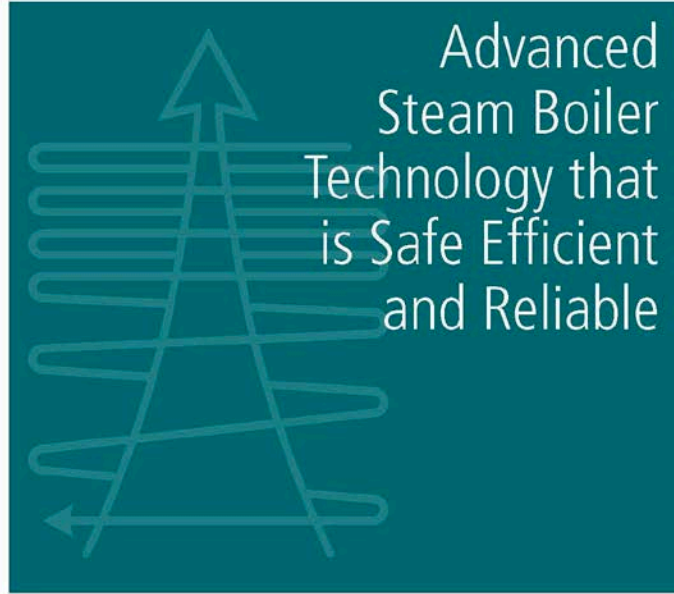


Steam Generators

Advanced
Steam Boiler
Technology that
is Safe Efficient
and Reliable



SAVES FUEL
SAVES SPACE
SAVES TIME
SAVES MONEY



Clayton Industries



*Worldwide Headquarters
City of Industry, California*

Established in 1930

Privately Owned

Clayton Industries



Bornem, Belgium



Mexico City, Mexico



*Maquiladora Plant
Tijuana, Baja Mexico*



*Service & Chemical Sales Headquarters
Cincinnati, Ohio, USA*

Clayton U.S. / Canada Sales/Service Offices



Europe Sales/Service Offices



Clayton Industries

Thermal Products

Steam Generators -

*Fired and Un-Fired Units
25 to 1500 BHP, Saturated Steam
200 to 1500 BHP, Superheated Steam
Pressures up to 3000 psig
Low NOx Burners - 50 to 1500 BHP*

Feedwater Treatment Systems -

*Atmospheric, D/A, and Semi-Closed Systems
Automatic Water Softeners
Chemical Injection Systems
Blowdown Systems*

Chemicals -

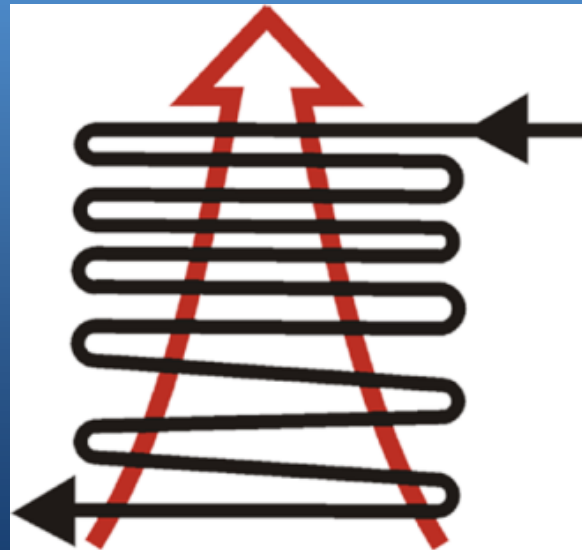
*Feedwater Treatment
Condensate Treatment
Cooling Tower Treatment*

