

Applications and Case Studies of Non-Condensing Economizers

HeatSponge Boiler Economizers
Engineered and Manufactured by
Boilerroom Equipment Inc, Latrobe PA

Economizers and Technologies for Boiler System Efficiency

May 2008

Presented by Vincent Sands, PE
Principal, Boilerroom Equipment, Inc.

Conventional Boiler Economizers

- The most common type of economizer design and installation
- Provides indirect contact heat transfer between the boiler exhaust and a water stream
- Almost always represents a sensible heat transfer only although limited condensation on low water temperature applications can be accommodated
- Installed inline with the boiler exhaust and stack

HeatSponge Boiler Economizers

Conventional Boiler Economizers

- When conventional boiler economizers are utilized
 - When initial cost is a concern as conventional boiler economizers reflect a low cost approach to energy efficiency
 - When there is not enough of a heat sink in the available water to accommodate condensing heat transfer
 - To be used in conjunction with condensing units to efficiently reduce the level of sensible energy prior to entering a condensing unit allowing for less expensive condensing units
 - When corrosive fuels would not allow for condensing

HeatSponge Boiler Economizers

Conventional Boiler Economizers

- Capacity range for typical economizers
 - Since a boiler does not need an economizer to operate an installation will be based solely on the economic justification
 - The lowest practical capacity range for an economizer considering current fuel pricing tends to be in the range 100 HP

HeatSponge Boiler Economizers

Conventional Boiler Economizers

- Key advantages to conventional economizers
 - Low capital cost
 - Easy installation
 - No moving parts
 - Very low maintenance
 - No parasitic loss from fans or other equipment
 - Takes up no floor space when installed in the exhaust stack

HeatSponge Boiler Economizers

Conventional Boiler Economizers

- Three Different Types of Economizer Heat Recovery Applications
 - Full condensing – flue gas exits economizer under dew point - external economizer design
 - Low Temperature – low tube wall temperatures may initiate localized condensing however the bulk of the flue gas remains above the dew point – conventional economizer manufactured out of stainless steel
 - Conventional Economizer – No part of the economizer is ever exposed to temperatures that could condense

HeatSponge Boiler Economizers

Conventional Boiler Economizers

- Key parts of a conventional economizer
 - TUBES: The heart of the unit is a finned tube element
 - Fins are utilized because water can absorb energy at a greater rate than flue gas can give it up
 - Finned tubes provides more gas side heating surface to compensate for the reduced heat transfer
 - Fin pitch is a function of a fuel's fouling ability
 - CASING: The tube bundle is enclosed in an insulated, gas-tight casing

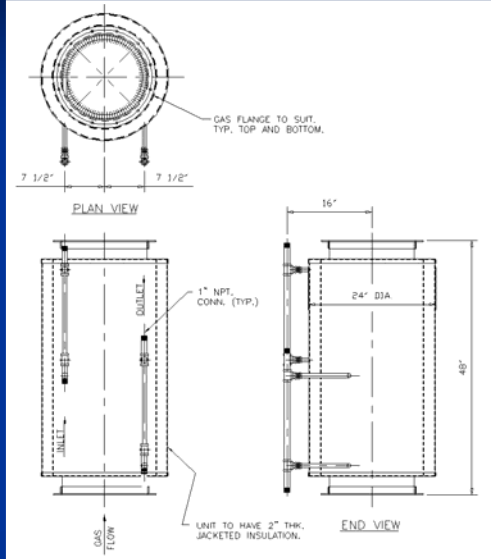
HeatSponge Boiler Economizers

Types of Conventional Economizers

- There are two fundamental types of conventional economizers
 - Coiled Economizers
 - Typically the cheapest type of economizer
 - Not repairable in place so are considered to be throw-away units
 - Require internal dampers or baffles to direct flue gas flow over the finned tube bundle
 - Available in both carbon steel and stainless steel tubes

