



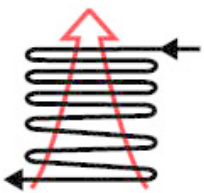
Your Single Worldwide Source For Steam Technology

The Clayton Advantage In Boiler Efficiency

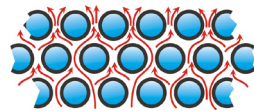
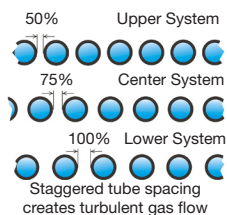
The Clayton Steam Generator has been designed to provide high quality, dry steam, rapidly and efficiently. The exclusive controlled circulation and counter-flow heat exchanger design is the heart of the Clayton Steam Generator. The Clayton design offers substantial fuel savings and size/weight advantages. Sizes range from 25 to 1000 bhp with design pressures up to 3000 psig. The Clayton design is inherently safe, with no possibility of a hazardous steam explosion and a flawless safety record.

The unique design of the Clayton Steam Generator offers significant efficiency advantages over conventional firetube boilers. A recent major university study concluded that by applying realistic assumptions and measuring the true fuel-to-steam efficiency of the whole boiler system, a Clayton Steam Generator averages 5.8% higher efficiency than conventional firetube boilers. In addition, the efficiency advantage of a steam generator increases above these amounts if steam demand fluctuates.

Clayton Advantage #1: Unique Heat Exchanger



The unique Clayton heat exchanger results in the highest thermal efficiency of any boiler. The boiler feedwater runs counter to the exhaust gases resulting in optimum heat transfer. The heat exchanger coil design and spacing ensure turbulent flow of the exhaust gases across the coil, thus facilitating good heat transfer rates. The Clayton heat exchanger relies on controlled, forced, circulation, as opposed to natural circulation in conventional firetube boilers. The spiral spring coil design allows rapid start-up



Varying tube spacing ensures high velocity

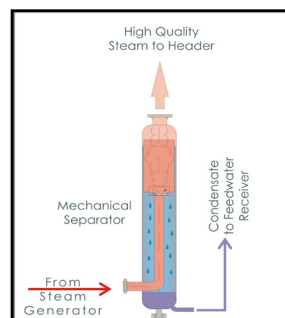
Clayton Advantage #3: Lower Surface Area



The external surface of an operating steam boiler is hotter than its surroundings and therefore loses heat by both radiation and convection. The losses represent heat radiating from the boiler and heat loss due to air flowing across the boiler. Low exterior surface area means low area for convection and radiant heat loss. Due to

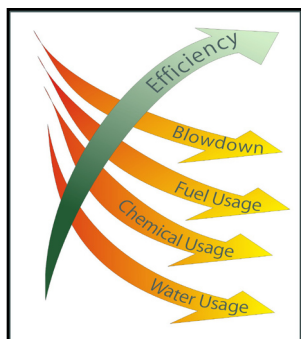
the size of conventional firetube boilers, radiation and convection losses from the boiler to the boiler room will normally run 1.4% to 1.6%. These same losses on a Clayton Steam generator, with much lower surface area, will run less than 0.75%. A Clayton Steam generator is also highly efficient in its use of space. Space is at a premium in most installations: either for existing or new construction. Clayton is the ideal solution to these space considerations. Our small footprint, typically 1/4th to 1/3rd of a firetube, means that our Steam Generator can be placed in an existing facility without the need for new construction. Even two units for twice the steam capacity, will fit in the space required for one firetube boiler. For new facilities, construction costs can be reduced significantly with the use of a Clayton Steam Generator.

Clayton Advantage #4: High Quality Steam



Clayton's method of producing steam includes a steam separator that provides significantly higher quality steam than conventional boilers. Our steam quality is 99.5% or better in most instances. Higher quality steam means higher energy. A pound of steam typically contains 3 to 5 times the amount of heat than in a pound of water at the same temperature and that heat is more easily recovered in your process. The steam quality from a Clayton Steam Generator is typically 1% or more higher than from a conventional boiler resulting in higher efficiency.

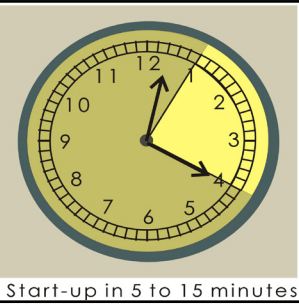
Clayton Advantage #2: Reduced Blowdown



Dissolved solids are introduced into every steam system and must be controlled to acceptable levels. This is accomplished by blowing down quantities of boiler water in order to remove some of the solids. While necessary, blowdown is inefficient since it not only removes water already heated to saturation, but also feedwater chemicals. The blowdown rates in a Clayton Steam generator are typically 1/8th to 1/10th the amount of blowdown in a conventional boiler and result in a 1% higher efficiency for the Clayton.