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Major Design Features

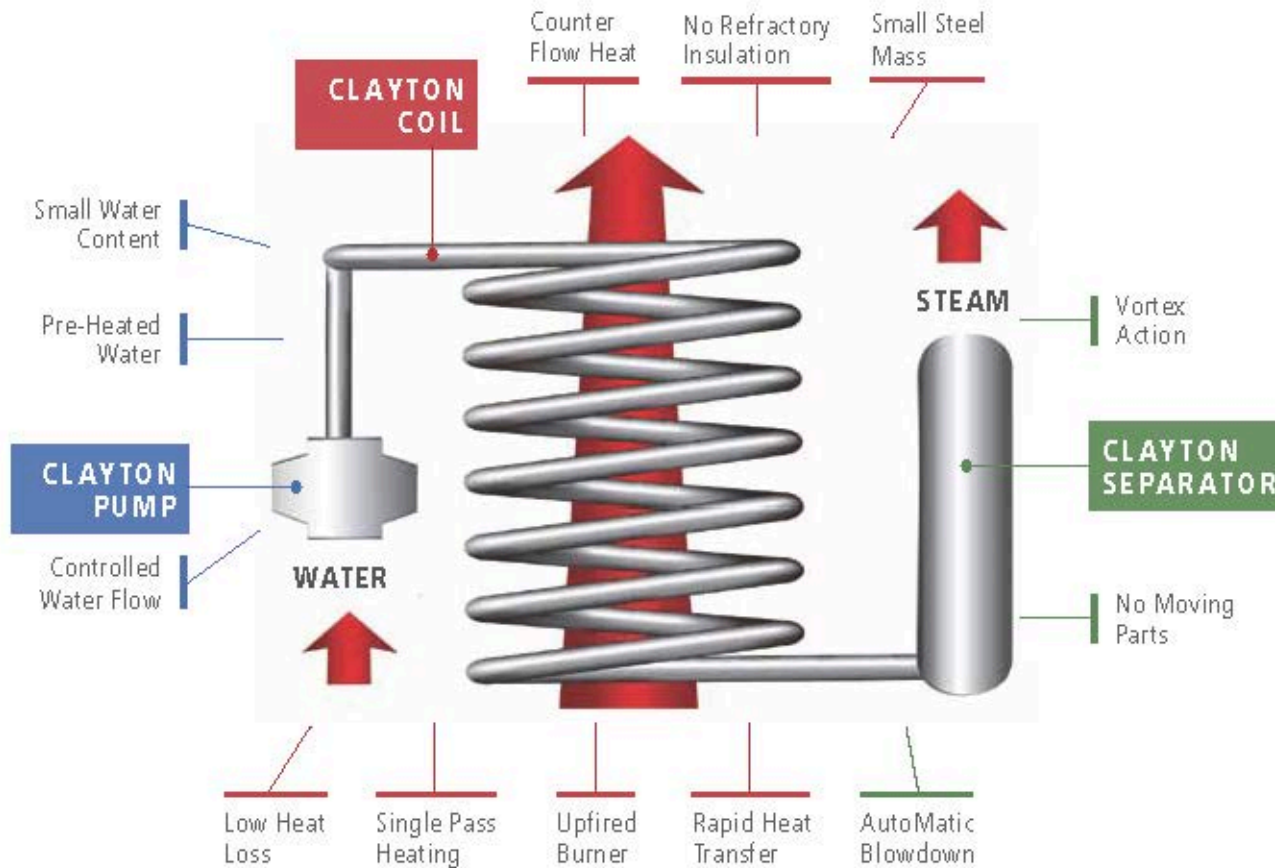
Counter-Flow Heat Exchanger

Controlled Circulation



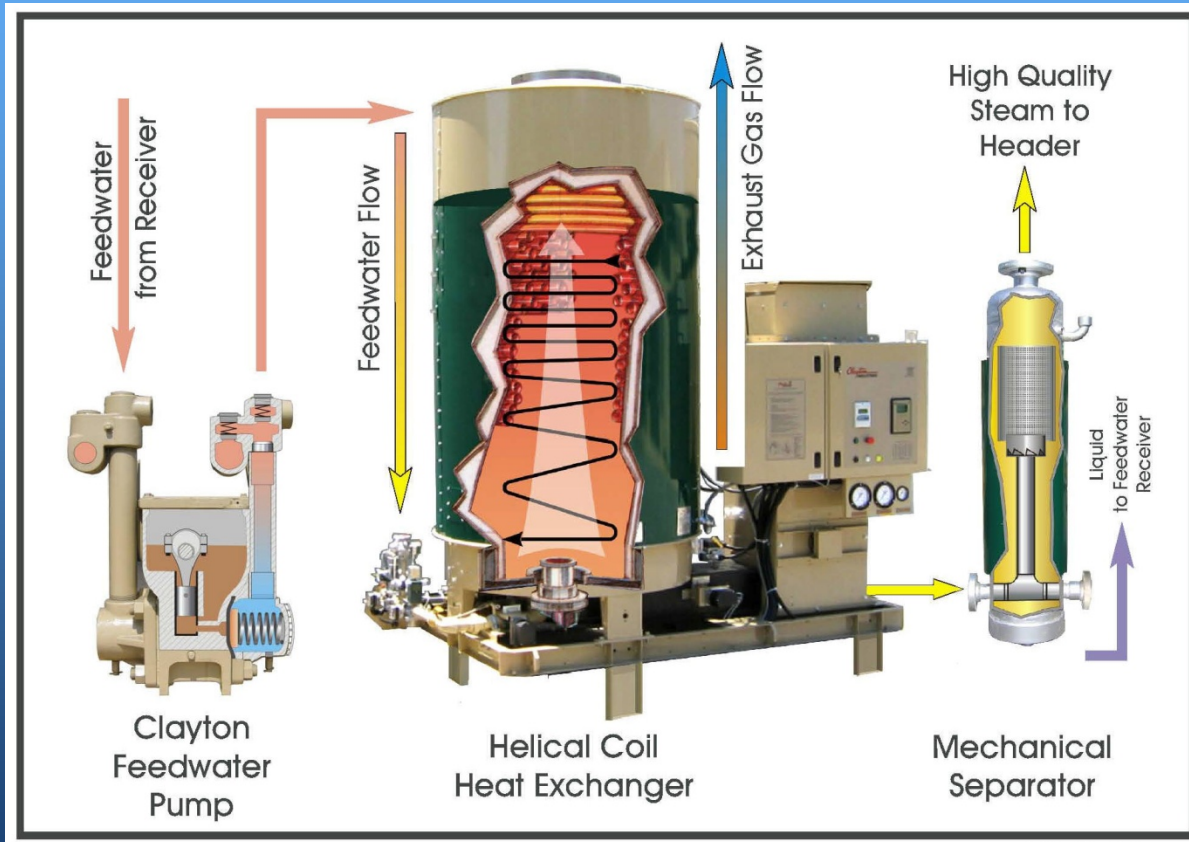
How We Make Steam

THE CLAYTON PUMP ■ THE CLAYTON COIL ■ THE CLAYTON SEPARATOR

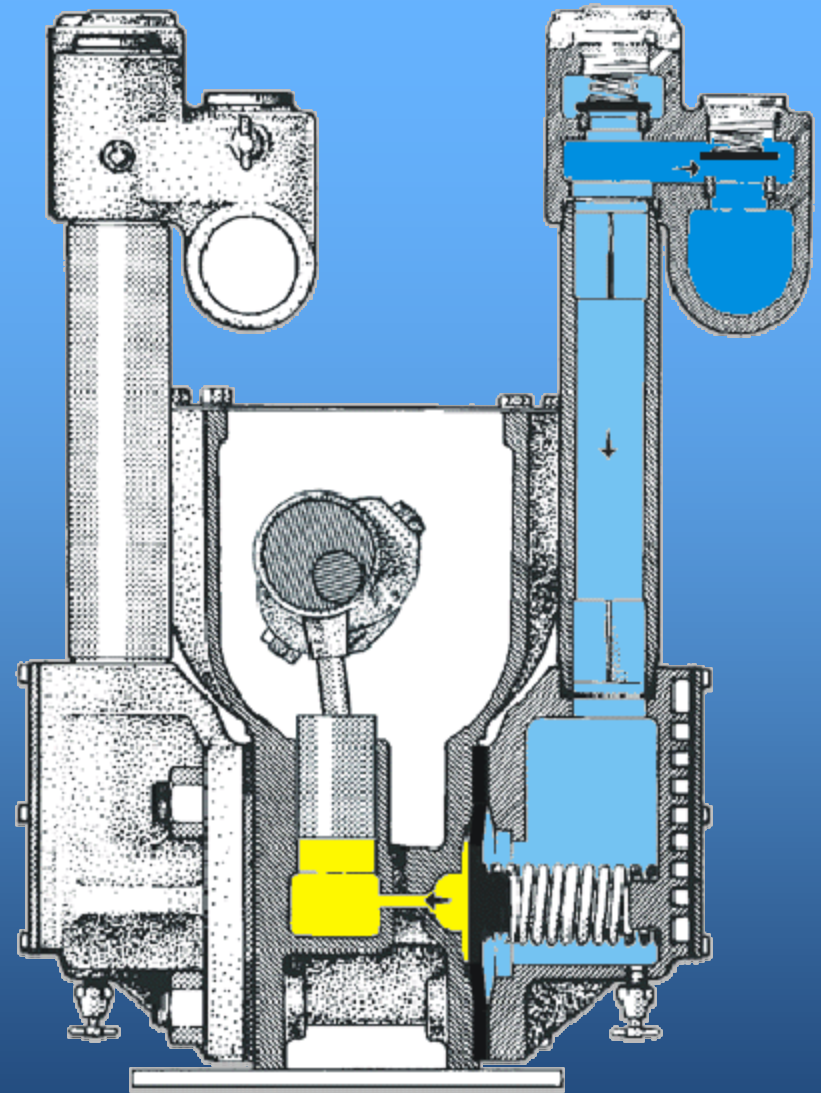
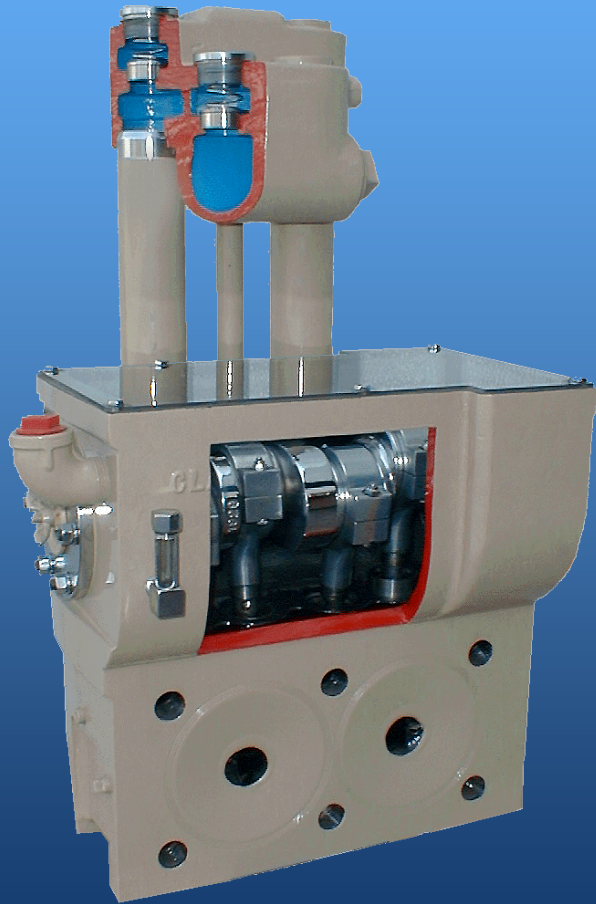


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Main Steam Generator Components



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Positive Displacement Feedwater Pump

