



INDUSTRIAL WATERTUBE BOILERS

Innovative solutions for maximum efficiency

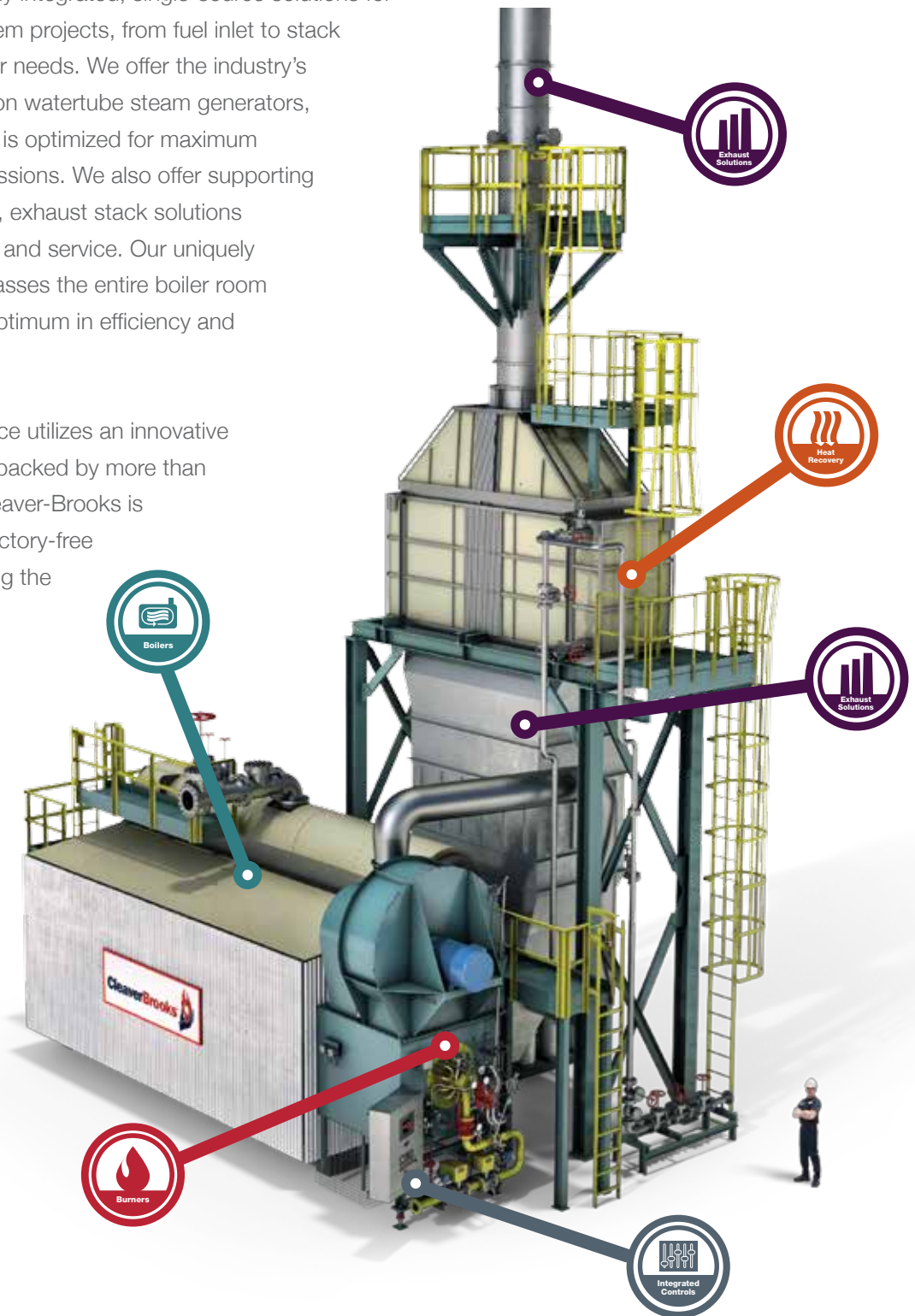
Cleaver-Brooks Engineered Boiler Systems
Manufacturers of Nebraska Boilers, NATCOM
Burners and ERI HRSG Systems

