Fulton Heating Solutions

Condensing Hydronic Boiler Product Lines

5/28/2017

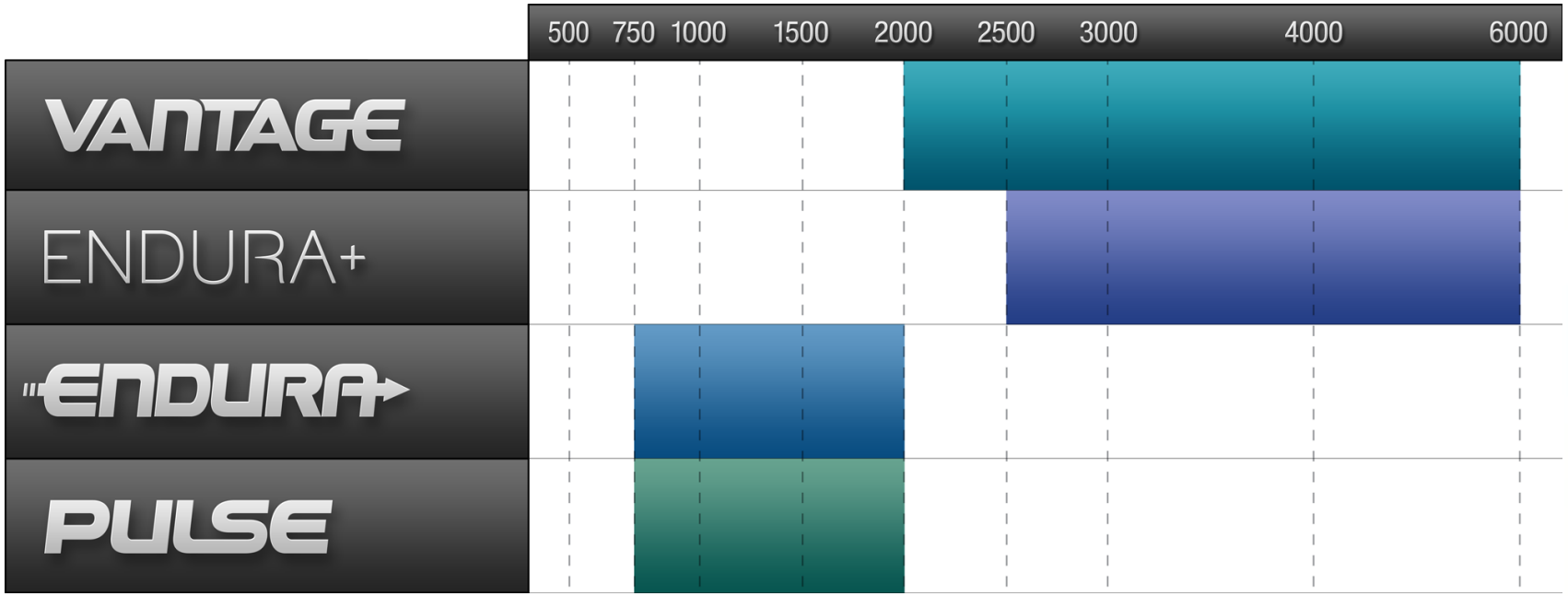
Fulton Heating Solutions

- Based in Syracuse, NY
- A division of The Fulton Companies, a privately held global manufacturer of rugged, robust and reliable boilers since 1949
- Commercial heating hydronic (hot water) boilers for a wide range of applications

Fulton Heating Solutions

Fulton® www.fulton.com

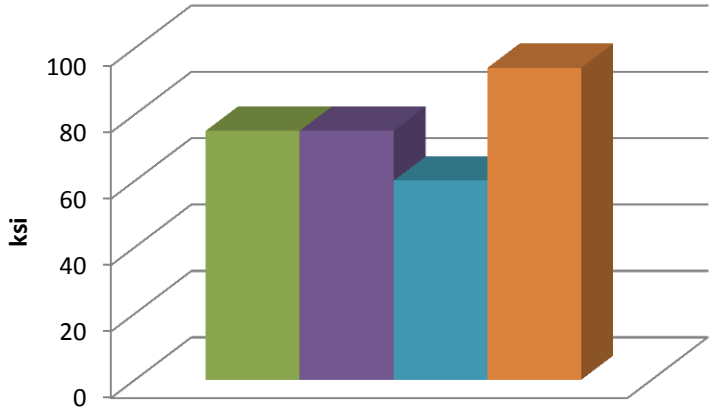
750 MBTU/hr - 6,000 MBTU/hr



Boilers Built with Duplex Stainless

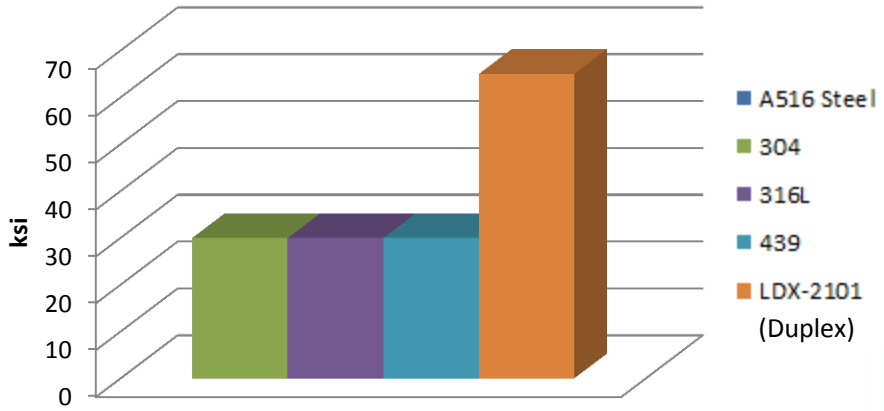
Ultimate Tensile Stength (min)

(Higher is Better)



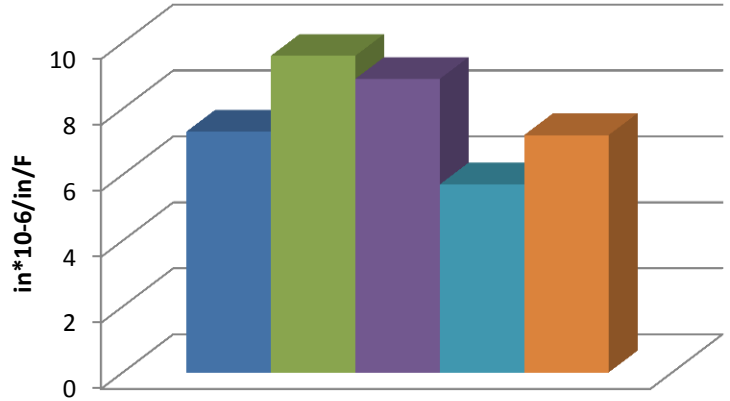
0.2% Yield Stength (min)

(Higher is Better)



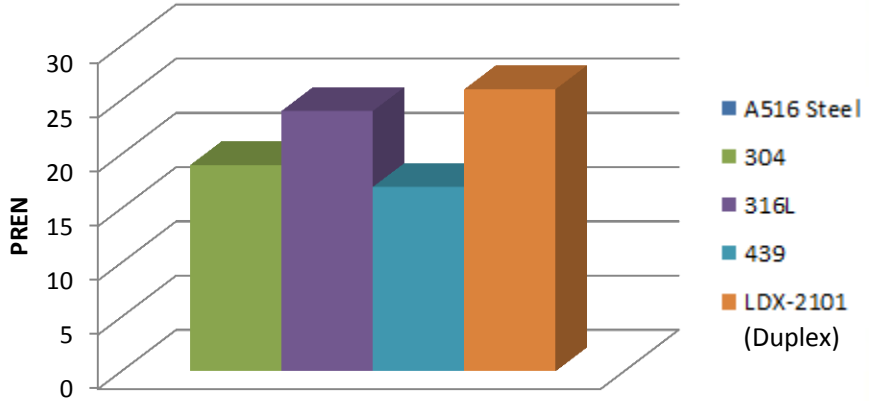
Coefficient of Thermal Expansion

(Closer to steel is better)



Pitting Resistance

(Higher is Better)



Fulton® www.fulton.com

Vantage - Condensing Hydronic Boilers

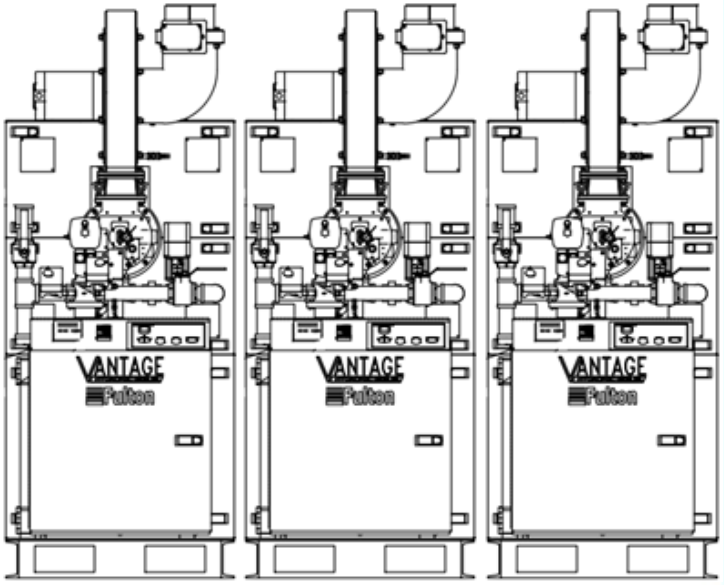
- Capacities range from 2,000,000 to 6,000,000 BTU/hr
- High mass, high volume fire tube design
- Rugged duplex stainless steel condensing heat exchanger
- Ultra high efficiencies
- Dual fuel capabilities with #2 oil
- Industrial controls and burner platforms for superior reliability

