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

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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
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

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
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

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
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 provide 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

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
Coiled 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
Repairable Rectangular 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
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
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
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

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
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
    - Simple payback 1/5 year.
    - Savings over 10 years $1,788,250.00

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 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 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
Product Support

- On-line performance, pricing and engineering support is available at our Internet site [www.HeatSponge.com](http://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