Why Deaerate?

"Why is a deaerator necessary?" The answer is that it **pays**. The pay back is in real dollars via many routes.

It could be obvious, such as the need for less blowdown, a reduction in oxygen scavengers and chemical additives, or an opportunity to reclaim heat, by recovering exhaust and flash steam. There is approximately a 1% fuel savings for every 10 degree rise in feed water temperature.

The savings may also be subtle, such as those accomplished through improved heat transfer by eliminating the insulating non-condensable gasses, corrosion control in the entire steam and condensate system, and a reduction in the thermal shock to the boiler by feeding water closer to the boiler temperature.

In addition to these immediate savings, a **ZER-O-PAC** deaerating system adds value to the original purchase by utilizing heavier duty equipment which will result in longer equipment life, thereby amortizing the cost over a longer period of time. One example is the use of **ASME** tanks with heavier gauge steel, having a higher copper content than that used in a standard condensate tank. Pumps will automatically become heavier duty when used on a deaerator, and pipe sizes are increased to keep friction losses to a minimum.

In conclusion, the **greatest value** in a deaerator comes through protecting the largest single investment in a boiler room, the **boiler**. As its cost increases, the necessity to protect this investment through total deaeration becomes mandatory.

Industrial Steam Two-Compartment Deaerator
vs.
BFS Industries Class "S" Deaerator

The **Industrial Steam Two-Compartment** design evolved from the atmospheric type deaerator design originated by Schaub Engineering and copied by Domestic and Industrial Steam. This atmospheric type deaerator was never accepted, possibly because of its poor performance and therefore Schaub went out of business and Domestic discontinued its use. Industrial Steam, we suspect, had a similar problem and opted to market a pressurized deaerator by merely pressurizing their atmospheric design.

The double tank design manufactured by Industrial Steam touts huge storage capacities which is in reality a total capacity of both compartments. The fallacy of this is that one of the compartments contains undeaerated water and is therefore unusable as boiler feedwater. It is questionable why this is an advantage since if undeaerated water is acceptable, why not then merely install a "quick opening by-pass" feeding directly from the city water line into the deaerator. A "recycle pump" is also required by design to move the water from one section to another.

All in all, this system is a make-shift of its predecessor, which requires additional equipment, maintenance, expenditures, and space with absolutely no advantage. A BFS deaerator on the other hand, will store only fully deaerated water and maintain it for immediate use. When comparing BFS and Industrial Steam, it should be determined how much **"fully deaerated"** water is required and what each deaerator design actually offers.

It should also be pointed out that all respected, time-proven deaerator manufacturers such as Permutit, Chicago Heater, Crane Cochrane and Garver, to mention just a few, utilize a single compartment Spray/Scrubber type design.

BFS INDUSTRIES, LLC
www.bfs-ind.com

Pressurized vs. Atmospheric Deaerators

The following discussion relates to the virtues of pressurized deaerators over the atmospheric type.

1. The pressurized deaerator, such as Spray, Spray Scrubber, Packed Column, and Tray types, is more accepted by consulting engineers, architects and knowledgeable users. This point is illustrated by that fact that of the three major atmospheric type deaerators manufactured in this country, only one remains actively in business. Further, even this company has broadened their scope by adding pressurized deaerators to their line. Our Spray/Scrubber, Pressurized type deaerator is of the original, time-proven design.

2. A major argument by the atmospheric competition is actually based on a weakness. The fact that they have a large exit port for dissolved gasses allows the escape of great amounts of steam as well. This is certainly a detriment in these days of rapidly rising fuel costs.

3. The fact that the atmospheric unit is fully vented limits the water temperature to a maximum of 212º F (at sea level). This not only leaves the effluent vulnerable to re-contamination by non-condensable gasses, but increases the thermal shock on the boiler.

4. Another weakness touted by the competition as an advantage is the fact that their tanks have some sort of lining. This in itself, is an admission that their deaerator is ineffective since they cannot even keep corrosion from occurring within its walls. If this system truly deaerated as ours does, there would be no need for any linings.

5. It must be pointed out that in order to vent the liberated non-condensables from any system, it is necessary to have a pressure differential. In order to maintain even the slightest differential pressure in a so-called fully vented system, huge quantities of steam must be expended through the vent, supposedly carrying the non-condensables with them.

6. An atmospheric system requires the use of a two-section tank, transfer pumps, a spray manifold with many small spray valves, steam injection tubes, heat exchangers and many other items not required in a pressurized system. This additional equipment increases, not only initial expenditures, but maintenance and operating costs as well. The standard spray/scrubber type deaerator has but one moving part, the spray valve, which requires little or no maintenance. The remainder of the system is based on the natural flow and counter-flow of steam and water within the deaerator at controlled velocities. None of this requires any mechanical parts that can wear or otherwise interfere with the proper operation of the system.