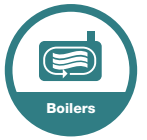
Industrial Watertube Boilers

Total Integration from the Company that Pioneered It

Only Cleaver-Brooks offers totally integrated, single-source solutions for every aspect of your boiler system projects, from fuel inlet to stack outlet, custom built to meet your needs. We offer the industry's widest range of natural circulation watertube steam generators, and every aspect of our system is optimized for maximum efficiency, reliability and low emissions. We also offer supporting controls systems, heat recovery, exhaust stack solutions and complete aftermarket parts and service. Our uniquely engineered integration encompasses the entire boiler room and is designed to deliver the optimum in efficiency and environmental sustainability.

Every industrial watertube furnace utilizes an innovative welded-membrane wall design backed by more than 80 years of experience. And Cleaver-Brooks is the only manufacturer with refractory-free boiler wall construction, including the burner throat.





Engineered Boiler Systems Product Overview

	Capacity	Fuel Type	Design Pressure	Application	Emissions
D-Style	10,000 to 500,000 lb/hr Steam	Natural gas, #2 and #6 oil, alternative fuels, combination	Up to 1,500 psig	Steam, temperatures to 1,050°F	Available to <7ppm NOx* Ultra-Low CO
A-Style	10,000 to 500,000 lb/hr Steam	Natural gas, #2 and #6 oil, alternative fuels, combination	Up to 1,500 psig	Steam, temperatures to 1,050°F	Available to <7ppm NOx* Ultra-Low CO
O-Style	10,000 to 500,000 lb/hr Steam	Natural gas, #2 and #6 oil, alternative fuels, combination	Up to 1,500 psig	Steam, temperatures to 1,050°F	Available to <7ppm NOx* Ultra-Low CO
CBND	10,000 to 225,000 lb/hr Steam	Natural gas, #2 oil	Up to 375 psig	Saturated Steam	Available to <7ppm NOx* Ultra-Low CO
Elevated Drum & Modular	200,000 to 1,000,000 lb/hr Steam	Natural gas, #2 and #6 oil, alternative fuels, combination	Up to 1,500 psig	Steam, temperatures to 1,050°F	Available to <7ppm NOx* Ultra-Low CO
FC-OSSG	150,000 to 500,000 lb/hr Steam	Natural gas, #2 and #6 oil, propane, digester, combination	Up to 2,500 psig	Saturated steam	Available to <7ppm NOx* Ultra-Low CO
HRSGs	10,000 to 500,000 lb/hr Steam	Natural gas, #2 oil, propane, digester, landfill	Up to 2,300 psig	Steam, temperatures to 1,050°F	Available to <2ppm NOx* Ultra-Low CO
High Temperature Hot Water & Thermal Fluid Heater	20 to 200 MMBTU/hr Water	Natural gas, #2 oil, propane, digester, landfill	Up to 2,300 psig	Hot Water Fluid Heater	Available to <7ppm NOx* Ultra-Low CO

*available to <2ppm NOx with SCR

Custom Watertube Boilers

10,000 to 500,000 lb/hr

Cleaver-Brooks uses our experience and expertise to ensure every watertube boiler we manufacture is the highest quality in the industry and offers the lowest operational costs possible for that style of boiler. We leverage our specialized engineering expertise to deliver fully customized steam solutions that meet your specific needs. Our extensive range of watertube products, delivering from 10,000 to 500,000 lb/hr of steam, are available in D-, A- and O-style configurations.

Both single- and dual-stage integral convective superheaters are available, and can accommodate Selective Catalytic Reduction (SCR) and CO catalyst. And you have your choice of firing natural gas, #2 and #6 oil, alternative fuels or a combination, available to <7ppm NOx.