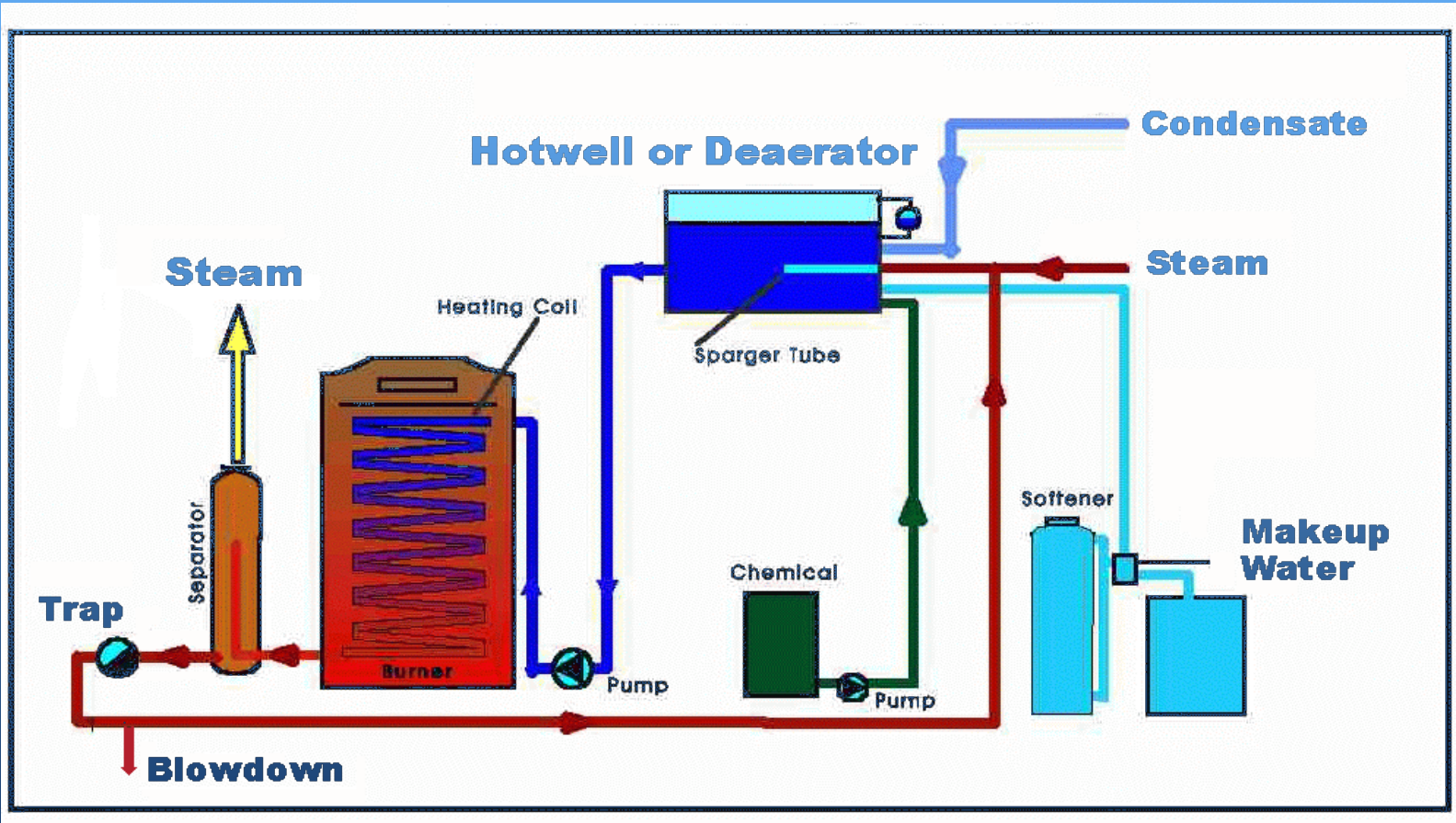
Consistent Quality Steam



Steam Separator
99.5% Quality
Fixed Vane design

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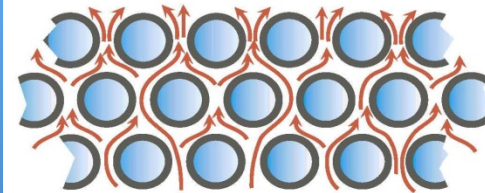
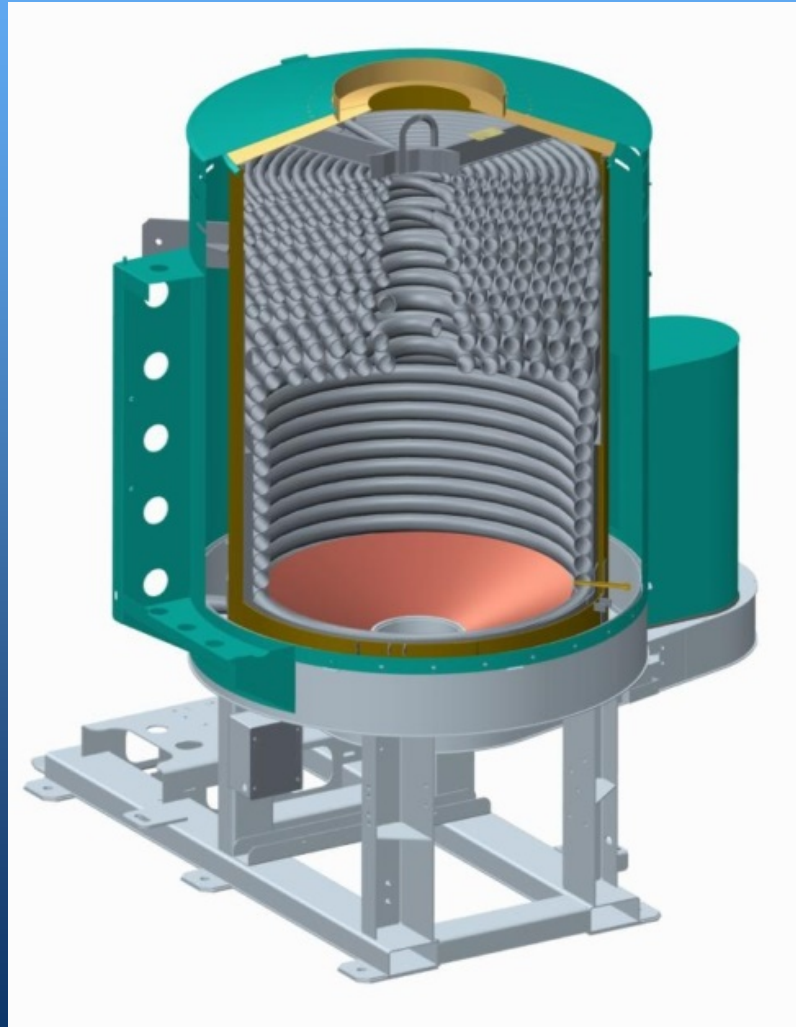
Typical Steam Generator System



