STEAM TRAP FACT SHEETS BY C.R.DAUGHERTY & APPLICATION ENGINEERING DEPT. FEB. 1985 CLS

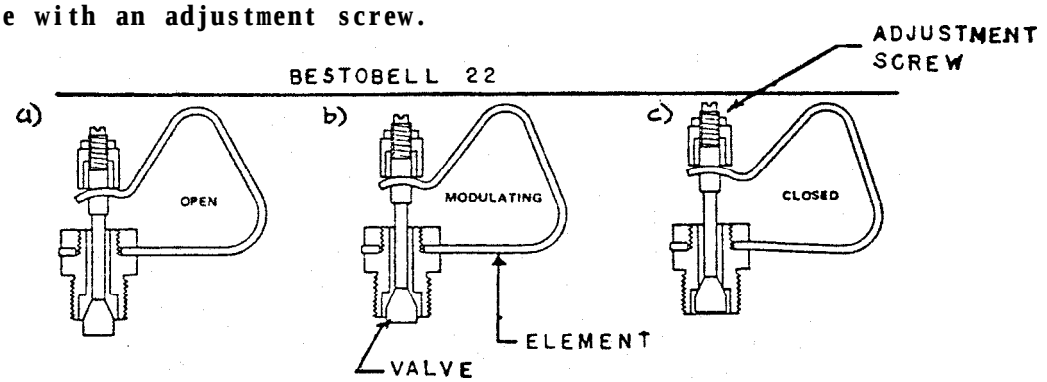
STEAM TRAP FACT SHEET

SUBCOOLING TRAPS

(Bi-Metal Type)

TYPICAL MFG: Bestobell Delta Series

BASIC OPERATION: A single or combination of elements usually attached to a piston type valve with an adjustment screw.



a) Cold condensate around element allows the valve to open and discharge condensate.

b) A balance is established between the opening force provided by the service pressure and the closing force of the element created by the temperature. The element adjusts the valve opening to accommodate the quantity of condensate being discharged.

c) When the condensate reaches saturation - steam temperature, the expansion or deflection in the case of a Bestobell element will close the valve shut.

ADVANTAGES:

1) No live steam loss with normal operation.
2) In line repairable and adjustment.
3) Decreased discharge of flash steam.
4) Makes best use of sensible heat.
5) Not effected by water hammer.
6) Not effected by superheat.
7) Can be installed in any direction.
8) Back pressure does not cause trap to fail.

DISADVANTAGES:

1) Backs up condensate with normal operation - lowering PH levels and causing corrosion and steam leaks ahead of trap.
2) Susceptible to dirt - can waste steam.
3) Must have strainer or integral strainer.
4) Build up of chemicals and dirt on element changes operation.
5) Erratic operation - variance in load/pressure - operation back up condensate varying degrees - can also waste steam depending on conditions.

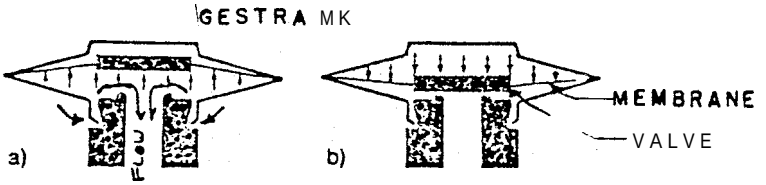
STEAM TRAP FACT SHEET

SUBCOOLING TRAPS

(Bellows Type)

TYPICAL MFG: Gestra MK Series

BASIC OPERATION: Usually a single convoluted welded bellows; a flexible membrane with an attached valve and a charge of alcohol and water between the bottom (membrane) and the top of the bellows. The whole structure is called the capsule and is usually removable while the body stays in line.



a) The temperature surrounding the bellows is relatively low. The liquid inside the bellows is condensed and the pressure in the capsule is lower than the service pressure. This in turn lifts the membrane and opens the valve, thereby discharging condensate.

b) As the surrounding condensate approaches saturation temperature, the liquid filling starts to evaporate and the pressure in the capsule pushes the membrane and valve in a closing direction.

ADVANTAGES:

1) No live steam loss with normal operation.
2) Replaceable capsule without breaking piping (some models).
3) Small and light weight.
4) Decreased discharge of flash steam.
5) Makes best use of sensible heat.
6) Can be installed in any direction.
7) Suitable for all pressures and flow rates within its range.
8) Back pressure does not cause trap to fail.

