Monday, March 13, 2017

Steam Trap Operation: Steam and Steam Heat Exchangers Basics (Part 10)

For the last two weeks, R. L. Deppmann Monday Morning Minutes has explained how the float and thermostatic steam trap operates, offering some tips for troubleshooting problems in the field. This week we select a trap for the example used in this steam and steam heat exchanger basics series.
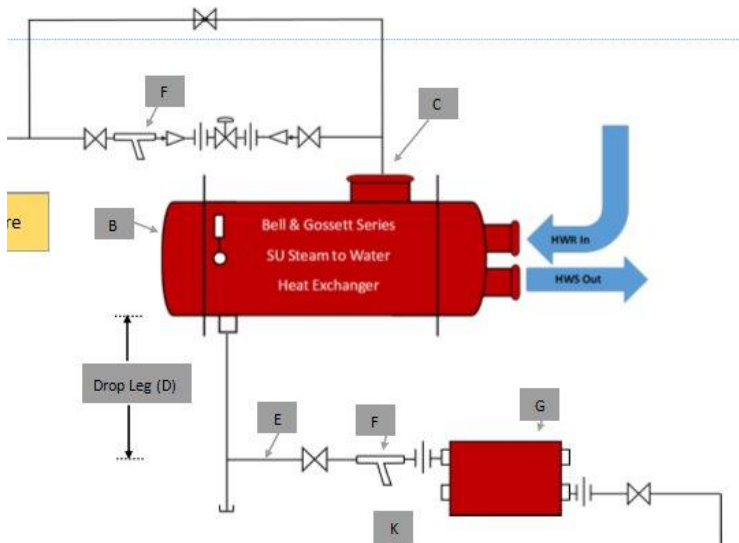
Our example heat exchanger has a capacity of 2,000 pounds per hour (PPH) with 10 PSIG steam pressure to a modulating steam control valve. We will assume the steam pressure to the heat exchanger is 5 PSIG after the control valve pressure drop. We learned in the last two blogs that a float and thermostatic steam trap is the correct choice for this application.

Before we select the trap, I want to answer this question: Why Hoffman? Hoffman, a Xylem brand, manufactures many quality steam traps. The F&T trap starts with hardened stainless steel (SS) seat and pins, SS float, lever, and thermostatic element. All of this is wrapped with a cast iron 30,000 PSI tensile body with grade 5 bolts. A durable, quality product for this aggressive duty.

Safety factors when selecting the Hoffman steam trap.

The selection starts with an appropriate safety factor applied to the 2000 PPH load. In modulating heating load applications, we recommend you use a minimum of a 1.5 safety factor. One reason there are safety factors applied to steam trap selections is the

catastrophic results if a trap is undersized. In part 8 of this series, we described the operation of the trap. If more PPH of condensate enters the trap than it is rated for, condensate will back up and damaging water hammer may occur. How can this happen?

Let's start with the heat exchanger itself. There

Capacities (Gross ... gs)