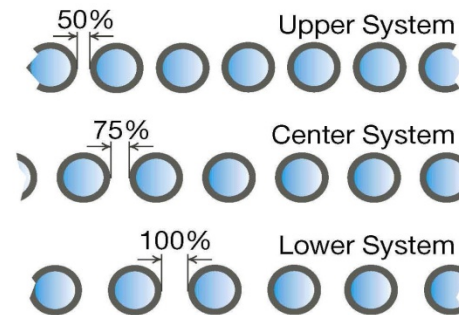


Unique Coil Design

Controlled Circulation, Counter Flow Heat Exchanger



Staggered tube spacing
creates turbulent gas flow



Varying tube spacing
ensures high gas velocity

Typical Coil Assembly



Coil Features

Continuous Mono-tube Coil

Steel tubing – SA-178 Grade A

No drums, headers or manifolds

Entire Coil housed in Steel Jacket

Ultra-Low Water Volume

SIGMA-FIRE PRODUCT LINE

25 to 200 BHP



Compact Footprint

*Reduced Noise &
Vibration*

Off-Mounted FW pump

Modulating Controls

Low NOx Burners

High Efficiency

E-SERIES PRODUCT LINE

150 to 1,500 BHP



Compact Footprint

*Rapid Start-up and
Load Response*

High Efficiency

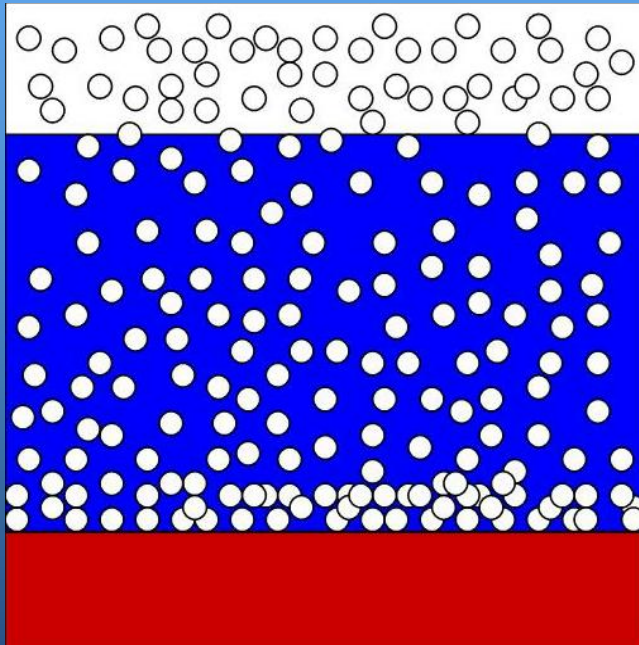
Modulating Controls

Low NOx Burners

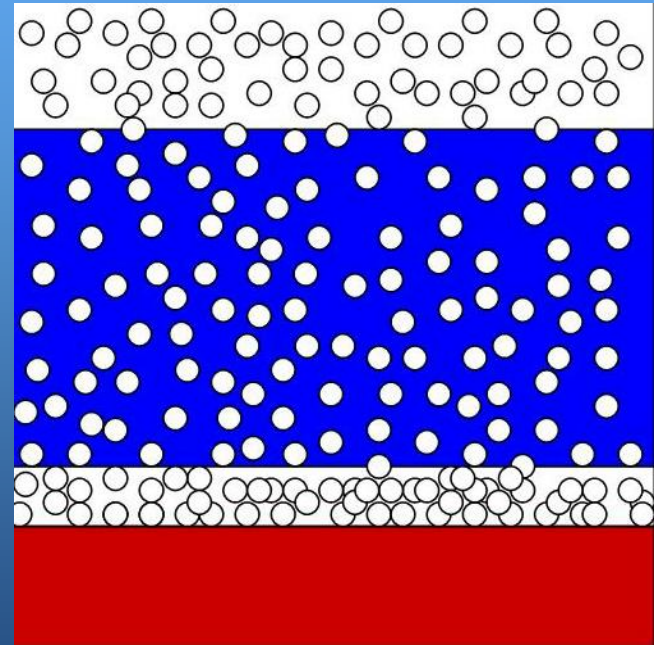
*Up to 3000 psig
Superheat Models*

Clayton Industries

Controlled Water Circulation



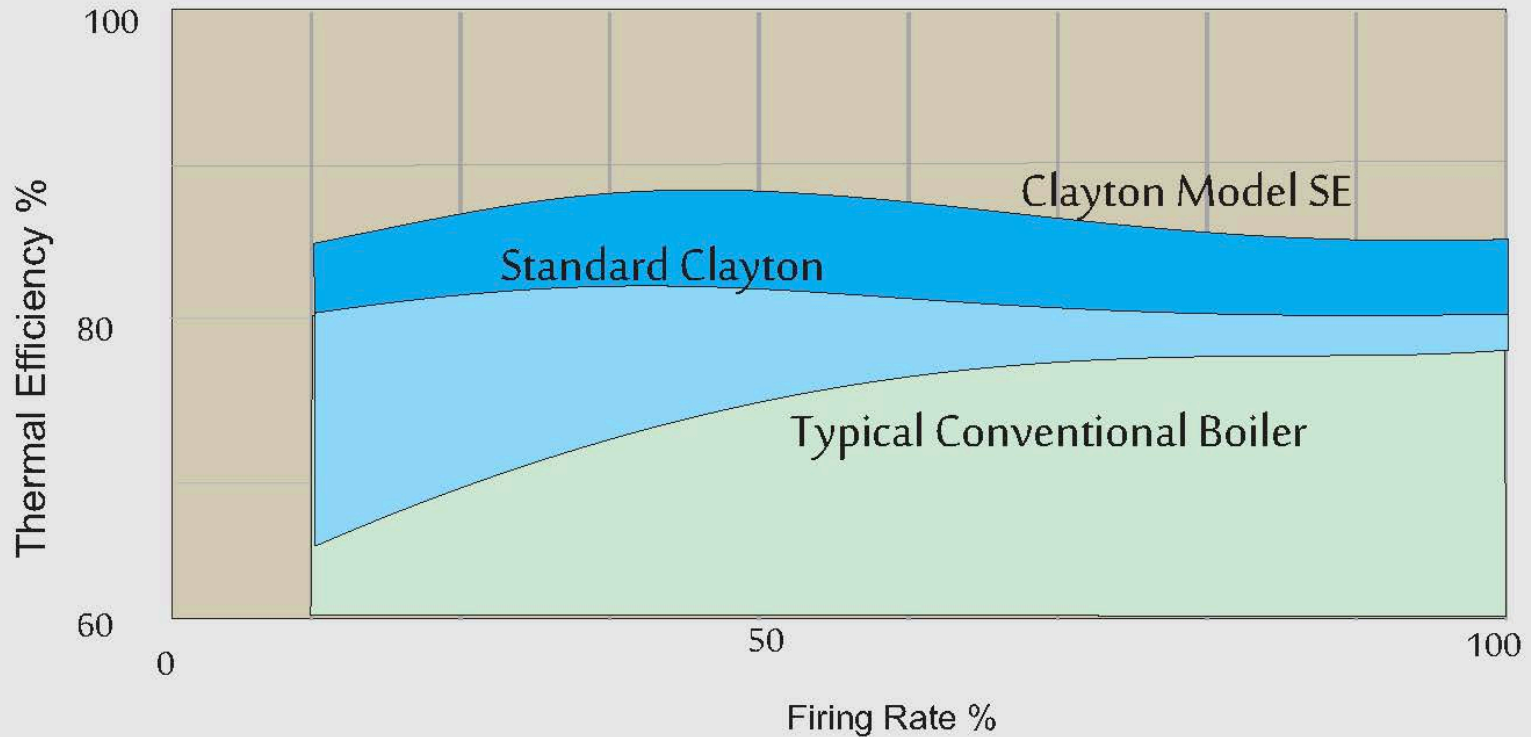
*Good Circulation =
Good Heat Transfer*



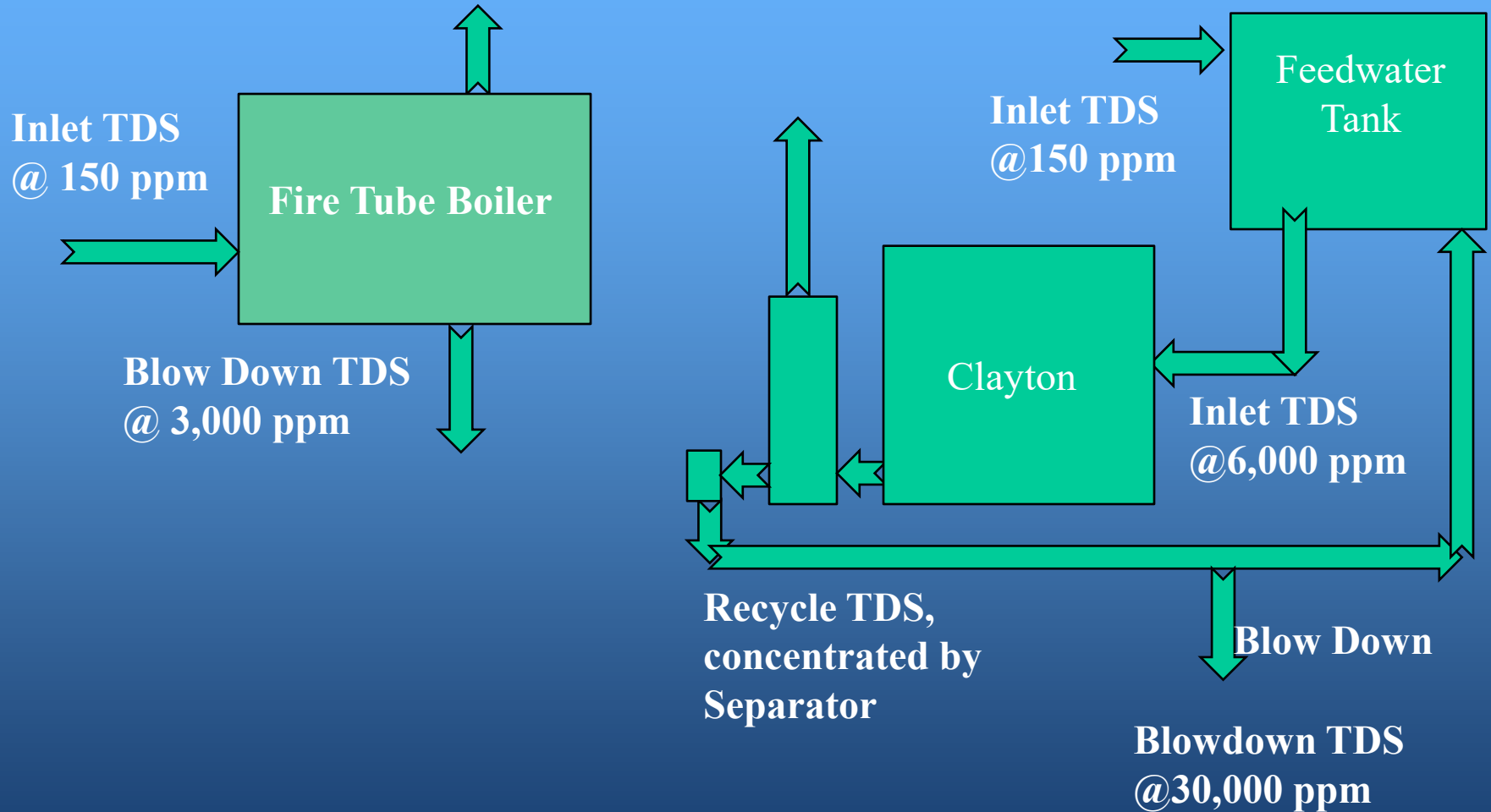
*Steam Blanketing =
Poor Heat transfer*

Thermal Efficiency

Typical Efficiency vs Firing Rate.



Blow Down Savings





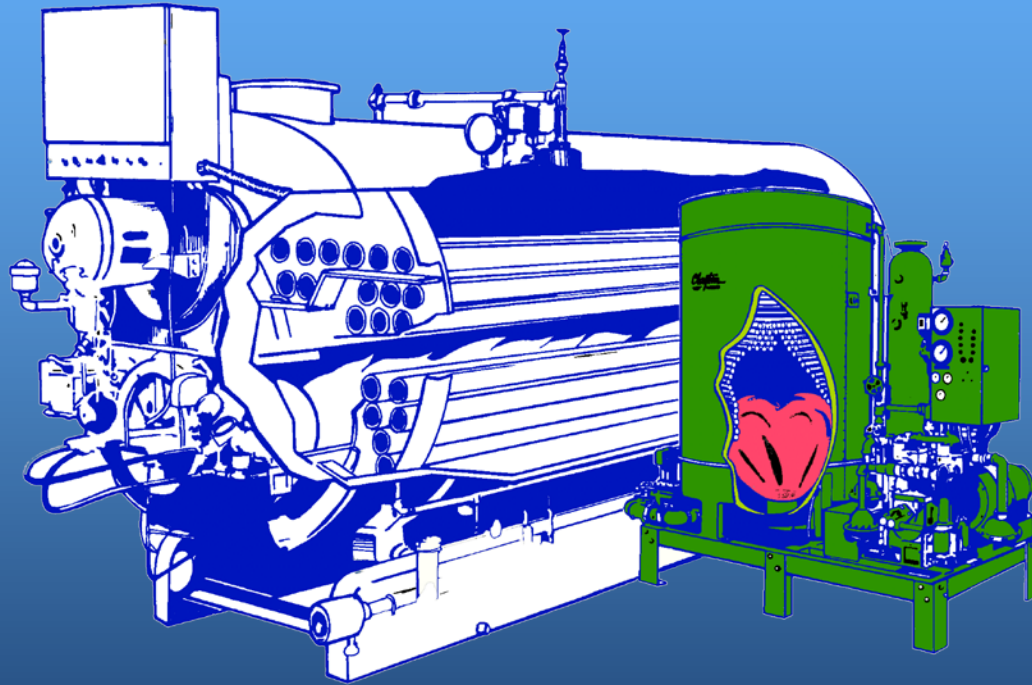
Design

