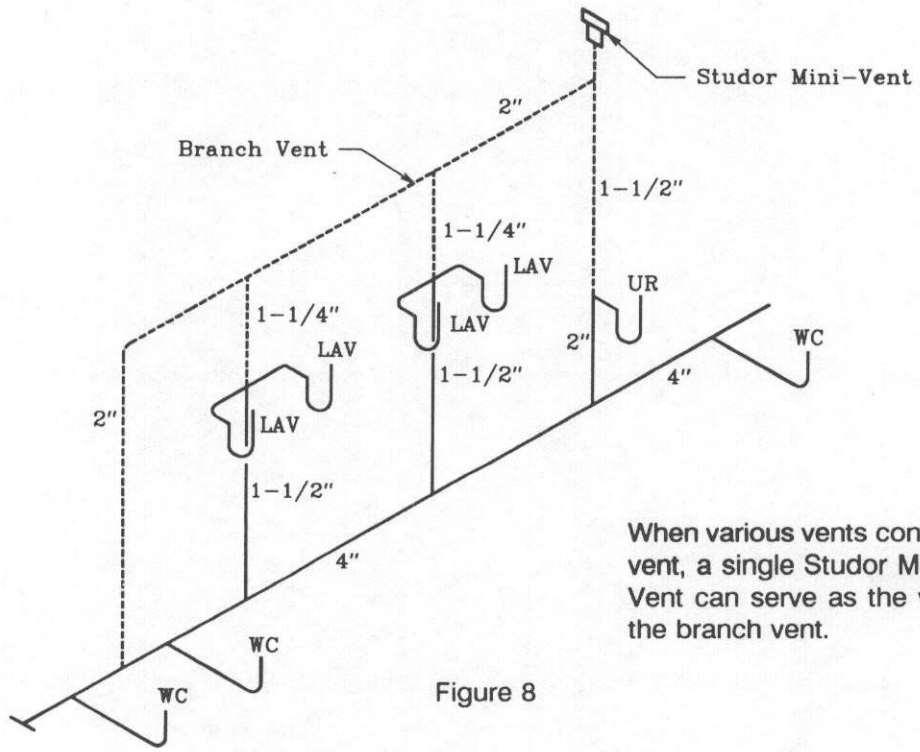


Figure 7

When the horizontal drainage branch connects to a stack having more than four (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



When various vents connect to a branch vent, a single Studor Mini-Vent or Maxi-Vent can serve as the vent terminal for the branch vent.

Figure 8

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Multiple Venting Arrangements

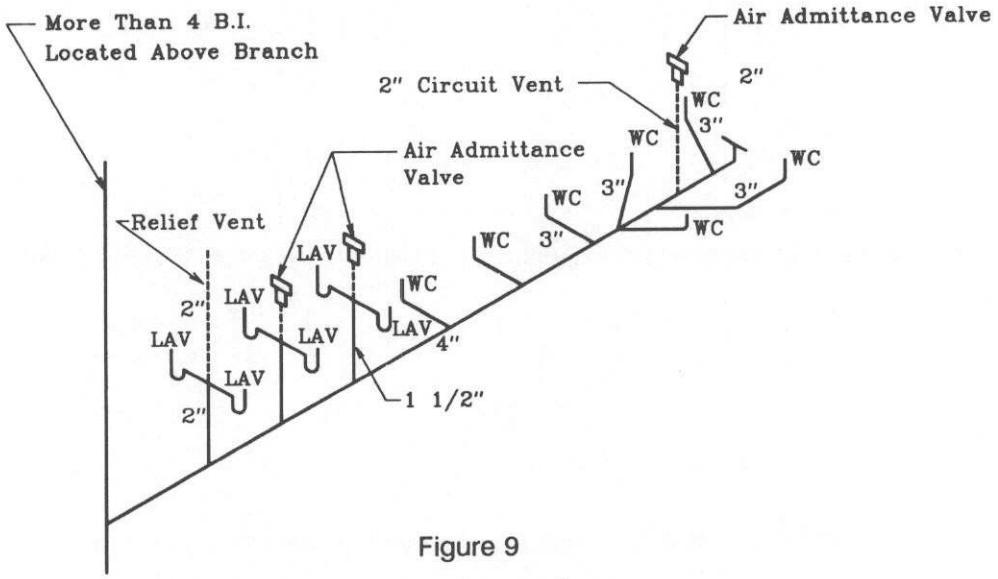
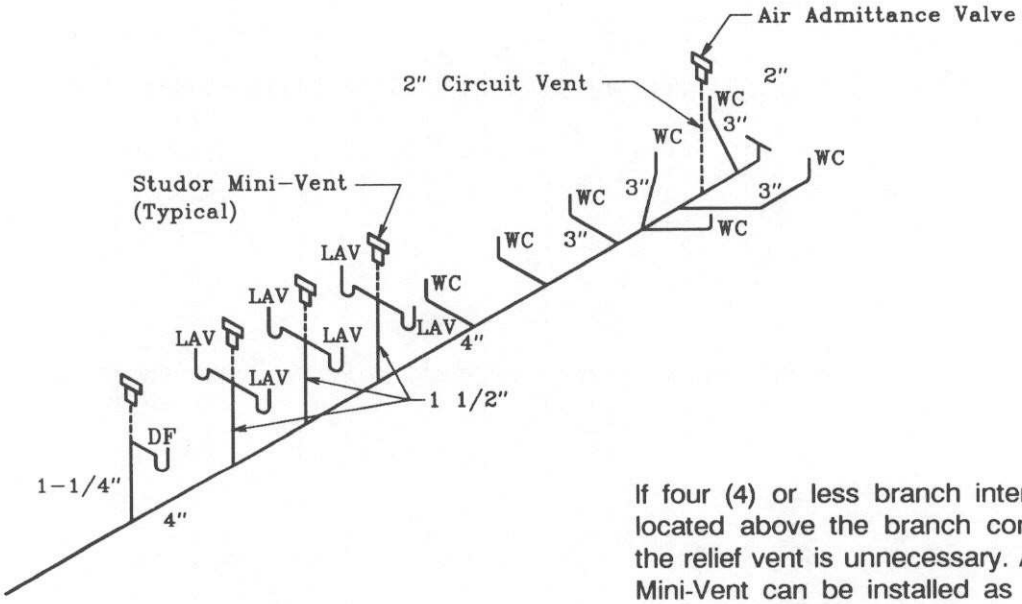


Figure 9

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



If four (4) or less branch intervals are located above the branch connection, the relief vent is unnecessary. A Studor Mini-Vent can be installed as the vent terminal for the two (2) lavatories.

Figure 10

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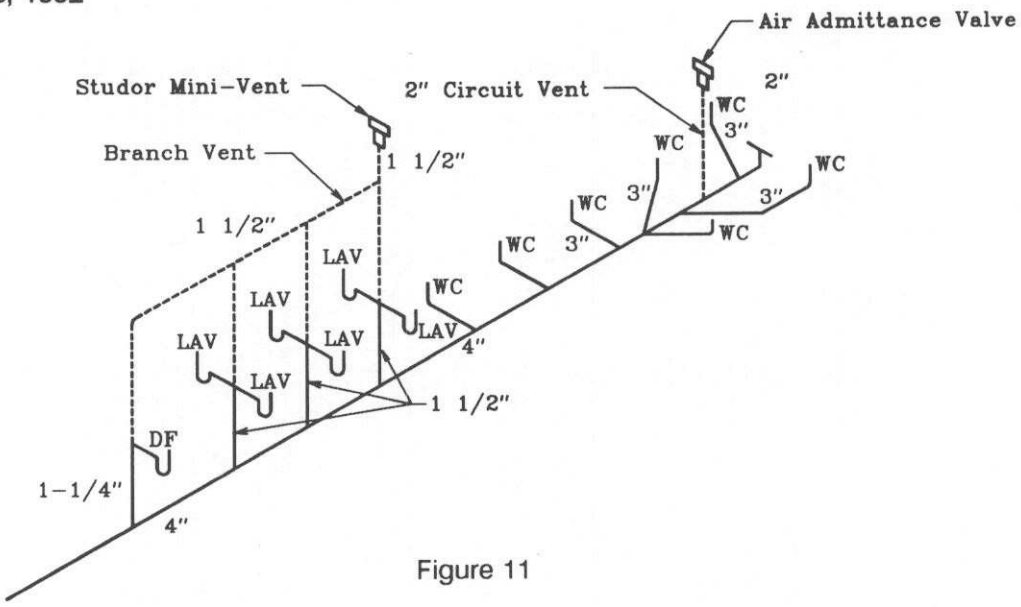


Figure 11

The individual and common vents may connect to a branch vent with a single air admittance valve serving as a vent terminal.

