Before we begin...

- This webinar is being recorded and recording will be available.
- To receive CEU certificate*, please remain logged in for the full duration of the live event.
- Following the event, please fill out the survey to help us continually improve.

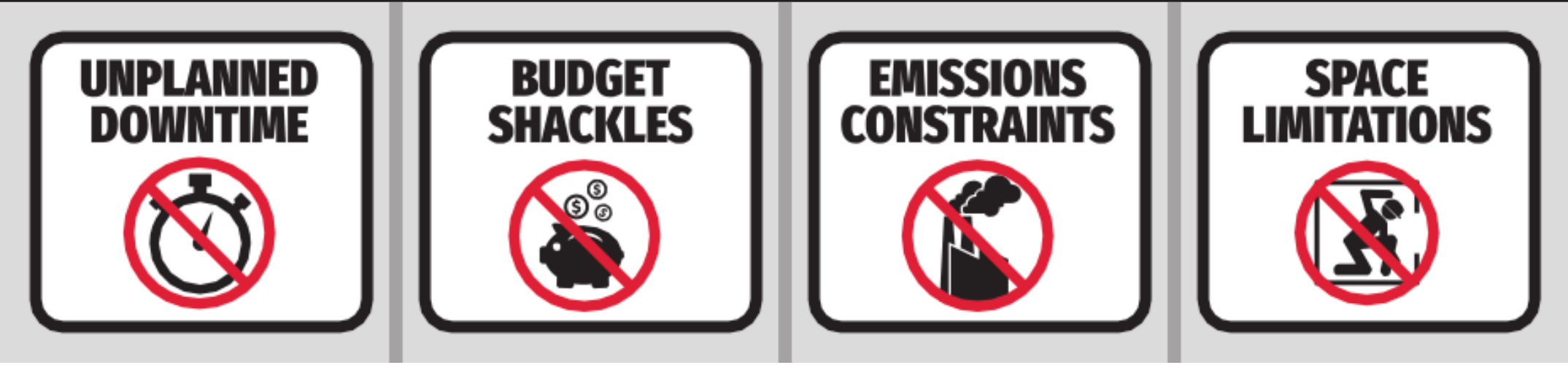
SUPERIOR BOILER

*Subject to stand and local guidelines and regulations.


ENGINEERED WASTE HEAT SOLUTIONS
Efficiency Tailored for You

Superior Boiler helps you

outwit your challenges



SUPERIOR BOILER

For over 100 years, we've been finding **solutions to the world's greatest boiler challenges.**

BACKGROUND
THE SUPERIOR BOILER STORY

1917

Hugh C. Gass founds Superior Welding Shop in Hutchinson.

WORLD WAR II

Superior Welding Shop transforms into a training facility, preparing around 200 welders for the war effort.

1945

Superior Boiler Works moves into a 5,000 sq. ft. facility with 10 employees.

1960'S

Equipment sizes increase, addition of the 3-pass dry back firetube boiler and the new firebox boiler requires more manufacturing space, expanding to 83,000 sq. ft.

1970'S

Added 3-pass wetback, horizontal return tube boilers and waste heat recovery boilers. Now producing fire tube boilers up to 600hp and fireboxes up to 350hp.

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1984

Superior Boiler produces its first (of many) 1000hp gas and oil-fired boiler.

2002

Superior builds the largest single furnace firetube boiler in the industry, a 2200hp dry back.

2014

Superior Boiler purchases Triad Boiler. Product line expands to include both hot water and steam vertical firetube boilers commonly used in commercial heating applications.

2016

Superior purchases English Boiler, adding watertube boilers to its product offerings.

2021

Added another facility in Hutchinson, bringing the company to 300,000 sq.ft of manufacturing space.

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SCOTCH MARINE BOILERS

DRYBACK & WETBACK (10-2,500 BHP)

- Firebox/Modified Firebox Boilers (7-447 Bhp)
- Waste Heat Boilers - engineered & customized for each project
- Horizontal Return Tubular (HRT) Boilers

WATERTUBE BOILERS

Up to 300,000 LB/HR

- Industrial package watertube boilers
- Heat recovery steam generators (HRSG)
- Forced circulation hot water boilers
- Solid fuel boilers
- Modular boiler systems

BOILER ROOM ACCESSORIES

- Spray & Tray Deaerators; 3,500 LB/HR – 500,000 LB/HR
- Boiler Feed Tanks
- Economizers
- Blow Down & Flash Tank Separators
- Modular water treatment systems

VERTICAL FIRETUBE BOILERS

7-150 BoHP

CONDENSING BOILERS

4,000,000 – 12,000,000 BTU/HR

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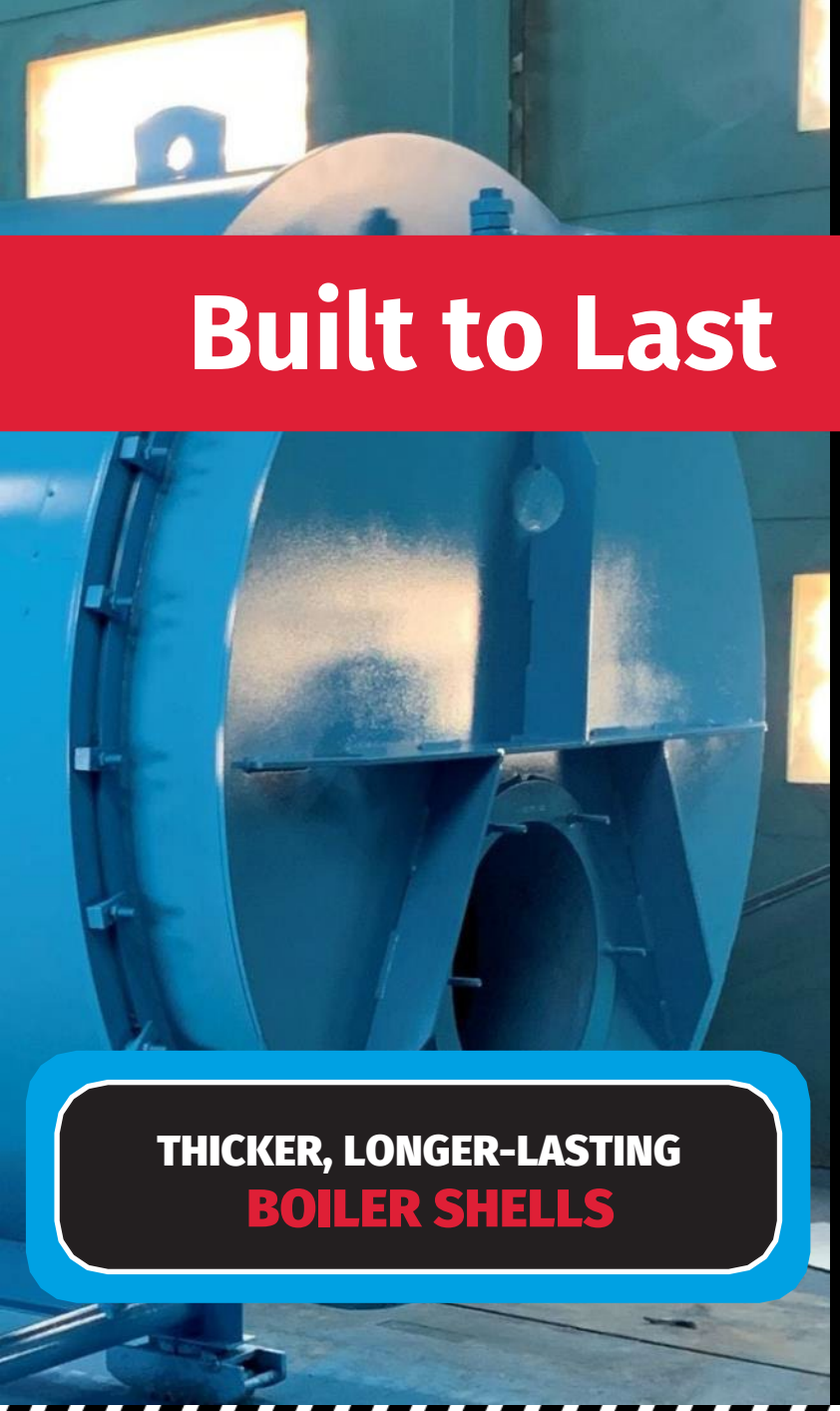
Superior Quality