Counter-Flow Heat Exchanger Controlled Water Circulation

- Using these two principles we eliminate the need for a large vessel . This greatly reduces the water volume and size of the heat exchanger needed. The benefits are:
 - Smaller physical size and weight
 - Much quicker start-up and load response.
 - Lower radiation and convection losses.
 - Linear thermal efficiency – No penalty for part load operation
 - Reduced blow down by concentrating the TDS in less water.
 - Greatly reduced risk of explosion.

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Size Comparison



Clayton Requires ½ the Floor Space

Clayton Industries

Water / Steam Safeties

MAIN FEEDWATER PUMP RELIEF VALVE - Protects pump against blockage in water line.

POLS – Pump Oil Level Switch – shuts off pump if fluid level inside pump either goes up or down.

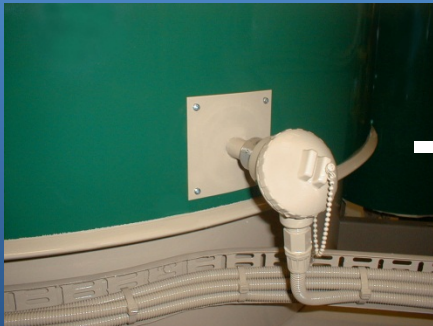
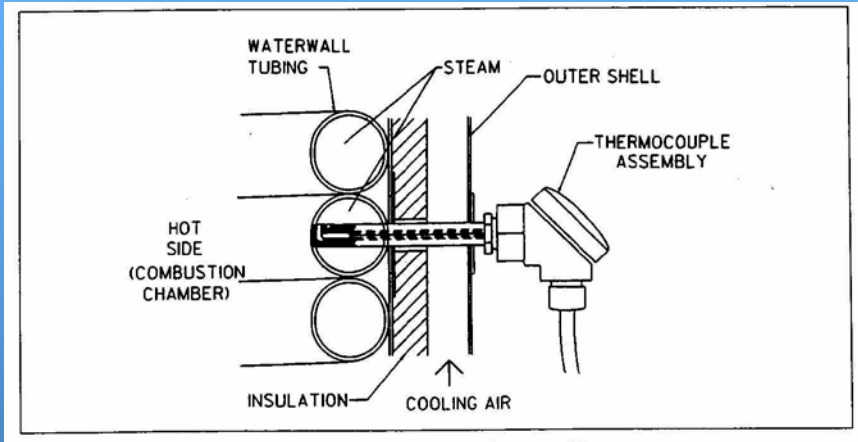
MTLC – Main Temperature Limit Controller – Dual thermocouple embedded in coil that senses fire side metal temperature and shuts down unit if temperature limits exceeded.

ATS – Auxiliary Thermostat Switch – sensing bulb in Upper body of steam separator that shuts down unit if superheat condition occurs.