Vent Stack - Stack Vent

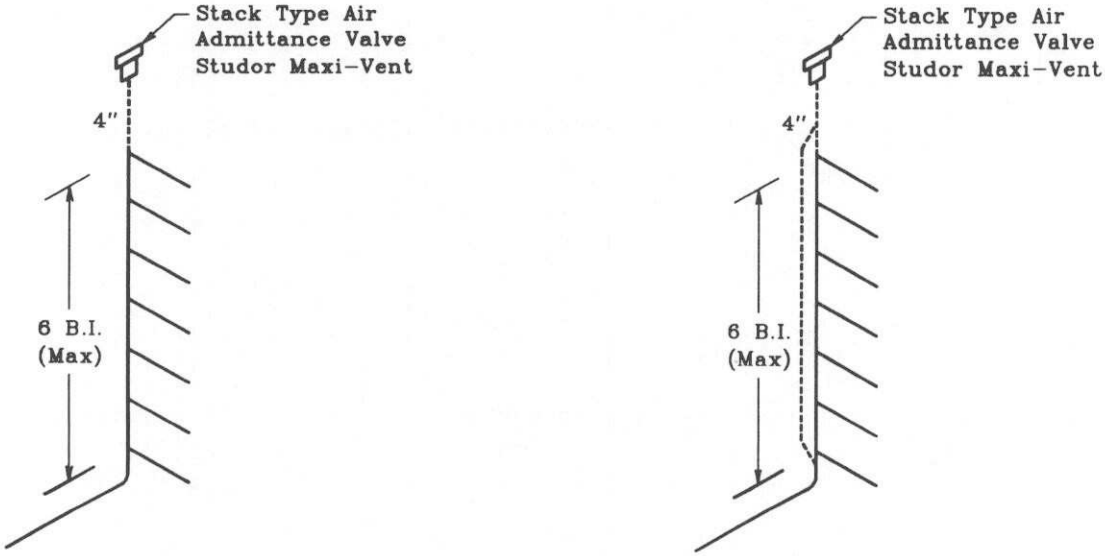


Figure 12

The stack type air admittance valve, Studor Maxi-Vent or Studor Mini-Vent, can serve as the vent terminal for a vent stack or stack vent. The maximum height of the drainage that is vented with an air admittance valve is six (6) branch intervals.

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Single Stack Venting System

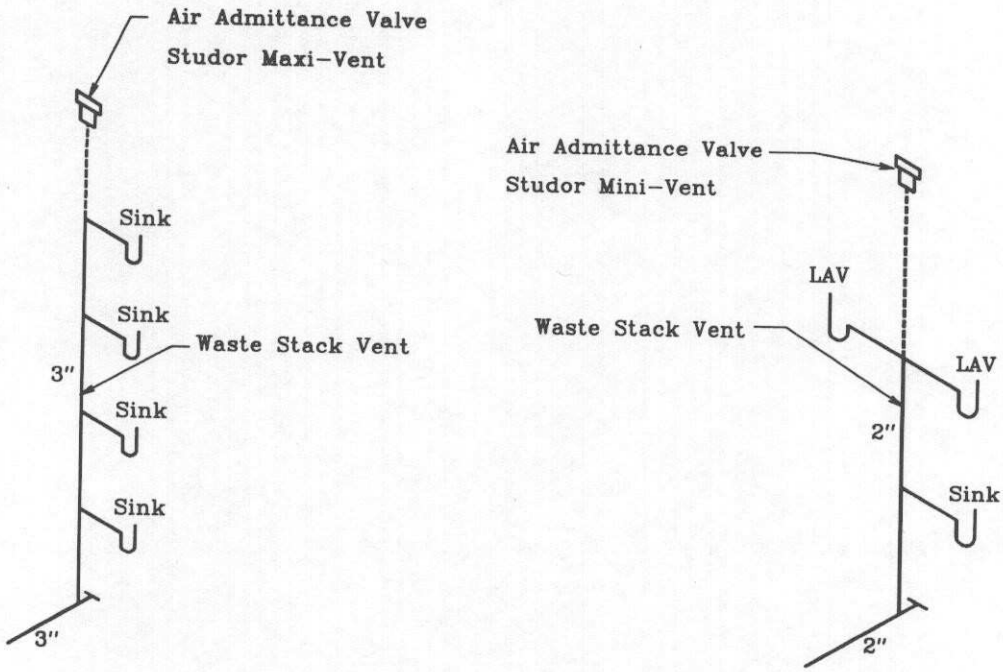


Figure 13

The Studor Maxi-Vent or Studor Mini-Vent can serve as the vent terminal for a single stack venting system. The maximum height of the single stack venting system with an air admittance valve is six (6) branch intervals.

Installation Requirements: The Studor Mini-Vent and Studor Maxi-Vent must be installed in accordance with the manufacturer's installation instructions. Failure to follow the manufacturer's instructions may result in the improper operation of the valve.

In addition to the manufacturer's installation instructions, the following requirements shall apply:

1. The Studor Mini-Vent and Studor Maxi-Vent shall be located a minimum of four (4) inches above the weir of the fixture trap.

2. Each Studor Mini-Vent and Studor Maxi-Vent shall be accessible for service, repair, or replacement.

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3. The Studor Mini-Vent and Studor Maxi-Vent shall be located to allow the adequate air to enter the valve. When located in a wall space or attic space, ventilation openings shall be provided, opening into the space.

4. The Studor Mini-Vent and Studor Maxi-Vent shall be installed in the vertical upright position. The maximum offset from the vertical position shall not exceed fifteen (15) degrees.

5. The vent shall connect to the drain with a vertical connection to maintain an unblocked opening in the piping to the Studor Mini-Vent or Maxi-Vent.

6. A minimum of one vent shall extend outdoors to the open air for every building plumbing drainage system unless specifically engineered.

7. The Studor Mini-Vent and Studor Maxi-Vent shall only be installed as a branch vent terminal for fixtures located on the same floor.

8. The use of the Studor Mini-Vent and Studor Maxi-Vent as a stack-type air admittance valve shall be approved as an alternative by the code official.

9. Studor Maxi-Vents installed in an attic area shall be located a minimum of six (6) inches above any ceiling insulation.

10. The Studor Maxi-Vent shall have the inner lip of the gasket cut off and removed where used on a connection to 4 inch vent.

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 shall 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 a fixture. The relief vent shall connect to the vent stack, stack vent, or extended outdoors to the open air.

Limitations of Use:

The following limitations of use shall apply to the Studor Mini-Vent and Studor Maxi-Vent:

1. Where located in areas subject to freezing temperatures the Studor Mini-Vent and Maxi-Vent shall have the polystyrene packing container installed over the top of the valve.