HeatSponge Boiler Economizers

Coiled Economizers



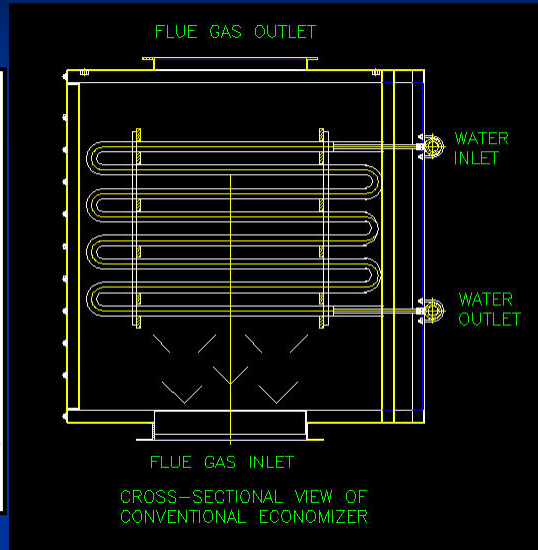
HeatSponge Boiler Economizers

Types of Conventional Economizers

- Rectangular Economizers (two types)
 - Non-repairable box-type economizers
 - The cheapest rectangular design
 - All welded construction makes repairs possible but very expensive and time consuming
 - Requires ASME code welders to perform repairs
 - Typically only available in carbon steel
 - Commonly installed on very large industrial watertube boilers and solid fuel fired boilers where heavy fouling is an issue
 - Repairable rectangular units
 - Tube elements can be replaced quickly and inexpensively with no need for welding
 - Water catch and drain assembly in bottom of unit
 - Tubes and casing available in various metallurgies
 - Ideal for gas fired firetube boilers up to medium size water tube boilers

HeatSponge Boiler Economizers

Repairable Rectangular Economizers



HeatSponge Boiler Economizers

Conventional Boiler Economizers

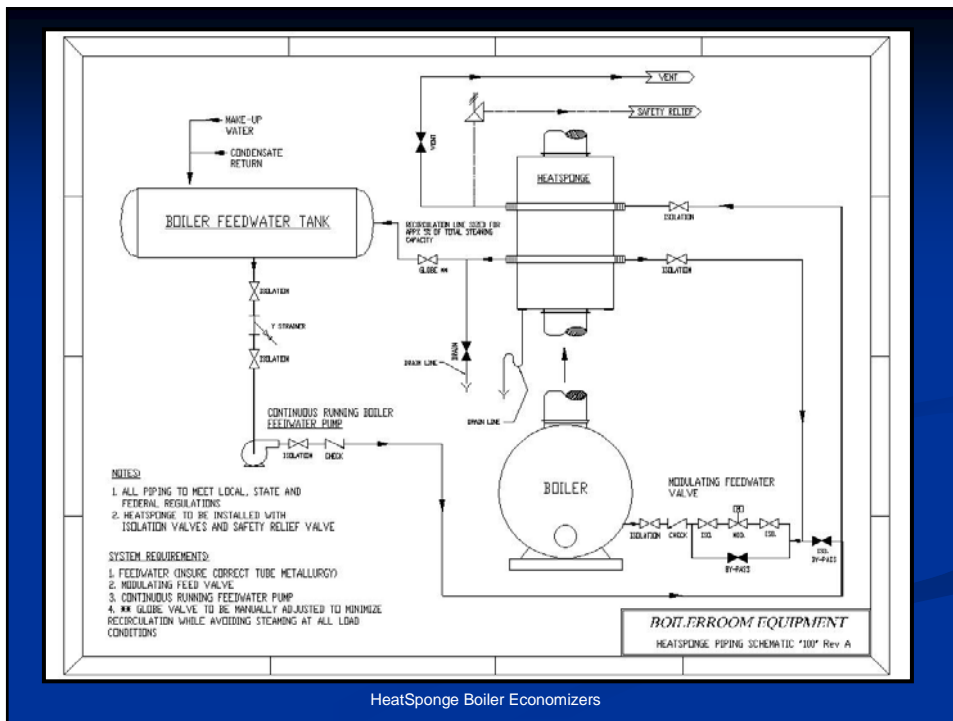
- Design Considerations
 - Inlet water temperature and condition
 - Deaerated water can utilize carbon steel tubes and fins
 - Non-Deaerated water must utilize stainless steel tubes and fins to avoid oxygen pitting and cold temperature related corrosion
 - Water flow must be constant to avoid stagnation and the steaming and hammering that accompanies stagnant flow
 - Boiler maximum flue gas backpressure
 - Excessive backpressure will impact proper burner operation and could reduce capacity