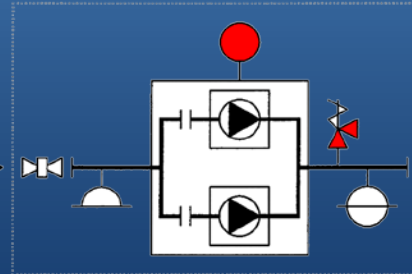
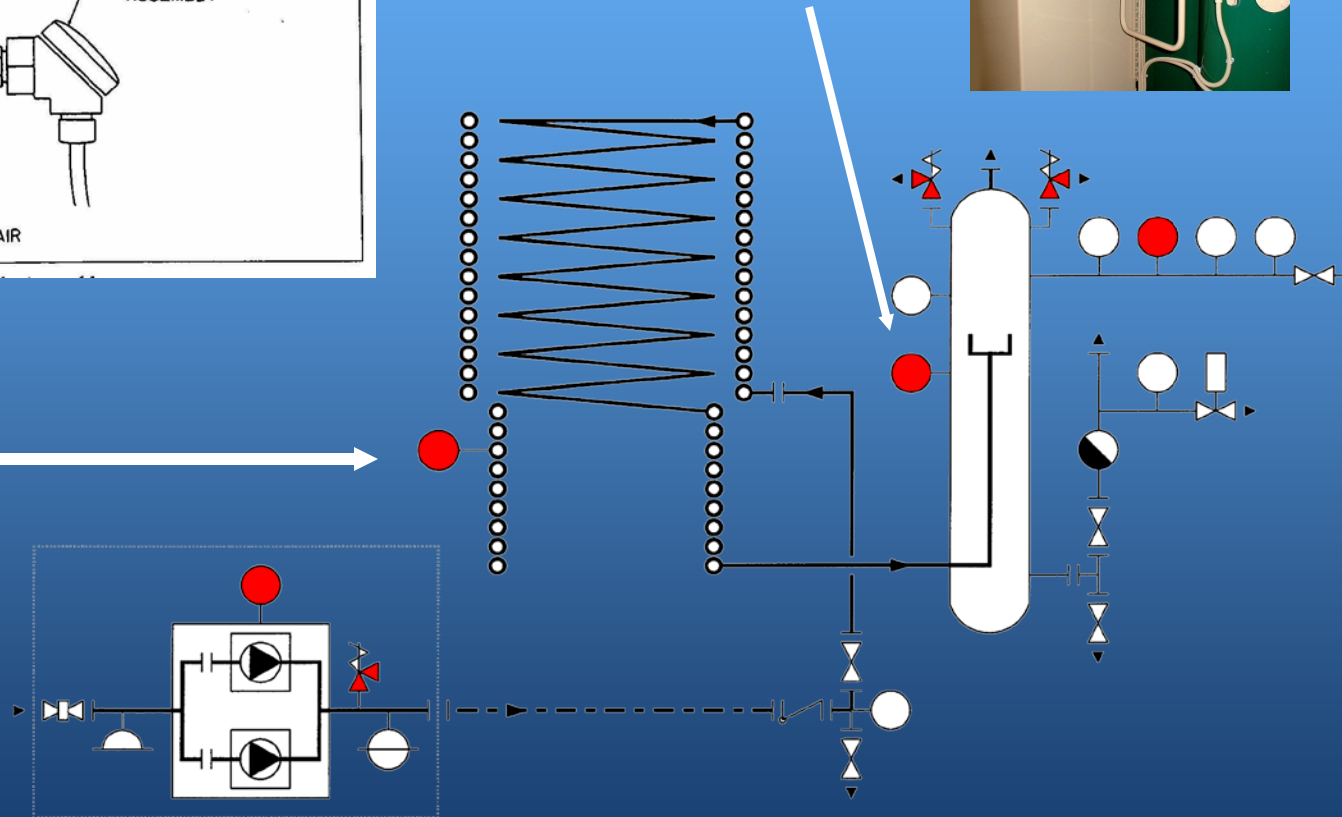
LPS – Limit Pressure switch – Shuts down unit if steam pressure approaches relief valve setting

STEAM RELIEF VALVE (s) – Mounted on top of steam separator to protect separator from over-pressurization.

Coil Dual Thermocouple Assembly



ATS Switch



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Fuel / Combustion Air Safeties

ESC – Electronic Safety Control - Main burner control device.

Siemens LMV burner management controls. “Non-recycle” type controls requiring manual reset after any lockout condition.

APS – Air Pressure Switch - Senses combustion air pressure and closes gas valves if pressure drops below a pre-set level. Requires manual re-set.

UV Scanner – Monitors flame and de-energizes gas circuit if flame lost.

GPSH/L – Gas Pressure Switch for both High and Low Gas Pressure - If pressure outside of limits, shuts off unit and requires manual reset.

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Other Safety Devices

GROUP MOTOR PROTECTORS – GMPs are provide for protection of all electrical motors.

COOLING AIR PRESSURE SWITCH – shuts down unit if cooling air blower on low NOx does not put out proper air pressure.

VOLUTE TEMPERATURE SWITCH – shuts down unit on low NOx units if volute temperature exceeds limits.

EIS – Electrical Interlock Switch – De-energizes 115VAC control circuit if panel door opened during operation



Clayton Industries

A-B Micrologix PLC Based Control Systems

PLC

PROGRAMMABLE
LOGIC
CONTROLLER



CLAYTON INDUSTRIES' PLC BASED STEAM SYSTEMS INCORPORATE THE LATEST TECHNOLOGY IN BOILER CONTROLS, AND PROVIDE INSTANT TOUCH ACCESS TO OPERATING CONTROL AND INFORMATION



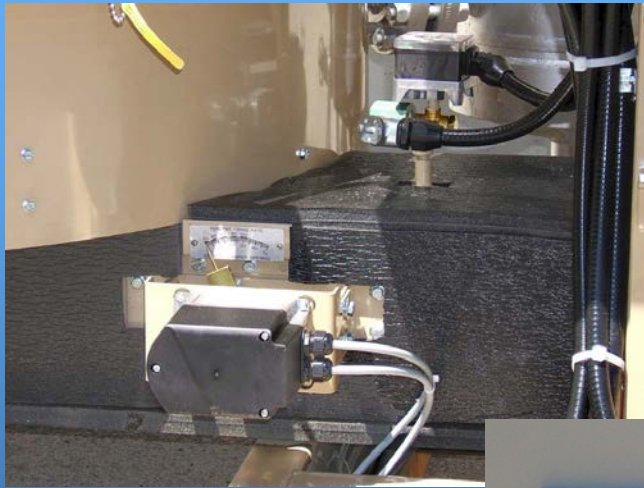
- INCREASED EQUIPMENT RELIABILITY BY ELIMINATING MECHANICAL RELAYS AND TIMERS.
- PROVIDES DIRECT COMMUNICATION LINKS WITH BOILER ROOM AND PLANT CONTROL SYSTEMS
- ALLOWS FOR MULTIPLE UNIT CONTROL SEQUENCING
- COMPATIBLE WITH MODBUS, ETHERNET/IP AND BACNET PROTOCOLS

CLAYTON COMPUSTEAM PLC

Siemens LMV51 Linkage-less Burner Management System



Siemens LMV51 Linkage-less Burner Management System



Air Damper Valve



Gas Actuator



Clayton Industries

Advanced Low NOx Technology

Since 1930, Clayton has been a leader in the development and manufacture of innovative and highly efficient Steam Generators. Backed by worldwide sales and service, our unique Steam Generators have proven the superiority and ability to provide reliable, cost effective steam production around the world. Working from proven designs and philosophies, our commitment to continuing research and development has made Clayton one of the most respected names in the boiler industry. In keeping with this strong background we are pleased to introduce our latest product line of very Low NOx - Low CO Steam Generators. These unique combustion systems provide extremely low emissions without sacrificing efficiency and reliability. Clayton's clean emissions technology is "not just a step ahead, but **A STEP BEYOND.**"

Clayton Steam Generators:

- **SAVE FUEL**
The unique counter flow design provides higher fuel-to-steam efficiency than traditional boilers.
- **ARE SAFE FOR PERSONNEL AND EQUIPMENT**
Inherently safe, the Clayton design eliminates hazardous steam explosions.
- **PROVIDE RAPID RESPONSE**
The Clayton design responds rapidly to sudden or fluctuating load demands.
- **START FAST**
The Clayton design will provide full output from a cold start within fifteen minutes, without thermal stress.
- **ARE COMPACT AND LIGHTWEIGHT**
The Clayton design typically occupies one-third of the floor space and weighs 75% less than a traditional boiler.
- **ENSURES HIGH QUALITY STEAM**
Clayton provides a 99.5% quality separator to minimize moisture in the steam.
- **OFFERS ADVANCED CONTROLS**
PLC controls, Variable Speed Drives and a linkage-less servo controlled burner management system are standard.
- **INCLUDES OUTSTANDING SUPPORT**
Every Steam Generator is backed by Clayton factory direct sales and service plus full service feedwater treatment.