Vantage - Models and Sizes

- VTG-2000/DF
  - 2,000,000 BTU/hr
- VTG-3000/DF/LE
  - 3,000,000 BTU/hr
- VTG-4000/DF/LE
  - 4,000,000 BTU/hr
- VTG-5000/DF
  - 5,000,000 BTU/hr
- VTG-6000/DF
  - 6,000,000 BTU/hr

Vantage - Features and Benefits

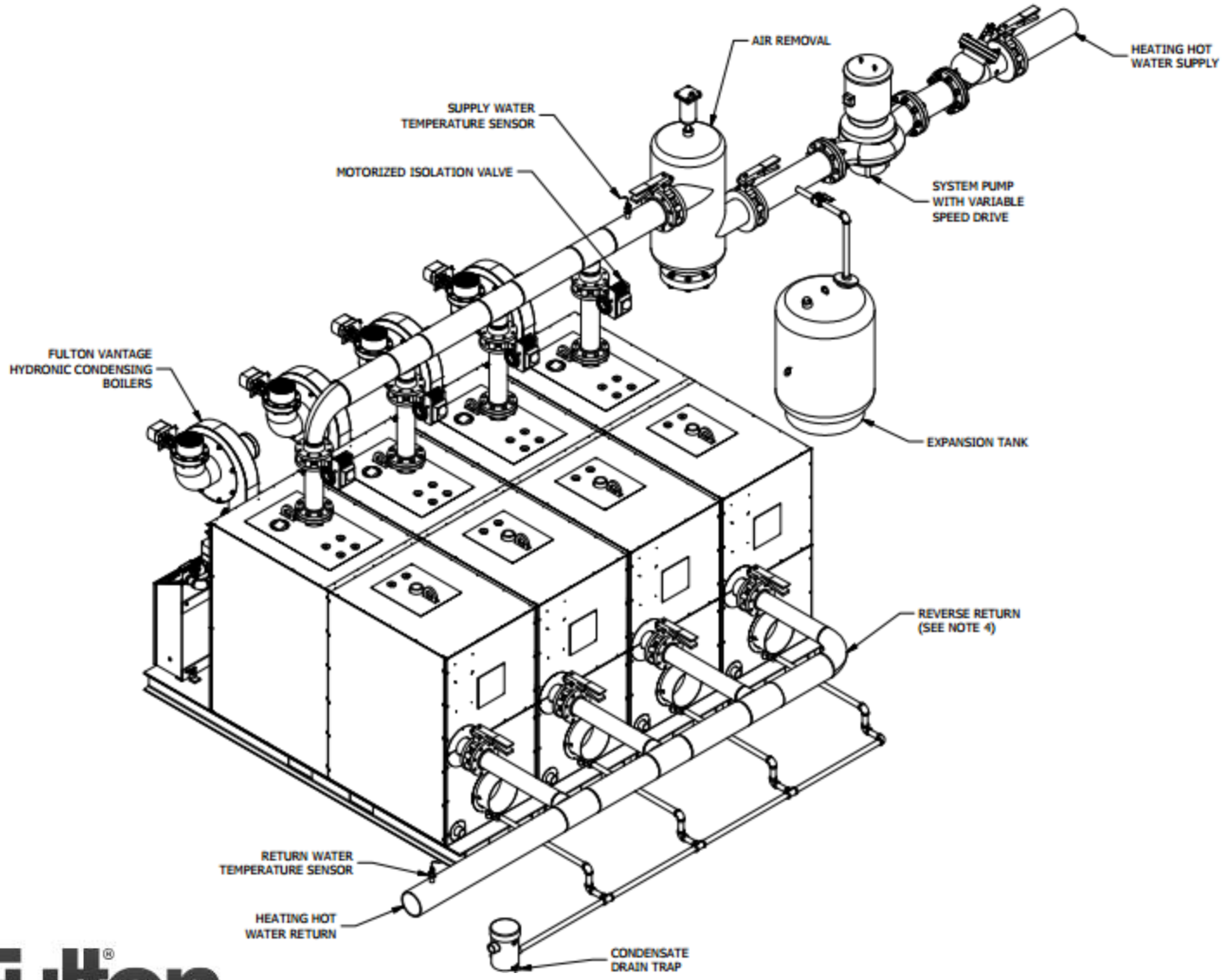
- Does not require primary secondary piping
  - Designed for variable primary flow
- No minimum return water temperature on NG or LP
- One inch side clearance
- Zero flow will not harm the heat exchanger



Vantage - Other Benefits

- High water volume:
  - Reduced cycling with greater buffer volume
  - Low water side pressure drop, reduced pumping cost
- Thicker and more robust materials
- Larger Delta-T tolerance (100°F)
- Biogas and Digester Gas capabilities (Custom Configured)

Vantage - Variable Primary Flow



Vantage - Certifications and Compliance

- ASME Sec IV, CRN
- UL-795 Listed
- AHRI Certified Efficiencies
- CSD-1 and CSA
- XL GAPS (GE GAP / IRI)
- Factory Mutual Compliant
- SCAQMD & TCEQ (LE Models)
- NFPA 85 Option Available

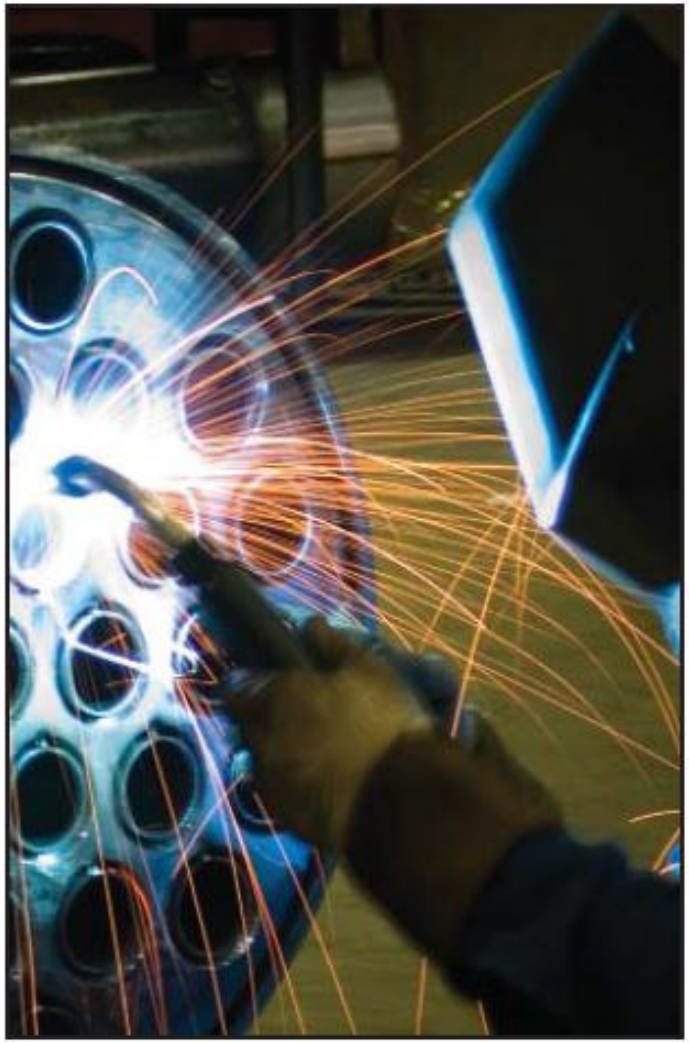
Fulton www.fulton.com

Vantage - Leading AHRI Efficiencies

Model	Certified Thermal Efficiency (Nat. Gas)
VTG-2000 / DF	95.7%
VTG-3000 / DF	96.3%
VTG-4000 / DF	96.9%
VTG-5000 / DF	92.6%
VTG-6000 / DF	94.0%

