THERMOSTATIC STEAM TRAPS

Thermostatic steam traps, as their name implies, operate in direct response to the temperature within the trap. There are two primary types: *BELLOWS* and *BIMETALLIC.*

BELLOWS TRAPS

Of all actuating devices, the bellows trap most nearly approaches ideal operation and efficiency and is most economical. It is positive in both directions, is fast acting and does not require adjustment.

Bellows traps employ only one moving part - a liquid filled metal bellows - which responds quickly and precisely to the presence or absence of steam.

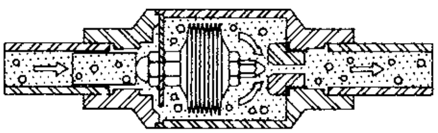
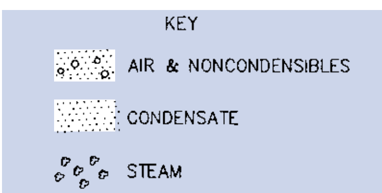


FIGURE 13

During startup and warmup, a vacuum in the bellows keeps it retracted, with the valve lifted well clear of the seat permitting air and non-condensibles to be freely discharged (**Figure 13**).



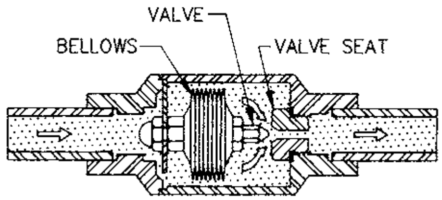


FIGURE 14

Next, condensate is discharged (**Figure 14**). Then heat from arriving steam will cause the liquid in the bellows to vaporize and close the valve (**Figure 15**).

At temperature, the valve will remain closed indefinitely opening only when condensate, air or other non-condensibles cause it to retract and open.

When live steam re-enters the trap housing, the bellows extends immediately, trapping the steam (**Figure 15**).

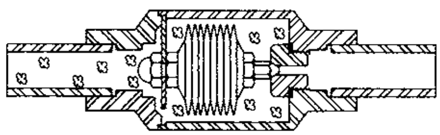


FIGURE 15

The bellows, unlike a disc trap, is a temperature sensitive rather than a time cycle device. There is no way that air can be mistaken for steam and cause binding, since bellows react to temperature only. And unlike bucket traps, bellows traps do not require a variety of sizes for valves and seats for various pressures.

BIMETALLIC TRAPS

Bimetallic traps work like the differential metal strip in a thermostat, using the unequal expansion of two different metals to produce movement which opens and closes a valve.

Figure 16: When the cooler condensate contacts the bimetallic discs, the discs relax. Inlet pressure forces the valve away from its seat and permits flow.

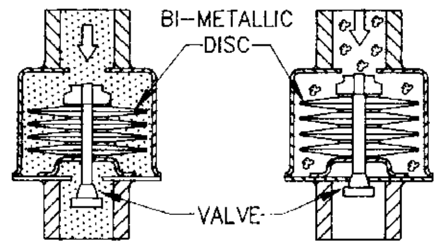


FIGURE 16 **FIGURE 17**

Figure 17: When steam enters the trap and heats the bimetallic discs, the discs expand forcing the valve against its seat preventing flow.

Bimetallic traps are simple and positive in both directions. However, they have a built-in delay factor which makes them inherently sluggish. Moreover; they do not maintain their original settings because the elements tend to take a permanent set after use, which requires repeated adjustment to maintain efficiency.

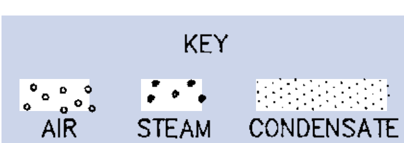
MECHANICAL STEAM TRAPS

There are two basic types of mechanical steam traps:

1) FLOAT & THERMOSTATIC
2) INVERTED BUCKET

Inverted bucket traps, as their name suggests, operate like an upside down bucket in water.

Figure 1: During startup, the trap is filled with water, with the bucket (A) at



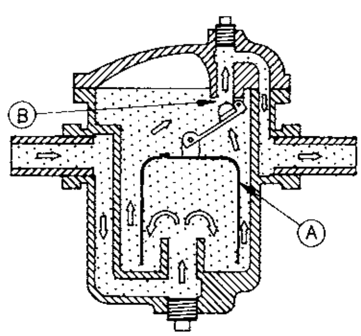


FIGURE 1

the bottom and the valve (B) fully open to allow condensate to flow out freely.