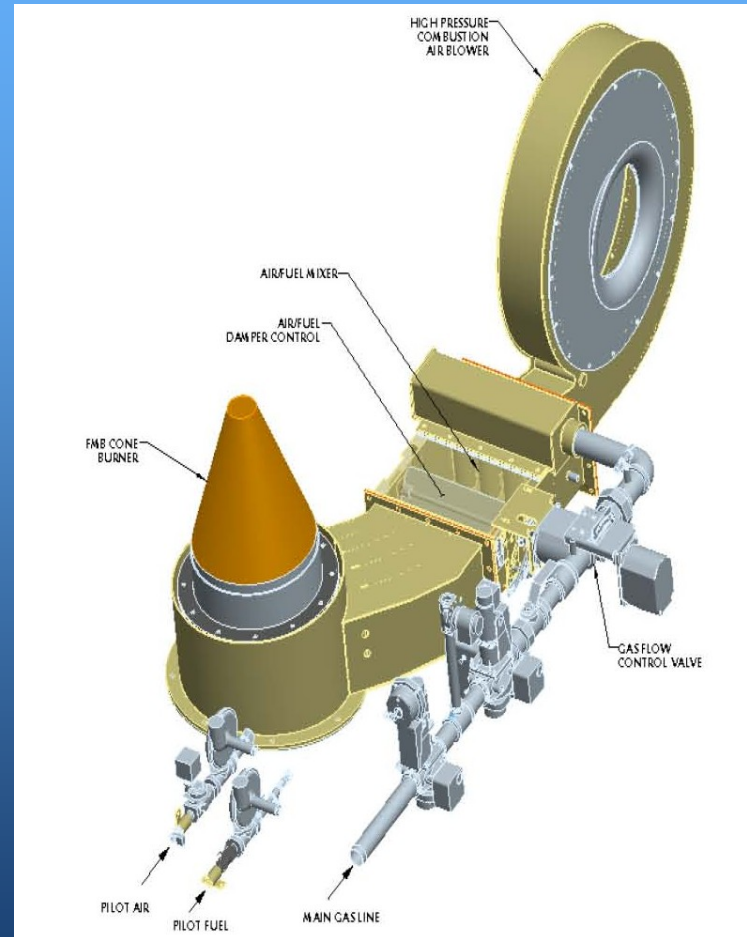


E204 200 BHP
Steam Generator

Low NOx Systems

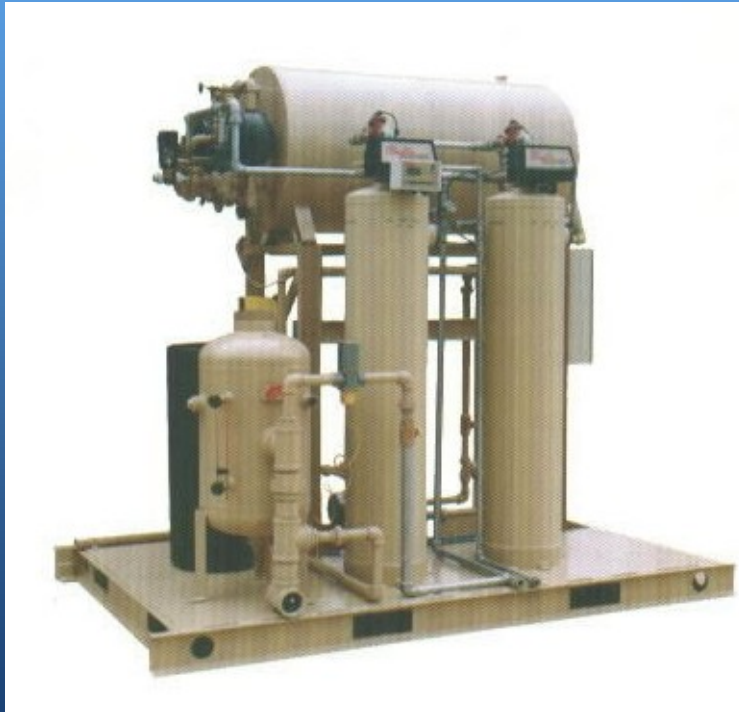
*FGR and Fiber Metal
Designs available with
NOx emissions
guaranteed down to
6 ppmv*

CLAYTON FIBER METAL BURNER



Complete Feedwater Skid Packages

All Components mounted on a single deck plate & connected together for ease of installation

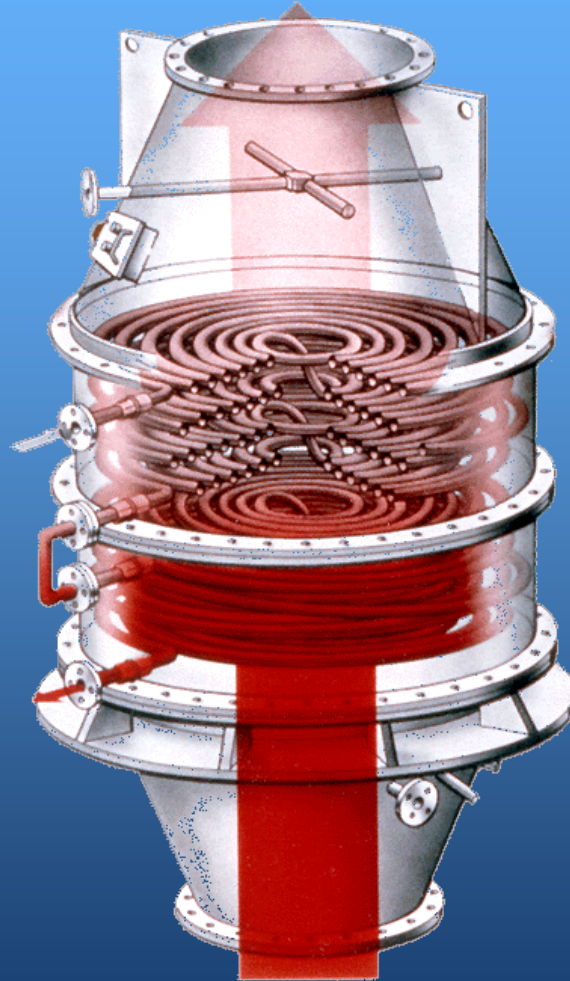


Clayton Industries

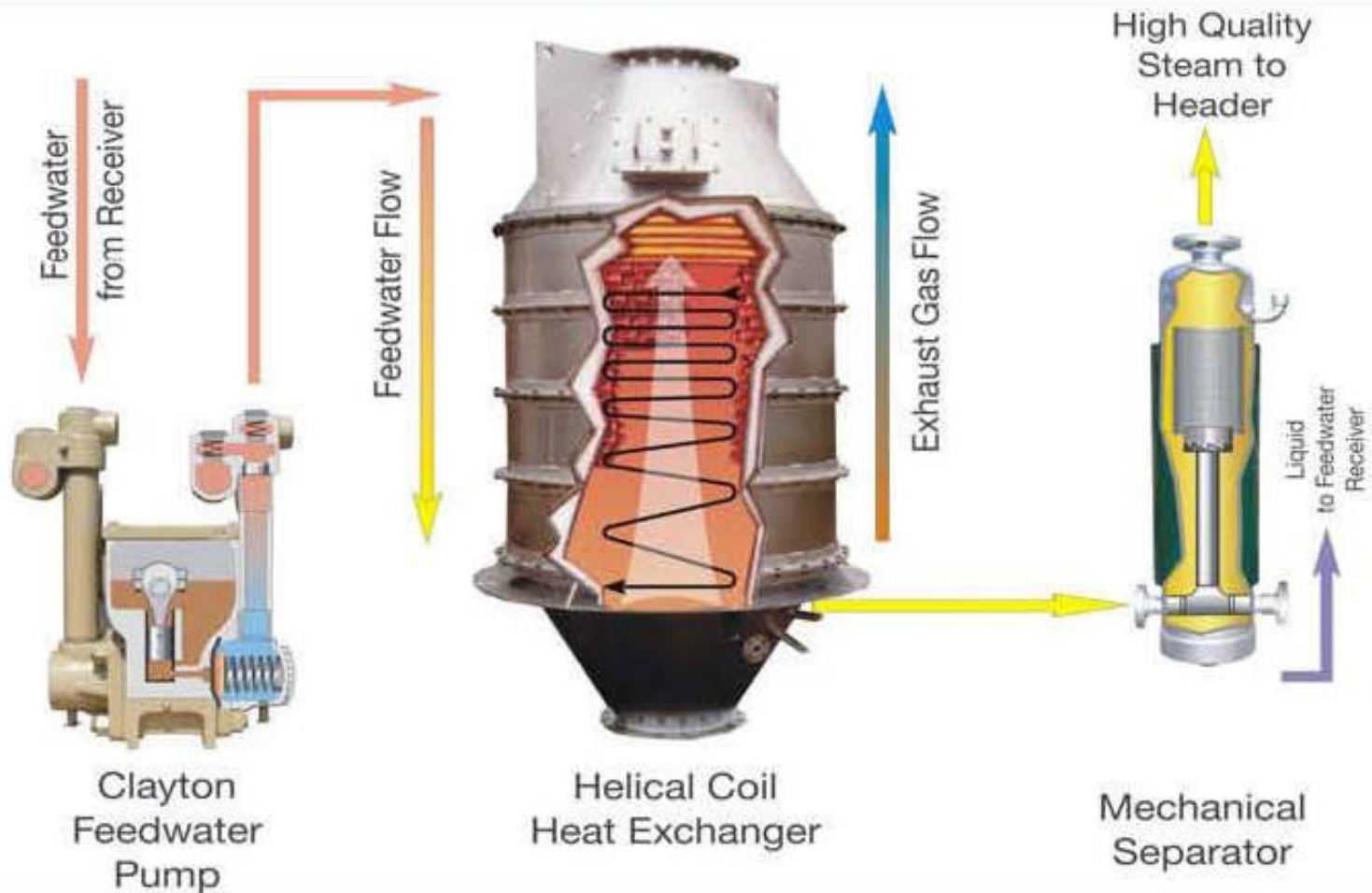
Complete Generator / Feedwater System Skids



Clayton Exhaust Gas Boilers



How Steam Is Produced In A Clayton Heat Recovery Boiler



ENHANCED OIL RECOVERY



Over 50 Years Experience in Oil Recovery

Enhanced oil recovery (EOR) using Thermal technology is the most widely employed EOR method. The two main methods for Thermal EOR (TEOR), cyclic and steamflood, have the greatest certainty of success and potential application in about 70% of enhanced oil recovery worldwide. Thermal methods also give the highest recoveries at the lowest costs.

