

Investigational Study on Significance of Vents and Traps in Designing a Plumbing System

R.Sibiya

Department of Civil Engineering,
Sri Ramakrishna Engineering College,
Coimbatore, India,
7502437307

V.Mythili

Department Of Civil Engineering,
Sri Ramakrishna Engineering College,
Coimbatore, India
9600615261

C.Vivek Kumar

Assistant Professor,
Department of Civil Engineering,
Sri Ramakrishna Engineering
College, Coimbatore, India
9791426508

ABSTRACT

Plumbing system has great influence in the stability of the super and sub structure. Plumbing system vents are an integral part of plumbing drainage systems. A typical household drainage and vent system features two piping systems, both of which are interconnected. One system pipes water away from fixtures and conducts that water towards a sewage or septic system. The other piping system supplies atmospheric air to each fixture. Without vents, an interconnected plumbing drainage system will not work properly. Sewage disposal systems produce some pretty nasty odors and some can even be dangerous, in order to protect us traps are essential.

Keywords

vents, traps, fixture

1. INTRODUCTION

In the modern plumbing vent and traps and selection of proper fixture plays a vital role in increasing the life period of the proposed structure. Vents are pipes used in plumbing in order to regulate air pressure in the waste – system pipes and facilitate the proper flow of waste through the pipe. Similarly traps play an important role in the prohibition of backflow of solid and fluid water and in avoiding the odour nuisance in the closets and in sinks. The modern plumbing, give more importance to drain-waste-vent system. Also in the plumbing system selecting proper fixture also play an important role in maintaining undisturbed flow of waste in pipes. When the outlet vertical pipes are drawn it is necessary to provide clamping in order to protect the walls of the building in case of any leakage in the pipe which may create dampness and other problems in the walls.

COMMON MISTAKES IN DWV PLUMBING SYSTEM

- Not considering upper floor plumbing when designing under slab plumbing {UPC 908.1, 311.2} Vents from basement fixtures need to extend dry to roof but can be combined – see below where you can combine vents. UPC allows bathroom wet venting for combinations of fixtures within one or two bathrooms located on the same floor in dwelling units. See UPC 908.4 for details.
- Not providing a vent for every trap {UPC 901.0, 902.0} Every trap needs a vent, most are dry (see UPC 908.4 where wet venting allowed) to roof originating from fixture trap arm – see below where you can combine vents – also grading of combination vents.

- Installing a sanitary Tee instead of wye or long sweep for drainage connection or back to back fittings (sinks) not directional {UPC 701.2.3} {UPC 704.1, 704.2, 706.0} Sanitary tees may only be used on drainage piping when transitioning from horizontal (1/4" per foot) to vertical. All others must sweep in direction of flow with proper drainage fittings.
- Trap arm too long for size of pipe {UPC 1002.2} {UPC Table 10-1} Horizontal distance from trap weir to inner edge of vent shall be within distance in Table 10-1, but not closer than 2 times the diameter of the trap arm.
- Clothes washer trap not within prescribed distance {UPC 804.1} Standpipe not more than 30" or less than 18" above trap- no trap installed below floor – trap installed 6" to 18" above floor.
- Drain piping {UPC 708.0} and vent pipe {UPC 905.1} not to grade Drain piping can be horizontal (1/4" per foot), vertical, or 450- vent piping shall be free of sags and be graded and connected to drip back by gravity to drain pipe it serves.
- Not having cross section of vent equal to the sewer size {UPC 904.1} The size of required sewer pipe is equal to the size of the vent through the roof, separate vent areas may be combined to equal sewer pipe area. 2
- Connecting vents below flood height of highest fixture {UPC 905.3} Vents should be 6" above flood-level rim of fixture before offsetting horizontally, or need to use drainage fittings and grade to drain. Vents shall rise to 6" above flood-level rim of fixture served before being connected to any other vent.
- Combining too many fixtures on vent pipe {UPC Table 7-3, Table 7-5} Use Table 7-3 and determine # of fixture units for each type fixture, add all fixtures on common vent, not to exceed max. # of fixtures for size of vent. Most common error is more than 24 fixture units on 2" vent pipe.
- Vents connected "flat" rather than above horizontal centerline of sewer {UPC 905.2} Vents connecting to horizontal drainage shall connect above horizontal centerline of the downstream drain pipe.
- Cutting too large a hole for piping in bearing wall or joist {IRC 502.8 602.6} See chart – Bearing Wall 40% of depth – Interior non-bearing 60% - 5/8" minimum to edge.
- Pipe protection nail plates too small {UPC 313.9} When piping penetrating framing member that are closer than 1" to edge a steel nail plate that extends a min. 1 1/2" beyond the outside diameter of the pipe that needs protection.