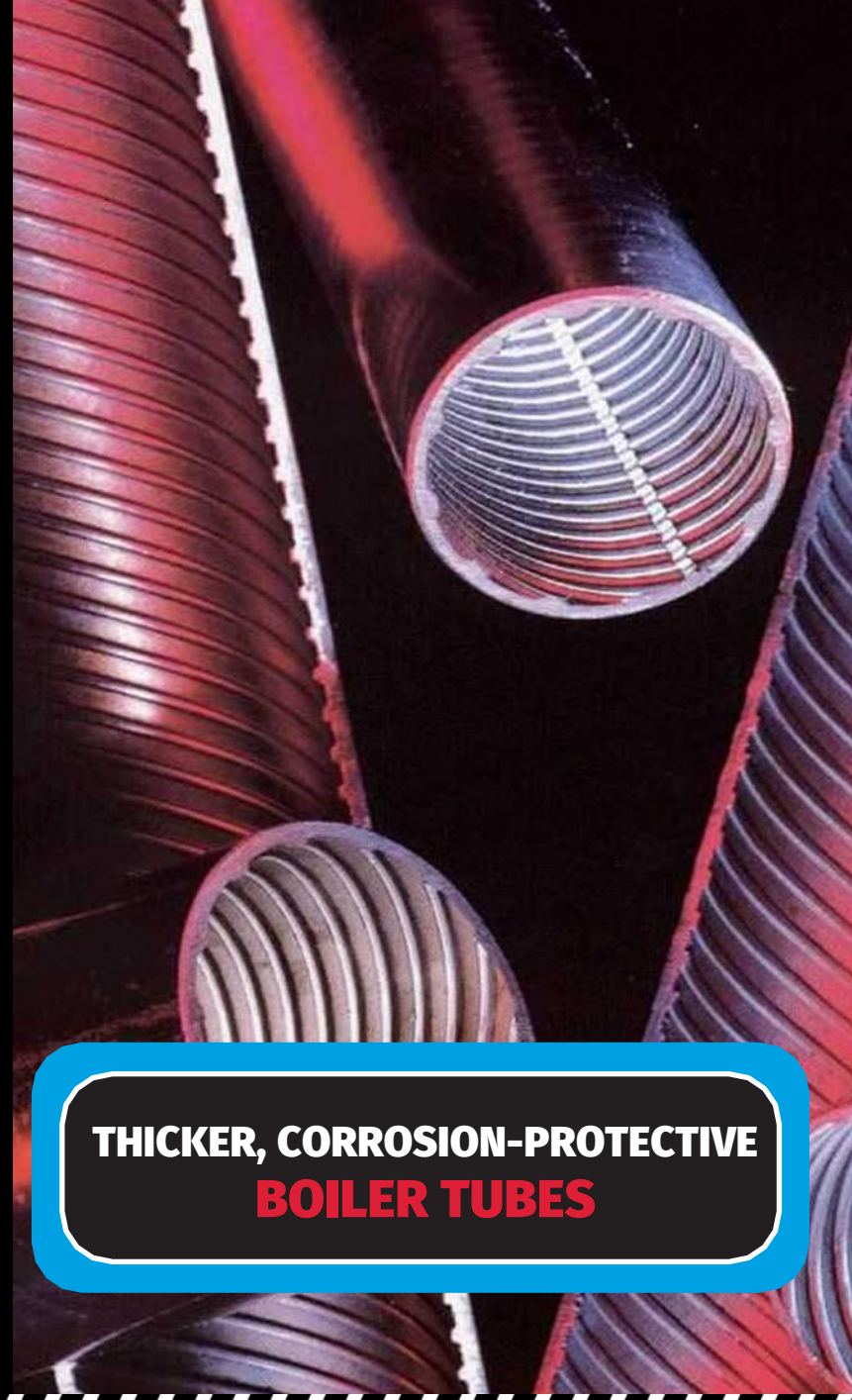
ISO 9001:2015 | ASME | NBIC

Built to Last



THICKER, LONGER-LASTING
BOILER SHELLS

THICKER, STANDARD-SPACED
TUBESHEETS

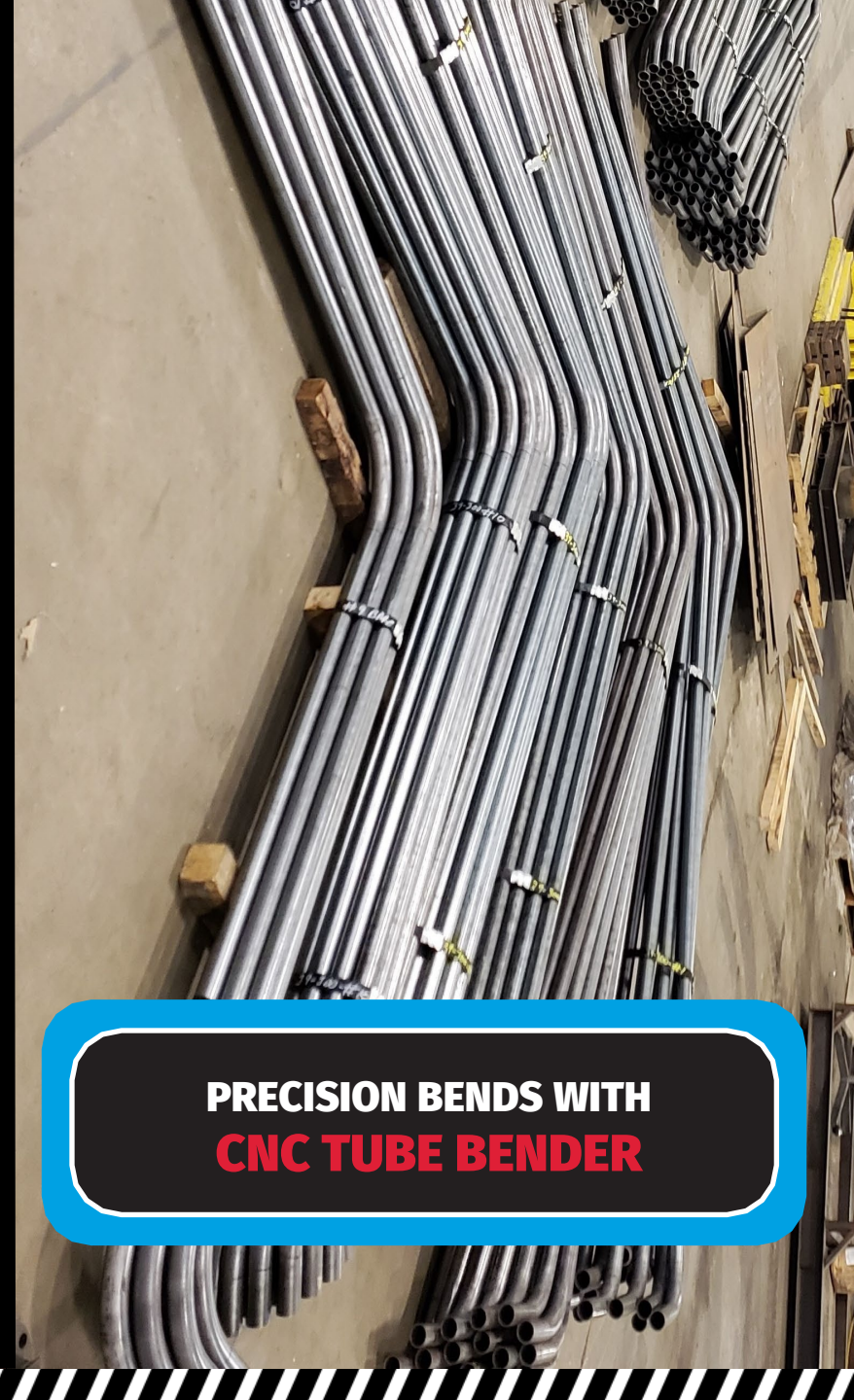


THICKER, CORROSION-PROTECTIVE
BOILER TUBES

Built to Last

CUSTOM-ENGINEERED
DESIGNS

MAXIMUM CLAMPING POWER
SERRATED HOLES



PRECISION BENDS WITH
CNC TUBE BENDER

Burner Flexibility

Superior boilers are burner neutral and work with any brand

- ✓ Easier and more cost-effective to maintain
- ✓ Use the qualified boiler technician of your choice for maintenance
- ✓ If burner ever needs to be replaced, use any compatible model

NON-PROPRIETARY PARTS

We use non-proprietary parts, so maintenance and repairs can be completed by the qualified boiler contractor of your choice.

Our Presenters

Matt Steele

VP of Sales & Marketing

3 Years of Boiler Experience

Engineering Degree

Mokhtar Matallah

VP of Engineering, Firetube

26 Years of Boiler Experience

Mechanical Engineering Degree

Sundeep Bodapati

VP of Engineering, Watertube

11 Years of Boiler Experience

Mechanical Engineering Degree

Don Whitman

VP and General Manager, Watertube

33 Years of Boiler Experience

Mechanical Engineering Degree

Definitions

WHRB (Waste Heat Recovery Boiler)