DISADVANTAGES:

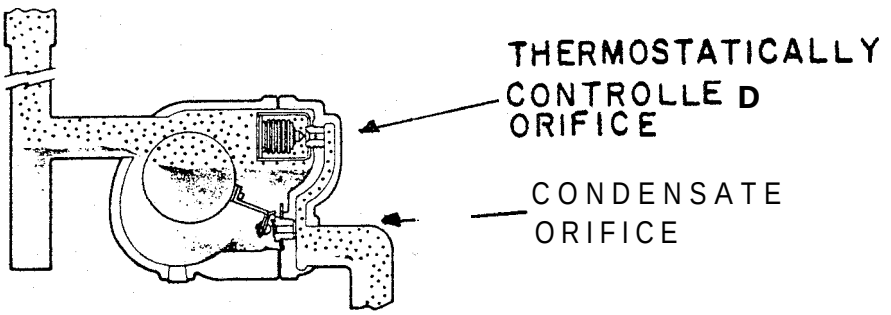
1) Many models tend to fail closed.
2) Susceptible to dirt - on flat valve and seat cause trap to waste steam - valve can't fully close.
3) Backs up condensate with normal operation - lowering PH levels and causing corrosion and steam leaks ahead of trap.
4) Susceptible to water hammer.
5) Must have strainer or integral strainer.
6) Erratic operation - variance in load/pressure - operation back up condensate varying degrees.

STEAM TRAP FACT SHEET

FLOAT & THERMOSTATIC (F&T) TRAPS

TYPICAL MFG: Sarco, Hoffman, Dunham-Bush

BASIC OPERATION: Float & Thermostatic (F&T) steam traps use a float mechanism to discharge condensate and a separate thermostatic controlled orifice to discharge non-condensible gases.



As condensate enters the body of trap, a water level is formed which causes the ball float to rise, opening the lower condensate orifice to discharge. A water seal exist over this condensate orifice to prevent loss of live steam. Non-condensible gases that accumulate above the water seal will be discharged through the thermostatically controlled orifice at the top. A temperature depression of approximately 15 F from true steam temperatures is required before the thermostatic device opens the discharge orifice.

ADVANTAGES:

1) Handles large quantities of non-condensibles due to separate orifice for that purpose.
2) Continuous condensate discharge provides stable return line temperatures to minimize possible water hammer.
3) Water seal over condensate orifice prevents loss of live steam.
4) Large condensate capacities available.

DISADVANTAGES:

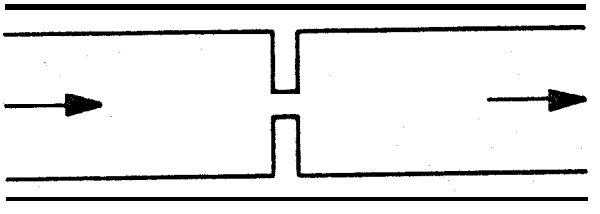
1) Susceptible to dirt because of the low position and modulating mode of the condensate orifice.
2) With steam off, water remains in trap body - freeze-ups can occur.
3) Water hammer could cause failure with collapsed floats or ruptured thermostatic bellows element.
4) Cannot be used in superheat - bellows air vent would be damaged.
5) Normally fail closed.

STEAM TRAP FACT SHEET

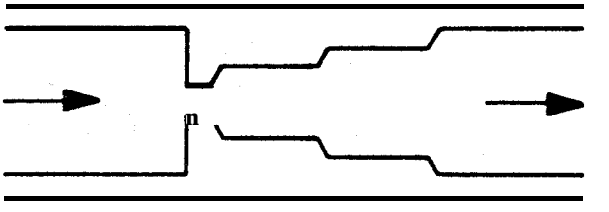
ORIFICE TRAPS

TYPICAL MFGS: Steamgard/Steam-Miser/Flexitallic

BASIC OPERATION: Fixed hole size mounted in a small pipe fixture to control the flow of steam, condensate and air from a heat exchanger. Orifice size is generally very small (.020" dia.) but will vary depending upon max. condensate load expected on any given job. Orifice size is selected by manufacturer only - and it is a very critical selection. The orifice can either be a flat or elongated hole.