2. The Studor Mini-Vent and Studor Maxi-Vent shall not be installed as a vent terminal for any sump vent.

3. The Studor Mini-Vent and Studor Maxi-Vent shall not be used to vent a special waste or chemical waste system.

4. The Studor Mini-Vent and Studor Maxi-Vent shall not be located in a supply or return plenum.

5. The maximum height of drainage stack being vented by a stack type air admittance valve shall be 6 branch intervals.

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Summary: The Studor Mini-Vent and Studor Maxi-Vent can be used as individual and branch type air admittance valves and stack-type air admittance valves when approved as an alternative by the code official. The code official may use this engineering report as supporting documentation to approve the acceptance of the Studor Mini-Vent and Studor Maxi-Vent as a stack type air admittance valve.

Engineering Certification: This engineering report was prepared by Julius Ballanco, P.E., President, JB Engineering and Code Consulting, P.C., licensed as a Professional Engineer in the State of Indiana, License #60900631.

Respectfully submitted,

Julius Ballanco, P.E.
President



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United States Testing Company, Inc.
1341 NORTH 108th EAST AVENUE • TULSA, OKLAHOMA 74116 • 918-437-8333 • Fax: 918-437-8487

REPORT OF TEST

CLIENT: Studor Inc.
2030 Main Street
Dunedin, FL 34698

Report No.: TS93-0515.1
Date: 9/10/93

Attn: Sture Ericson

SUBJECT: Evaluation of Air Admittance Valves for Compliance with ASSE 1050-91.

ITEMS TESTED

Samples of two sizes of air admittance valves were submitted by the Client.

1. Maxi-Vent: fits 4", 3" and 2" piping
2. Mini-Vent: fits 2", 1-1/2" and 1-1/4" piping

TEST PROCEDURE

The units were tested in accordance with ASSE Standard 1050-91.

CONCLUSION

Both units comply with the requirements of ASSE 1050-91.

Dale E. Holloway

DEH/dh

Dale E. Holloway, Manager
Product Evaluation

SGS Member of the SGS Group (Société Générale de Surveillance)

• Biology • Chemistry • Environmental • Materials • Facilities in Principal Cities •

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TEST RESULTS

1.3.3 Size: **Reference**

Maxi-Vent: Sizes 4", 3" and 2"
Mini-Vent: Sizes, 2", 1-1/2" and 1-1/4"

1.3.4 Temperature Range: **PASS**

See 2.6, below.

1.3.5 Flow Capacity: **Pass**

See 2.5, below.

1.4.1 Protection of Moving & Sealing Components: **Pass**

The inverted sealing member and the insect screen are judged to provide adequate protection from foreign objects which might affect the sealing function of the device.

1.4.2 Structural Strength: **Pass**

The device withstood the specified tests and is judged to withstand the stresses encountered in normal venting service.

1.4.3 Mechanical Function: **Pass**

As shown by the test data of Sections 2.4 and 2.5, below, the device does open with negative differential pressure and close by gravity with zero or positive pressure.

1.4.3.1 Leakage: **Pass**

See 2.4, below.

1.4.3.2 Connections: **Pass**

It is not possible to run a pipe sufficiently far into the device to restrict air flow or to interfere with working parts.

1.4.4.2 Dissimilar Metals: **Pass**

There are no metals used in the device.

1.4.4.3. Internal Metallic Parts: **Pass**

There are not metals used in the device.

1.4.5 Connections: **Pass**

1.4.5.3. Solvent Cement Joints: **Pass**

The joints are intended for solvent cement joints or gasket joints.

1.5.1 Marking of Device: **Pass**

	Maxi-Vent	Mini-Vent
Manufacturer's Name/Mark	Studor	Studor
Model Number	9062 Maxi	9062 Mini
"ASSE 1050"	ASSE 1050	ASSE 1050
Marking Method	Molded	Molded

1.5.2 Packaging: **Pass**

	Maxi-Vent	Mini-Vent
Manufacturer's Name/Mark	Studor	Studor
Model Number	9062 Maxi	9062 Mini
Type of device, capacity, stack diameter, height	Pass	Pass

1.5.3 Installation Instructions: **Pass**

Adequate instructions, which include the limitations of Section 1.5.4, are packed with the units.

2.1 Drawings: **Pass**

Necessary drawings and information were supplied.

2.2.1 Quantity: **Pass**

Three production samples of each device were supplied.

2.3 Low Pressure Test: **Pass**

Both units withstood the low pressure test with no measurable pressure loss.

2.4.1 Response Test: **Pass**

	Maxi-Vent	Min-Vent	Require-ments
Opening Time, T_2-T_1, sec.:	<0.1	<0.1	≤0.5
Max. Pressure, in. H^2O:	<0.2	<0.2	≤0.3

2.4.2 Capacity: **Pass**

	Maxi-Vent	Min-Vent
Air Flow at 1/2 in. H^2O, cfm:	350	80
Requirement, cfm:	250, min.	42, min.
Water Loss in Trap Seal:	0.3	0.3
Requirement, in.:	0.5, max.	0.5, max.

2.5.2 High Temperature Extreme: **Pass**

After 250,000 cycles of operation following 8 hours exposure to 150 degrees F, neither device showed any indication of performance degradation.

2.5.4 Low Temperature Extreme: **Pass**

After 250,000 cycles of operation following 8 hours exposure to -40 degrees F, neither device showed any indication of performance degradation.

2.5.6 Frost Closure Test: **Pass**

	Maxi-Vent	Min-Vent	Require-ments
Valve Operation:	Yes	Yes	Yes
Max. Trap Seal Loss, in H^2O, in.:	0.3	0.3	0.5, max.

United States Testing Company, Inc.

1341 NORTH 108th EAST AVENUE • TULSA, OKLAHOMA 74116 • 918-437-8333 • Fax: 918-437-8487

REPORT OF TEST

CLIENT: Studor Inc.
2030 Main Street
Dunedin, FL 34698

Report No.: TS93-0515.2
Date: 9/10/93

Attn: Sture Ericson

SUBJECT: Testing of Air Admittance Valves.

ITEMS TESTED

Samples of two sizes of air admittance valves were submitted by the Client.

1. Maxi-Vent: fits 4", 3" and 2" piping
2. Mini-Vent: fits 2", 1-1/2" and 1-1/4" piping

TEST PROCEDURE

The units were tested as Type A and Type B in accordance with ASSE Standard 1051-90.

CONCLUSION

As indicated by the results below, both units comply with the requirements of ASSE Standard 1051-90 as Type A and Type B valves.

Dale E. Holloway

Dale E. Holloway, Manager
Product Evaluation

DEH/dh

SGS Member of the SGS Group (Société Générale de Surveillance)

• Biology • Chemistry • Environmental • Materials • Facilities in Principal Cities •

UNITED STATES TESTING COMPANY, INC. REPORTS AND LETTERS ARE FOR THE EXCLUSIVE USE OF THE CLIENT TO WHOM THEY ARE ADDRESSED AND THEY AND THE NAME OF THE UNITED STATES TESTING COMPANY, INC., OR ITS SEALS OR INSIGNIA ARE NOT TO BE USED UNDER ANY CIRCUMSTANCES IN ADVERTISING TO THE GENERAL PUBLIC AND THEIR COMMUNICATION TO ANY OTHERS OR THE USE OF THE NAME OF UNITED STATES TESTING COMPANY, INC. MUST RECEIVE OUR PRIOR WRITTEN APPROVAL. OUR REPORTS APPLY ONLY TO THE STANDARDS OR PROCEDURES IDENTIFIED, TO THE TESTS CONDUCTED, AND TO THE SAMPLE(S) TESTED AND/OR INSPECTIONS MADE. UNLESS OTHERWISE SPECIFIED, THE TEST AND/OR INSPECTION RESULTS ARE NOT INDICATIVE OR REPRESENTATIVE OF THE QUALITIES OF THE LOT FROM WHICH THE SAMPLE WAS TAKEN OR OF APPARENTLY IDENTICAL OR SIMILAR PRODUCTS AND NOTHING CONTAINED IN OUR REPORTS SHALL BE DEEMED TO IMPLY OR MEAN THAT UNITED STATES TESTING COMPANY, INC. CONDUCTS ANY QUALITY CONTROL PROGRAM FOR THE CLIENT TO WHOM THE REPORT IS ISSUED. SAMPLES NOT DESTROYED IN TESTING ARE RETAINED A MAXIMUM OF THIRTY DAYS AT WHICH TIME THEY MAY BE SHIPPED BACK TO THE CLIENT.