The Clayton TEOR Steam Generator is a complete, self-contained, automatic generating unit ready for operation when connected to the heating system, fuel and power supply. The basic design is a once through, forced circulation, spirally wound smooth tube heat exchanger. The Clayton design offers significant fuel savings and size/weight advantages. The Clayton design is inherently safe, with no possibility of a hazardous steam explosion.



Steam Generators Range From 25 BHP to 750 BHP Packages up to 1500 BHP

The Clayton Advantages

Rapid Start-up
Compact Design

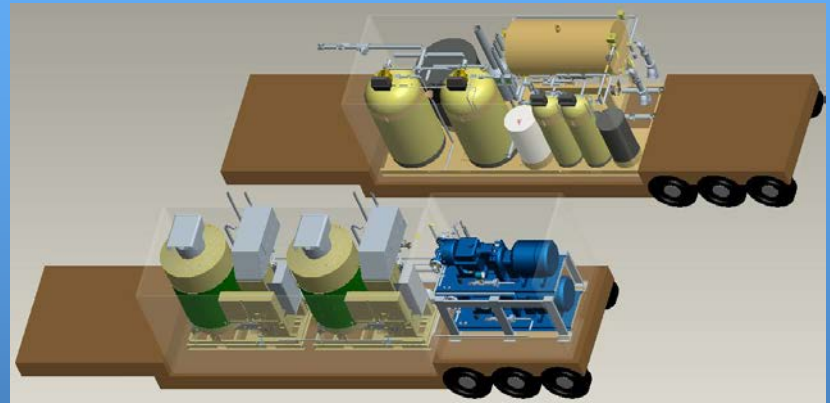
Fuel Efficiency
Low Emissions

Unsurpassed Safety
Packaged Systems

Specifically tailored to oil field thermal recovery specifications, the Clayton TEOR Steam Generator is truly a portable heater. The compact design allows the unit to be skid mounted, trailer mounted or containerized. This portability means that they are versatile and adaptable to a variety of field conditions and applications.

The Clayton TEOR Steam Generator delivers more usable BTUs to the formation at a considerably lower cost than any combination of available components.

Compared with conventional steam boilers, Clayton Steam Generators are notable for their compact size, light weight and low emissions. They are prized for their reliability, fuel economy, fully automatic PLC controls, plus the ability to start-up and follow load cycles quickly.



Trailer Mounted Steam Generator

OFFSHORE / MARINE



OFFSHORE STEAM GENERATORS...

AT THEIR BEST WHEN THE GOING GETS TOUGH

Size, Safety and Performance Are Ideal for Offshore Oil Rigs

Few environments place greater demands on men and machinery than offshore oil rigs. The weather is seldom resort-like. The work is demanding. Space is at a premium. And dependability is highly prized.

Small wonder that more and more petroleum and oil exploration companies call for Clayton steam generators on their offshore oil rigs. These multi-purpose generators — available in a wide range of capacities — perform numerous important functions:

- Heating work floors
- Desalinization
- Heating rooms
- Heating drilling fluid
- De-icing
- Cooking
- General clean-up



Generator Sizes Range from 20 BHP to 700 BHP.

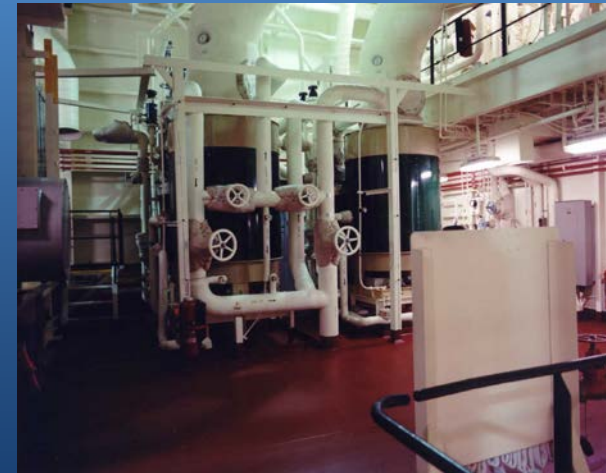
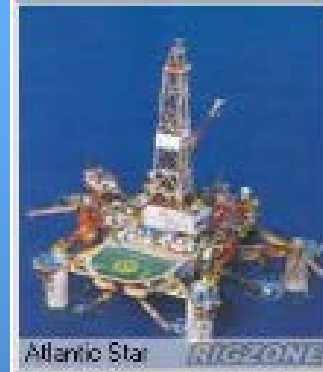
But Clayton steam generators, used by major industries around the globe, are valued on offshore rigs for more than versatility.

Compared with conventional steam boilers the generators are notable for their compact size, light weight, low emissions and absence of explosion hazard. They are prized for their reliability, fuel economy, fully automatic PLC based controls, plus the ability to start-up and follow load cycles quickly.

And Clayton Steam Generators are backed by a world-wide support team of engineers and technicians to keep you online and in full production.

TYPICAL APPLICATIONS

- | | | |
|---------------------------------|---------------------------------|---|
| • Floating Production Platform | • Semi-Submersible Drilling Rig | • Dynamically Positioned Drilling Ships |
| • Sub-Sea Operations Vessels | • Offshore Steam Rentals | • General Marine/Offshore Use |
| • Harsh Environment Jack-Up Rig | • GEO Services/FPSO | • Product Tankers |
| • Deep Water Jack-Up Rig | • Chemical Tankers | • Cargo Vessels |



Some of Clayton Customers



Visit us at www.ClaytonIndustries.com



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Compact, Highly-Efficient, Quick-Starting Steam Generator Systems

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Product Focus
New SigmaFire Sizes
Industry Focus
Offshore/Marine



Since its inception on October 20, 1930, Clayton Industries has established a world-wide reputation as a leading manufacturer of equipment for industrial process steam generation—both fired boilers and unfired waste heat boilers. Their unique controlled circulation, counter-flow design offers many operational advantages and benefits over conventional boilers. Clayton Industries' design principles and the use of the latest technology in its control systems make them the favorite choice in today's high efficiency energy markets.

Welcome to our website! We look forward to hearing from you and serving your steam generating needs with our professional and experienced staff. For **steam boiler** and **steam generator** information, please see our Boiler and Steam Basics.

The company is headquartered in City of Industry, California, USA and has major manufacturing facilities located in the United States, Belgium and Mexico to serve its diverse worldwide markets. Direct Sales and Service support centers are located worldwide and are provided by carefully selected and thoroughly trained distributors in many areas throughout the world. Clayton understands that new ideas and technology are the driving force in the economies of developed and developing countries around the world. Clayton Industries is ideally positioned to lead this technological revolution through the 21st century and beyond by providing its customers with reliable and highly efficient compact steam generating systems.

Industry Affiliates



Trade Shows: Visit us at:

- **Canadian Healthcare Engr. Society**
Kingston, Ontario, Canada 6/3-5/2012 Booth 34
- **Canadian Boiler Society**
Toronto, Ontario, Canada 6/6-8/2012 Booth
- **ASHE**
San Antonio, Texas 7/15-18/12 Booth 936

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For further information email us at: sales@claytonindustries.com

Thank you!