Office of Physical Plant
ENGINEERING SERVICES
University Park, PA

Technical Bulletin OPP-TB-232216.001

Steam Trap

Float &Thermostatic Trap Selection

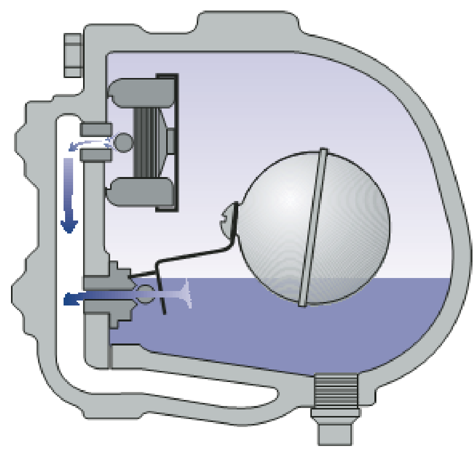
Background

This document is intended to assist with the selection and proper installation of Float and Thermostatic (F&T) steam traps relative to the type of application and steam pressures typical of HVAC and lab equipment found in campus buildings.

Float & Thermostatic Trap

The majority of steam traps in PSU buildings are Float & Thermostatic (F&T) traps. F&T traps have a ball type float attached to a lever. The lever is attached to a valve head and pivot point. When condensate enters the trap, the float rises with the liquid level and mechanically pulls the valve off the seat to allow condensate to be discharged. A thermostatically operated air vent discharges "non-condensables" (primarily air) to the exterior of the trap or into the condensate piping. The air vent closes when it reaches the designated steam saturation pressure.

Applications:	• Low pressure (15 psig) drip legs and all HVAC applications (regardless of pressure) except steam tracing, radiators and mains >30 psi. Best trap type for **modulating** control.
Options:	• Integral vacuum breaker • Gage glass (large traps) • Steam Lock Release (SLR)
Failure:	• This type of trap typically fails closed. • A clanging/rattling sound indicates a loose mechanical linkage and a good possibility of steam bypass or future failure. • A pinhole leak in the ball float will sink the ball or water hammer will collapse the float. No sound will be heard and the trap will be cold.
Advantages:	• Superior air removal, continuous condensate flow.
Disadvantages:	• Will fail closed if steam pressure exceeds rated trap pressure.



Float & Thermostatic Steam Trap
Source – Spirax Sarco

Sizing

1. **Identify the maximum operating pressure (PMO)**

   This is equal to the nominal system operating pressure (usually 15 psig) and it is an important first step in the selection process. Maximum condensate load is important too, but disregarding the PMO can result in traps that are much larger and more expensive than necessary or a trap that can't open under excessive pressure. **The selected trap PMO must be greater than or equal to the system PMO.** Refer to OPP-TB-238216 102 "Coils (Steam) – Trap PMO".

2. **Identify the minimum trap inlet pressure (skip this step if control is modulating)**

   The minimum trap inlet pressures in the PSU low pressure system are listed below:

   - 5 psig for heating devices without control valves (unit heaters with cycling fans)
   - 7 psig for drip legs

3. **Determine minimum differential operating pressure at full load**

   The type of steam control used in the application determines the minimum differential pressure across the trap at full load. It is also extremely important to consider downstream "lift" in non-modulating applications. Applications involving potential lift should be avoided or reviewed by OPP Engineering Services.

   - Non-modulating control – (differential pressure = minimum trap inlet pressure - lift)
   - Modulating control – (differential pressure = 0.5 psi) Do NOT "lift" condensate in this application. Refer to OPP-TB-238216.101 "Coils (Steam) – Condensate Drainage".

4. **Determine maximum condensate load on trap**

   - Use the total coil load found on equipment submittals, schedules, or calculated. Please refer to OPP Engineering Services if a calculated load is required.
   - Divide total coil load by number of sections (trap load = coil load / # of sections)

5. **Calculate required trap capacity (lbs/hr)**

   A safety factor of 2 is applied to the maximum condensate load for applications less than 30 psi to allow for cold coil warm-up. A safety factor of 3 is used for HVAC preheat coils at steam pressures greater than 30 psi, with modulating control.