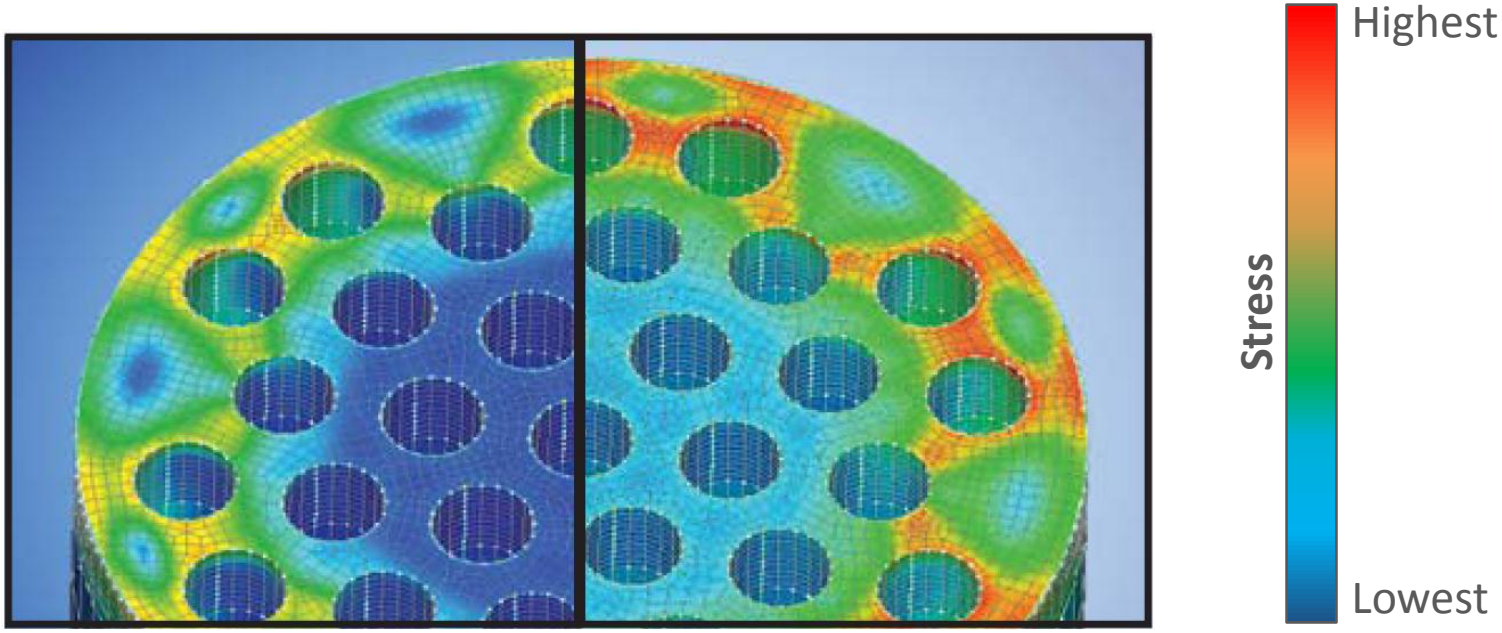
Vantage - Heat Exchanger Design

- High-mass firetube platform
- Conservative material thicknesses for boiler longevity
- Lifetime thermal shock warranty
- Duplex alloy stainless steel condensing heat exchanger



Vantage - Duplex Alloy Stainless Steel

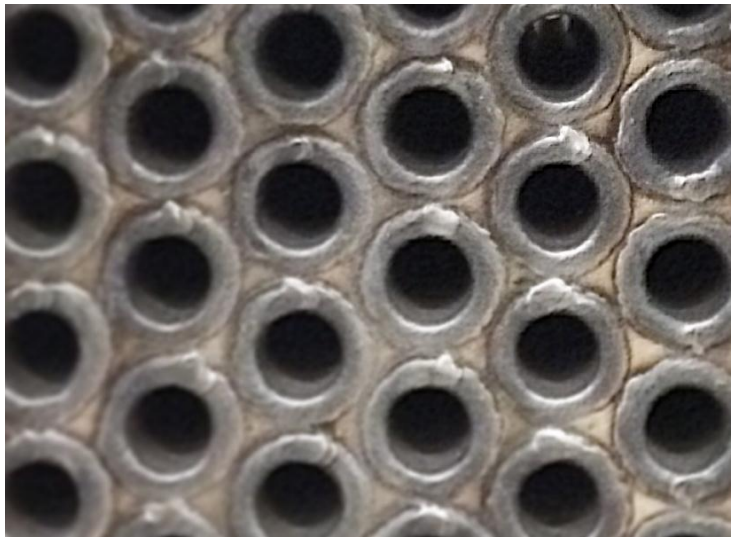
- A stainless alloy far superior to 316L and 439 used in competing boilers
- Duplex experiences lower stresses due to a low coefficient of thermal expansion