ORIFICE PLATE



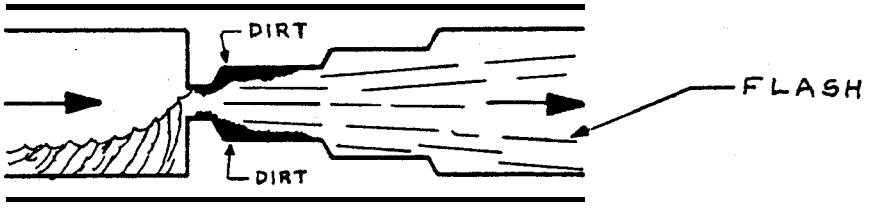
STAGED ORIFICE TRAP

ADVANTAGES:

1) Live steam loss can be limited due to extremely small orifice sizes used compared to standard traps when in a failed open mode.
2) Small physical size reduces radiation loss.
3) Can be mounted in any position.
4) No moving parts to wear and replace.

DISADVANTAGES:

1) Small size orifices are easily plugged with dirt.
2) Requires a fine mesh strainer ahead of orifice w/frequent cleaning.
3) Given orifice size can effectively drain condensate only within a narrow output rate. If condensate load varies too much, orifice will either back up condensate or blow live steam. Not recommended where condensate loads can vary.
4) A continuous back-up of condensate creates a water seal on the trap orifice and prevents the removal of non-condensable gases from the heat exchange equipment. This results in excessive corrosion.
5) Small orifice, high velocity flow and dirty steam, can add up to errosive wearing of the orifice hole - enlarging to oversize with increased loss of live steam.
6) Dirt, boiler chemicals and corroded metal can dissolve in condensate. When hot condensate passes through the orifice, it flashes into steam, leaving the dirt, boiler chemicals and corroded metal behind. This can easily plug the orifice from the back side since they are typically so small (0.020 inches).



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THERMO-DYNAMIC (Disc) TRAPS

TYPICAL MFGS: Sarco, Yarway, Hoffman, Anderson, Clark-Reliance

BASIC OPERATION: Pressure of condensate lifts disc off seat. Flow is across the underside of the disc to outlet orifice. Discharge continues until flashing condensate and steam approaches the trap. (See Fig. 1).

A high velocity jet of flash steam reduces pressure under the disc and at the same time builds up pressure in the control chamber above disc. This drives the disc to the seats to shut off the flow and close trap. Trap remains closed as long as pressure above disc is greater than inlet pressure on bottom of disc. (See Fig. 2).

Pressure in chamber above disc decreases as the trapped steam there condenses. The disc is lifted by inlet pressure and the trap again opens. (See Fig. 3).

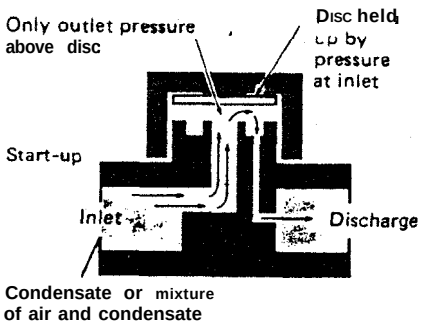

FIG. 1

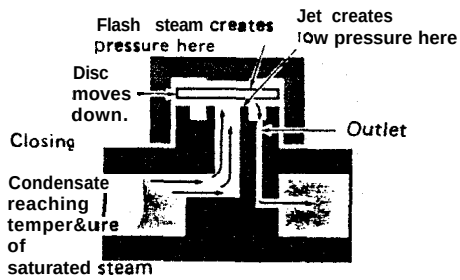

FIG. 2

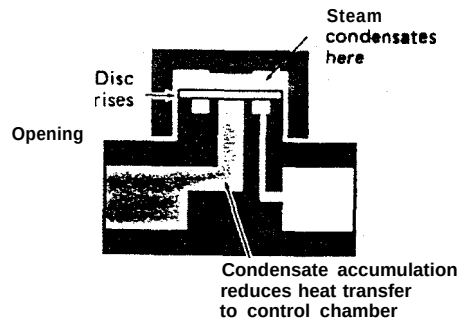

FIG. 3

ADVANTAGES:

1) Small, lightweight.
2) One orifice size for all pressures.
3) Large capacities available for its size.
4) One moving part.

