CONDENSATE LEVEL SWITCHES FOR STEAM SERVICE

Situation: A steam condensate level switch operates only occasionally; usually when a control system component (valve, D/P cell, computer, etc.) has failed. It is the last line of defense against a catastrophic failure such as a steam explosion, burnout, turbine damage, etc. It must always work reliably.

Solution: A device of the simplest design, which has the longest history of no-failure reliability, will be the best choice. Delta Controls' Series 700 mechanical float and displacer actuated level switches fit the description and are the best choice for these applications. They have been in worldwide steam condensate service for over 25 years without a failure.

You must select the proper sensing element and body to insure that the inherent reliability is achieved. The basis and rules for hardware selection follow.

Saturated condition is defined as when the steam liquid and vapor phases are in equilibrium and neither condensation nor evaporation is occurring. There is a corresponding temperature at which saturation conditions occur for every specific pressure reading.

The **density of the steam vapor** varies with the pressure and becomes a significant factor at 650 PSIG and higher. The weight of the vapor pushes down while the weight of the condensate pushes up on the sensing element. The actual net SPG lifting the element is the SPG of the condensate minus the SPG of the vapor. This value must be equal to or higher than the "MIN SPG" spec for the sensing element selected.

It is possible to **"superheat"** the vapor to a higher than saturation temperature at the system pressure. In this case, the density of the vapor is lower than it is at saturation conditions. The minimum SPG difference will always occur at saturated conditions; therefore the sensing device will see a higher net SPG under superheated conditions and will continue to work reliably at higher temperatures.

The rule is: Size the sensing element (float or Displacer) for saturated conditions at the highest working pressure; Be sure that it will also physically contain the highest temperature and maximum pressure to be encountered in the applications. Contact Shreveport Engineering for any Application Assistance that you may need, or with any questions that you may have.

The table below shows the density in terms of SPG, which is based on the density of water at 77°F (25°C) and 1 atmosphere (standard temperature and pressure reference conditions) Linear interpolation for pressures other than the steam / condensate saturation conditions shown below will be adequate in most cases.

Saturated Steam Conditions				SPG @ Saturation			Saturated Steam Conditions				SPG @ Saturation		
PSIG	°F	Bar	°C	Liq	Vap	Net	PSIG	° F	Bar	°C	Liq	Vap	Net
15	250	1.0	122	0.944	0.001	0.941	750	512	51.7	267	0.773	0.027	0.746
50	298	3.4	149	0.918	0.002	0.916	850	527	58.6	275	0.758	0.030	0.728
100	358	6.9	171	0.896	0.004	0.892	900	534	62.1	279	0.751	0.033	0.718
125	353	8.6	179	0.888	0.005	0.883	1000	545	69.0	285	0.741	0.036	0.705
150	366	10.3	187	0.880	0.005	0.874	1250	572	86.2	300	0.711	0.046	0.665
250	406	17.2	209	0.854	0.009	0.845	1500	596	103.4	313	0.681	0.058	0.623
400	447	27.6	232	0.825	0.014	0.811	1750	617	120.7	381	0.656	0.072	0.583
450	459	37.0	238	0.816	0.016	0.800	1800	621	124.1	327	0.647	0.073	0.573
500	471	34.5	244	0.808	0.018	0.790	2000	636	137.9	336	0.622	0.085	0.537
550	479	40.0	248	0.800	0.019	0.781	2250	652	155.2	344	0.597	0.098	0.499
600	490	41.4	254	0.792	0.022	0.771	2500	668	172.4	353	0.557	0.122	0.435
650	497	44.8	258	0.784	0.023	0.761	2750	682	190.0	361	0.516	0.147	0.369
700	506	48.3	263	0.777	0.025	0.746	3000	695	207.0	368	0.462	0.186	0.276
							3135	703	216.0	373	0.393	0.212	0.181

@ 3191.5 PSIG (220 Bar) and 705.4° F (374.1° C); both liquid and vapor = 0.3181 SPG density units and have the same density, which is 19.84 lbs/ft^3 (318.1Kg/M^3)

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