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- Installing Dishwasher w/o air gap fitting {UPC 807.4} No domestic dishwasher shall be directly connected to drainage system or food disposer without the use of an approved dishwasher airgap fitting on the discharge side of the dishwasher. Airgaps shall be installed above the flood level of sink or drainboard which ever is higher.
- Tapping DWV pipe for condensate or HWH pressure relief valve discharge piping {UPC 311.2} No drainage or vent piping shall be drilled and tapped for the purpose of making connections thereto, and no cast-iron soil pipe shall be threaded. Pipe to terminate at approved drain with air-gap or exterior of building. 3 UPC 311.2 No drainage or vent piping shall be drilled and tapped for the purpose of making connections thereto, and no cast-iron soil pipe shall be threaded.

2. VENTS

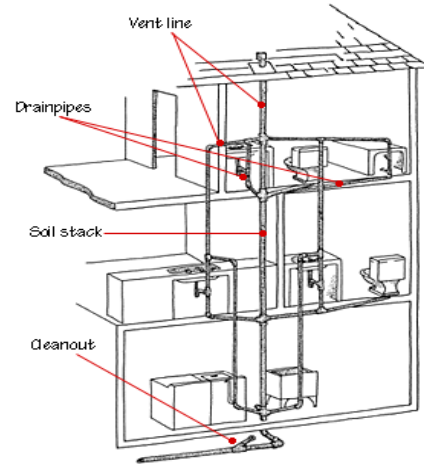
In plumbing, a **drain-waste-vent** (or DWV) is part of a system that removes sewage and greywater from a building and regulates air pressure in the waste-system pipes, facilitating flow. Waste is produced at fixtures such as toilets, sinks and showers, and exits the fixtures through a trap, a dipped section of pipe that always contains water. Everyone knows that every toilet, bath tub, sink, shower, etc. will have a drain to carry the water away to sewage treatment (or) septic tank. But everyone not knows that they also need to be vented. Vents pipe is a pipe above a waste pipe (or) soil pipe that allows waste gas to escape from the system.

2.1 Purpose of Vent

A sewer pipe is normally at neutral air pressure compared to the surrounding atmosphere. When a column of waste water flows through a pipe, it compresses air in the pipe, creating a positive pressure that must be released or it will push back on the waste stream and downstream trap water seals. As the column of water passes, air must flow in behind the waste stream, or negative pressure results. The extent of these pressure fluctuations is determined by the fluid volume of the waste discharge.

Excessive negative air pressure, behind a "slug" of water that is draining, can siphon water from traps at plumbing fixtures. Generally, a toilet outlet has the shortest trap seal, making it most vulnerable to being emptied by induced siphonage. An empty trap can allow noxious sewer gases to enter a building.

On the other hand, if the air pressure within the drain becomes suddenly higher than ambient, this positive transient could cause waste water to be pushed into the fixture, breaking the trap seal, with serious hygiene and health consequences if too forceful. Tall buildings of three or more stories are particularly susceptible to this problem. Vent stacks are installed in parallel to waste stacks to allow proper venting in tall buildings.



2.2 Necessity of Vents

If there is no vent, a number of problems may occur:

- The fixture without a vent may drain slowly
- The drain will likely make bubbling noise
- The water in the trap could siphon out, resulting in a potent sewer smell
- The smell emitted from an unsealed trap (methane gas) poses a health risk

2.3 Place Vent Not Essential

Vent pipe shall be permitted to be omitted on an interceptor when such interceptor acts as a primary settling tank and discharge through a horizontal indirect waste pipe into the secondary interceptor. The secondary interceptor shall be properly trapped and vented.

Traps serving sinks that are part of the equipment of bars, soda fountains, and counters need not be vented when the location and construction of such bars, soda fountains, and counters is such as to make it impossible to do so. When such condition exist, aid sinks shall discharge by means of indirect waste pipe into a floor sink (or) other approved type of receptor.

2.4 Vent Pipe Grades and Connection

- Vent and branch vent pipes shall be free from drops or sags, and each such vent shall be level or shall be graded and connected as to drip back by gravity to the drainage pipe it serves
- Where vents connect to a horizontal drainage pipe, each vent pipe shall have its invert taken off above the drainage centerline of such pipe downstream of the trap being served
- Vent pipes shall undiminished in size above the roof or shall be reconnected with a soil or waste vent of proper size
- Two fixtures shall be permitted to be served by a common vertical pipe when each such fixtures wastes separately into an approved double fitting, having inlet opening at the same level
- The vent pipe opening from a solid or waste pipe, except for water closets and similar fixtures, shall not be below the weir of the trap
- Unless prohibited by structural conditions, each vent shall rise vertically to the point not less than 152 mm above the flood level rim of the fixtures served before offsetting horizontally, and whenever 2 or more vent pipe converge, each such vent

pipe shall rise to a point not less than 152mm in height above the flood level rim of the plumbing fixture it serve before being connected to any other vent .