DISADVANTAGES:

1) Will not close on steam pressures less than 5 psig.
2) Will not close on back pressures to 80% of steam pressure.
3) Required close clearances make trap very susceptible to dirt.
4) Not immediately responsive to changing condensate loads - backs up condensate between cycles.
5) Discharge cycle rate determined by pressure loss.above the disc. Ambient conditions can determine this by cooling effect on trap body resulting in rapid steam condensing and pressure loss above disc.
6) Rapid cycling occurs on very light loads.
7) Rapid cycling occurs as trap begins to wear.
8) Rapid cycling creates increased live steam loss.
9) Very slow in discharging non-condensable gases.
10) Very short operating life - 6 months to 1 year average.

STEAM TRAP FACT SHEET

TLV "J" SERIES
FREE FLOATING BALL STEAM TRAP

TYPICAL MFG: TLV

BASIC OPERATION: 1) Condensate discharge is achieved by condensate floating the ball away from the valve seat. 2) Air venting is achieved by the bimetal flexing at a given temperature, opening or closing the air vent valve. See Fig. 1. 3) Steam is trapped because the ball sinks in steam, closing the main valve seat and the bimetal gets hot in steam, closing the air vent.

ADVANTAGES:

1) Floating ball directly closes valve - no hinges, levers or pins.
2) Floating ball allows continuous discharge of condensate.
3) Bimetal air vent withstands water hammer.
4) Ball and seat replaceable without breaking pipe connection.
5) Ball is free to rotate within trap for larger wearing surface.
6) Thermostatic valve has manual venting capability for adjustable blow-through (DC effect). See Fig. 2.
7) Straight through horizontal connections - also top-in bottom out drawn stainless -steel available (SST-3).

DISADVANTAGES:

1) Thermostatic element opens at only one temperature usually 140°F. This temperature is so low that the trap is easily air bound. User is then forced to leave open the manual air vent, causing steam loss.
2) Ball and seat form an almost flat seal - See Fig. 3 - this causes basically on/off discharge since very little float movement opens seat fully.
3) Low load applications tend to create high steam loss through trap. Small slugs of condensate can unseat the ball causing steam to leak through the trap. See Fig. 4.
4) Ball can be damaged by water hammer causing ball to leak and sink (fail closed) or collapse and not seat (fail open).
5) Ball bouncing against seat can dent the ball causing steam loss due to poor seating ability of dent.
6) Seat is difficult to remove from trap and must be driven out with a punch through the drain plug.

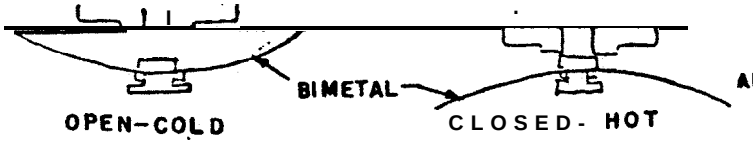

FIG. 1

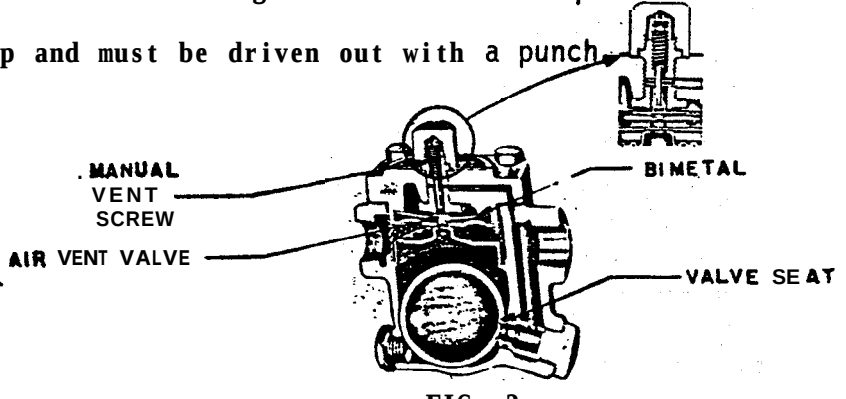

FIG. 2

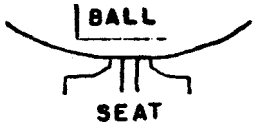

FIG. 3

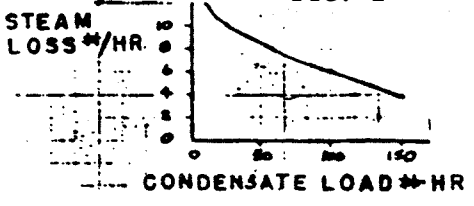

FIG. 4