FEATURES

- Membrane wall constructions are 100% water-cooled and refractory-free
- Grooved tube seats for improved tube-to-drum attachment
- Large, water-cooled furnace areas feature refractory-free burner throat to optimize emissions performance and longevity and reduce maintenance
- Fully welded gas seals are used throughout to ensure gas-tight operation

Capacities

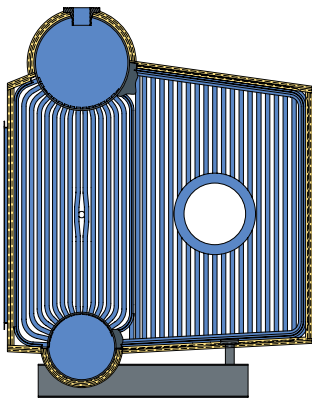
10,000 to 500,000 lb/hr

Design Pressure

Up to 1,500 psig

Steam Temperature

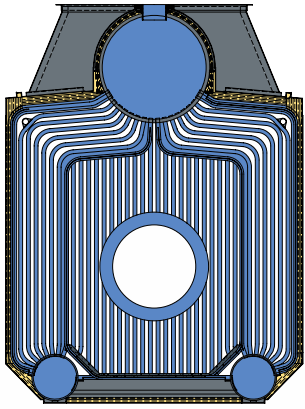
Up to 1,050°F



D-STYLE

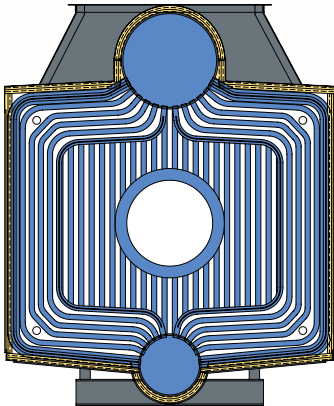
The D-style is a 100% membrane water-cooled furnace, reducing costly, time-consuming, annual maintenance. The burner throat and the front and rear walls are welded and refractory-free, utilizing our NATCOM burner design. D-style boilers can be customized to provide superheated steam. We offer both single- and dual-stage integral superheater systems with optional temperature control over turndown.





A-STYLE

The A-style design features a large, water-cooled furnace and an evaporator section with a low gas-side pressure drop that reduces fan power consumption. The vertical gas outlet minimizes the width of the overall package and allows for large steam capacities in restrictive footprints.



O-STYLE

This rugged design has become the true workhorse of the rental boiler industry. The vertical gas outlet on the O-style puts the economizer above the boiler, minimizing the width of the overall package. Its symmetrical design is ideally suited for mounting on a trailer for over-the-road transport. Cleaver-Brooks line of boilers for the rental industry continues to provide efficient and reliable service year after year, while withstanding rapid emergency startups.



Steam-Ready CBND

10,000 to 225,000 lb/hr

You choose the size and options you need on the Cleaver-Brooks Nebraska D boiler, and we'll have a solution that's ready faster than ever. We do not interface with any other brand's parts. Just like every Cleaver-Brooks system, steam-ready systems are integrated only with Cleaver-Brooks components. Available with emissions as low as 9 ppm NOx with combustion, 5 ppm NOx with Selective Catalytic Reduction (SCR) and 50 ppm CO, it's a flexible and cost-effective way to get your boiler room online fast, firing natural gas or #2 oil.

FEATURES

- Completely integrated and engineered from a single source
- Engineered integrations include watertube boiler, burner, heat recovery economizer and controls
- Engineering up front for shortened lead times
- Competitively priced
- Vast network of trained startup/service technicians