Any boiler recovering heat from another source for usable heat or energy

HRSG (Heat Recovery Steam Generator)

Heat from gas turbine exhaust (subset of a waste heat boiler)

Applications for WHRB

- Incinerator
- Gas Turbines
- Diesel Engines
- Biomass
- Syngas
- Burning Trash Recovery
- Thermal Oxidizer

Challenges with WHRB

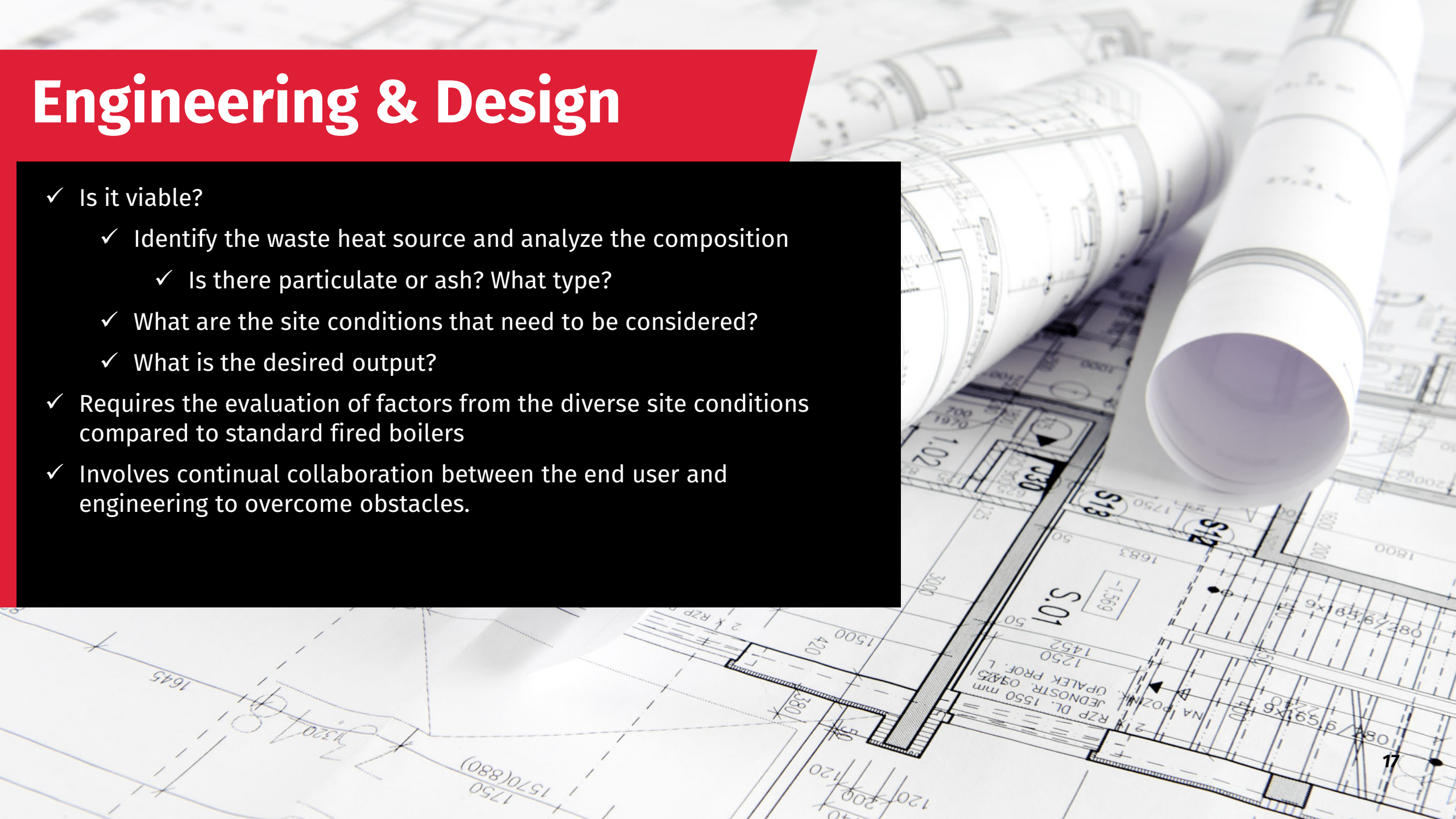
- Heat Source Not Well Defined
- Integration with Existing Infrastructure
- Meet Efficiency Expectations
- Lower Inlet Temperature than Fired Units
- Low Flue Gas Side Draft Pressure
- Supplemental Firing Requirements

Benefits of Custom Solutions

- Different Industrial Processes
- Varied Operating Conditions
- Sizing for Cost Effectiveness
- Site Constraints
- Seamless Integrations
- Environmental Compliance
- Meeting Efficiency Requirements

Engineering & Design

- ✓ Is it viable?
  - ✓ Identify the waste heat source and analyze the composition
    - ✓ Is there particulate or ash? What type?
  - ✓ What are the site conditions that need to be considered?
  - ✓ What is the desired output?
- ✓ Requires the evaluation of factors from the diverse site conditions compared to standard fired boilers
- ✓ Involves continual collaboration between the end user and engineering to overcome obstacles.