Duplex Alloy Stainless Steel **316L Stainless Steel**

Vantage - Heat Exchanger Design

- Rugged design
- Superior construction and materials
- No overlapping welds

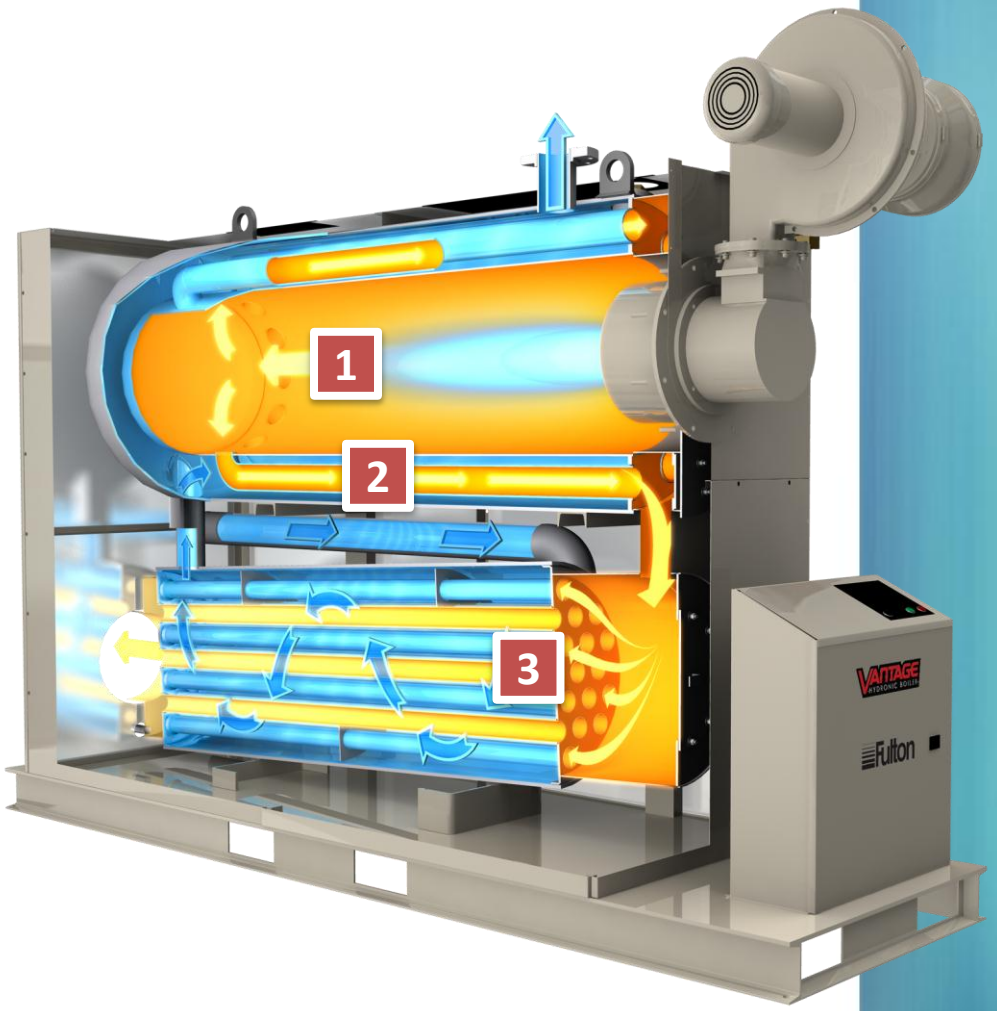


Fulton Vantage

Competition

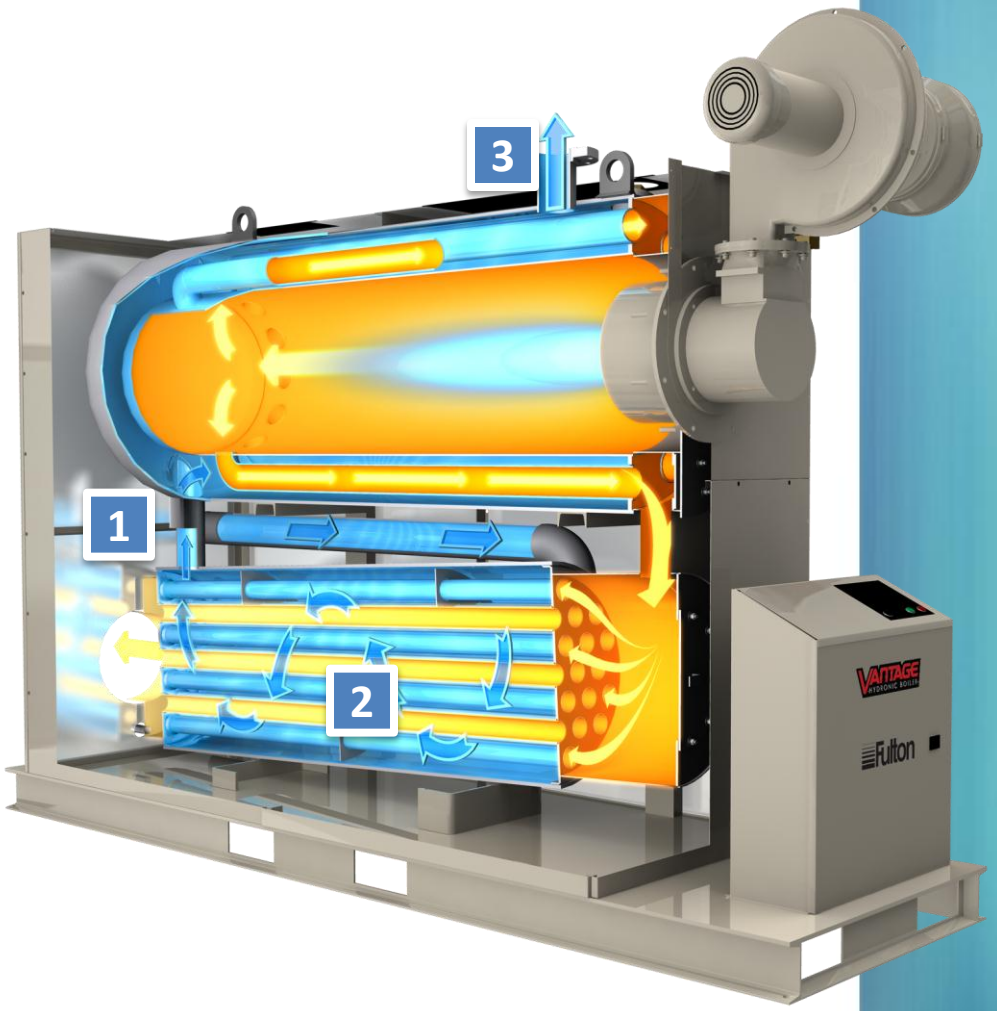
Vantage - Three Pass Fire Tube

1. Power burner fires horizontally into the first pass
2. Water backed turn around directs flue gases into radially welded schedule 40 pipes
3. Flue gases transition into the Duplex stainless steel condensing section



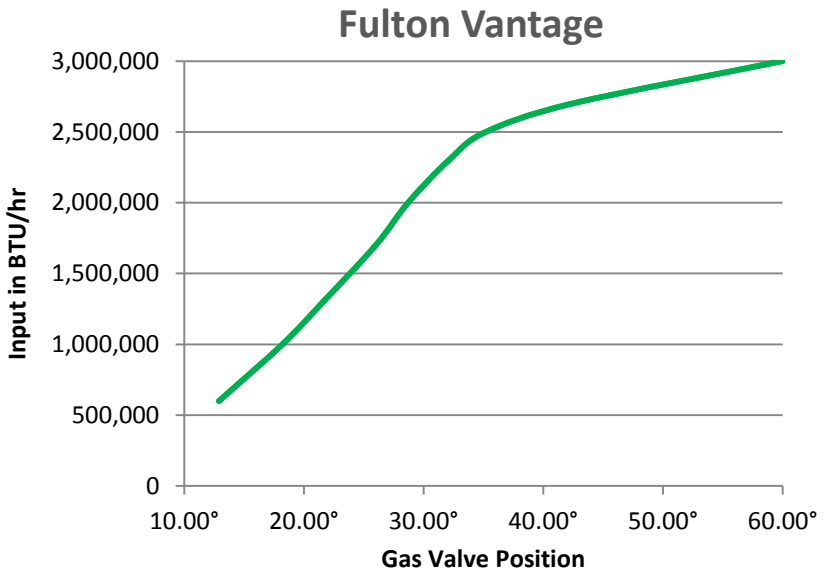
Vantage - Water Side

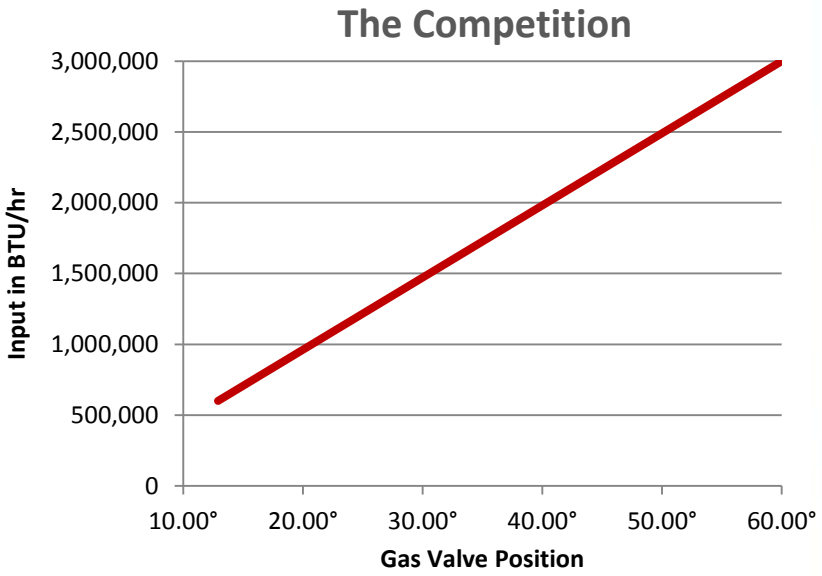
1. Return water enters at the rear of the boiler
2. Water passes through a series of baffles to optimize mixing and turbulence
3. Heated supply water exits at the top of the vessel



Vantage - Industrial Combustion Controls

- The air/fuel ratio required across a turndown range is non-linear
- The Vantage linkageless control with independent air and gas servo motors optimizes O_2 (Excess Air) with a non-linear combustion profile
- Maintaining low excess air increases combustion efficiency and decreases flue gas dew point temperatures (more condensing occurs)





Vantage - Standard Models

- Flexible and reliable industrial power burners
  - Maxon OvenPak (2-5MM)
  - Riello RS-160/E (6MM)
- Natural Gas, Propane or dual-fuel Natural Gas & Propane
- Rugged burner tolerates a wide range of operating conditions

Vantage - Dual Fuel (Gas/Oil) Models

- Natural Gas (or Propane) and #2 Fuel Oil
  - Riello RLS Series Burners
- Condensing on gas, B-100 bio diesel and ultra low sulfur (<15 ppm) fuel oil
- Simplified fuel selection (turn of a switch)
- Pressure atomized oil burner
  - Does not require compressed air
- Lights with direct spark ignition
  - Does not require a gas pilot
- Continuous operation on #2 fuel oil without derate or flame impingement
- **<u>True full time dual-fuel boiler!</u> Not just for *"emergency backup only"* like the competition!**

Vantage - Dual Fuel (Gas/Oil) Markets

- Healthcare and Medical Facilities
  - Fuel oil is a reliable standby fuel already available in many facilities with backup generators
- Fuel Curtailment Areas
  - Utility rebates may be available for customers able to switch to a backup fuel during peak demand
- Educational
- Government and Military

Vantage - Low Emissions (NO_x) Models

- Models available:
  - VTG-3000LE, VTG-4000LE
- Bekaert fiber mesh burner
  - <9, <20, or <30 ppm NO_x
- Natural gas, propane, or dual fuel natural gas & propane
- VFD blower automatically compensates for changes in combustion air temperature
- Meets SCAQMD and TCEQ Requirements

Endura - Condensing Hydronic Boilers

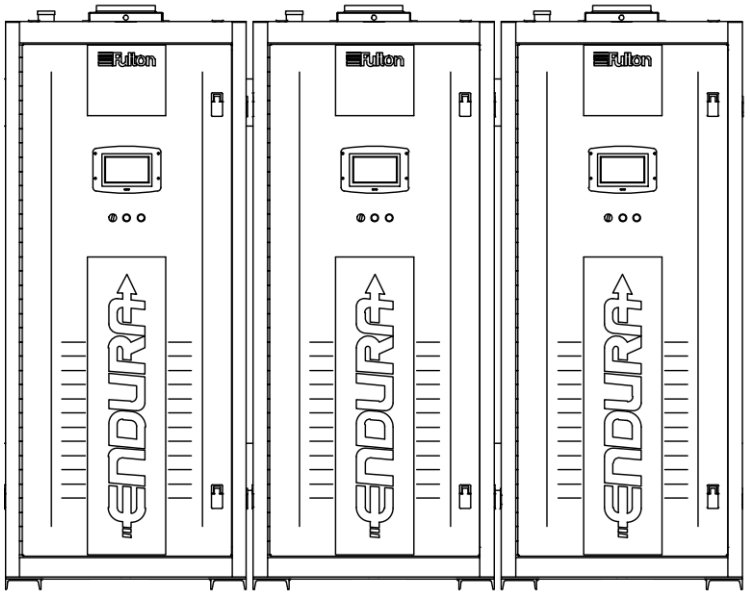
- 750,000 to 2,000,000 BTU/hr
- High mass, high volume fire tube
- Duplex alloy stainless steel heat exchanger
- Ultra-high efficiencies up to 99%
- Compact footprint that fits through a standard doorway
- **Quiet** operation
- Low Emissions <20 ppm NOx