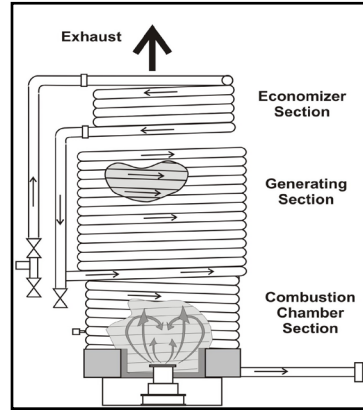
The Clayton Advantage In Boiler Efficiency

Clayton Advantage #5: Rapid Start-up



Clayton Steam Generators provide very rapid start-up. Typically, from 5 to 15 minutes, depending upon the size of the unit. This is a result of the low water content, typically, about 1/10th of the content of most conventional boilers of the same size. This rapid start-up ability results in reduced fuel and labor costs. Many operators of conventional boilers keep a boiler in a warm state during periods of non-use just so that it will be available quickly when needed. Since this is not necessary with a Clayton Steam generator, the fuel that would otherwise be used during that stand-by time is saved. The fuel consumed during the start-up period is also reduced because of the reduced time for start-up. Reduced start-up time can also result in reduced labor cost since it may not be necessary to bring an employee into the plant, earlier than otherwise needed, just to start-up the boiler.

Clayton Advantage #5: Integrated Stack Economizer

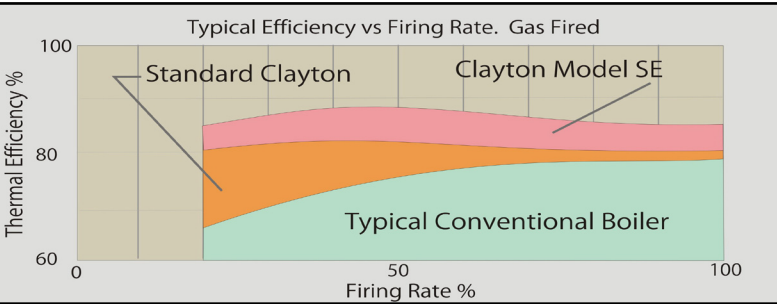


Flue gases from boilers are typically 400-600°F and a stack economizer can be used to recover this otherwise lost heat. A stack economizer is a water-to-air heat exchanger that is designed to use heat from hot boiler gases to preheat water. The water is most often used for boiler make-up water or some other need that coincides with the boiler operation. Stack economizers typically increase the overall efficiency of a steam system by approximately 4%. Stack economizers are generally supplied by third-party manufacturers and are shipped loose for installation in the stack. A Clayton Super Economizer (SE) is integrated into the steam generator system, mounted

and tested at the factory and arrives at your site ready to be installed as part of the Steam Generator. Clayton stack economizers are not only economical to purchase without additional installation cost, but they offer quick pay-back on investment.

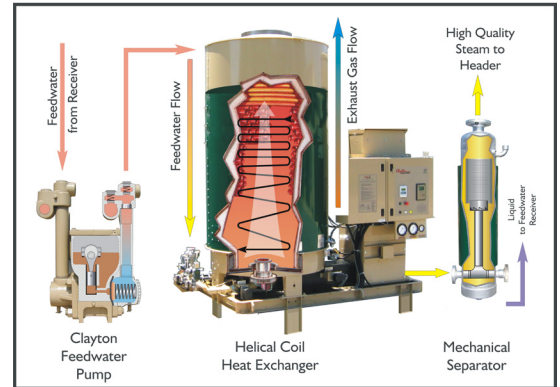
A conventional firetube boiler is a parallel heat exchanger and therefore the stack temperature will be higher than the temperature of the steam produced. A Clayton Steam Generator is a counterflow heat exchanger and the stack temperature can be below the temperature of the steam being produced. The stack temperature, a good measure of efficiency, of a Clayton Steam Generator equipped with a Super Economizer will, typically, be 80-100°F below the temperature of the steam being produced. Whereas, the typical 5 square feet of heating surface per boiler horsepower (3 or 4 pass) firetube boiler will have a stack temperature 90-100°F above the temperature of the steam produced.

Clayton Advantage #6: Flat Efficiency Curve



A Clayton Steam Generator's controlled circulation and counterflow heat exchanger design, alone, typically accounts for a minimum of a 5% improvement in fuel efficiency over conventional firetube boilers. Boilers have a certain efficiency curve that tends to result in the boiler having the highest efficiency at full-fire. As a conventional boiler is 'turned-down' to run at less than 100% capacity, efficiency typically drops. A Clayton Steam Generator, with its controlled circulation operates with essentially a flat efficiency across all firing rates. A Clayton Steam Generator maintains its peak efficiency at all firing rates and with its ability to follow load swings and respond quickly to load changes, there is never any sacrifice in efficiency. Keeping in mind that most industrial boilers installed today are oversized for the current steam demand, significant savings can be achieved with Clayton Steam Generators.

How Steam Is Produced In A Clayton Steam Generator



Clayton

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