Information to Plan Your Unit

Design Conditions

- ✓ Design Pressure
- ✓ Steam Pressure/Temperature
- ✓ Feed-Water Temperature
- ✓ Blowdown %
- ✓ Emissions Requirements

Flue Gas

- ✓ Gas Flow Rate
- ✓ Temperature
- ✓ Stack Temperature
- ✓ Max Flue Gas Pressure Drop

Gas Composition

- ✓ Carbon Dioxide
- ✓ Water
- ✓ Oxygen
- ✓ Nitrogen
- ✓ Hydrogen Chloride
- ✓ Sulfur Dioxide
- ✓ Ash or Soot

Job Specifications

- ✓ Steam Flow OR Stack Temp
- ✓ Ash Hopper
- ✓ Surge Flow
- ✓ Size Restrictions

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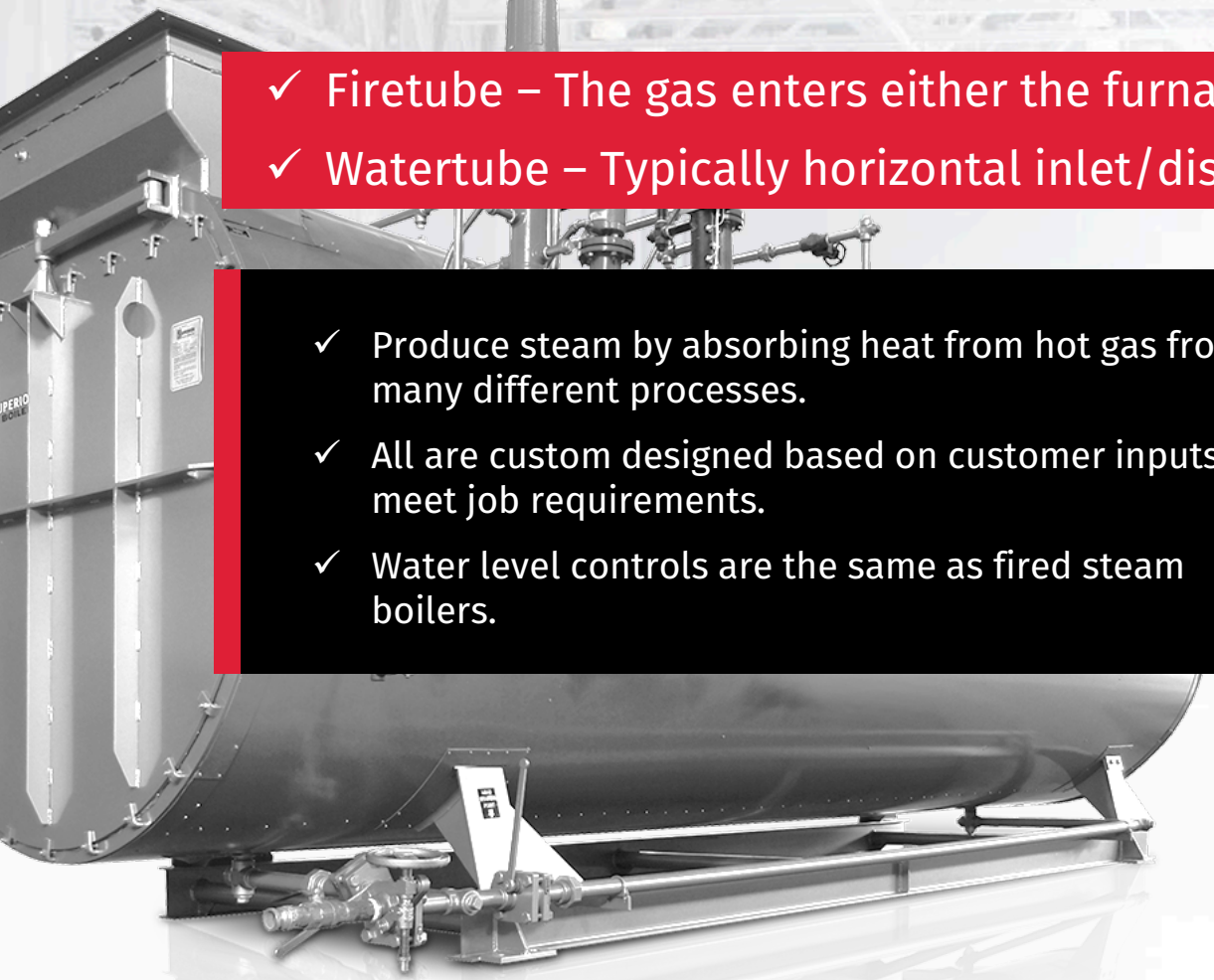
Firetube vs. Watertube WHRB

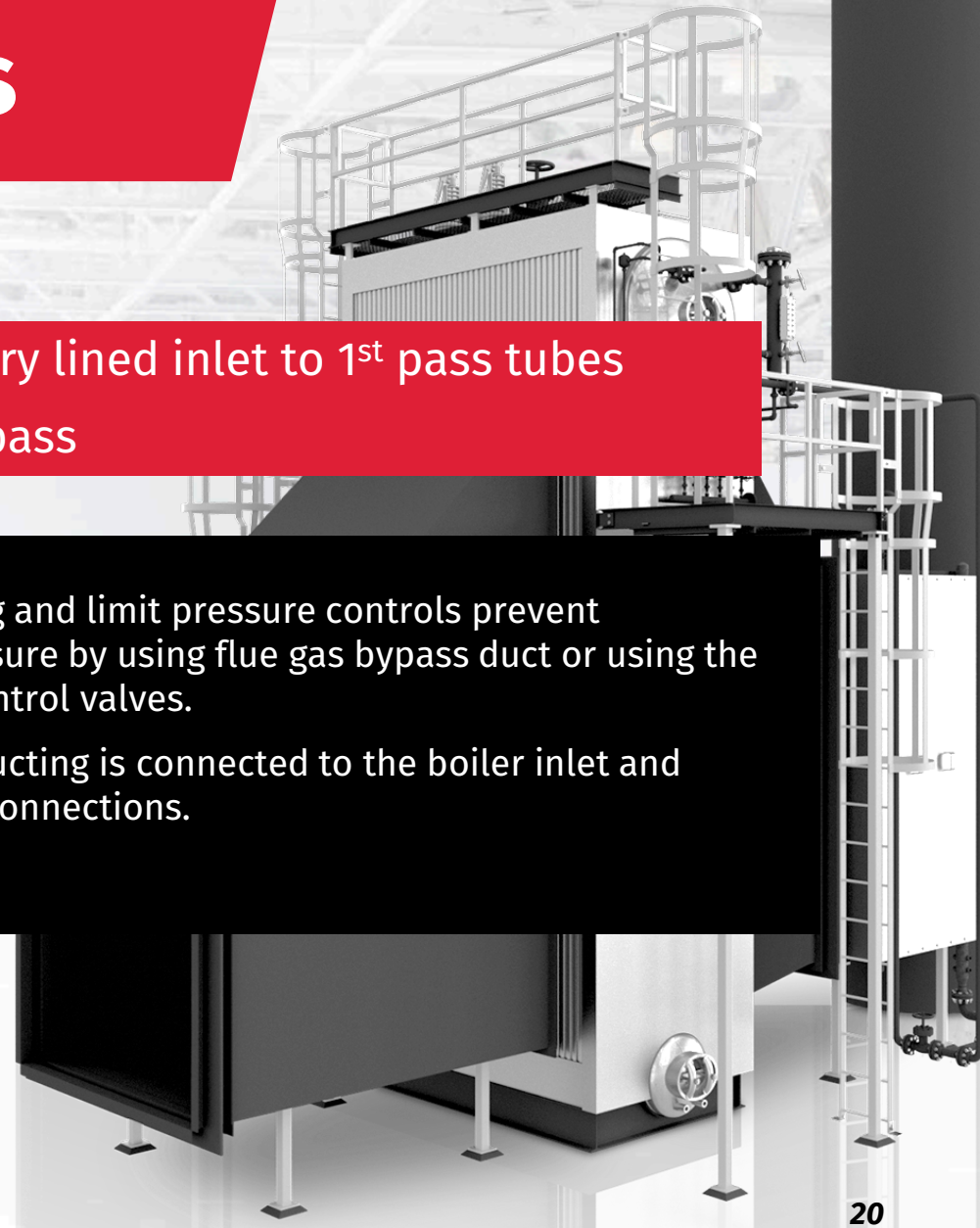
Firetube		Watertube
Used in a broad range of industrial applications	Primary Application	Primarily used in combined-cycle power plants and cogeneration systems.
Heat from exhaust gases	Heat Source	Heat from exhaust gases
Flue gas flow rate limited by pressure drops	Input Limitations	Flue gas flow rate max. of 400,000 lb/hr, Up to 10 inches of inlet flue gas pressure
Adaptable and customizable to suit broader range applications	Flexibility	Designed for power generation applications for maximum efficiency
Space heating, water heating, or driving additional processes	End Uses	Produces steam that drives a steam turbine, generating additional electricity or process steam