TEST RESULTS

1.3.2 Class: **Reference**

Both units were tested as Type A and Type B.

1.3.3 Size: **Reference**

Maxi-Vent: Sizes 4", 3" and 2"
Mini-Vent: Sizes 2", 1-1/2" and 1-1/4"

1.4 Construction: **Pass**

The design and construction satisfies the requirements of Section 1.4.

1.5.1 Marking of Device: **Pass**

Both devices are marked with the manufacturer's name, model number and the ASSE 1051 designation.

1.5.2 Package Marking: **Pass**

The packaging includes the manufacture's name, model description, pipe sizes and the fixture unit limitations.

1.5.3 Installation Instructions: **Pass**

Adequate instructions are packed with the units.

1.5.4 Installation Requirements: **Pass**

Adequate requirements are packed with the units.

2.3 Noise: **Pass**

No objectionable noises were generated by the devices.

2.4 Low Pressure Test: **Pass**

Both units withstood the low pressure test with no measurable leakage.

2.5.1 Capacity Test, Single Fixture: **Pass**

When tested in accordance with Section 2.5.1, both units showed no loss of trap seal.

2.5.2 Branch Type Air Admittance Valves: **Pass**

When tested in accordance with Section 2.5.2, both units showed no loss of trap seal in excess of 1/2 inch for the conditions listed.

Unit	Stack	Branch
Small	3"	1/1-2"
Small	3"	2"
Large	3"	2"
Large	3"	3"
Large	4"	4"

2.6.2 High Temperature Extreme: **Pass**

After 50,000 cycles of operation following 8 hours exposure to 150 degrees F, neither device showed any indication of performance degradation.

2.6.4 Low Temperature Extreme: **Pass**

After 250,000 cycles of operation following 8 hours exposure of -40 degrees F, neither device showed any indication of performance degradation.

SOUTHERN BUILDING CODE CONGRESS INTERNATIONAL, INC.

900 Montclair Road
Birmingham, Alabama 35213

The Committee on Compliance in review of the data submitted finds that, in their opinion, the product, material, system or method of construction specifically identified in this report conforms with or is a suitable alternate to that specified in the standard codes, SUBJECT TO THE LIMITATIONS IN THIS REPORT.

The Committee on Compliance has reviewed the data submitted for compliance with the Standard Plumbing Code and submits to the Building Official or other authority having jurisdiction the following report. Portions of this report were previously included in compliance report #8751.

REPORT NO.: 9062

EFFECTIVE DATE: 8-1-90

EXPIRES: See current SBCCI COMPLIANCE REPORT LISTING

CATEGORY: PLUMBING MATERIALS AND SYSTEMS

SUBMITTED BY:

STUDOR INCORPORATED a/k/a
STUDOR TRADING, LTD
12605 AUTOMOBILE BOULEVARD
CLEARWATER, FLORIDA 34622

I. PRODUCT TRADE NAME

Studor® (Maxi-Vent® and Mini-Vent®) Air Admittance Valves

II. PERFORMANCE OF PRODUCT FOR WHICH EVALUATION IS REQUESTED

Alternative to plumbing vent and vents through the roof

III. USES

Studor Maxi-Vents are installed on the top of stack vents or vent stacks inside the building to permit air to enter the pipework when negative pressures occur thus protecting the traps. Under a positive pressure within the system the valves insure air tightness, preventing foul air from entering the building.

Studor Mini-Vents are for connection to fixture drains to prevent excessive water loss from trap seals by self and induced syhphonage arising from water flow in small diameter branch discharge pipes. The Studor Mini-Vents are used as an alternate to individual or common vents for a water closet, lavatory, bathtub, shower or sink.

IV. DESCRIPTION

The Studor Maxi-Vent comprises four acryonitrile-butadiene-styrene (ABS) components (ie. lid, upper body, lower body and diaphragm carrier), three synthetic rubber components (ie. diaphragm, O-ring seal and connector) and two low density polyethylene (LDPE) insect nets. See Figure 1.

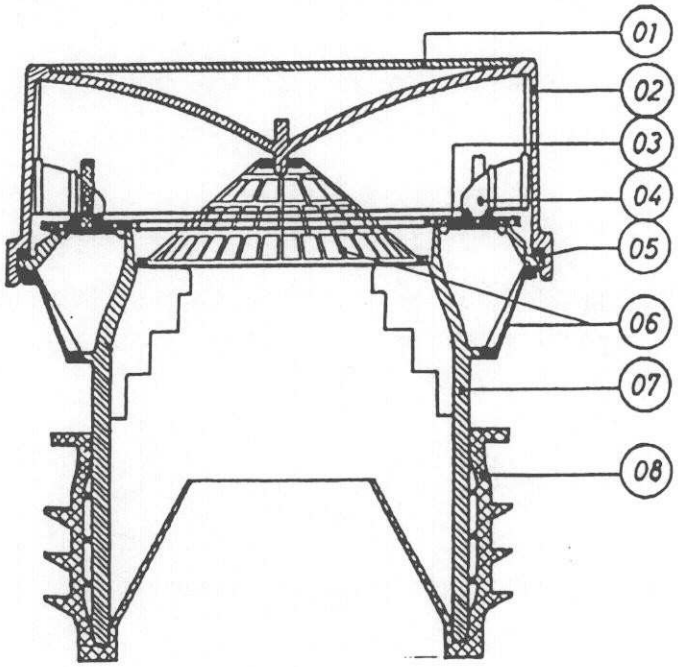
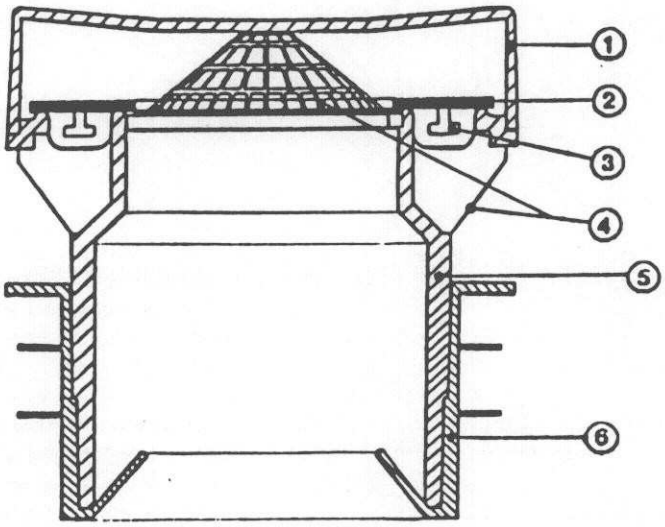


Figure 1 - Studor Maxi-Vent air admittance valve

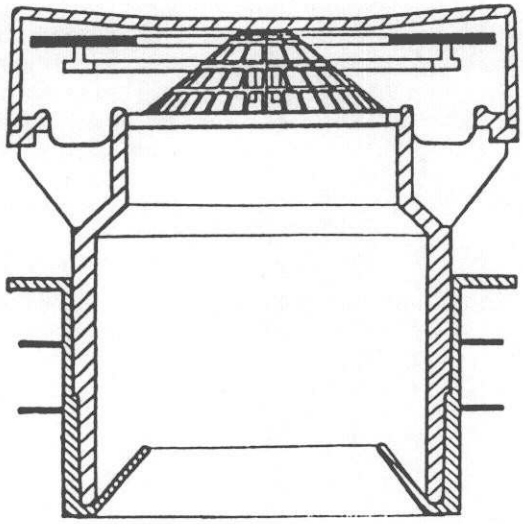
1. Lid
2. Upper body
3. Diaphragm
4. Diaphragm carrier
5. O ring
6. Insect nets
7. Lower body
8. Rubber connector

The Studor Mini-Vent comprises three ABS components (ie. valve cover, diaphragm carrier and lower body), a synthetic rubber diaphragm, an ethylene vinyl acetate (EVA) connector and two LDPE insect nets. The valve cover and lower body are fusion welded together. See Figure 2.