HeatSponge Boiler Economizers

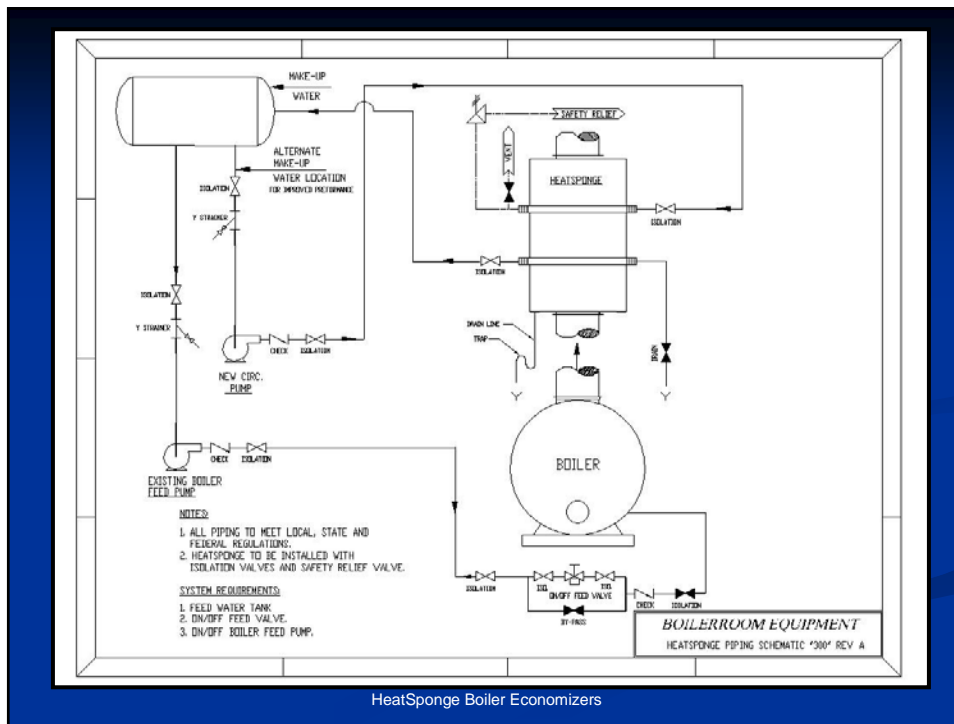
Conventional Boiler Economizers

- Typical conventional boiler economizer applications and location of installation
 - Boiler feedwater heating
 - Installed between feedwater tank and boiler
 - Make-up water (for applications with high make-up water rates)
 - Installed between softener and feedwater tank or circulates from a tank and returns to the same tank to take advantage of improved heat transfer from the greater temperature differential
 - Process water flow not related to boiler steaming rate
 - Wash down water
 - Process water
 - Potable water
 - Space heating water

HeatSponge Boiler Economizers



HeatSponge Boiler Economizers



Examples of Recovery and Payback

- 150 HP / 150 psig Scotch Marine fire tube
 - 160 deg F water from an atmospheric feed tank
 - 450 deg F stack temperature
 - \$ 12.00 mmbtu
- HeatSponge model SHORTY-2-[B5SS]
 - Btu recovery @ high fire 186,000 btu/hr
 - Savings in dollars \$ 2.24 an hour
 - Savings over one year at 12 hour / 5 day operation is \$ 7,000.00
 - Up front cost for one economizer \$ 8,000.00
 - Includes stainless steel casing, tubes, and fins to allow for localized condensing inside of economizer without damage to economizer
 - Simple payback 1.1 years
 - Savings over 10 years \$ 70,000.00