Waste Heat Boiler Operations

- ✓ Firetube – The gas enters either the furnace or a refractory lined inlet to 1st pass tubes
- ✓ Watertube – Typically horizontal inlet/discharge, single pass

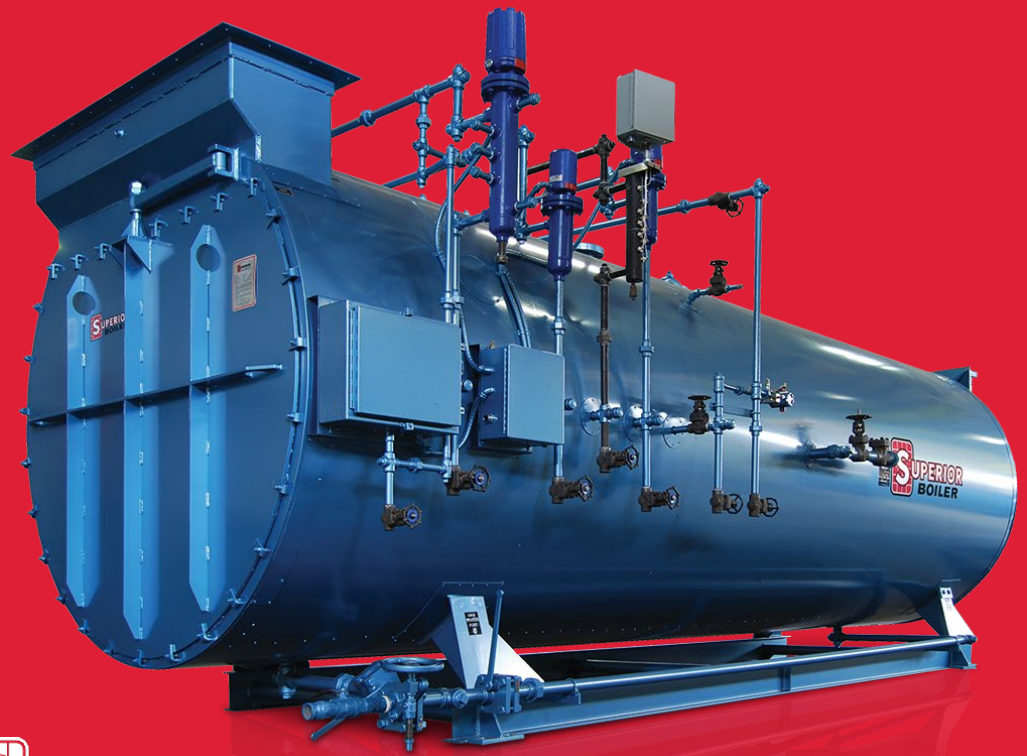
- ✓ Produce steam by absorbing heat from hot gas from many different processes.
- ✓ All are custom designed based on customer inputs to meet job requirements.
- ✓ Water level controls are the same as fired steam boilers.
- ✓ Operating and limit pressure controls prevent overpressure by using flue gas bypass duct or using the steam control valves.
- ✓ Bypass ducting is connected to the boiler inlet and exhaust connections.





Superior Boiler's Waste Heat Offerings

Firetube Product Line



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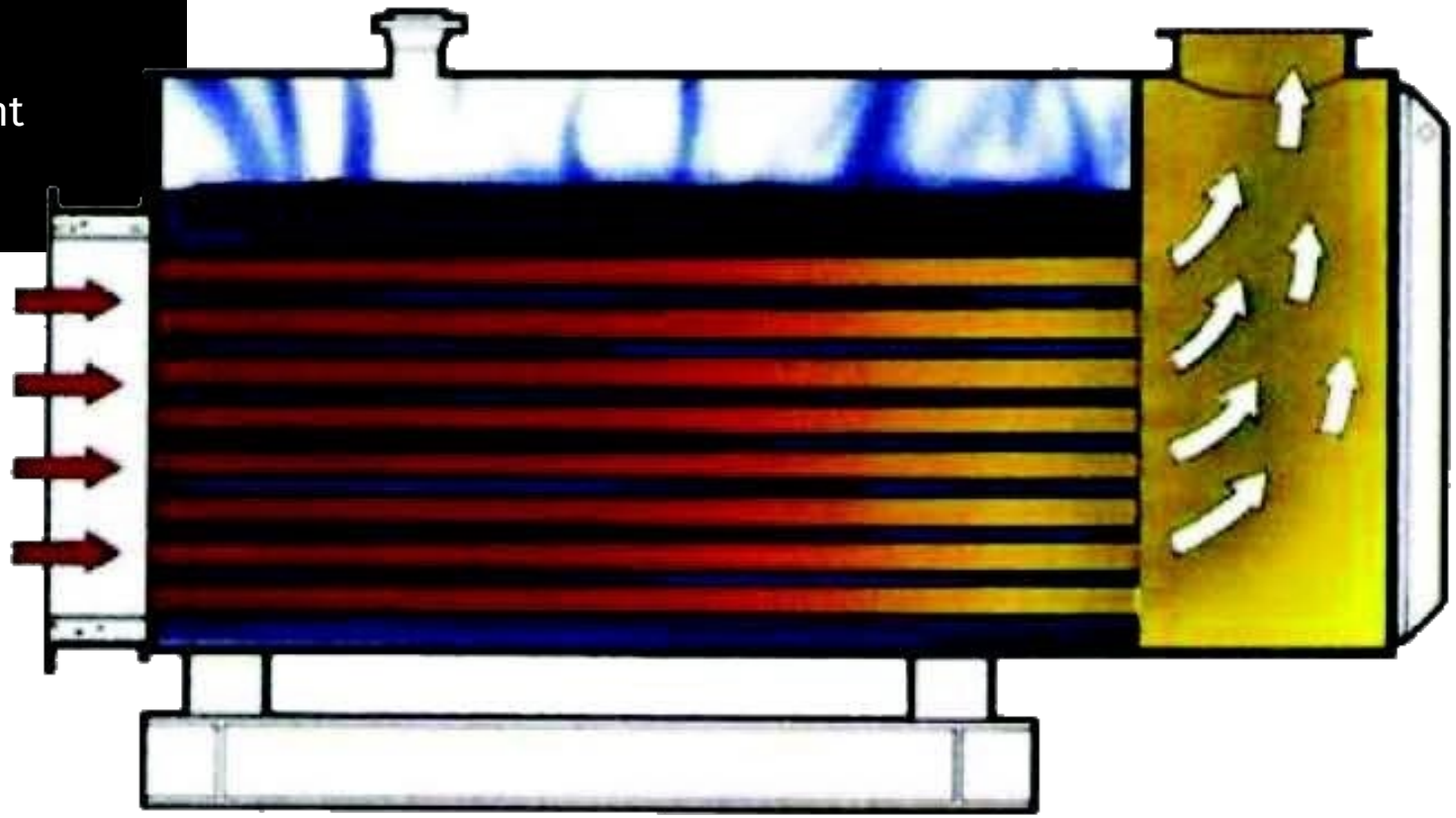
Kiowa Style