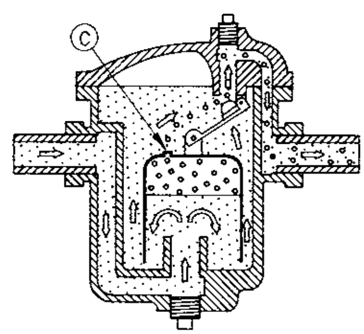


FIGURE 2

Figure 2: Air trapped in the bucket escapes through a vent hole (C). On

MECHANICAL STEAM TRAPS CONT'D.

some buckets, an additional vent hole is controlled by a bimetallic strip which is kept closed by the steam. Therefore, the vent only operates during startup. This limits bucket trap air handling capacity.

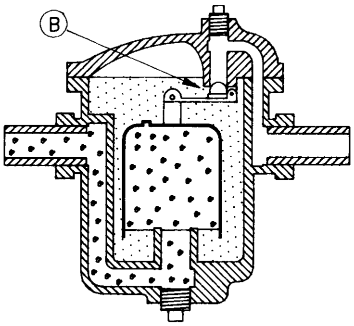


FIGURE 3

Figure 3: At temperature, steam enters under the bucket and causes it to float up and close the valve (B). During heat use, any condensate entering the line is forced up into the bucket. The bucket looses buoyancy and drops down, reopening the valve and discharging the condensate. (see Figure 1)

Bucket traps are rugged and reliable, however, air building up in the bucket can bind them closed causing condensate to back up in the line. Also, they can waste steam if they lose their prime

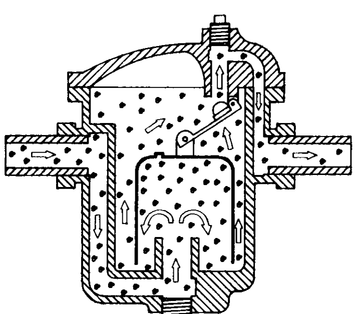


FIGURE 4

(see Figure 4). Bucket traps require priming water in the trap which makes them vulnerable to freeze up unless expensive insulation is added.

Because bucket traps rely on a fixed force, the weight of the bucket, discharge orifices must be sized by pressure. For example, a trap sized to operate at 50 PSIG will not open at 150 PSIG.

Float traps are manufactured in a variety of sizes, shapes and configurations. The most commonly used (for steam service) is the float and thermostatic, or F & T. F & T traps combine the excellent air venting capabilities of a thermostatic trap with the liquid level controlling capabilities of a float trap.

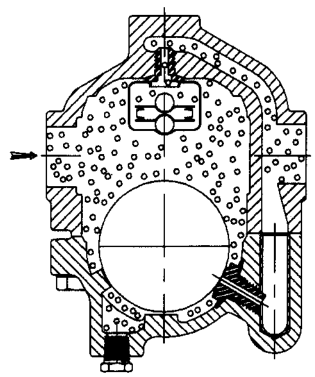


FIGURE 5

Figure 5: During startup, before condensate reaches the trap, the thermostatic element is fully open to discharge air. The float rests on the lower seat.

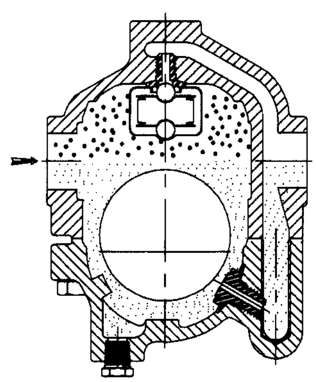


FIGURE 6

Figure 6: As hot condensate and steam reach the trap, the thermostatic element expands, closing the air vent. Condensate lifts the float, allowing condensate to flow out of the trap.

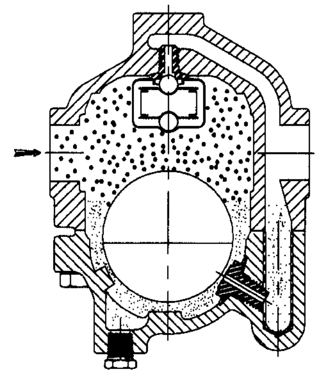


FIGURE 7

Figure 7: As the condensing rate decreases, the float lowers, reducing flow through the trap. The buoyancy of the float will maintain a liquid level seal above the lower seat ring, preventing the escape of steam. As with inverted bucket traps, float and thermostatic traps rely on a fixed force (the buoyancy of the float). Discharge orifices must be sized by differential pressure. Placing a low pressure float and thermostatic trap in high pressure service will result in the trap locking up. A contrasting characteristic of both the float and thermostatic and inverted bucket is the discharge cycle. A float & thermostatic trap tends to continuously discharge condensate while the inverted bucket trap discharges condensate in cycles.