Endura - Models and Sizes

- EDR-750
  - 750,000 BTU/hr
- EDR-1000
  - 1,000,000 BTU/hr
- EDR-1500
  - 1,500,000 BTU/hr
- EDR-2000
  - 2,000,000 BTU/hr
- Larger capacities with Endura+

Endura - Features and Benefits

- Does not require primary secondary piping
  - Designed for variable primary flow
- No minimum return water temperature requirement
- One inch side clearance
- Zero flow will not harm the heat exchanger



Endura - Variable Primary Flow

Endura - Certifications and Compliance

- ASME Sec IV, CRN
- ETL Listed to UL-795
- AHRI Certified Efficiencies
- CSD-1 and CSA
- XL GAPS (GE GAP / IRI)
- Factory Mutual Compliant
- SCAQMD & TCEQ Compliant

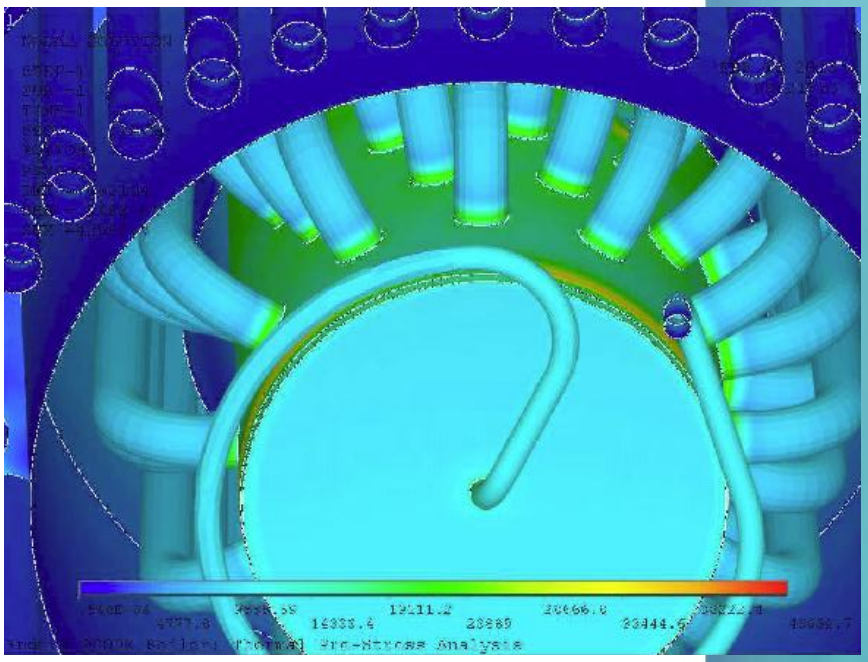
Fulton www.fulton.com

Endura - Leading AHRI Efficiencies

Model	Certified Thermal Efficiency (Natural Gas)
EDR-750	97.1%
EDR-1000	95.3%
EDR-1500	93.5%
EDR-2000	93.7%

Endura - Heat Exchanger Design

- Duplex Alloy Stainless Steel
  - **A material far superior to 316L and 439 used in competing condensing boilers**
  - Other applications include saltwater processing, pharmaceutical and nuclear power
  - Lower stresses with low thermal expansion
  - Superior strength and corrosion resistance compared to 316L and 439 grades

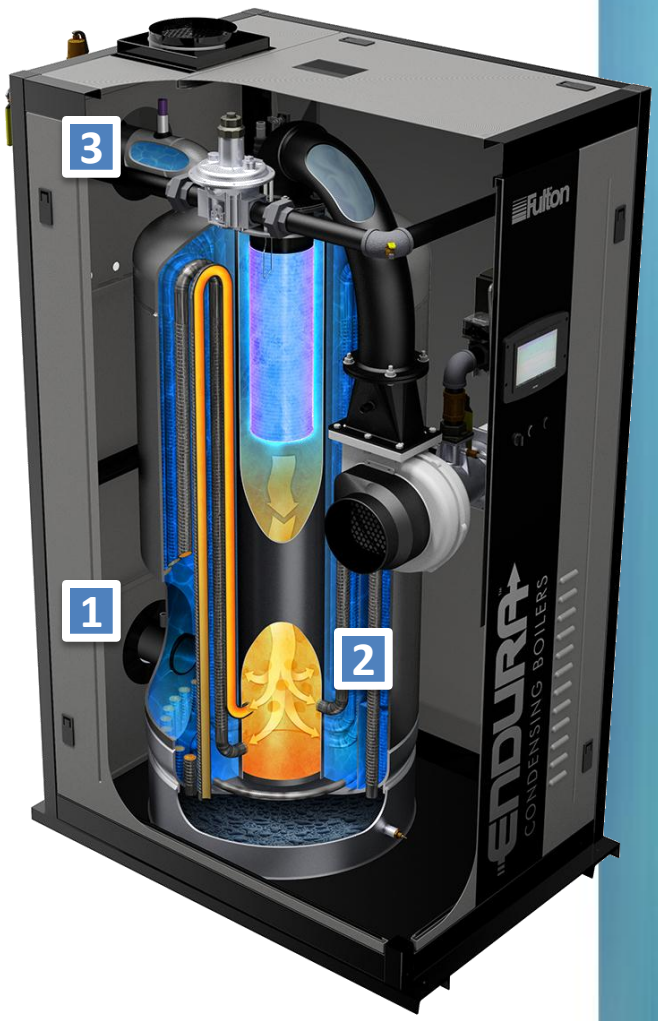


Endura - Three Pass Fire Tube

A. Fresh air is drawn in, recaptures radiant losses within a sealed cabinet
B. Zero governor fuel/air mixture is pressured by the blower, into the burner
C. Three pass Duplex alloy SS firetube heat exchanger
D. Flue gases are exhausted and condensate sent to drain

Endura - Water Side

1. Return water enters at the bottom of the pressure vessel
2. Baffles provide a three pass counter-flow to maximize heat transfer
3. Heated supply water exits at the top of the pressure vessel



Customer Connections

A. Combustion Air Inlet

B. Fuel Supply

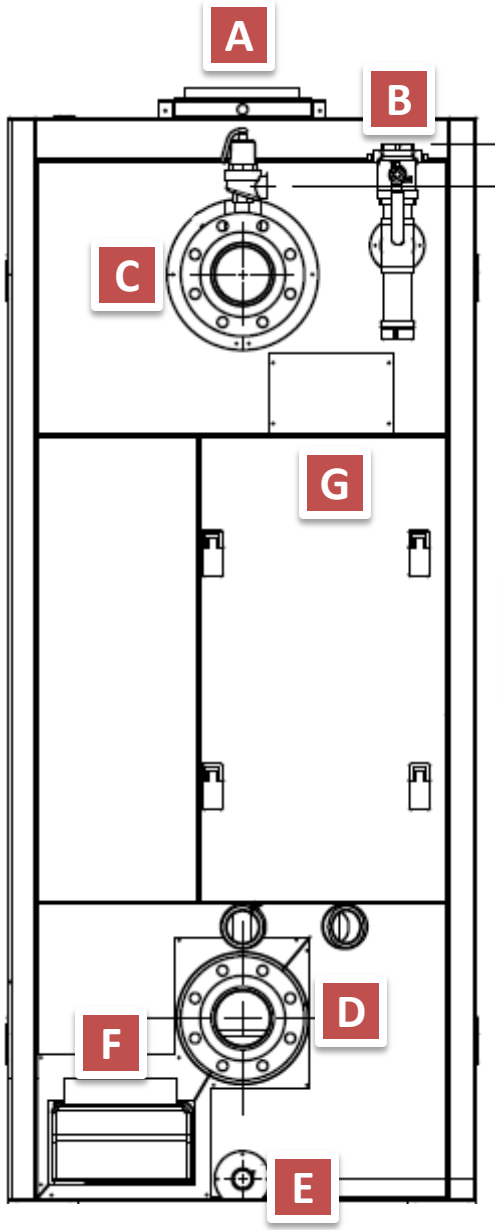
C. Supply Water (Outlet)