Model	Size in.	Orifice Size in. (mm)	1/4 (0.017)	1/2 (0.035)	1 (0.07)	2 (0.14)	5 (0.35)	10 (0.69)	15 (1.0)	20 (1.4)	25 (1.69)	30 (2.1)	40 (2.8)	50 (3.5)	60 (4.2)	75 (5.2)	100 (6.9)	125 (8.6)	150 (10.4)	175 (12.1)
									Capacities in Pounds of Condensate Per Hour (kg/hr.)											
FT015H-3	3/4	.253 (6.4)	390 (177)	500 (227)	680 (308)	910 (413)	1100 (500)	1450 (658)	1600 (725)											
FT015H-4	1	.253 (6.4)	390 (177)	500 (227)	680 (308)	910 (413)	1100 (500)	1450 (658)	1600 (725)											
FT015H-5	1 1/4	.312 (8)	600 (272)	770 (350)	980 (444)	1240 (562)	1640 (744)	2000 (907)	2340 (1062)											
FT015H-6	1 1/2	.500 (13)	1280 (581)	1700 (771)	2050 (930)	2550 (1157)	3500 (1588)	4400 (1996)	5300 (2404)											
FT015H-8	2	.687 (17)	2500 (1134)	3150 (1429)	4000 (1814)	5000 (2268)	6800 (3084)	8300 (3765)	9800 (4405)											
FT030H-3	3/4	.235 (6)	380 (172)	470 (214)	630 (285)	870 (395)	1050 (475)	1380 (625)	1530 (695)	1700 (770)	1820 (825)	1900 (860)								
FT030H-4	1	.235 (6)	380 (172)	470 (214)	630 (285)	870 (395)	1050 (475)	1380 (625)	1530 (695)	1700 (770)	1820 (825)	1900 (860)								
FT030H-5	1 1/4	.253 (6.4)	420 (190)	550 (250)	740 (335)	1000 (450)	1200 (545)	1550 (700)	1760 (800)	2000 (907)	2200 (1000)									
FT030H-6	1 1/2	.438 (11)	580 (263)	800 (362)	1200 (544)	1680 (762)	2600 (1179)	3500 (1387)	4500 (2041)	5200 (2358)	5700 (2585)	6100 (2766)								
FT075H-3	3/4	.166 (4.2)	160 (72)	210 (95)	280 (125)	360 (165)	520 (235)	700 (320)	800 (360)	870 (395)	930 (420)	970 (440)	1120 (510)	1230 (560)	1300 (590)	1450 (658)				
	1	.166	160	210	280	360	520	700	800	870	930	970	1120	1230	1300	1450				

are fouling factors applied to shell and tube heat exchangers during the selection process. In an earlier R L Deppmann Monday morning Minutes article called *Heat Exchanger Fouling Factors* I explained how fouling factors could increase the surface area by 35% or more. In a cold startup, the log mean temperature difference (LMTD) of the heat exchanger could be twice as much as the design which again increases the PPH capacity of the heat exchanger. Both of these reasons may cause the heat exchanger or heating coil to use more PPH of steam if the steam control valve can pass it.

Steam control valves are sized based on C_v, which is derived from the capacities needed. It is rare that the required C_v is met exactly — there is always some oversizing. In addition, during times of startup when the heat exchanger or coil can take more capacity, the control valve can provide 10-15% more by dropping the outlet pressure. Add to that the effects of wet steam or superheat and the 1.5% safety factor does not seem so large. I'll talk more about this in later articles about pressure reducing valves.

Selecting the Hoffman float and thermostatic steam trap.

Our example requires 2000 PPH in a low pressure 10 PSIG system. The 1.5 safety factor gives us a rated capacity of 3000 PPH. We use a differential of ½ PSIG. This differential is selected because the pressure in the shell may drop as low as "0" as discussed above and in the earlier *Condensate Drop Leg and Pipe Size: Steam and Steam Heat Exchanger Basics Part 4* blog article. Let's select a steam trap using the Hoffman Specialty Catalog HS-900F.

We will use a Hoffman model FT015H-8, which is a 2" "H" pattern float and thermostatic steam trap. The same model may be selected using the Hoffman steam trap selection software available through our selection and design tools web page link.

Steam Station - [Traps selected for given conditions]

File   Main   Select   Calculate   MyEsp   Internet   Help

Steam Load with Safety Factor added   3000

Please, click the desired row to select a trap.

Back to Conditions

Help

Differential Pressure   0.5

Trap 1

You are currently viewing

Unit	Model	Connection Size	Orifice Size (in.)	Seat psig	Trap Capacity (lb/hr)
1	FT015H	2	0.687	15	3150
2	FT015X	2	0.97	15	8000
3	FT030X	2	0.876	30	4600
4	FT075X	2	0.585	75	3150
5	FT015C	2-1/2	1.875	15	20000
6	FT030C	2-1/2	1.625	30	17000
7	FT075C	2-1/2	1.031	75	7700
8	FT125C	2-1/2	0.797	125	5300
9	FT175C	2-1/2	0.688	175	3350

Next week the R. L. Deppmann Monday Morning Minutes will look at the strainers in steam and condensate systems.