Section with valve shut

1. Valve cover
2. Diaphragm
3. Diaphragm carrier
4. Insect nets
5. Lower body
6. Connector



Section with valve open

Figure 2 - Studor Mini-Vent air admittance valve

An expanded polystyrene cover is supplied with each Studor Maxi-Vent to prevent condensation from forming within the valve under cold service conditions. The cover also serves as a packaging box.

V. INSTALLATION

Installation must be in accordance with the manufacturer's instructions. The Studor Maxi-Vent is installed at the top of the vent stack or stack vent a minimum of six inches above the flood rim of the highest fixture served by the vent. The Studor Maxi-Vent must be located within an accessible ventilated attic space, or other accessible location that will permit the unrestricted flow of air into the valve. The Studor Maxi-Vent is supplied with a synthetic rubber connector which enables the valve to be push fitted into a 4" diameter or onto a 2" diameter PVC pipe. It may also be solvent-welded to a 3" diameter PVC pipe in accordance with manufacturer's instructions. The Studor Maxi-Vent must be installed in a vertical position.

The Studor Mini-Vent is push fit onto 1-1/4" diameter pipes. The Mini-Vent may also be connected onto a 1-1/2" diameter PVC pipe by using a hubless coupling. It may also be solvent-welded in accordance with manufacturer's instructions. To prepare pipe for fitting, the pipe must be cut square to its axis and any burrs removed. The pipe should then be marked with a line indicating the correct insertion depth in accordance with the manufacturer's instructions, the pipe end smeared with silicone lubricant and the valve fitted. The Studor Mini-Vent must be installed within a horizontal distance from the fixture trap equal to the distance permitted in the code between a trap and its vent. The valve must be a minimum of 4" above the trap arm. The Studor Mini-Vent must be located in an easily accessible area.

VI. SUBSTANTIATING DATA

1. Certificate of independence from the National Swedish Institute for Building Research.
2. Project No. 52902142-0 from the National Swedish Institute for Building Research of "Mini Studor" air admittance valve dated December 7, 1982.
3. Project No. 52902100-8 from the National Swedish Institute for Building Research of Studor Air Admittance Valves (90mm) dated September 8, 1980.
4. British Board of Agreement Certificate No. 84/2139.
5. Scientific and Technical Center for Building Construction (French Government) Test #19592, dated January 24, 1984.
6. U.S. Testing Company, Inc. #TS89-0139 and TS89-0405, dated July 13, 1989.

VII. REFERENCES TO THE STANDARD CODES

Standard Plumbing Code - 1988 Edition with 1990 Revisions

Section 102.7	Alternate Materials and Methods
Section 602.14	Joints for Plastic Pipe and Fittings
Section 1402	Protection of Trap Seal
Section 1404	Vent Terminal

VIII. COMMITTEE FINDINGS

The Committee on Compliance in review of the data submitted finds that, in their opinion, Studor Incorporated's Maxi-Vent and Mini-Vent Air Admittance Valves conform with or are suitable alternates to that specified in the Standard Plumbing Code or Supplements thereto.

IX. LIMITATIONS

1. The Studor Maxi-Vent and Studor Mini-Vent Air Admittance Valves shall be installed in accordance with this report and the manufacturer's installation instructions.
2. The pipe material and sizes to which the valves are connected must be in accordance with this approval and the manufacturer's recommendation.
3. The valves shall not be installed in spaces used as supply or return air plenums for HVAC systems.
4. The size of drainage, waste and vent piping must be in accordance with The Standard Plumbing Code.
5. A maximum of nine buildings in succession may be vented with air admittance valves when connecting to a public sewer system. Every tenth building shall have a conventional opened piped vent terminal.
7. Plumbing systems must be designed by an engineer when using the Studor Maxi-Vent or Mini-Vent Valves without at least one conventional opened pipe vent terminal per building drain.
8. Plumbing stacks are limited to five stories in height or five branch intervals.
9. The Studor Maxi-Vent should not be used when the soil stack provides the only ventilation for septic tanks.
10. The Studor Mini-Vent may be used as an alternate venting system to branch vents and circuit vents serving no more than six fixture units per branch and not more than 5 branch intervals per stack.

X. IDENTIFICATION

The Studor Mini-Vent and Studor Maxi-Vent shall be identified by molded lettering on the lid, indicating the name of the product, the manufacturer's name, the country where manufactured, the Southern Building Code Congress International Seal and the number of this report.

XI. PERIOD OF ISSUANCE

SEE CURRENT SBCCI COMPLIANCE REPORT LISTING FOR STATUS OF THIS COMPLIANCE REPORT.

Report prepared by:

James D. Connell, P.E.
Manager of Plan Review

Certified by:

Billy R. Manning, P. E.
Director of Engineering and Education

COMMITTEE ON COMPLIANCE
Southern Building Code Congress International

C. Curtis Mann, P.E., Chairman
New Orleans, Louisiana

David E. Buck, P.E.
Alcoa, Tennessee

Freeman L. Wood
Fayetteville, Arkansas

FINAL REPORT

PRINTED JANUARY, 1993

RESEARCH REPORT NO. 92-46

CATEGORY 30 - PLUMBING MATERIALS, DEVICES AND SYSTEMS

BOCA® EVALUATION SERVICES, INC.

4051 West Flossmoor Road • Country Club Hills, Illinois 60478-5795 • 708/799-2305

STUDOR MINI-VENT AND MAXI-VENT AIR ADMITTANCE VALVES

STUDOR, INC.
2030 MAIN STREET
DUNEDIN, FL 34698

1.0 DESCRIPTION OF EVALUATION

This report is an evaluation of the Studor Maxi-Vent and Mini-Vent as air admittance valves for use in plumbing vent systems.

2.0 DESCRIPTION AND USE OF PRODUCT

The Studor air admittance valves are intended for use as an alternative to a vent pipe that extends to the outdoor air. The valves are one-way valves designed to allow air to enter the plumbing drainage system when negative pressures develop. The valves close by gravity and seal the vent terminal when the internal drain pipe pressure is equal to or exceeds atmospheric pressure (see Figure 1).

The Studor Mini-Vent and Maxi-Vent air admittance valves are used as vent terminals for individual, common, wet, circuit, branch and stack vents provided at least one (1) vent which extends to the outside atmosphere is connected to the same drainage system that the air admittance valve serves. The capacity of the Studor air admittance valves are dictated by the size and capacity of the vent pipe to which they are connected.

The Studor Mini-Vent air admittance valve is constructed of acrylonitrile butadiene styrene (ABS) plastic. A factory-installed polyethylene screen is used to prevent foreign objects from entering the valve's air ports. The Mini-Vent's diaphragm is elastomeric and the connector seal is constructed of ethylene vinyl acetate. See Figure 2. The Studor Mini-Vent is designed to fit on nominal 1 1/4-, 1 1/2-, or 2-inch PVC or ABS plastic pipe. The Mini-Vent is equipped with a connector which allows push-fit installations on 1 1/4 inch piping or in a 2 inch pipe fitting. The 1 1/2 inch pipe size may be solvent welded or connected by means of a hubless coupling.