HeatSponge Boiler Economizers

Examples of Recovery and Payback

- 500 HP / 150 psig Scotch Marine fire tube
 - 227 deg F water from a deaerator
 - 450 deg F stack temperature
 - \$ 12.00 mmbtu
- HeatSponge model BOSS-8-[B5CC]
 - Btu recovery @ high fire 614,000 btu/hr
 - Savings in dollars \$ 7.37 an hour
 - Savings over one year at 24/7 operation is \$ 64,385.00
 - Up front cost for one economizer \$ 21,415.00
 - Includes standard carbon steel casing, tubes, and fins suitable for a conventional installation
 - Simple payback 1/3 year
 - Savings over 10 years \$ 643,850.00

HeatSponge Boiler Economizers

Examples of Recovery and Payback

- 500 HP / 150 psig Scotch Marine fire tube
 - 50 deg F 100% make-up water
 - 450 deg F stack temperature
 - \$ 12.00 mmbtu
- HeatSponge model BOSS-8-[B5DS]
 - Btu recovery @ high fire 786,000 btu/hr
 - Savings in dollars \$ 10.77 an hour
 - Savings over one year at 24/7 operation is \$ 94,100.00
 - Up front cost for one economizer \$ 35,000.00
 - Includes stainless steel casing, tubes, and fins to allow for localized condensing inside of economizer without damage to economizer
 - Simple payback 1/3 year.
 - Savings over 10 years \$ 941,000.00

HeatSponge Boiler Economizers

Examples of Recovery and Payback

- 60,000 pph / 150 psig water tube
 - 227 deg F water from a deaerator
 - 525 deg F stack temperature
 - \$ 12.00 mmbtu
- HeatSponge base model BOSS-15-[B5CC]
 - Btu recovery @ high fire 1,700,000 btu/hr
 - Savings in dollars \$ 20.47 an hour
 - Savings over one year at 24/7 operation is \$ 178,825.00
 - Up front cost for one economizer \$ 33,800.00
 - Includes standard carbon steel casing, tubes, and fins Includes standard carbon steel casing, tubes, and fins
 - Simple payback 1/5 year.
 - Savings over 10 years \$ 1,788,250.00

HeatSponge Boiler Economizers

HeatSponge Products

- The HeatSponge was developed from a clean sheet of paper to be the most advanced high-value added economizer available to industry
- We manufacture two of the three types of units
 - Coiled Economizers
 - Repairable Rectangular units
- Our on-line sales engineer facilitates fast and easy selections and proposals

HeatSponge Boiler Economizers

HeatSponge Coiled Economizers

- HeatSponge SHORTY model economizers
 - Only supplied to a maximum of 300 HP
 - All surfaces exposed to flue gas including tubes and fins manufactured out of stainless steel
 - Unique proprietary internal baffle design eliminates need for problem riddled damper arrangement
 - Designed to accommodate some condensing

HeatSponge Boiler Economizers

HeatSponge Rectangular Economizers

- In our opinion the HeatSponge represent the highest value-added design available to industry
- Three models allow for various boiler capacity and heat recovery applications
 - BOSS – Standard model HeatSponge
 - SUPER – High recovery HeatSponge for additional heat recovery
 - TITAN – Large boiler HeatSponge
- No ASME code welds in the unit
- All tubes connect to the headers via a compression fitting allowing for fast and easy replacement of failed elements
- Fully insulated one-piece design allows for easy installation
- Various tube and casing metallurgies to allow for use in a wide variety of applications
- Inlet gas area features a water collection and drain system to keep condensation, rain, or potential water from a tube failure from entering the boiler where it can cause damage

HeatSponge Boiler Economizers

Product Support

- On-line performance, pricing and engineering support is available at our Internet site www.HeatSponge.com
- Allow "Bruce" our automated on-line sales engineer to assist you in the generation of a complete proposal package at any time
- Contact an inside sales engineer at our plant by calling 1-866-666-8977

HeatSponge Boiler Economizers