(continued on the following page)

Pressurized vs. Atmospheric Deaerators (continued)

7. The heat exchanger required by the atmospheric type deaerator is usually installed on the transfer pump discharge to super-heat the feedwater prior to entering the deaerating section. The heating efficiency across the tubular exchanger is not as great as our direct contact of steam and water.

8. Our pressurized deaerator is built in accordance with ASME code for unfired pressure vessels which sets uniform, high quality limits on the vessel. Since this is not required in an atmospheric unit, the quality of the tank is sacrificed. Further, the user can enjoy the peace of mind knowing our system has been tested by rigid procedures and guaranteed by the American Society of Mechanical Engineers to meet these standards.

9. The atmospheric system has no provision for utilizing flash or turbine exhaust steam which, if available, would have to be wasted.

We have attempted to present this information factually and objectively.

When Should a Surge/Transfer Pump System Be Used with a Deaerator?

A surge system, when used with a deaerator, acts as a buffer between the returning condensate and the deaerator tank. It also serves as a place to mix the condensate and make-up, prior to pumping to the deaerator.

Some points to consider when deciding whether to specify a surge/transfer system:

1. When using a pressurized deaerator, operating at 5 psig, gravity returns may not have enough static pressure to overcome the deaerator operating pressure and the drop across the spray valves. Approximately 10 psig is needed at the inlet to the deaerator tank to overcome these pressure drops. An atmospheric surge tank system can accept these returns and pump them to the deaerator.

2. A deaerator, like any mechanical device, operates best under steady state conditions. Installations that have a high rate of condensate return can overload the deaerator with water if multiple condensate pumps start simultaneously. The result is that the incoming condensate will be heated and deaerated, and then leave through the overflow to the drain, taking valuable BTUs with it! A surge system allows the condensate to be collected in a large tank, and fed to deaerator at a rate determined by the deaerator level control valve. If the surge tank does overflow, the loss is minimized due to the fact that no steam has been used to heat and deaerate this water.

3. Make-up water use is minimized by giving preference to condensate returns. The make-up valve on the surge system will open only during periods of low condensate return, when the surge tank reaches a low level.

4. The surge tank operates at atmospheric pressure, resulting in lower temperatures in the tank. This allows the tank to be mounted at a lower elevation above the transfer pumps, which facilitates the piping of low head return lines.

The surge system can be piped so that during deaerator shutdown and servicing, the boiler feed pumps can draw water from the surge tank. This minimizes plant downtime.
The percentage of condensate returns and the number of condensate pumps in the plant are the major factors in determining when a surge system is necessary. BFS can help you with a system evaluation, to determine whether a surge/transfer system is right for your application.

Are Boiler Feed Pump Suction Strainers a Good Idea?

It is often asked whether a pump suction strainer is necessary or recommended. The purpose of a suction strainer is to act as a particulate strainer or filter ahead of the pump. This prevents large particles from entering the pump.

Before the introduction of the low-flow/high-head multi-stage centrifugal type pump, turbine type pumps were used almost exclusively for on/off boiler feed service for steam boilers. The turbine pump impeller was designed with very close tolerances within the pump. Any grit or sediment that entered the pump would result in accelerated erosion of these close-tolerance areas, leading to premature pump wear and loss of performance. These pump characteristics made the use of a strainer a necessity with a turbine type pump.

A centrifugal pump does not have these close tolerances, and therefore the use of a strainer at the inlet is not mandatory. Grit and sediment can pass through the pump without causing harm to the pump.

Below is a list of considerations regarding the use of suction strainers:

1. **Suction Losses:** The addition of a strainer in the suction line of a pump increases the losses in the suction line, thereby decreasing the NPSH available to the pump. As the strainer fills with particles, the pressure drop across the strainer increases, further reducing the NPSH available. This situation becomes more critical as the temperature of the pumped water increases. When a feedwater pump is pumping from a deaerator, the water is already at the flash point, and any increase in the suction losses could lead to a flashing condition and pump cavitation.

2. **Increased system maintenance:** Because of the reason stated above, it is important that the strainer basket be checked regularly. If the installation is in a remote area and maintenance checks are rare, a clogged strainer will eventually lead to pump failure and a boiler low water condition.

3. **Can particles get into the pump without a strainer?:** BFS utilizes an anti-sludge suction connection on all deaerators and boiler feed tanks. This connection has an internal projection from the tank bottom of 2" to 3". This prevents any sediment and large particles from leaving the tank through the suction opening. In BFS deaerators, the water entering the deaerator must travel through a series of spray valves, baffles, trays and other restricted flow paths before deaeration is complete and the water is ready for use. The number and size of the particles that will make it through this path and into the storage area is limited.

It is BFS' conclusion that any benefit of a suction strainer is far outweighed by the risks which can lead to pump failures and other system problems.