The Maxi-Vent air admittance valve is constructed of acrylonitrile butadiene styrene (ABS) plastic. A polyethylene screen is used to prevent foreign objects from entering the valve's air ports. The Maxi-Vent's diaphragm, o-ring and connector are elastomeric. See Figure 3. The Maxi-Vent is designed to fit on nominal 2, 3 and 4-inch PVC or ABS plastic pipe. The Maxi-Vent is installed either by push fit installation on 2 inch pipe, in 4 inch pipe or through the use of hubless coupling or solvent weld installation methods on 3 inch pipe. The inner lip of the connector is removed when used in a 4 inch pipe.

3.0 CODE ANALYSIS OF SUBMITTED INFORMATION

The following information was submitted by the proponent for demonstration of compliance with the respective code sections listed above each item of information. The basis is the 1993 BOCA National Plumbing Code.

3.1 AIR ADMITTANCE VALVE FOR INDIVIDUAL, BRANCH AND CIRCUIT VENTING APPLICATIONS

CODE SECTION P-1808.1 Approval: This section requires air admittance valves intended for use in individual, branch and circuit vent applications to conform with the requirements of ASSE 1051; Performance Requirements for Air Admittance Valves for Plumbing Drainage Systems, Fixture and Branch Devices.

INFORMATION SUBMITTED:

3.1.1 Report Number EN90-0337, dated May 31, 1990, issued by United Stated Testing Company, Inc., in accordance with ASSE 1051. The results show that the Studor Maxi-Vent and Mini-Vent air admittance valves comply with the requirements of ASSE 1051.

Please contact BOCA Evaluation Services, Inc., with any questions you may have regarding this report. Additionally, please contact us if you have any information on the performance of the product described herein which is contrary to this report. This report is subject to the limitations listed herein and to the specific product, data and test reports submitted by the applicant requesting this report. Independent tests were not performed by BOCA Evaluation Services, Inc., and BOCA Evaluation Services, Inc., specifically does not make any warranty, either expressed or implied, as to any findings or other matter in this report or as to any product covered by this report. Evaluation reports are not to be construed as representing aesthetics or any other attributes not specifically addressed nor as an endorsement or recommendation for the use of the subject of the report. This disclaimer includes, but is not limited to, merchantability.

3.2 AIR ADMITTANCE VALVE FOR VENT STACK AND STACK VENT APPLICATIONS

CODE SECTION P-107.4 Alternative materials and equipment: This section allows the use of alternative materials and equipment not specifically prescribed by the code, provided any such alternative is found to provide, for the purpose intended, at least the equivalent of that permitted by the code.

CODE SECTION P-903.2 Trap Seal: This section requires all vent systems to be designed and installed so that the trap seal is subjected to a maximum pneumatic pressure differential equal to 1-inch water column.

NOTE: In addition to the provisions found in Article 18 which permits the use of air admittance valves to serve as an individual, branch or circuit vent for fixtures on the same floor level, the applicant has chosen to demonstrate that the Studor Mini-Vent and Maxi-Vent are also suitable alternatives for vent stack and stack vent applications. The basis for this demonstration includes testing performed in accordance with ASSE 1050 "Performance Requirements for Air Admittance Valves for Plumbing Drainage Waste and Vented Systems Stack-Type Devices".

The performance requirements of ASSE 1050 are based on the air flow requirements within a soil stack which are more stringent than the performance requirements of ASSE 1051 "Performance Requirements for Valves Installed as Individual or Branch Vents". The air admittance valves are designed to pass the volume of air required to prevent negative pressure fluctuations of one (1) inch water column. Since the air admittance valves are only designed to relieve negative internal pressures, they are still required to be installed in conjunction with a minimum of one (1) vent that terminates outside the building.

INFORMATION SUBMITTED:

3.2.1 Report Number EN91-0612, dated January 6, 1992, issued by United States Testing Company, Inc., in accordance with ASSE 1050. The device opened to allow air into the drain system within one-half (0.5) seconds after negative pressure was applied without permitting a negative pressure of three-tenths (0.3) inch water column to occur. The test further showed that the device did not permit a negative pressure of one (1) inch water column to occur after the valve opened. The report also included temperature range, pressure loss and frost closure testing. In summary, the Studor Mini-Vent and Maxi-Vent air admittance valves comply with the requirements of ASSE 1050 for a Stack-Type air admittance valve.

3.2.2 Report of tests performed on the Studor Mini-Vent, Test Number SIB 82-2142-01, Project Number 52902141-0, dated December, 1982, issued by the National Swedish Institute for Building Research. The valve was tested for leakage when subjected to pressures ranging from 1 atmosphere up to a 1-inch water column and did not allow air to leak out of the drainage system. The valve was also subjected to a negative pressure and it opened to admit air. The valve was tested in a 5 story plumbing test assembly where water closets on multiple floors were flushed simultaneously in which the valve opened to admit air into the drainage system under reduced pressure conditions.

3.2.3 Report of tests performed on the Studor Maxi-Vent, Test Number SIB 80-2100-81, Project Number 52902100-8, dated September, 1980, issued by the National Swedish Institute for Building Research. The valve was tested for tightness when the drainage system was subjected to positive pressures, and for capacity when the drainage system was subjected to negative pressures. The valve was tested on a 6 story test assembly. The valve did not permit the loss in any trap seal to exceed one (1) inch water column.

4.0 INSTRUCTIONS TO THE CODE OFFICIAL

The Studor Mini-Vent and Maxi-Vent air admittance valves have been evaluated for conformance with the sections of the 1993 BOCA National Codes as listed in the "Code Analysis of Submitted Information" section of this report. This report is limited to the applications and products as stated herein. This evaluation is based solely upon the information provided to the BOCA Evaluations Services, Inc. by Studor, Inc and has not been independently verified by BOCA-ES. The Committee intends that this report be used as information for determining compliance with those sections, with the following limitations:

Limitations

4.1 This report is subject to annual certification. The failure of the applicant to comply with this requirement will result in the lapse of this report. Further use of, or reference to, this report is then no longer permitted and it is removed from the quarterly listing. To verify that this is a current report see the current BOCA Evaluation Services, Inc. Product Evaluation Quarterly.

4.2 A vertical connection is required when a vent served by a Studor Mini-Vent and Maxi-Vent connects to a horizontal drain.

4.3 A minimum of one (1) vent shall extend to the outdoors to the open air for every building drainage system that utilizes a Studor Mini-Vent or Maxi-Vent.

4.4 A horizontal branch drain containing a vent equipped with a Studor air admittance valve shall connect to the drainage stack or building drain a maximum of four branch intervals from the top of the stack, or the horizontal branch shall be provided with a relief vent which connects to a vent stack, 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.

4.5 The Studor Mini-Vent and Maxi-Vent are required to be located within the maximum developed length permitted by the BOCA National Plumbing Code for a vent.

4.6 The Studor Mini-Vent and Maxi-Vent shall not be located in spaces used as supply or return air plenums.

4.7 The Studor Mini-Vent and Maxi-Vent shall not be installed in non-neutralized special waste systems as described in Article 7 of the BOCA National Plumbing Code.

4.8 The Studor Mini-Vent and Maxi-Vent shall not be installed as a vent terminal for a sump vent.

4.9 The maximum height of a drainage stack being vented by a Studor Mini-Vent or Maxi-vent shall be 6 branch intervals.

4.10 The vent system utilizing a Studor air admittance valve shall be designed and installed so that the trap seal(s) be subject to a maximum pneumatic pressure differential equal to 1-inch water column.

