April 30th 2007

To: All US, Canadian, Far East, South American, Middle East, African Representatives
**Re: Air Separation for Variable Volume Hydronic Systems**

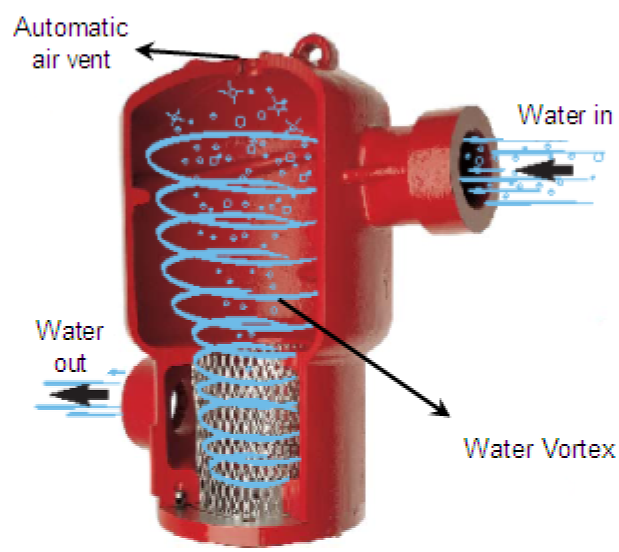
There is value in understanding the significant energy savings and the reduced maintenance and operating costs achieved by implementing variable speed pumping in HVAC systems. These savings are the reason variable speed pumping has become the industry standard for most cooling and heating systems in the HVAC world today. However, there has been little to no mention of the impact on the efficiency of air separation devices used in these systems, and what technologies would work best with this new wave of variable speed hydronic systems that has spread across the HVAC market.

Depending on location, building-load profiles indicate that the majority of the time, commercial buildings are operating at between 20% and 60% of total capacity, for both cooling and heating applications. This implies that system flow, and velocity, are reduced to as low as 20% of their full design level. This means that a flow velocity of 8 fps (2.5 m/s) could be reduced to as low as 1.6 fps (0.49 m/s) during periods of low load demand.

Below is a brief comparison of how these different air separation devices perform under part load variable speed pumping systems.

**Technology Comparison:**

**Vortex style air separators** work by inducing a whirlpool effect, where, through inertia, a pressure difference between the middle of the vortex and the edge is created. The air bubbles naturally migrate to the low pressure zone in the middle of the water vortex and rise to the top of the air separator, where they are relieved through an automatic air vent. This process is dependent on a minimum flow velocity so that the vortex is actually created. The performance of a vortex / tangential style air separator could be compromised when system velocity is drastically reduced, as is the case during low load intervals.



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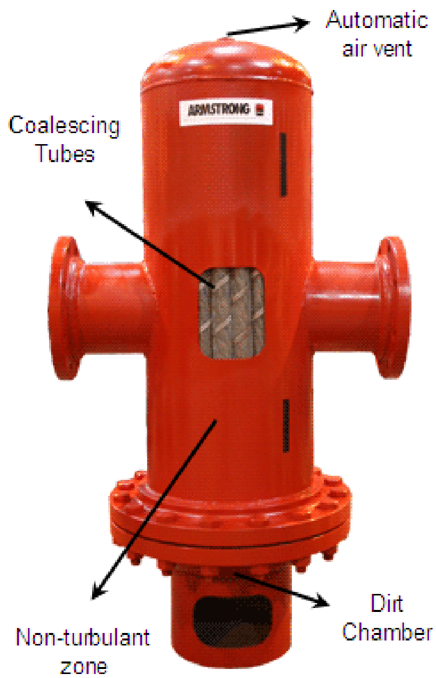
**Coalescing style air and dirt separators** work by slowing the movement of system fluid through a large cross-section of the air separator tank. The coalescing tubes allow the slow-moving micro bubbles to cling to the stainless steel tubes and coalesce, or join together. The bubbles then rise to the top of the air separator, where they are vented through an automatic air vent. In addition, dirt particles are directed down through the non-turbulent zone and stored in the dirt chamber at the bottom of the unit, where they can be removed periodically.

In this case, on low-load days, where the flow velocity is low, the performance of the coalescing-style air and dirt separator is improved.




**Conclusion:**

Both vortex / tangential and coalescing air separators are efficient at reducing the amount of entrained air in hydronic heating and cooling systems. However, due to the design, coalescing style air separators, such as Armstrong's DAS series, are more effective at removing entrained air in variable speed HVAC systems. The reduced system velocity during low load periods actually enhances the performance of the coalescing style air separator, allowing it remove more air and dirt. On the other hand, vortex / tangential style air separators need a minimum velocity to maintain the vortex and the pressure differential which allows the air bubbles to migrate to the top and escape through the air vent. As variable volume hydronic systems can cause flow velocities to be reduced to as low as 20% of their design levels, this can drastically compromise the performance of a vortex / tangential style air separator

It is for the above reasons that Armstrong recommends specifying coalescing-style air separators for variable volume systems.

For any questions or concerns regarding air removal, please feel free to contact the Armstrong Technical Support department at techsupport@armlink.com

Best Regards,

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