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BOILER FEED • CONDENSATE • DEAERATOR • VACUUM

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Re: Custom Design for Application Where Temperature Of ALL System Returns Exceeds Saturation Point.

This letter examines one approach to handling an application where the temperature of the all system returns exceeds the saturation point (i.e., high pressure returns). It summarizes the sequence of operation between the deaerator, the high temperature boiler feed unit (Model HT-M) and the boiler. The pressure values used in this letter are for a specific application and *may be applicable* for other jobs. However, the factory should be consulted first.

The main purpose of this custom, engineered design is to improve the efficiency of the steam system by not wasting the 35 psig flash steam. In addition to conserving the flash steam, the design also uses a portion of the flash steam to deaerate the make-up water saving additional energy.

On start-up, the deaerator will get steam from the steam header of the boiler operating at 125 psig. The steam pressure will be reduced down by pressure reducing valves to 25 psig before the steam passes into the steam regulators on the deaerator which in turn feed steam into the preheat tubes on the deaerator at 5-7 psig. The pumps on the deaerator function as transfer pumps that run continuously – feeding water through a modulating feed water valve into the high temperature boiler feed unit (Model HT-M). The pumps on the HT unit function as the boiler feed pumps – running continuously and feeding water into the boiler[s].

At start-up, the HT-M unit will need a way to raise water temperature up to at least 180 degrees (F). This *must* be manually achieved on the HT-M unit. It could be done through the 25 psig steam line as an option. The high-pressure system returns are piped back to the HT-M unit entering into the stainless steel sparge tube below the water line. Once the tank of the HT-M starts to pressurize, the energy will blend into the water eventually producing steam pressure of 35 psig. The 35 psig steam coming out of the HT-M unit is greater than the 25 psig that was initially feed into the regulators on the deaerator at start-up. Therefore, the higher pressure of 35 psig will now feed the steam into the deaerator regulators that are designed to further reduce the pressure down to 5-7 psig. The 25 psig from the steam header will be used as an emergency back-up source.

If the HT-M unit pressurizes above 35 PSIG, a Spence EQ-5 valve will open up and vent the 40 psig (see diagram). If the EQ-5 valve fails, there still is a safety relief valve set at 45 psig to relieve the full pressure.

The tank on the HT-M unit is ASME code stamped for 100 psig. The HT-M unit is equipped with an overflow drainer just in case the tank floods. The HT-M unit is also equipped with a compound gauge and a vacuum breaker – in case the system is shut off or goes cold. In addition, the HT unit will have high and low water alarms plus a low water cut-off.

At start-up, while the boiler operating pressure rises slowly from 0 psig, there is little backpressure on the boiler feed centrifugal pumps. Without any backpressure, the boiler feed pumps will “run out the curve” creating pump cavitations that will cause the pumps to prematurely fail. Therefore, if the boiler feed pumps are used to fill the boiler at boiler start-up, the boiler feed pumps must be manually balanced to keep the pumps from cavitating.

The boiler feed pumps on the HT-M unit are sized to handle two scenarios:

1. Start-up operations when pressure in HT-M is 0 psig.
2. Ongoing operations at design conditions with the boiler running at 125 psig and a possible pump suction pressure of 40 psig in the HT-M unit.

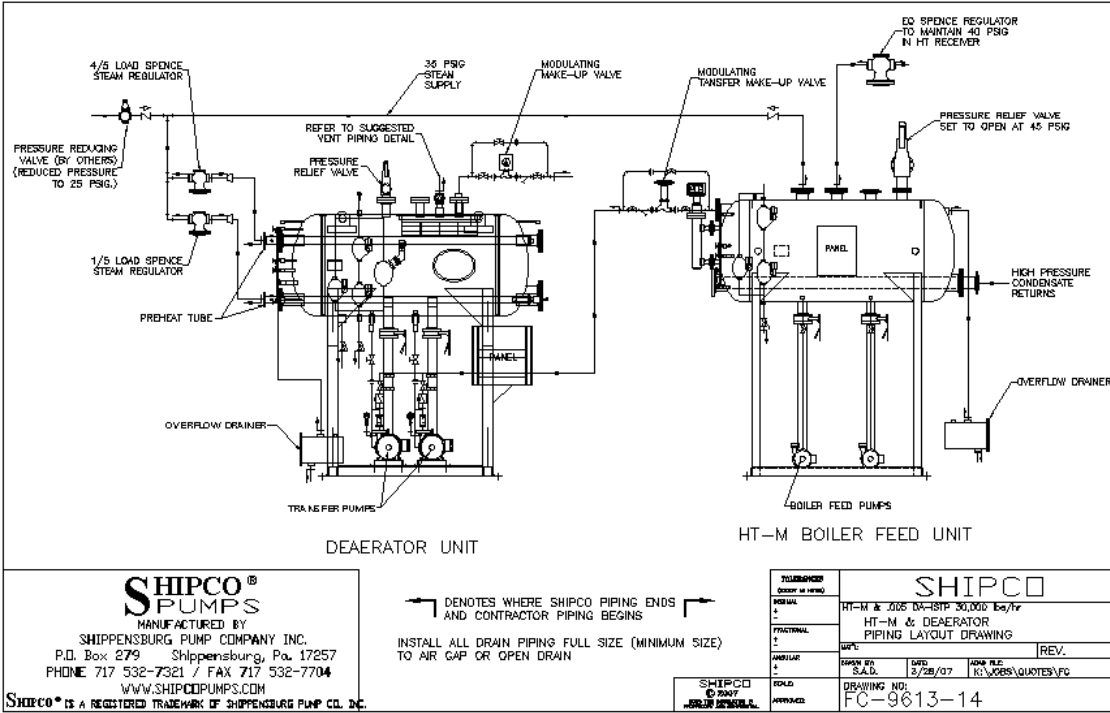
At startup of the HT-M unit, when the boiler is operating at 125 psig and the pressure in the HT-M is at 0 psig, the boiler feed pumps must be sized to overcome the boiler pressure of 125 psig.

Once the HT-M unit and deaerator are up and running, the boiler feed pumps must handle design operating conditions of approximately 80 psig discharge pressure (i.e., 125 boiler operating pressure minus the 40 psig in the HT-M tank).

Due to the pressure differential between HT-M startup conditions and ongoing operating conditions, the boiler feed pumps will be fitted with automatic, flow control valves. The automatic flow control valve is rated for a particular differential pressure range that keeps the pumps from “running out the curve” because of the lower discharge pressure of 80 psig. Because the pressure differential can exceed the pressure range of the automatic flow control valve rendering it ineffective at startup, manual balancing may still be required initially until the pressure differential is within the spring range of the flow control valve.

The transfer pumps on the deaerator are sized to overcome a possible pump suction pressure of 40 psig in the HT-M unit. These pumps are also fitted with an automatic, flow control valves because of the pressure differential that exists between startup conditions of 0 psig in the HT-M and ongoing operating pressure of 40 psig.

The deaerator will be sized for start-up load. Once the system is in full operation, the deaerator will only deaerate the make-up water since the temperature of all the system returns exceeds saturation temperature. In addition, the deaerator unit will have high & low water alarms plus a low water cut-off.



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 INSTALL ALL DRAIN PIPING FULL SIZE (MINIMUM SIZE)
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TOLERANCES (unless otherwise noted)		SHIPCO	
FINISH	HT-M & 705 DA-817P 30,000 Psi/yr		
FRACTIONAL	HT-M & DEAERATOR		
	PIPING LAYOUT DRAWING		
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SHIPCO	3/28/07		
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