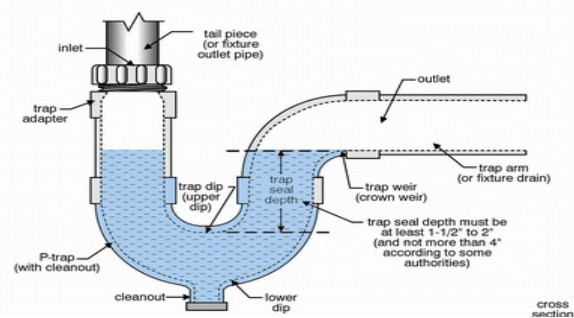
2.5 Vent Termination

- Each vent pipe shall extend through its flashing and shall terminate vertically not less than 152mm above the roof ,nor less than 305mm from any vertical surface.
- Vent pipes for outdoor installations shall extend not less than 3048mm above the surrounding ground and shall be securely supported
- Joints at the roof around vent pipe shall be made water tight by the use of approved flashing or flashing material

3. TRAPS:

A fitting or device so designed and constructed as to provide , when properly vented ,a liquid seal that will prevent the back passage of air without materially affecting the flow of sewage or waste water through it is called as trap. The trap arm is the portion of a fixture drain between a trap and vent. In the trap the vertical distance between the crown weir and the top dip of the trap is called trap seal and the device or system of piping that maintains a water seal in a remote trap is called as trap premier.

Trap terminology



3.1 Features of Traps:

A trap has following features:

- It may be manufactured as an integral trap with the appliance as in some models of EuropeanWC, or it may be a separate fitting called an attached trap, which is connected to waste or foul water outlet of appliances.
- The traps should be of a self-cleansing pattern.
- Traps for use in domestic waste should be convenient for cleaning.
- A good trap should maintain an efficient water seal under all conditions of flow.

3.2 Importance of Traps:

- There are traps in every drain because any connection that leads to the drain system is also possible outlet for sewer gas.
- It also provides resistance to back flow of drains into the sink or closets

3.3 Types Of Traps:

There are different types of traps. Selection of the required type of trap will give better efficiency.

- Gully Trap
- P Trap
- S trap
- Floor trap
- Intercepting trap
- Grease trap
- Bottle trap
- Q trap

3.3.1 Gully trap

These traps are constructed outside the building to carry waste water discharge from washbasin, sinks, bathroom etc. and are connected to the nearest building drain/sewer so that foul gases from sewer do not come to the house. These are deep seal traps, the depth of water seal should be 50 mm minimum. It also prevents the entry of cockroach and other insects from sewer line to waste pipes carrying waste water.

3.3.2 P trap

This trap is used with Indian water closet (ORISSA Pattern). The traps are made from cast iron or UPV sheet. This trap also has water seal and prevents entry of foul gases to the house.

3.3.3 S trap

This trap is similar to P. trap and is used for fixing water closets in toilets. The only difference between P trap and S trap is that P. trap is used for outlet through the wall whereas S. trap is used for outlet through the floor.

3.3.4 Floor trap

This trap is provided in the floor to collect waste water from washbasin, shower, sink and bathroom etc. These are available in cast iron or UPVC material and have removable grating (JALI) on the top of the trap. The minimum depth of water seal should be 50 mm.

3.3.5 Intercepting trap

This trap is provided at the last main hole of building sewerage to prevent entry of foul gases from public sewer to building sewer. It has a deep-water seal of 100 mm.

3.3.6 Grease trap

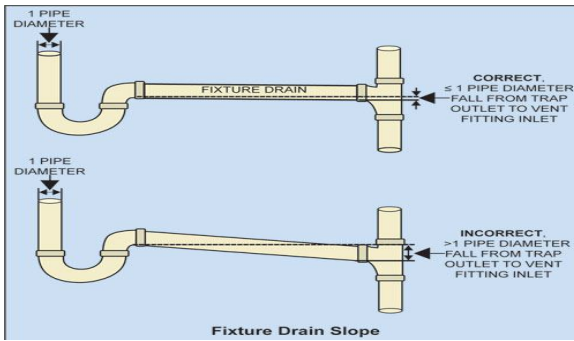
This trap is a device to collect the grease contents of waste and can be cleaned from the surface. This is generally used in food processing unit.

3.3.7 Bottle trap

This trap is used below washbasin and sinks to prevent entry of foul gases.