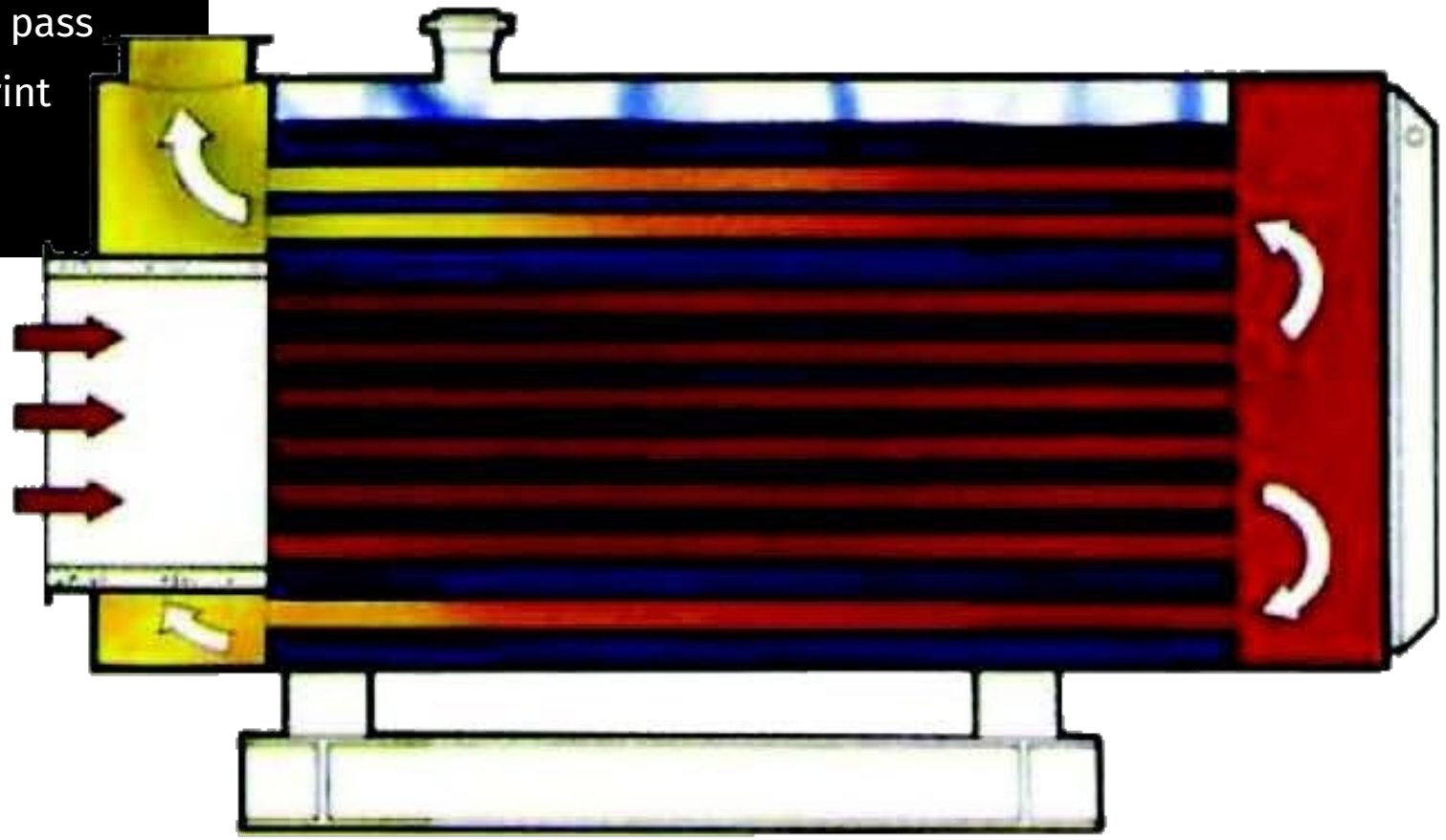
- ✓ 1-Pass with all tubes
- ✓ Limited to 1,800° F inlet gas temperature
- ✓ Lowest pressure drop of any model
- ✓ Rifled tubes can be added to reduce footprint



SUPERIOR BOILER

Comanche Style

- ✓ 2-Pass with all tubes
- ✓ Limited to 1,800° F inlet gas temperature
- ✓ Reduced overall length compared to single pass
- ✓ Rifled tubes can be added to reduce footprint
- ✓ Simplified bypass ducting