Capacities

10,000 to 225,000 lb/hr

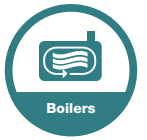
Design Pressure

Up to 375 psig

Steam Temperature

Saturated Steam



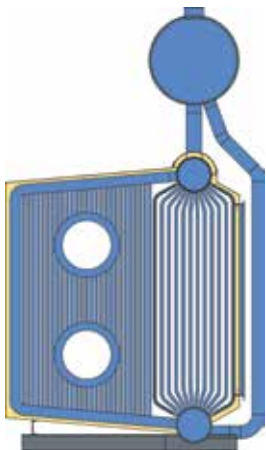


Modular-Style Watertube Boilers

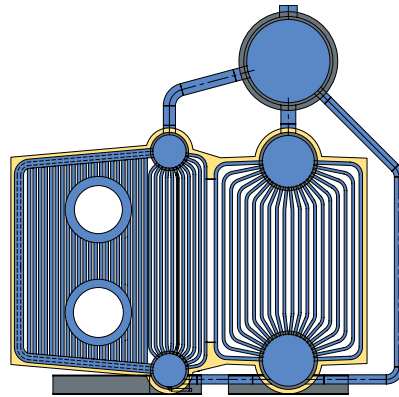
200,000 to 1,000,000 lb/hr

The Cleaver-Brooks elevated drum design maximizes shop assembly time while minimizing the cost of field labor often associated with boilers of such high capacity. The elevated drum design is a 100% membrane water-cooled furnace, reducing costly, time-consuming, annual maintenance. The front and rear walls are welded and refractory-free, as well as the burner throat, when integrated with our NATCOM burner. Elevated drum boilers can be customized to provide superheated steam. We offer both single- and dual-stage integral superheater systems with optional temperature control over turndown. Our design allows for reduced gas-side pressure drop and smaller forced-draft fans and can accommodate Selective Catalytic Reduction (SCR) and CO catalyst.

Elevated Drum and Modular-Style



Elevated Drum



Modular-Style

FEATURES

- Minimal field assembly
- Faster, more cost-effective delivery time versus field erect boilers
- Reduced gas-side pressure drop and smaller forced-draft fans
- Superheated steam options available
- Dual burners available to meet specific applications
- Can accommodate Selective Catalytic Reduction (SCR) and CO catalyst



Capacities
200,000 to 1,000,000 lb/hr
Design Pressure
Up to 1,500 psig
Steam Temperature
Up to 1,050°F

Forced-Circulation Steam Generator (FC-OSSG)

150,000 to 500,000 lb/hr

The Cleaver-Brooks FC-OSSG combines the benefits of a traditional D-style watertube boiler, with high saturated steam purity and very low blowdown, and the ease of cleaning once-through steam generators (OTSG). This large-capacity steam generator is uniquely suited for the needs of the heavy industrial, refinery and petrochemical markets and is ideal for use in steam-assisted gravity drainage (SAGD) applications utilizing produced water. Available to <7 ppm NOx or higher and will fire natural gas, #2 and #6 oil, propane, digester or a combination.

FEATURES

- Highly efficient steam solutions capable of meeting strict emissions requirements
- Increased efficiency with minimal blowdown
- 10:1 turndown
- Single-source integrated boiler/burner/control package engineered to work together
- Smaller footprint for reduced material cost and space savings
- Shipped modular packages for ease of installation
- 100% mechanically cleanable by pigging

Capacities

150,000 to 500,000 lb/hr

Design Pressure

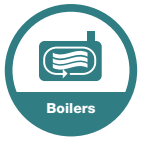
Up to 2,500 psig

Steam Temperature

Saturated Steam



(Patent Pending)



Heat-Recovery Steam Generators and Waste Heat Boilers

10,000 to 500,000 lb/hr

With state-of-the-art, customized, packaged heat-recovery steam generators for gas-fired turbines from 1 to 95 MW, Cleaver-Brooks is a leading global provider of natural circulation-packaged and modular HRSG products for gas turbine, process exhaust, incinerator exhaust and hot water generation. We also manufacture Thermal Fluid Heaters (TFH) and High Temperature Hot Water (HTHW) generators, which incorporate a fluid-cooled membrane wall construction for the furnace and heating coil enclosure, creating a highly efficient, shop-assembled package. These units are available for most applications ranging from 20-200 MMBTU/hr. We have extensive experience customizing systems for your specific application. Our systems can increase efficiency for large-scale industrial applications such as thermal oxidizers, incinerators, FCCUs, thermal oil heaters, economizers and air heaters.