5.0 INFORMATION REQUIRED ON PLANS AND SPECIFICATIONS

5.1 The language "See BOCA Evaluation Services, Inc. Research Report No. 92-46."

5.2 The construction documents shall contain the design and layout of the entire drainage system. This includes, but not limited to, plan views, riser diagrams, all pipe sizes, drainage fixture units and detailed information on the locations of all Studor Mini-Vent and Maxi-Vent. Such documents shall clearly show that the limitations stated in this report are met.

5.3 The manufacturer shall supply instructions on the proper and safe installation of the product. Such instructions shall include details showing:

5.3.1 The Studor Mini-Vent and Maxi-Vent are required to be installed in the vertical upright position.

5.3.2 The Studor Mini-Vent and Maxi-Vent are required to be installed a minimum of four (4) inches above the weir of the fixture trap.

5.3.3 The Studor Mini-Vent and Maxi-Vent are required to be accessible for inspection, service, repair and replacement.

5.3.4 The Studor Mini-Vent and Maxi-Vent are required to be installed in such a manner as to allow adequate air to enter the valve. When installed in a wall space or attic space, the valves shall be provided with ventilation openings in accordance with the manufacturer's installation instructions.

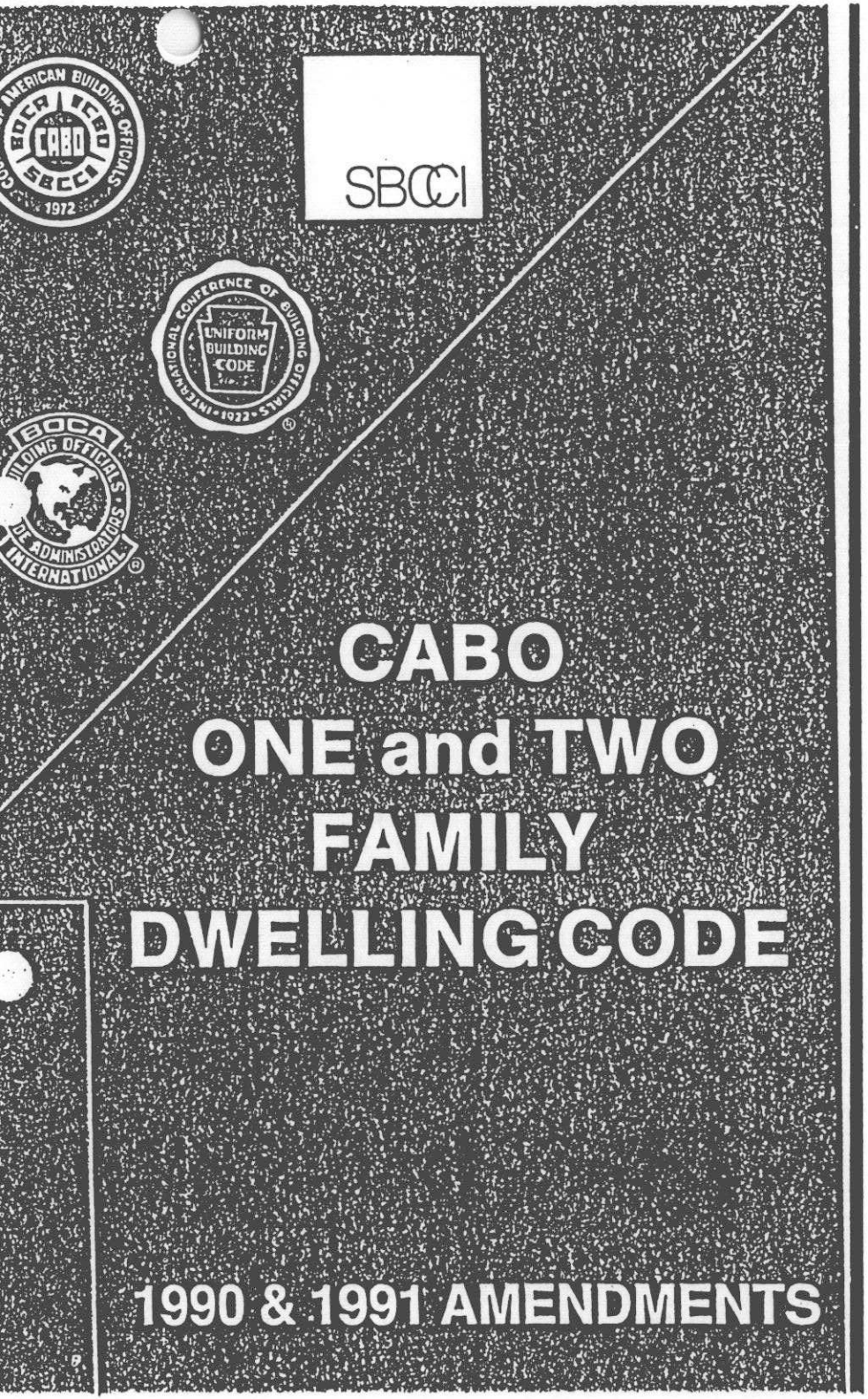
5.3.5 The Studor Mini-Vent and Maxi-Vent are required to be installed a minimum of six (6) inches above insulation materials.

5.3.6 Where the Studor Mini-Vent and Maxi-Vent are installed in areas subject to freezing, the valves shall be covered with the packing container in accordance with the manufacturer's installation instructions.

6.0 IDENTIFICATION

All containers or packages of the Studor Mini-Vent and Maxi-Vent air admittance valves shall be marked at the plant with the manufacturer's name and model number along with the language, "See BOCA Evaluation Services, Inc. Research Report No. 92-46."

Reference to this research report is limited to the identification as described herein. Any other reference to this report or the BOCA logo is prohibited.



Sec. M-1920.2, page 178. Revise third paragraph to read as follows (R70-90):

This inspection shall include and air, carbon dioxide or nitrogen pressure test, at which time the gas piping shall stand a pressure of not less than 10-pounds-per-square-inch gauge pressure and shall hold this pressure for a length of time satisfactory to the administrative authority, but in no case for less than 15 minutes, with no perceptible drop in pressure. These tests shall be made using air, carbon dioxide or nitrogen pressure only, and shall be verified in a manner satisfactory to the administrative authority. Necessary apparatus for conducting tests shall be furnished by the permit holder.

Chapter 20

Table No. P-2001.1, page 179. Delete the following standards from the table (R54-89 and R172-90):

ASTM A120
ASTM C296
ASTM D1869

Table No. P-2001.1, page 179. Add the following standards to the table (R55-89, R88-89, R74-90, R75-90 and R-76-90)):

ANSI Z21.41
ANSI Z21.45
ASSE 1001
ASTM B447
ASTM D2235
ASTM D2564
ASTM D3122
ASTM F402
ASTM F493
ASTM F656
CSA B602M

Table No. P-2001.1, page 179. Revise the designation of the standard as follows (R86-89):

ASME (ANSI) A112.18.1M

Sec. P-2016, page 184. Add the following definitions (R56-89, R77-90, R78-90 and R80-90):

Air admittance valve: A one-way valve designed to allow air into the plumbing drainage system when a negative pressure develops in the piping. This device shall close by gravity and seal the terminal under conditions of positive internal pressure.

Sec. P-2207.3.3, page 209. Revise section to read as follows (R113-90):

P-2207.3.3 Vent headers: Stack vents, vent stacks, individual vents, branch vents and relief vents connected in any combination to a common vent header (larger branch vent) shall be at least 6 inches above the flood-level rim of the highest fixture and terminate in accordance with Section P-2207.5. This header shall be sized in accordance with the requirements of Table No. P-2207.6.