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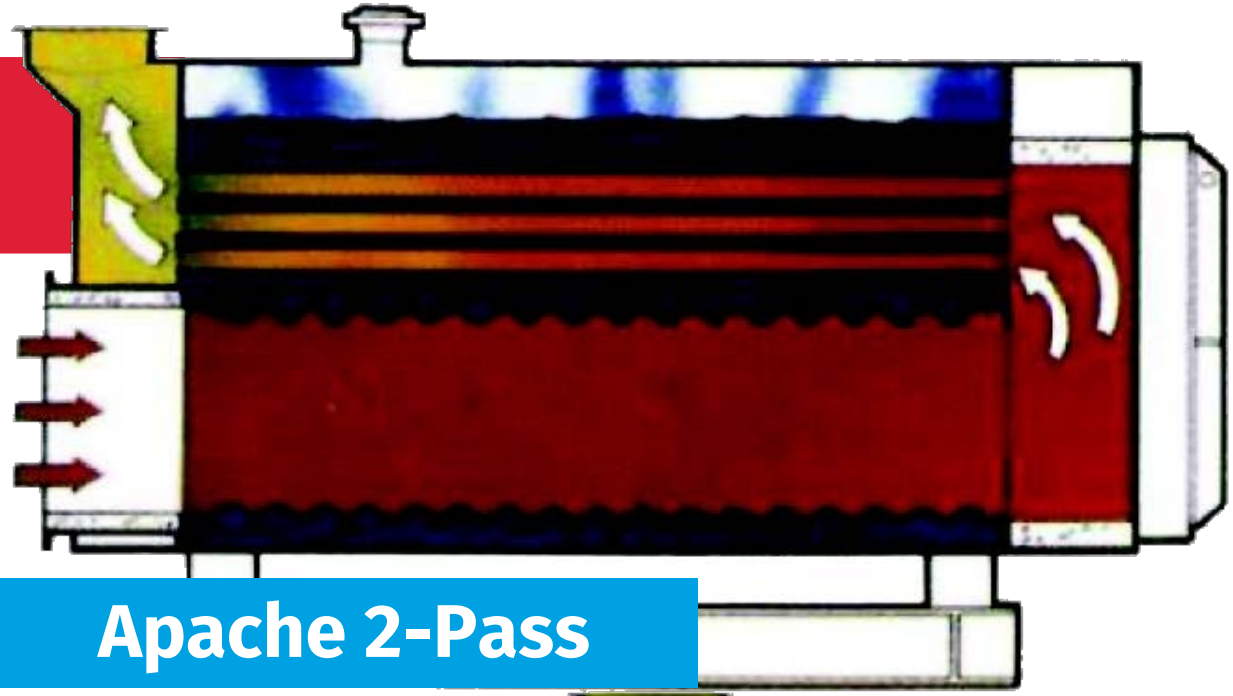
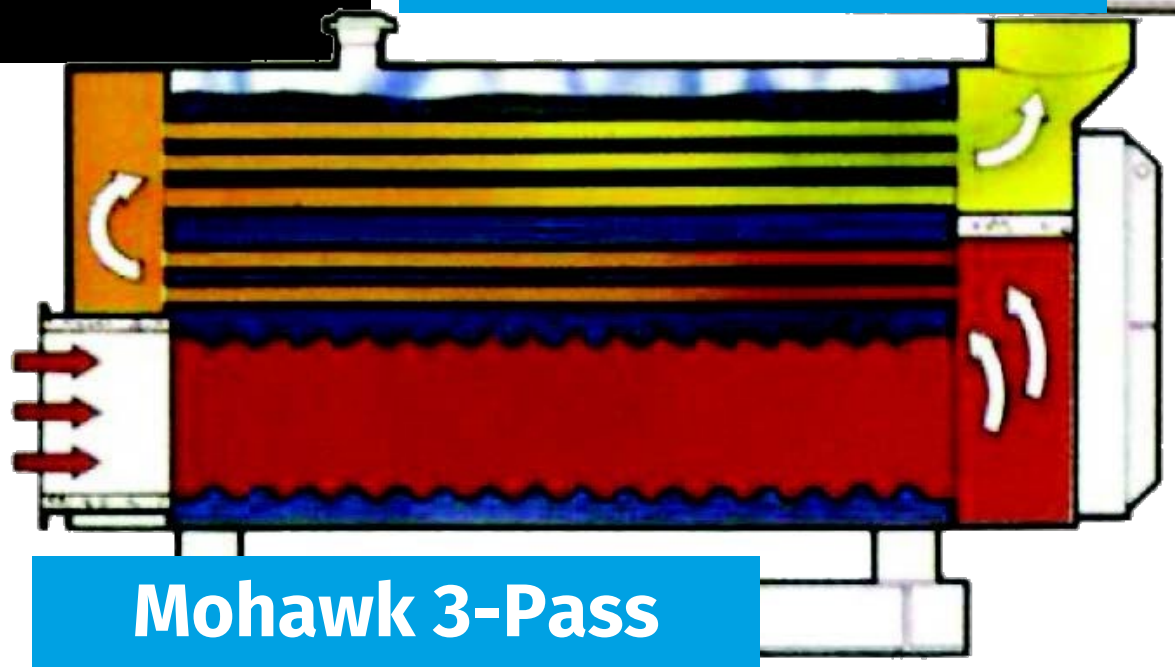
Apache/Mohawk Style

- ✓ Based on our 2 and 3 pass dryback units
- ✓ Furnace at tube patterns are customized to fit requirements
- ✓ Up to 2,400° F gas temperature
- ✓ Compatible with duct burner



Apache 2-Pass



Mohawk 3-Pass

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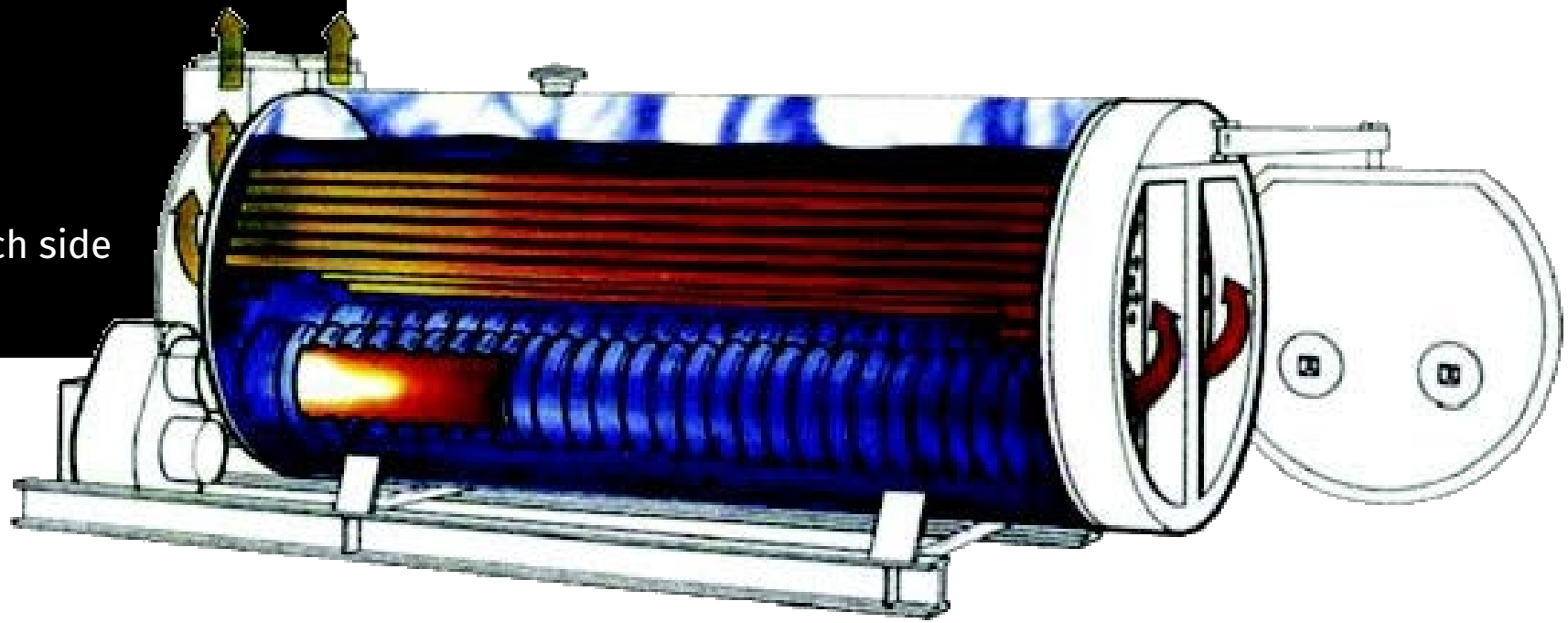
Cherokee Style

- ✓ 2 Pass Dryback boiler with dual chambered fired side and waste heat side
- ✓ Both sides include furnace and 2nd pass of tubes
- ✓ Refractory partition separates these sides at the boiler rear
- ✓ Waste heat side up to 2,400° F gas temperature
- ✓ These ***must be balanced*** to have approximately equal heat from each side



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Superior Boiler's Waste Heat Offerings

Watertube Product Line

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Huron – HRSG

- ✓ Available in multiple configurations
  - Cross drum
  - Single pass ‘O’ type
  - Single pass ‘A’ type
- ✓ Supplemental and Fresh air firing capabilities
  - ✓ Typically, natural gas as fuel
- ✓ Available with optional water-cooled furnace for duct firing
- ✓ Capacities from 10,000 to 120,000 lb/hr
- ✓ Design pressure up to 1,200 psig
- ✓ Superheated steam temperature up to 900˚F
- ✓ What is the Huron most commonly used for?
- ✓ Benefits/limitations of this model

Konza - iHRSG

- ✓ Integrated heat recovery steam generator
- ✓ Incorporates two proven technologies into one package
  - Single pass HRSG
  - Multipass fresh air fired boiler
- ✓ Provides full load with or without exhaust gas stream
- ✓ Generates steam or hot water
- ✓ Capacities available up to 1,000 HP
- ✓ Low emission fresh air fired burner with dual fuel capability
- ✓ When do you choose the Konza design over the Huron?