D. Return Water (Inlet)

E. Condensate Drain

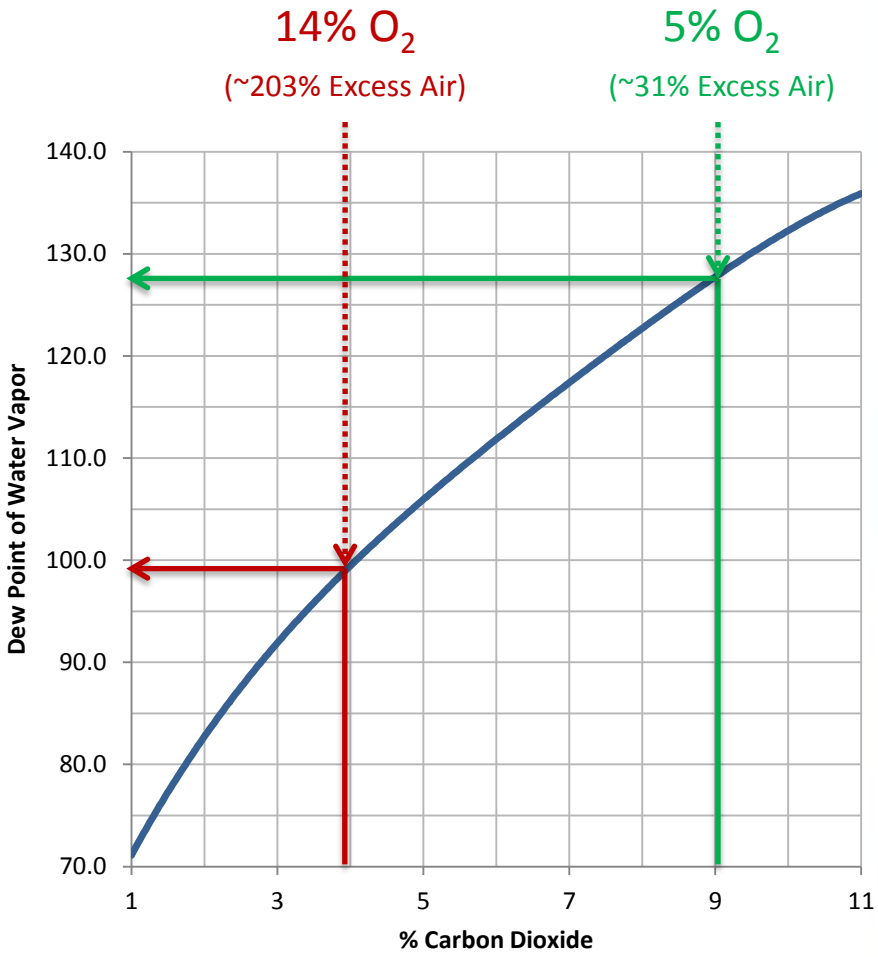
F. Exhaust Outlet

G. Electrical Connection



Endura - Effect of Excess Air on Dew Point

- Endura boilers operate with low excess air (5-6% O_2) at low fire and low NO_x
- As excess air increases, combustion efficiency and dew point decrease
- A boiler operating at 14% O_2 will need <100˚F return water to condense!



Endura - Premium Fit and Finish

- Industrial quality panel box wired in a UL 508 shop
- Primed and painted internally and externally
- Latching panels for ease in accessibility and service
- Clean wiring in conduit and wireways

Endura - Other Features and Benefits

- 4-28” W.C. natural gas pressure
  - Integral lock up gas pressure regulator
  - High and low gas pressure switches
- Flexible venting capabilities
  - PVC, CPVC, Polypropylene, AL 29-4C, 316L Stainless Steel
- Integrated Lead/Lag sequencing
  - Up to 8 boilers, parallel modulation
  - Outdoor reset, DHW priority
  - BMS: Modbus, BACnet, LonWorks

Endura - Stock Program

- Finished goods are stocked and ready to ship
  - **Same List Price!**
  - Complete, test-fired boilers
  - Perfect for fast-track jobs and emergency replacements

Pulse - Condensing Hydronic Boiler

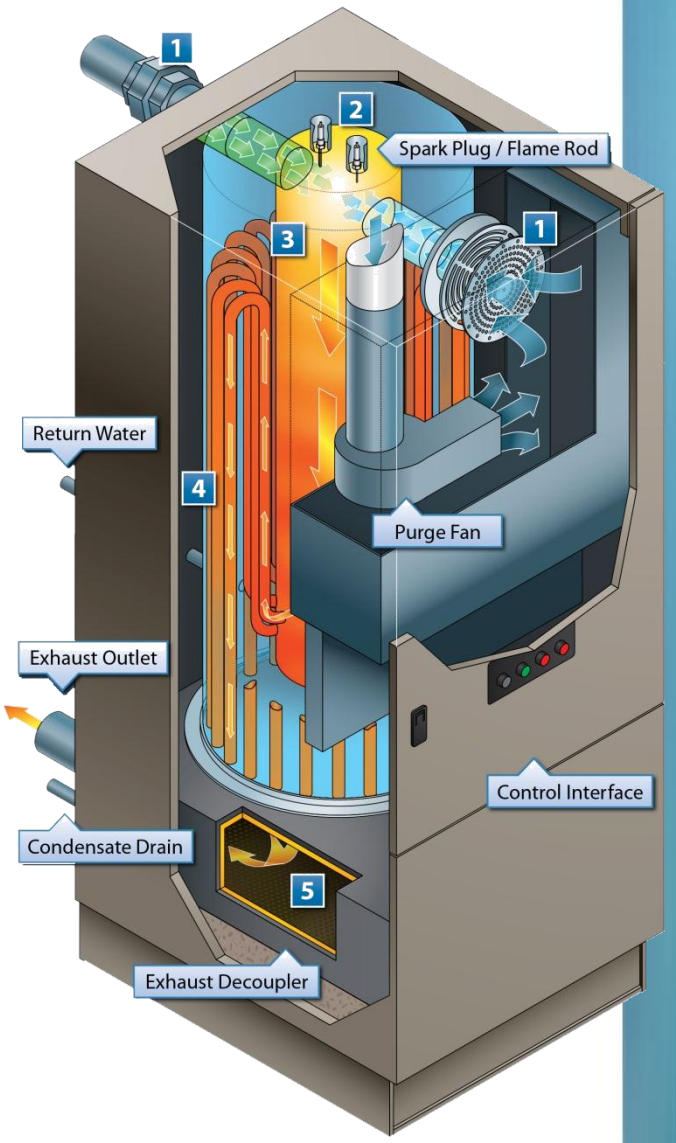
- Capacities from 750,000 to 2,000,000 BTU/hr
- Duplex alloy stainless steel tailpipes
- Compact footprint fire tube
- High mass and water volume
- Proven heat exchanger design
- Fulton has 25+ years of experience with Pulse combustion

Pulse - Models and Sizes

- PHW-750
  - 750,000 BTU/hr
- PHW-1000
  - 1,000,000 BTU/hr
- PHW-2000
  - 2,000,000 BTU/hr
- PDWH-1000 (Water Heater)
  - 1,000,000 BTU/hr

Pulse - Application Benefits

- Low cost of ownership
  - Extremely low electrical consumption (90W while running)
  - Minimal maintenance requirements
- No minimum return water temperature requirement
- Zero flow will not harm the heat exchanger
- Supports variable primary flow
- Dual fuel NG & LP option



Pulse - Certifications and Compliance

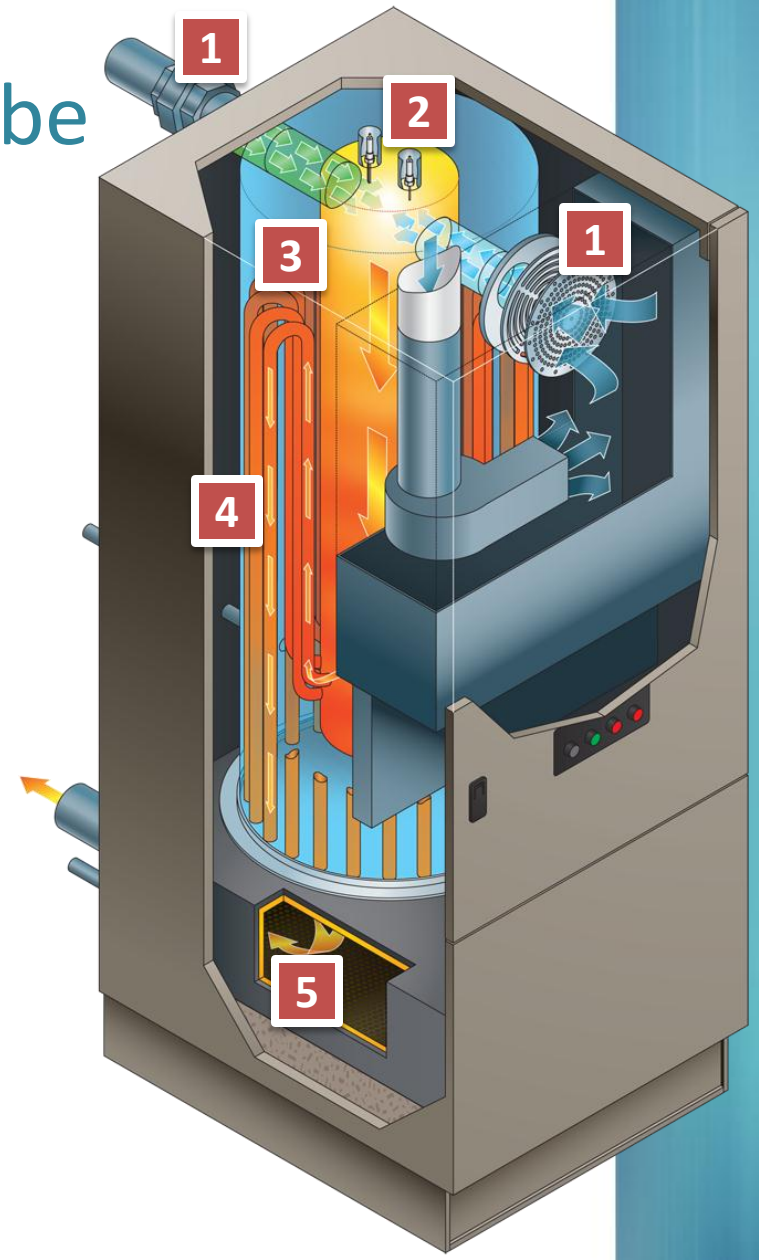
- ASME Sec IV, CRN
- ETL Listed to ANSI Z21.13 / CSA 4.9
- CSD-1 and CSA compliant gas train
- Factory Mutual and NFPA-85 gas train options available