FEATURES

- Multiple pressure units available
- External superheaters, economizers and feedwater heaters
- Compact design results in low installation costs
- Can accommodate Selective Catalytic Reduction (SCR) and CO catalyst

Capacities
10,000 to 500,000 lb/hr
Design Pressure
Up to 2,300 psig
Steam Temperature
Up to 1,050°F





Custom Controls Systems

The brains behind the system

Cleaver-Brooks utilizes an in-house instrumentation and controls department to develop next-generation boiler control and burner management systems. Our approach delivers seamless, single-source engineered boiler/burner package systems. Our controls range from a cost-efficient, standard boiler-control logic and flame safeguard system to a custom-engineered package to meet specific customer requirements. Regardless of the level of complexity, we will provide state-of-the-art hardware and programming for safe, reliable and efficient operation with a user-friendly interface. Cleaver-Brooks industrial watertube boilers are controlled by the Hawk 6000. Our control systems meet the latest NFPA, CSA, CE, TUV and GOST international codes and standards.

FEATURES

- Burner Management System (BMS)
- Combustion Control System (CCS)
- Plant Master Panel
- Balance of Plant Controls
- Supervisory Control and Data Acquisition (SCADA)
- Auxiliaries
- Factory Accepted Test (FAT) and Site Acceptance Test (SAT)
- Fuel transfer, simultaneous firing, preferred fuel strategies
- Solid state, loop controller, PLC and DCS platforms



Hawk 6000





NATCOM Burners

Unsurpassed engineering and testing

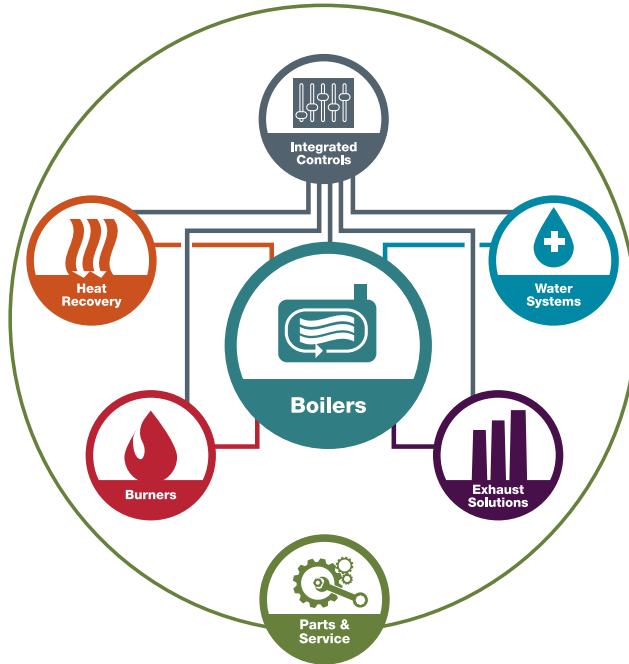
Every Cleaver-Brooks industrial watertube boiler is integrated with our NATCOM burners, which are custom-built to exacting specifications to meet each application and furnace configuration, ensuring seamless integration and unmatched fit and finish.

Our advanced, in-house Computational Fluid Dynamics (CFD) modeling is the key to our revolutionary NATCOM burner technology. Matching burner flame and furnace aerodynamics optimizes efficiency and lowers emissions without costly field tests. Simulations in a virtual environment provide calculations for fuel and air distribution in any furnace configuration. Our design provides ultra-low NO_x, ultra-low CO and minimal particulate matter (PM).

FEATURES

- Multi-fuels applications including natural gas, refinery gas, landfill gas (LFG) and other processed waste gases, light to heavy fuel oils, and liquid waste streams
- On-line adjustability and possible removal of individual gas injectors
- No refractory burner throat
- Unmatched flame stability with Center-Core technology
- NO_x levels available to <7ppm with FGR and <30ppm without FGR
- Ultra-low excess air for high efficiency
- High turndown ratio of 40:1 on gas and 10:1 on oil





Total Integration goes far beyond boilers.

For more than 80 years, Cleaver-Brooks has built a reputation for innovation in the boiler solutions industry. We remain committed to introducing technology and products that enable a more energy-efficient and environmentally friendly generation of steam and hot water.

When you come to us for a fully integrated solution, you can know that each element is created to the highest standards and all will work seamlessly together to give you a highly efficient and reliable solution for protecting your boiler system. To learn more, please call or visit us online at cleaverbrooks.com.



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