   Capacity = trap load x safety factor

6. **Select trap using manufacturer's table**

Capacities in lb/h hot condensate

Differential Pressure		FT-15				FT-30				FT-75			FT-125		
PSI	BAR	3/4" 1"	1-1/4"	1-1/2"	2"	3/4" 1"	1-1/4"	1-1/2"	2"	3/4" 1"	1-1/4" & 1-1/2"	2"	3/4" 1"	1-1/4" & 1-1/2"	2"
1/4	.017	279	600	1100	2300	279	375	1000	1300	160	550	850	100	400	550
1/2	.035	369	770	1700	2800	369	500	1300	1800	213	725	1100	135	520	675
1	.07	489	980	2400	3600	489	690	1700	2500	280	960	1500	175	680	880
2	.14	650	1240	3300	4650	650	910	2300	3400	365	1300	2000	230	890	1225
5	.35	785	1640	5000	6900	785	1200	3400	5200	520	1900	3100	330	1300	1950
10	.69	1000	2000	6600	9000	1000	1500	4600	6800	700	2650	4150	415	1700	2600
15	1.0	1075	2340	7600	10900	1075	1680	5500	7800	795	3050	4750	500	2050	3000

Example

A large air handler has a steam pre-heat coil with a modulating control valve and a total condensate flow of 5,569 lbs/hr. The coil is divided into 6 sections, so there are 6 individual traps.

PREHEAT COIL							
AIR SIDE						STEAM SIDE	
Max. Face Velocity (FPM)	EDB °F	LDB °F	Minimum Rows	Max. Fin Spacing FPI	Max. △ P Inch H_2O	Pressure in Coil	Flow lbs/hr
800	0	55	-	-	0.56	5	5569

1. **Identify the PMO.**
   Pressure in coil is listed as 5 psi and from review of other drawings you can see that the coil is served by the campus LPS system, which is 15 psi.

   PMO = 15, select Model FT-15

Model →	FT-15	FT-30	FT-75	FT-125
PMO	15 psig	30 psig	75 psig	125 psig
Sizes	3/4", 1", 1-1/4", 1-1/2", 2"			
Connections	NPT			
Construction	Cast Iron Body & Cover Stainless Steel Internals			
Options	Gauge Glass, Vacuum Breaker			

2. **Identify the minimum trap inlet pressure**

   This step is skipped because control is modulating.

3. **Determine minimum differential operating pressure at full load**

   Min. differential operating pressure is 0.5 psi for any trap downstream of a modulating control valve.

4. **Identify maximum condensate load**

   Load is divided by 6 because each coil section is trapped separately. (5,569 / 6 = 928 lbs/hr)

5. **Calculate required trap capacity (lbs/hr)**

   928 x 2 = 1,856 lbs/hr

6. **Select trap(s)**

   The coil will need (6) – 2" FT-15 traps.

Differential Pressure		FT-15				FT-30				FT-75			FT-125		
PSI	BAR	3/4" 1"	1-1/4"	1-1/2"	2"	3/4" 1"	1-1/4"	1-1/2"	2"	3/4" 1"	1-1/4" & 1-1/2"	2"	3/4" 1"	1-1/4" & 1-1/2"	2"
1/4	.017	279	600	1100	2300	279	375	1000	1300	160	550	850	100	400	550
1/2	.035	369	770	1700	2800	369	500	1300	1800	213	725	1100	135	520	675
1	.07	489	980	2400	3600	489	690	1700	2500	280	960	1500	175	680	880
2	.14	650	1240	3300	4650	650	910	2300	3400	365	1300	2000	230	890	1225
5	.35	785	1640	5000	6900	785	1200	3400	5200	520	1900	3100	330	1300	1950

1. Please provide feedback if you have suggestions for improving or correcting the content of this document. Contact Bill Rittelmann at wdr11@psu.edu or 724-712-9075.