CSA Group

INTERTEK ETL LISTED C US

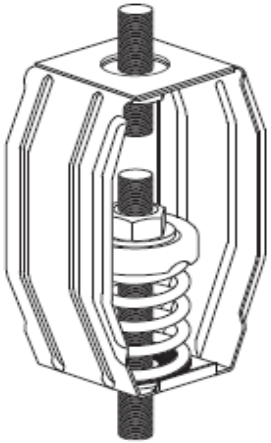
Pulse - Three Pass Fire Tube

1. Air & gas metering valves act as check valves; allowing flow into the combustion chamber
2. An igniter starts the pulse combustion process
3. Gas and air are drawn in by a series of positive and negative pressures maintaining the combustion process
4. Flue gases are forced through a series of tailpipes where condensing occurs
5. Flue gasses and condensate are collected for disposal



Pulse - Vibration Isolation

- Pulse boilers include:
  - Intake muffler
  - SS exhaust muffler
  - Spring isolators
  - Flexible connectors for water and gas piping
- Spring hangers are **<u>required</u>** on intake and exhaust piping (not supplied)



ENDURA+

- Condensing Hydronic Firetube Boilers
- 2,500,000 to 3,000,000 BTU/hr (Q3 2016)
- 4,000,000 to 6,000,000 BTU/hr (Q4 2016)
- The most advanced condensing boiler on the market
  - New Fulton-exclusive technology
- Ultra-compact footprint without sacrificing proven Fulton durability
  - Fits through a standard door
  - Dramatically lower heat exchanger stresses than the competition

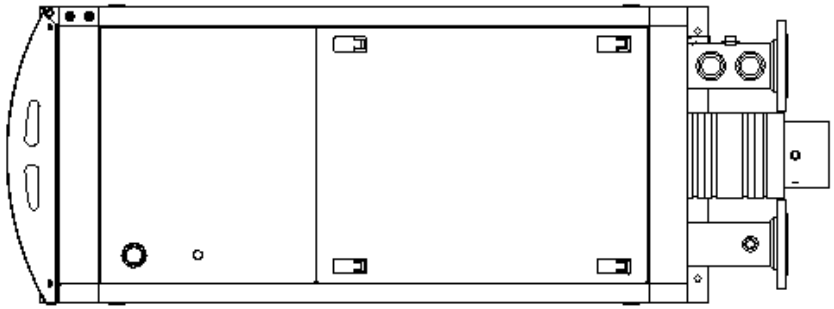
Fulton® www.fulton.com

PURE TECHNOLOGY

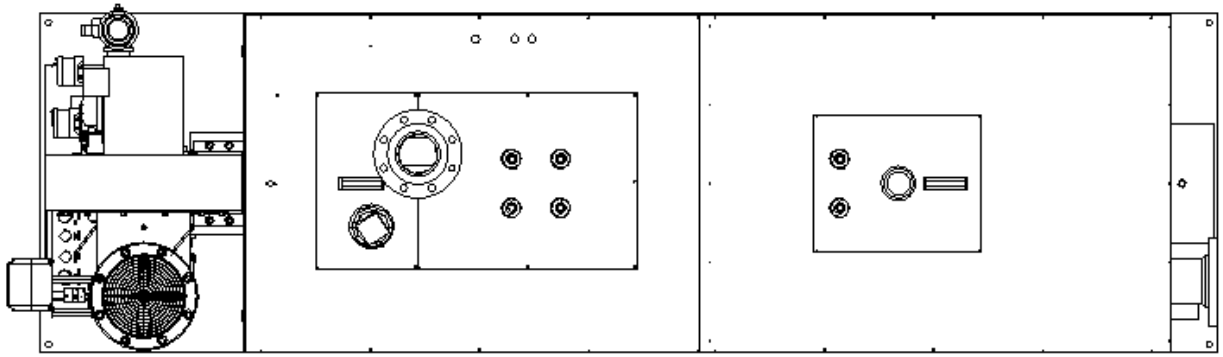
The design philosophy used by Fulton for the development of our new Steam and Condensing Boiler product lines. PURE Technology represents a “clean state” design approach.

Comprehensive system optimization by radically challenging heat transfer and mechanical design principles.

Ultra-Compact Footprint



EDR+3000



VTG-3000

Industry Leading Specifications

3MMBH SS Firetube	BMK	FBN	EDR+
Efficiency (%, BTS-2000)	93.5	92.0	**95.0**
Service Footprint (ft^2)	61	85	**51**
Heat Exchanger Warranty (yrs)	**10**	**10**	**10**
Thermal Shock Warranty (yrs)	10	10	**Lifetime**
Burner Warranty (yrs)	1	1	**5**
O_2 System	Monitor	None	**Trim**
Heat Exchanger Material	439 SS	316L SS	**Duplex SS**
Fits Through Std. Door	**Yes**	No	**Yes**
Vent Diameter (inch)	**8**	10	**8**

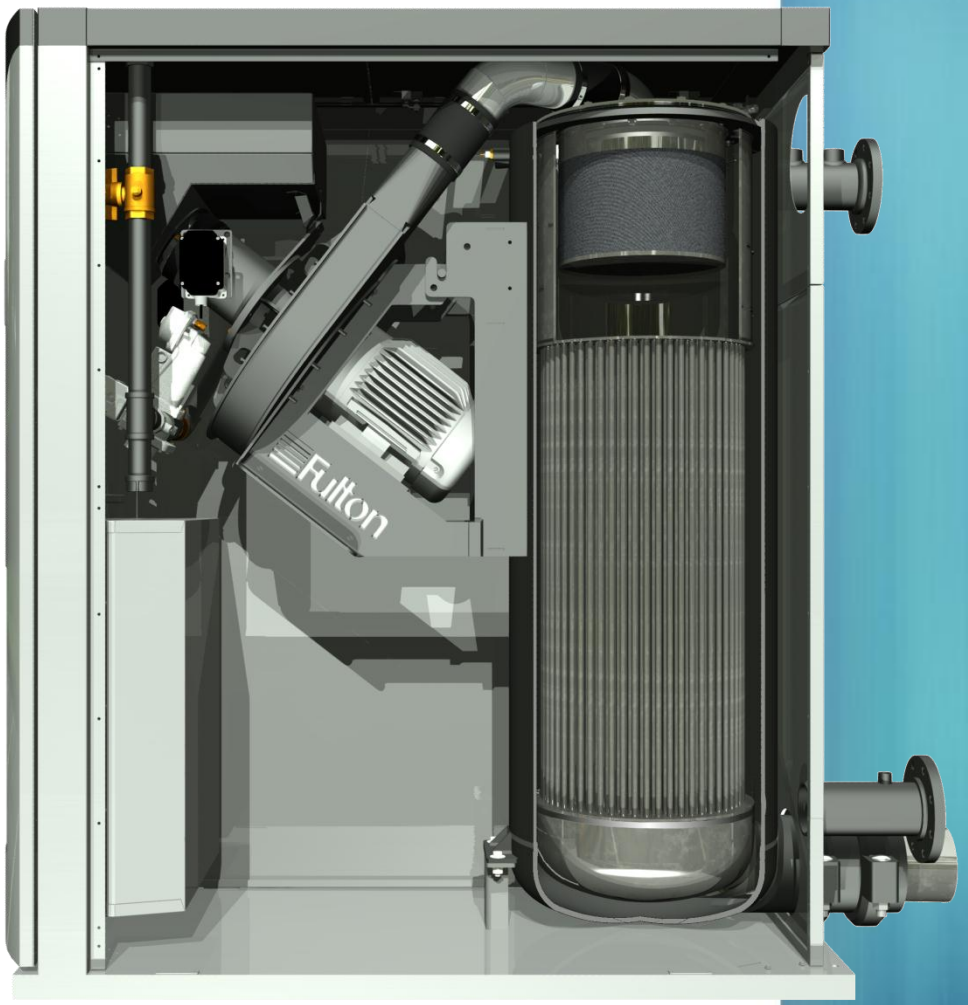
Primary Variable Flow

Features and Benefits

- Does not require primary secondary piping
  - Designed for variable primary flow
- No minimum return water temperature requirement
- Supports low gas pressure (4”WC)
- Longer vent runs up to 1.5”WC
- Low flow protection built into the controls