Sec. P-2207.4, page 209. Revise section to read as follows (R114-90):

P-2207.4 Mechanical vents: Approved mechanical venting devices shall be permitted for a single fixture or fixture trap where a vertical leg trap arm as described in Section P-2206.7.3 cannot be installed and no other practical alternative exists. The mechanical vent shall be installed a minimum of 6 inches above the flood-level rim of the fixture served and shall be accessible for periodic inspection and/or replacement.

Sec. P-2207.5, page 209. Add new section to read as follows (subsequent sections to be renumbered) (R116-90):

P-2207.5 Air admittance valves: Approved air admittance valves complying with ASSE 1051 as listed in Section S-26.2207 shall be permitted for a single fixture or for multiple fixture traps. The air admittance valve shall be installed to permit free movement of air and not less than 4 inches above the trap arm of the fixture served and shall be accessible for periodic inspection and/or replacement. Valves shall be sized per Section P-2207.11.

Sec. P-2207.5.5, page 210. Revise section to read as follows (R66-89):

P-2207.5.5 Frost closure: Localities having an average annual minimum design temperature 0 degrees F. (ASHRAE 97.5 percent column, winter, see Appendix A) shall be considered subject to frost closure. Vent terminals extending to the outside in such localities shall be at least 2 inches in diameter. When it is found necessary to increase the size of the vent terminal to meet this requirement, the change in diameter shall be made inside the building at least 1 foot below the roof. No increase in diameter is required in localities not subject to frost closure by the above criteria.

Sec. P-2207.5.6, page 210. Revise section to read as follows (R117-90):

P-2207.5.6 Vent terminals in attic spaces: Vent terminals equipped with approved air admittance valves may be located in accessible attic spaces where the building drainage system connects to a vented sewer. Valves shall comply with ASSE 1051 as listed in Section S-26.2207, shall be installed above the attic insulation and shall be sized according to Section P-2207.11.

Sec. P-2207.7.1, page 210. Delete section without substitution (subsequent sections to be renumbered) (R120-90):

P-2207.7.1 Fixtures connected to stack at different levels: Deleted.

Sec. P-2207.3.3, page 209. Revise section to read as follows (R113-90):

P-2207.3.3 Vent headers: Stack vents, vent stacks, individual vents, branch vents and relief vents connected in any combination to a common vent header (larger branch vent) shall be at least 6 inches above the flood-level rim of the highest fixture and terminate in accordance with Section P-2207.5. This header shall be sized in accordance with the requirements of Table No. P-2207.6.

Sec. P-2207.4, page 209. Revise section to read as follows (R114-90):

P-2207.4 Mechanical vents: Approved mechanical venting devices shall be permitted for a single fixture or fixture trap where a vertical leg trap arm as described in Section P-2206.7.3 cannot be installed and no other practical alternative exists. The mechanical vent shall be installed a minimum of 6 inches above the flood-level rim of the fixture served and shall be accessible for periodic inspection and/or replacement.

Sec. P-2207.5, page 209. Add new section to read as follows (subsequent sections to be renumbered) (R116-90):

P-2207.5 Air admittance valves: Approved air admittance valves complying with ASSE 1051 as listed in Section S-26.2207 shall be permitted for a single fixture or for multiple fixture traps. The air admittance valve shall be installed to permit free movement of air and not less than 4 inches above the trap arm of the fixture served and shall be accessible for periodic inspection and/or replacement. Valves shall be sized per Section P-2207.11.

Sec. P-2207.5.5, page 210. Revise section to read as follows (R66-89):

P-2207.5.5 Frost closure: Localities having an average annual minimum design temperature 0 degrees F. (ASHRAE 97.5 percent column, winter, see Appendix A) shall be considered subject to frost closure. Vent terminals extending to the outside in such localities shall be at least 2 inches in diameter. When it is found necessary to increase the size of the vent terminal to meet this requirement, the change in diameter shall be made inside the building at least 1 foot below the roof. No increase in diameter is required in localities not subject to frost closure by the above criteria.

Sec. P-2207.5.6, page 210. Revise section to read as follows (R117-90):

P-2207.5.6 Vent terminals in attic spaces: Vent terminals equipped with approved air admittance valves may be located in accessible attic spaces where the building drainage system connects to a vented sewer. Valves shall comply with ASSE 1051 as listed in Section S-26.2207, shall be installed above the attic insulation and shall be sized according to Section P-2207.11.

Sec. P-2207.7.1, page 210. Delete section without substitution (subsequent sections to be renumbered) (R120-90):

P-2207.7.1 Fixtures connected to stack at different levels: Deleted.

Sec. S-26.2109, page 273. Revise the date of the following standard (no change to title or referenced section) (R172-90):

ASTM

F409 — 1988

Sec. S-26.2110, page 273. Revise the date of the following standard (no change to title or referenced section) (R172-90):

ASTM

F409 — 1988

Sec. S-26.2207, page 273. Add new section to read as follows (R116-90 and R117-90):

SECTION S-26.2207 — VENT SYSTEMS

ASSE

1051 — 1990 Air Admittance Valves for Plumbing DWV Systems — Fixture and Branch Devices P-2207.5, P-2207.5.6

Sec. S-26.2301, page 273. Revise the date of the following standards (no change to title or referenced section) (R135-90 and R172-90):

ANSI

A112.19.2M — 1990

ASSE

1002 — 1979 (1986)
1006 — 1986
1007 — 1973 (1986)
1008 — 1973 (1986)

Sec. S-26.2301, page 274. Add the following standards (R76-90, R134-90 and R135-90):

ASME

A112.19.6 — 1990 Hydraulic Performance for Water Closets and Urinals . . . . . Table P-2301
A112.19.7M — 1987 Whirlpool Bathtub Appliances . . . . . Table P-2301
A112.19.8M — 1987 Suction Fittings for Use in Swimming Pools, Wading Pools, Spas, Hot Tubs and Whirlpool Bathtub Appliances . . . . . Table P-2301

ASSE

1001 — 1988 Pipe Applied Vacuum Breakers . . . . . Table P-2301

AMERICAN SOCIETY OF SANITARY ENGINEERING

For Plumbing and  *Sanitary Research*

This certifies that Studor, Inc. is authorized to display the A.S.S.E. Seal on its

Air Admittance Valve - Maxi Vent and Mini Vent

in the manner and under the conditions stated herein and any supplemental description sheets, in accordance with A.S.S.E. Standard Number 1050 - 1991

Tested: United States Testing Co., Inc.

This authorization is issued for one (1) year from date hereon and is renewable annually for a period of five (5) years subject to the conditions printed on the reverse side of this certificate.

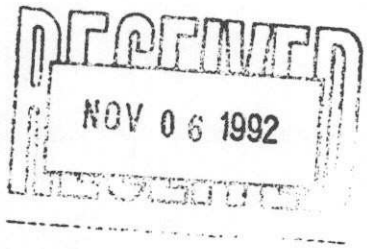
The SEAL displayed on a product indicates that the product has been tested for compliance with an appropriate and accepted A.S.S.E. Standard for performance in a system of plumbing.

The American Society of Sanitary Engineering has created the SEAL program to encourage improvements in plumbing products and systems in the interests of greater protection of public health and safety.

DATE March 26, 1993

CHAIRMAN _____
A.S.S.E. SEAL BOARD





AMERICAN SOCIETY OF SANITARY ENGINEERING
for Plumbing and Sanitary Research

P.O. Box 40362
Bay Village, Ohio 44140
(216) 835-3040

This certifies that the A.S.S.E. Seal Authorization to display the A.S.S.E.

Seal issued to :

Studor, Inc.

on 90/10/02 under A.S.S.E. Standard 1051 1990

for its: Air Admittance Valve
1-1/4,'' 1-1/2,'' and 2'' Mini Vent
2,'' 3,'' and 4'' Maxi Vent

has been renewed and will be in effect until: 10/2/93

DATE: 92/10/06

Gael H. Dunn

Gael H. Dunn, Executive Secretary