Comparison of Float Drain Trap and Inverted Bucket Trap Designs

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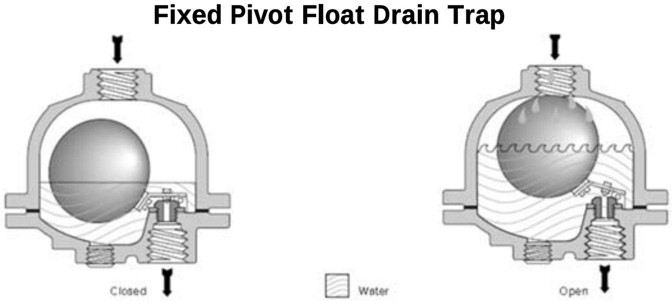
The removal of entrained water within steam processes is essential to recover energy, protect downstream equipment and enhance a process. Drain traps play an integral role in removing condensate from piping systems without loss of steam. Two of the most common drain traps used in piping systems are float drain traps and inverted bucket drain traps. These mechanical valves operate on similar principles however, they are used for different applications. This article compares and contrasts both designs in detail.

Float Drain Traps rely on the buoyancy of an internal, weighted float to open the valve and allow drainage of liquid once the trap body becomes sufficiently filled with liquid. The standard buoyancy of the float is calibrated to the specific gravity of water and thus functions well for water-like liquids; its buoyancy can be modified by adjusting the weight within the hollow float for use with other liquids.

Some float drain traps have a top-side inlet and a bottom-side outlet so that when the trap is installed at a low point in the system where liquid will accumulate, it gradually fills the trap body while any entrained air or steam percolates upward and back into the system via the traps inlet port. In cases where a float drain trap has a side inlet or is not directly below the liquid source, a vent port on the drain trap is used to vent air and steam back into the system, preventing vapor lock of the valve/float assembly.

Fixed Pivot Float Drain Trap



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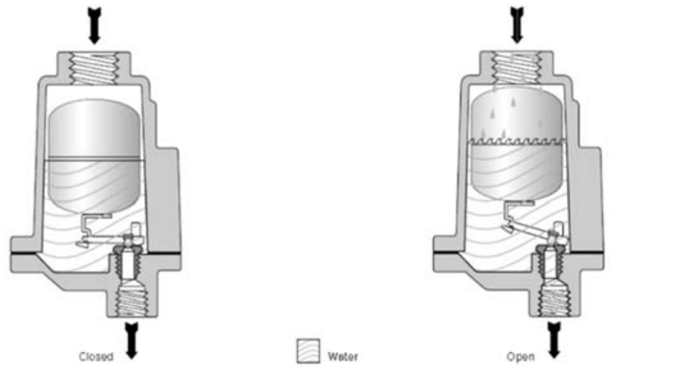
Fixed pivot style float drain traps connect the float to a fulcrum/lever/valve assembly such that when there is sufficient buoyancy of the float, the valve is lifted off its seat and liquid drains though the seat orifice at a rate based upon the diameter of the orifice and differential pressure of the system pressure vs. atmospheric pressure. There are several seat orifice diameters to accommodate drainage rates sufficient for the system while minimizing the number of closure cycles and corresponding valve/seat wear.

Free floating linkage and snap action float drain traps are variations which operate on the same principle but offer advantages in some applications. A free-floating linkage between the lever and valve improves the seal against the seat and a snap action style lever ensures the valve is 100% opened when draining liquid to minimize potential for clogging the seat orifice.

Free Floating Linkage Float Drain Trap



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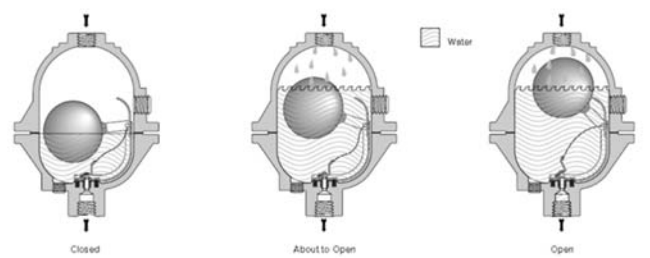
Snap Action Float Drain Trap



Filling Cycle. Trap valve has just closed. Spring bowed to right. Float rides high in water because no force is exerted on spring. As water enters, float rises, storing energy in spring. This increases submergence of float.

Float now is more than half submerged and spring has assumed a "handlebar mustache" shape. Energy stored in spring is due to increased displacement of water. A very slight rise in water level causes spring to snap to the left...

...Instantly the valve opens wide. This releases energy from spring and float again rides high in water. As water level drops, weight of float bends spring to right, causing snap closing of valve before all the water has been discharged.