Highly Engineered Like None Other

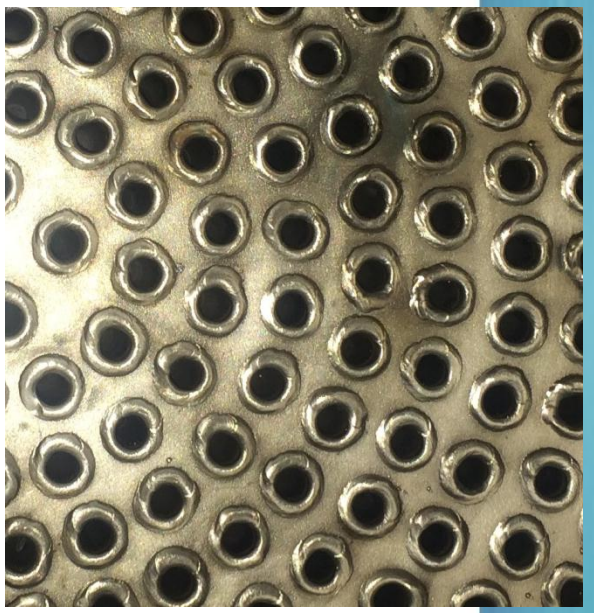
- Revolutionary platform developed in-house by Fulton
- Burner; combustion chamber; tube arrangement optimized as a **system**
- Water backed exhaust manifold
- Heat exchanger pinned only at the top; floating design; heat exchanger can freely grow without stresses



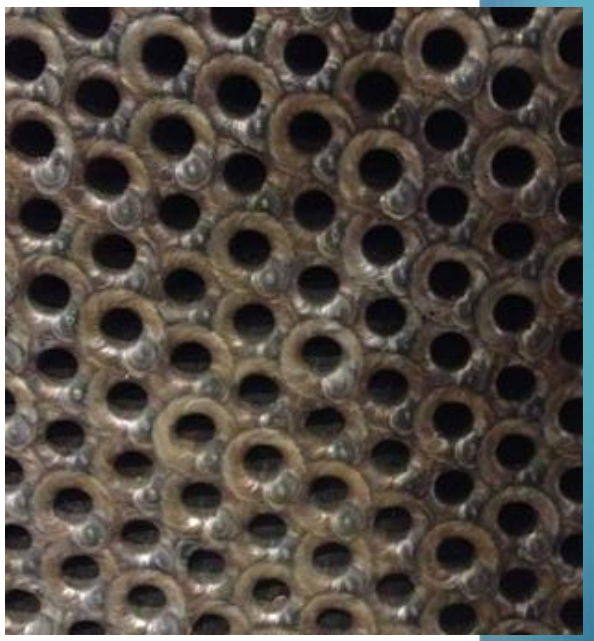
Heat Exchanger

- Duplex Alloy Stainless Steel
  - **Far superior to materials used in competing condensing boilers**
  - Also used in saltwater processing, pharmaceutical and nuclear power applications
  - Low stresses, low thermal expansion
  - Superior yield strength, tensile strength and PREN when compared to 316L, 304L, and 439 grades

Fulton Endura+



Aerco Benchmark

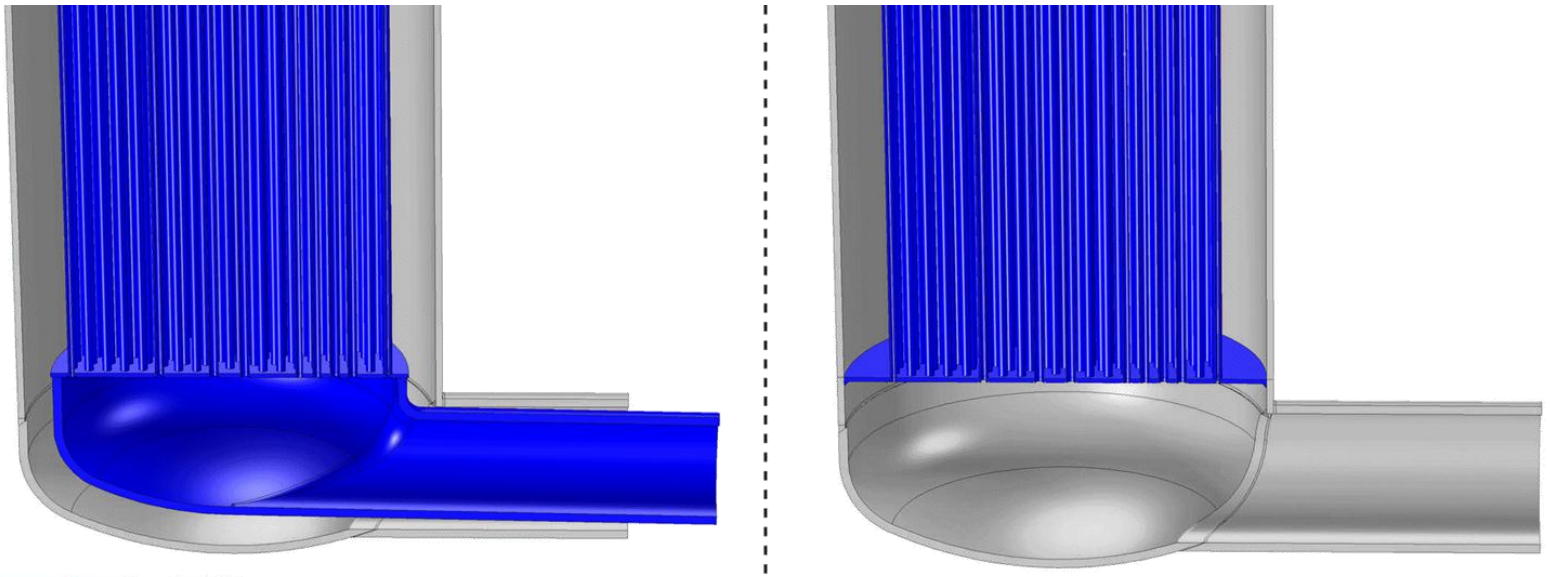


Patent Pending Exhaust Manifold

- Fulton exclusive
- Pinned/welded only at the top, the heat exchanger freely expands inside the shell as it transfers energy from hot combustion gases.
- Thermal growth is absorbed by the external deflection element, **eliminating longitudinal expansion stress.**
- Captures additional heat, maximizing fuel savings.

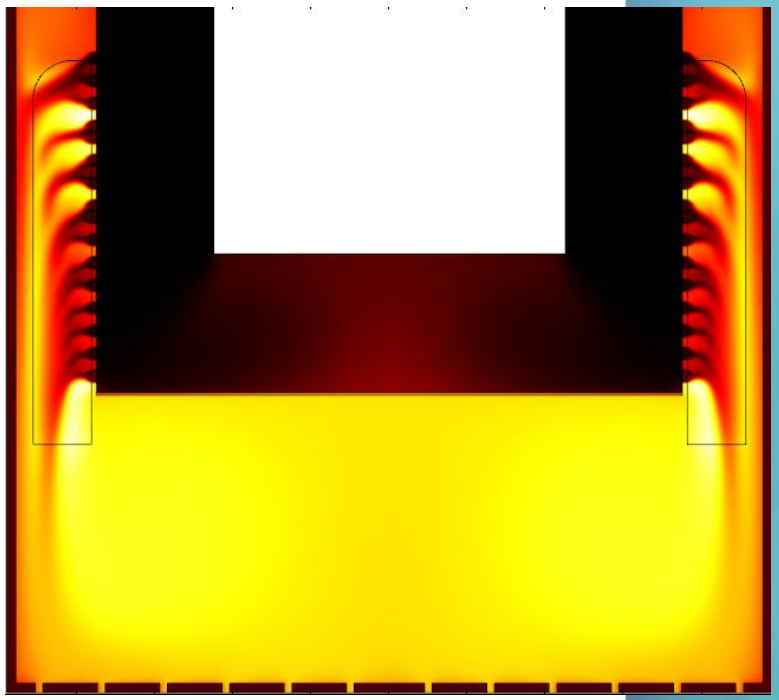
Patent Pending Stress Reliever

- Essentially completely eliminate longitudinal thermal expansion stress -- **an industry first**
- **All other designs** place these stresses directly onto the weakest and most vulnerable part of the boiler: the tubes



Reliable and Efficient Combustion

- Up to 15:1 Turndown
- **No zero governing!**
- Fulton exclusive partner: Worgas
- Precise, reliable, and repeatable servo motor air/gas mixture
- O_2 Compensation
  - Tunes the fuel/air ratio in real-time; automatically adjusting for seasonality



PURE TECHNOLOGY

Premium Fit and Finish

- **Appearance is perceived quality**
- Endura+ appearance quality is above and beyond anything Fulton or the competition has developed in the past
- Metallic flake powder coat over **16 gauge** panels
- Latching panels that come off in seconds
- Accessibility and ease of maintenance
- Clean wiring in conduit and wireways