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HeatSponge Two-Stage Heat Recovery Technology

The advancement of Two-Stage heat recovery technology is responsible for some of the greatest gains in boiler efficiency in a generation. Two-stage technology allows for multiple water heat sinks to extract more energy from exhaust gases than a single heat sink.

Boiler economizers had traditionally been utilized to recovery waste energy exiting the boiler. Since boiler feedwater tends to range between 180 and 227 degrees F the amount of energy that can be recovered is limited. Efficiency gains are limited to approximately 2 ½ to 3% due to the limitations of the laws of thermodynamics.

Two-stage technology provides further improvement in boiler efficiency by adding a second stage, usually condensing, after the first stage into a common casing for both heat exchanger sections. The second stage water flow very often tends to be boiler make-up water or a process water stream. Since the second stage usually enters the economizer at a temperature well under the dew point both a sensible and latent heat recovery can be realized resulting in far greater efficient gains. Modern two-stage economizers can provide efficiency gains in the 5% to 12% depending on the temperature and volume of the second stage heat sink.



*Figure 1 BEI SPLIT-TITAN STK
MODEL TWO-STAGE ECONOMIZER*

condensing which needs to be in a gas flow down orientation.

BEI offers two styles of two-stage economizer arrangements; the Stacked, STK, and Side-by-Side, SBS, which is an offering exclusive to BEI. The Stacked arrangement is the lowest cost method of making a two-stage economizer. In a stacked arrangement the second stage is placed above the first stage in a vertical arrangement. The advantage of a stacked design is a lower cost assembly. This arrangement however does have some disadvantages, the largest being the amount of condensation that can be realized. Since the second stage is located above the first stage and the economizer itself is commonly located above the boiler should the second stage create more condensation than the economizer can collect and drain in the lower transition it is possible to have condensation enter the boiler which is not an ideal situation. All BEI economizers feature a system of baffles and drains in the lower section of the economizer to collect and drain condensation, rain water, or even potential water from a tube leak before it can drop into the boiler. These drains however cannot handle excessive condensation. Furthermore, since the exhaust gases travel vertical up, the second stage will be unable to achieve optimum

The result of Boilerroom Equipment's efforts to develop the optimum arrangement for a two-stage economizer is the exclusive Side-by-Side (SBS) orientation. The SBS arrangement is an internal three-pass design in which the exhaust gases enter the bottom of the economizer in a conventional location and travel up over the first stage same as a STK model. As the exhaust gas reaches the top of the economizer in a SBS it transitions horizontally to a gas-flow down section where second stage is located. Flowing exhaust gas down allows for the optimization of forming condensation. Just as important, the SBS arrangement allows for the integration of a separate condensation sump isolated from the stack so there is never a concern of condensation being able to backflow into the boiler. SBS economizers can have the geometry of their second stage heat exchanger optimized to maximize condensing to far greater efficiency gains than can be realized in a STK arrangement. After passing over the second stage the exhaust gases enter a third, integral vertical up duct where they are discharged to atmosphere out of the top of the economizer. Same as the STK arrangements, the SBS HeatSponge two-stages are designed for extremely low gas side pressure losses operating solely on the draft created by the existing burner combustion air fan with no need for external draft systems.

The diagram below shows the internal of a SBS two-stage economizer in which the second stage has twice the amount of heating surface as the first stage. This economizer was installed on a 500 HP firetube boiler with the second stage flowing a process water stream enabling the boiler to achieve a final efficiency in the mid 90% range.

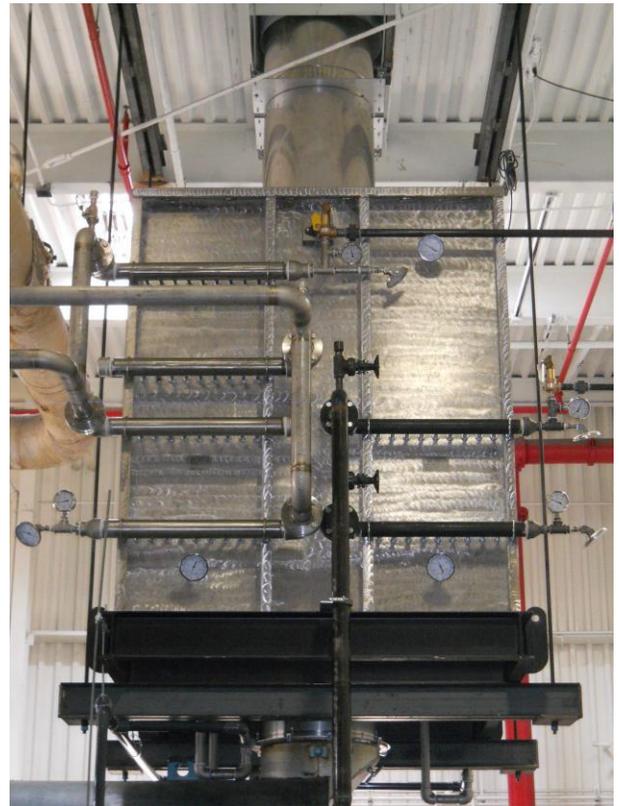
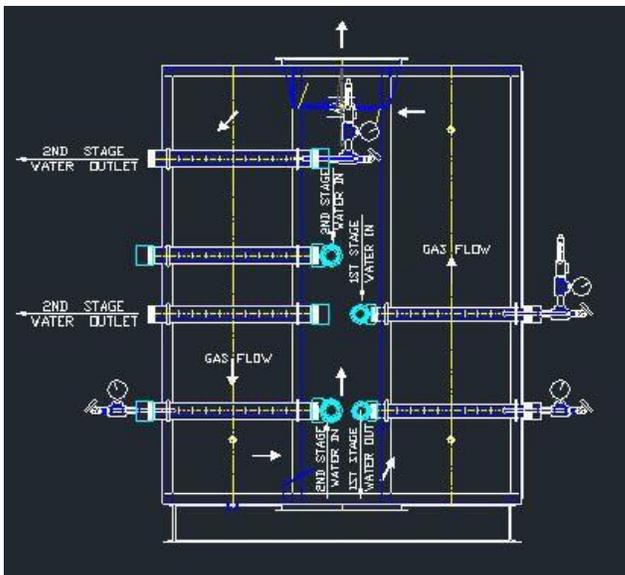


Figure 2 HeatSponge SBS/UB-TITAN TWO-STAGE ECONOMIZER



The SBS-BOSS configuration represents some of the larger Two-Stage economizers supplied by BEI. An SBS-BOSS offsets the second stage to reduce overall height and provide for easier accessibility for long term servicing. The fully condensing second stage is provided with exhaust gas flow down for optimum condensing and insurance that no condensation can enter the boiler.

Two examples of STK-SPLIT-TITAN economizers installed on Superior firetube boilers. Second stage sized for 100% make-up water flow in both applications.



STK-SPLIT-TITAN economizer installed on a Hurst firetube boiler at a California food processing facility. The second stage is sized for 100% make-up water flow

Thank you for your consideration of our HeatSponge brand of heat recovery solutions. Please do not hesitate to contact us any time we can be of service.

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