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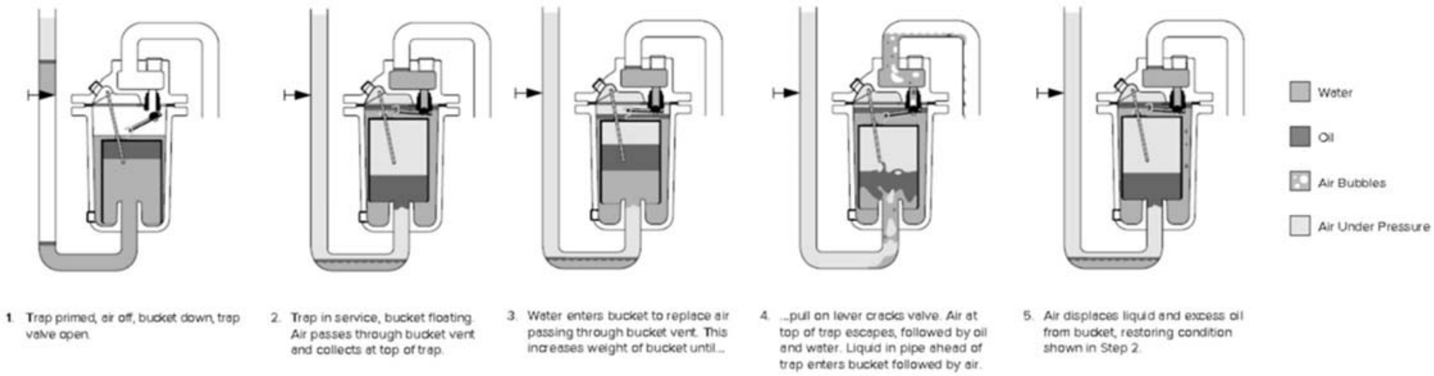
Key characteristics of a float style drain trap is that there is always a liquid barrier or seal between the process gas and drainage, thus when installed where freezing is a concern, a heater must be installed or the trap needs to be insulated. Float drain traps do not need to be primed with liquid and they should be periodically drained via their body drain plug to purge the trap body of any material that settled within the trap housing such as pipe scale or rust.

Advantages of float drain traps are that they eliminate steam loss during drainage and they are very reliable due to their overall simplicity. They can also be used for non-steam applications (compressed air and other industrial gas systems) to drain entrained liquids because you can adjust the weight of the float for liquids having extremely low or high densities. The standard float weight will work for liquids having a specific gravity as low as 0.40. They can also be used to separate a heavier liquid from a lighter liquid and as air vents.

Inverted Bucket Drain Trap Operation



Inverted Bucket Traps also operate on the principle of buoyancy although their mechanical design is more complex than a float drain trap. Inverted bucket drain traps are mostly used in steam systems although they can be used in compressed air and industrial gas systems

The two major components of an inverted bucket drain trap are the trap body and the internal "inverted bucket". The flow pathway is through a tube at the bottom side of the trap body protruding into the inverted bucket.

At the top of the inverted bucket is a vent orifice and linkage attached to a plunger and seat. When the bucket loses buoyancy, the valve is pulled away from the seat and the system pressure pushes condensate through the seat orifice.

Initially the trap body and bucket are filled with water, this is referred to as "priming the trap". Its purpose is to ensure a liquid seal at the valve seat orifice and a non-buoyant bucket.

As steam and condensate enter the trap, it is directed into the inverted bucket; the vent port allows air and other non-condensable gases to vent to an area above the inverted bucket. Once sufficient steam accumulates within the bucket, it becomes buoyant and closes the drain valve. As the steam entrapped in the bucket condenses into condensate within the bucket, the bucket loses buoyancy, causing the valve to open and entrained liquid and air to drain from the system. The volume of condensate purged is equivalent to the volume of steam required to create buoyancy, which is approximately 1/3 the volume of the inverted bucket.

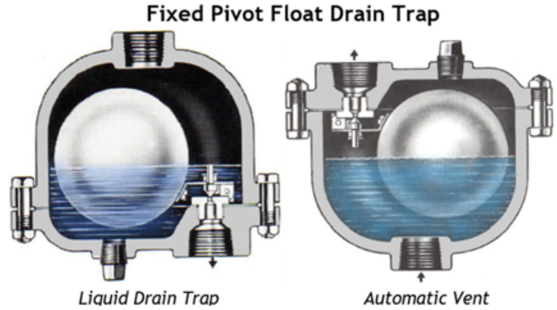
When used in a compressed air or other industrial (non-condensable) gas system, the gases which accumulate at the top of the inverted bucket are vented back to the system piping.

Advantages and Considerations:
Float drain traps offer advantages such as zero steam loss during drainage, simplicity, and reliability. They can be adjusted for various liquid densities and used for non-steam applications like compressed air systems. In contrast, inverted bucket traps are more adept at handling heavier oil contamination due to gravity-assisted drainage. They are especially effective in steam systems and can be used for industrial gas systems.

Both designs require periodic maintenance to remove contaminants, and heavy oil loading can impede their operation. Float drain traps are available in a wider variety of materials, can handle higher pressures, and accommodate higher liquid loads compared to inverted bucket drain traps.

Fixed pivot style float drain traps have an additional application as a high capacity air vent. When installed inverted, the valve remains open to vent gasses and automatically closes after the body is filled with liquid, causing the float to rise and close the valve orifice. Air vents are used to assist with pump priming and at high points in piping to reduce the amount of entrained air or gas in the system.

Fixed Pivot Float Drain Trap



In conclusion, while float drain traps offer simplicity and reliability, inverted bucket traps excel in managing oil contamination and recovering steam. The choice between the two depends on the specific requirements of the application. Whether it's steam or compressed air systems, selecting the right drain trap is essential for efficient condensate removal and system performance.

Let us put our 33 years of experience to work for you, think of Factory Direct Pipeline Products (https://fdpp.com) the next time you have a requirement for a liquid drainer!