3.3.8 Q trap

This trap is used in toilet under water closet. It is almost similar to S trap and is used in upper storey other than ground floor.



P-TRAP

In most homes, there is a P-trap installed under the sinks in the bathroom and kitchens. A P-trap is a plumbing fixture that has several purposes. It traps debris that has drained from the sink and prevents it from forming a clog deep within the plumbing system, and to stops sewer gases from passing into the home. P-traps can be made from PVC pipe or steel, the latter is often used for exposed plumbing as it looks more attractive. While there are other styles of traps available, it is important to also know which are prohibited by the California Code from use.

3.4 Working Of P-Trap Design

A P-trap gets its name because it combines two 90 degree joints with a horizontal overflow pipe and gives the entire unit the shape of the letter “P.” One of the 90 degree joints exits the drain of the sink and then is joined to another which contains a water seal system that allows for water to flow into the overflow pipe, but not to flow backward toward the sink.

It is this back flow prevention that prevents sewer gas from escaping into the house. Sewer gas can contain many noxious odors which at the least, may smell like rotten eggs and at their worst, can be explosive and poisonous. The traps installed in the plumbing lines help to form a barrier of water within the P-trap. At the bottom of the “P” is a small cleanout tap that can be used to remove clogs the P-trap has contained.

4. CLAMPS

Noisy pipes caused by loose piping are minor inconveniences that most homeowners deal with. Loose pipes can be easily remedied by means of plumbing clamps, and the market contains various types of plumbing clamps to meet every pipe support need. These clamps work not only in resolving noisy pipes but in boosting the integrity of pipelines too.

4.1 Importance Of Clamps:

- Clamps enhance lasting and smooth running plumbing system.
- Less strain in pipes
- Added protection as a leak-free piping system.

4.2 Types Of Clamps:

4.2.1 Split-type clamps

These clamps are mainly made from durable plastic.

4.2.2 Suspension clamps

Like the split type, suspension clamps are also made from durable plastic.

4.2.3 Flat clamps or straps

These clamps can be manufactured from galvanized steel or copper-plated

4.2.4 Felted clamps

Felted clamps are made from galvanized steel with felt liner for added insulation.

4.2.5 Touchdown clamps

These clamps could be fabricated from steel or plastic.

4.2.6 Snap-in clamps

Snap-in clamps are made from durable plastic.

FIELD STUDY IN IMPROPER PLUMBING



Fig 5.1 Clamping was not provided which lead to damage of Wall

REMEDIAL MEASURE:

- Provision of clamping
- Replacing the damaged joint



Fig 5.2 Using T Joint Instead OF Wye Connection

Ref: Fig-9.23, Effect of fitting in branch flow(UPC-2011)

Reason : WYE has good vertical velocity when compared to tee connection

REMEDIAL MEASURES:

- Replacing the T joint by WYE joint which will enhance the easy flow of waste with high vertical velocity



Fig 5.3.a Damage of walls due to absence of clamping



Fig 5.3b Vent should be 152m above the roof and it should not be near to any water source Ref:UPC2008 class 906.1

5. CONCLUSION

- In order to made the structure free from damage and to increase the life time proper plumbing system is essential.
- Plumbing systems have been in use for thousands of years, however only in the past 100 years did they evolve as we know them today.
- Higher concentrations of people living in cities forced plumbers to become involved in sanitation. Plumbers achieved a very high status in society 100 years ago, as they were responsible for public health.
- Because disease can spread easily and rapidly in water systems, it is important that individuals who work in these fields be regulated, knowledgeable and responsible. That is why plumbers are licensed in many states and cities.
- Plumbing system vents are an integral part of plumbing drainage systems. Many people do not realize the complicated nature of plumbing drainage and vent and trap systems.
- By the provision of venting the foul smelling gases like methane , hydrogen sulphide, fluoride, carbon monoxide are removed from the drain pipes (both solid and fluid waste). Hence prevention of entry of these gases into the structure will be done successfully.
- Plumbing trap is a device that keeps a small amount of liquid every time the fixtures is used. The amount of retained liquid is called a trap seal. This trap seal prevents sewage system odors, gases and vermin (Mice, Insects, etc.) from entering the living or work space. The most common of all plumbing traps is the p-trap it is used on kitchen sinks, lavatories and laundry sinks.
- Provision of clamps helps in preventing noise in case of loose pipes, avoid vibration, less strain .
- Plumbing system with proper vents and trap fixtures

REFERNCES

- 1) International Residential Code (IRC-2012)
- 2) International Plumbing Code (IPC 2012)
- 3) Uniform Plumbing Code (UPC-2008)
- 4) National Standard Plumbing Code (NSPC 2009)