Discussing Deaerator Turndown and Modern Deaerator System Design

The basic functions of any pressurized deaerator (DA) are essentially the same. The DA facilitates the mechanical means of removing the harmful dissolved gases from make-up water and condensate along with providing storage of the hot deaerated water until needed by the boiler(s). The primary mechanism used to achieve the deaeration of the water is the application of heat. It is paramount, in all DA installations, that the design of the steam supply assembly allows steam to be fed into the tank at a rate that is always greater than the potential demand from the maximum flow of water into the tank. This water flow is not based on the process load requirements, but should be determined from the maximum throughput of the make-up water components at the specific site conditions. The manner in which the water is heated is the defining attribute that separates one DA design from another.

Although most DA designs incorporate some distinguishing feature or features that set it apart from the competition, it seems that only for the purposes of conversation, deaerators have been boiled down to two main types, tray-type and spray-type. There are many sources that provide comparisons between these types of deaerators, a majority of which use a common set of schematic diagrams and include similar definitions of the key features. The general descriptions of each type are considerably rudimentary and only identify the fundamental characteristics with the most basic components and controls. These simplistic forms are not representative of the majority of the deaerator designs currently available. This is especially true in the case of the spray-type deaerators.

The Hurst Oxymiser is not a traditional spray type deaerator. Our design incorporates numerous modifications and additions that distinguish it from the basic form.

The spray assembly utilizes proprietary spring-loaded spray valves. These stainless steel valves have an adjustable cracking pressure for installations with low water pressure. The number of spray valves needed for each DA size is determined by the rated output. The spray valves are designed to atomize the incoming water in an atmosphere of steam to improve heat transfer and maximize the release of dissolved gases from the water. The spring-loaded valve disk maintains a uniform spray pattern throughout the complete range of flow conditions.

The Oxymiser design includes a small opening in the lower portion of the scrubber section that causes some of the stored water to be entrained with the incoming water collected from the spray heads. This additional volume of water increases the available flow through the scrubber section. Also, this helps to circulate the stored water in the tank and maintain consistent temperatures throughout the tank. The steam loads required to maintain the stored water at near saturation temperatures, convection losses to the environment, and losses from the continuous venting of gases and steam are enough to ensure that a minimum amount of steam is always flowing through the scrubber section. This constant steam demand along with the steady flow of available water results in higher velocities and greater turbulence at low load conditions. The effectiveness of this scrubber section at reduced capacities is significantly increased when compared to conventional designs.

The Oxymiser is available with a PLC based control package that maximizes the deaerators overall efficiency. The modulating control valves on the incoming water and steam supply can be fine tuned to optimize the effectiveness of the feedwater system. Additional functionality can be developed based on a customer's specific needs or process requirements. The control system includes PID loop controllers for the various control valves, pumps, etc. that can be adjusted to achieve the desired results. The setup

of the controls, even with the standard version, is designed to allow the deaerator to achieve the guaranteed limits from idle conditions up to the rated capacity.

It is very important for our customers to provide accurate information for each deaerator installation during or prior to the confirmation of an order. This data is used to determine the size of all the ancillary components, including steam pressure reducing valves, make-up water control valves, pressure relief valves, etc. Improper sizing of these components can greatly impact the effectiveness of the deaerator. The design and functionality of the condensate system is another important factor in maximizing the efficiency of the entire feed water system.