Superior's FT WHRB Case Study

- ✓ University in the eastern United States
- ✓ Boiler is 2-pass dryback with rifled tubes
- ✓ Heat source is from gas turbine
  - ✓ Flue gas composition ISO GT Only:
    - ✓ CO2 3.00%
    - ✓ O2 14.00%
    - ✓ N2 76.00%
    - ✓ H2O 7.00%
- ✓ Duct Burner at furnace inlet
- ✓ Capacity – 27,000 lb/hr with heat from gas turbine only, 40,000 lb/hr with supplemental firing [duct burner]

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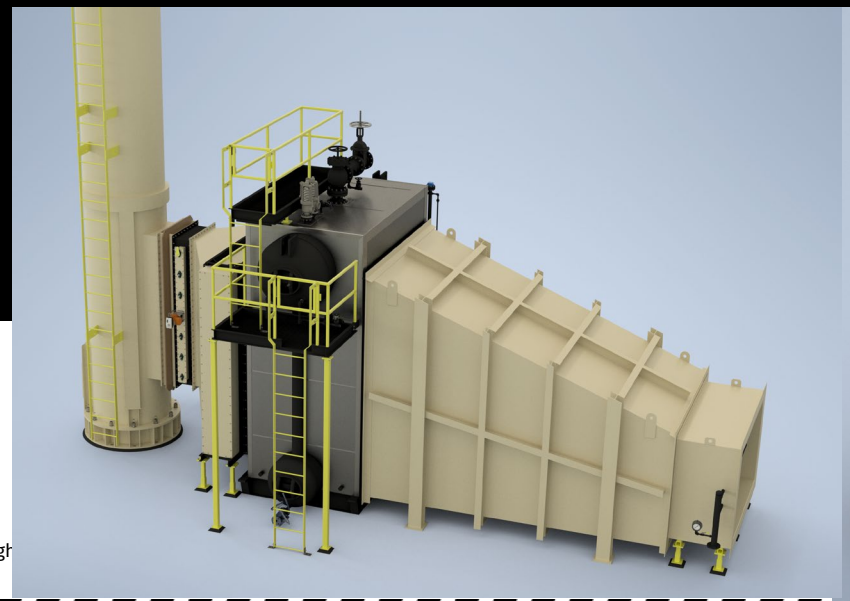
Superior's WT WHRB Case Study

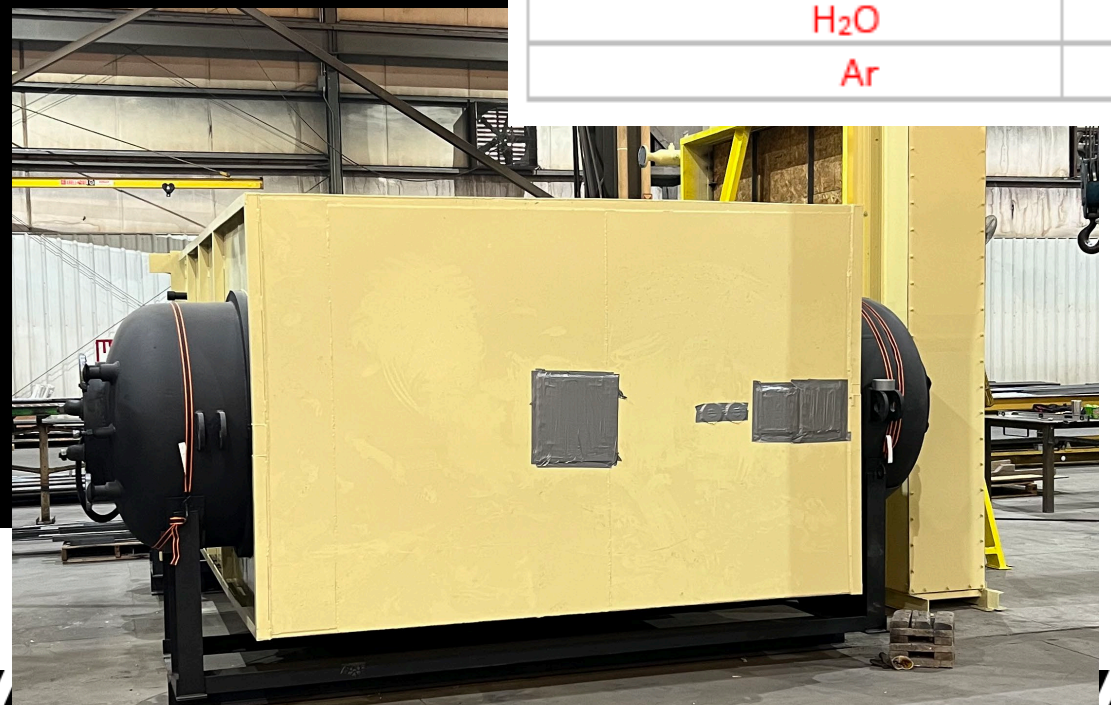
- ✓ US Air Force Base
- ✓ HRSG boilers including natural gas fired duct burners and fresh air firing
- ✓ Flue gas composition at 100% engine load from exhaust gas from 4 natural gas fired reciprocating engine.
  - ✓ CO_2 5.2%
  - ✓ O_2 10.0%
  - ✓ N_2 74.4%
  - ✓ H_2O 9.5%
  - ✓ Ar 0.9%
- ✓ Duct Burner:
  - ✓ NOx: 0.08 lb/MMbtu
  - ✓ CO: 0.05 lb/MMbtu
- ✓ Outlet pressure with minimum design pressure of 150 psig, operating pressure range of 100-120 psig



Superior's WT WHRB Case Study

- ✓ Minimum Performance Requirements:
- ✓ Minimum Duct Burner load:
  - ✓ 13,120 lb/hr
  - ✓ 117 psig
  - ✓ 348° F
  - ✓ 3% Blowdown
- ✓ Fully fired steam capacity:
  - ✓ 32,140 lb/hr
  - ✓ 117 psig
  - ✓ 348° F
  - ✓ 3% blowdown
- ✓ Multiple Engines with Duct Fire

Description		Max Flow	Min. Flow	Fresh Air
Engine Flow, pph		129,500	32,375	120,000
Engine Temperature, °F		732	732	70
Firing Temp, °F		1200	1200	930
Comp. %Vol.	N_2	74.4	74.4	79
	O_2	10.0	10.0	21
	CO_2	5.20	5.20	0
	H_2O	9.50	9.50	0
	Ar	0.90	0.90	0



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How do you make your WHRB last?

- ✓ The number of starts/how much it cycles change will affect the life of the boiler.
  - ✓ Design considerations to help decrease thermal shock
    - ✓ Diverter Dampers to meter flue gas at startup
    - ✓ Heating coil to have equipment at near operating temperatures prior to startup
- ✓ Upstream equipment effects the boiler
  - ✓ Heat Source
  - ✓ Duct Burner

Q&A

Hit us with your challenges

THANK YOU

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