CleaverBrooks®

Waste Heat Solutions

When Sustainability and Efficiency Matter

A Cleaver-Brooks Sustainable Solution

Decreasing Your Carbon Footprint While Increasing Plant Efficiency

Cleaver-Brooks waste heat solutions are the result of decades of boiler engineering experience and our commitment to the four cornerstones of successful plant operation: Safety, Efficiency, Reliability and Sustainability.

Waste heat boilers recover process heat to generate steam or recover heat from solid, liquid or gaseous incinerators, reducing the need for fired steam generation.

Supporting your sustainability goals, our waste heat solutions can:

- Replace the need for additional auxiliary-fired boilers
- Eliminate 410 tons of CO_2 for every 1 MMBTU/hr recovered
- Reduce 280 lbs of NOx and CO emissions annually

Our waste heat solutions meet the strict performance and sustainability criteria required to earn the Cleaver-Brooks Sustainability Seal. Find out more at cleaverbrooks.com/sustainability.

Reliability, Sustainability and Efficiency Engineered by the Experts

Cleaver-Brooks is the leading provider of energy recovery solutions and the only totally integrated, single-source supplier in the world, from waste heat inlet to stack outlet. Whether you need a packaged waste heat boiler or waste heat recovery unit, our systems achieve energy efficiency, emissions reduction and decarbonization.

Our energy recovery solutions capture and use heat that would otherwise be wasted from manufacturing processes and potentially displaces the need for additional steam or power generation.

Cleaver-Brooks project teams ensure that the energy recovery system is designed to your specifications, and our trained craftsmen produce boilers that are guaranteed to meet your exact standards. With state-of-the-art technology and expertise earned during 100 years in the industry, Cleaver-Brooks delivers reliability, sustainability and overall plant efficiency.

Waste Heat Boilers

Where sustainability meets innovation

Cleaver-Brooks offers a complete selection of waste heat boilers that incorporate our membrane wall construction. These boilers are designed to recover heat from various sources such as gas turbines, thermal oxidizers or manufacturing processes. Capturing this waste heat and generating steam in a waste heat boiler reduces the need for fired steam generation, increases plant sustainability and reduces greenhouse gases.

Single-Pass Open Bottom A- or O-type Boiler

- Applications with dust and/or ash loading
- Bare or combination bare and finned tubes
- Low pressure drop

Two-Pass Waste Heat Boiler with Furnace

- Applications with dust and/or ash loading
- Elevated inlet temperature
- Partial combustion occurring in furnace
- Bare tubes

Vertical Tubes/Cross Flow Boiler Series

- Clean gas applications
- Combination bare and finned tubes

	Single-Pass Open Bottom A- or O-type	Two-Pass Waste Heat Boiler with Furnace	Vertical Tubes / Cross Flow
Steam Flow	10,000 – 150,000 lb/hr	10,000 to 300,000 lb/hr	500,000 lb/hr
Steam Temp.	Up to 900 °F	Up to 900 °F	Up to 900 °F
Steam Pressure	Up to 2,300 psig	Up to 2,300 psig	Up to 2,300 psig
Gas Flow	Up to 200,000 lb/hr	Up to 200,000 lb/hr	Up to 1,000,000 lb/hr
Membrane Wall	✓	✓	–

Waste Heat Recovery Units

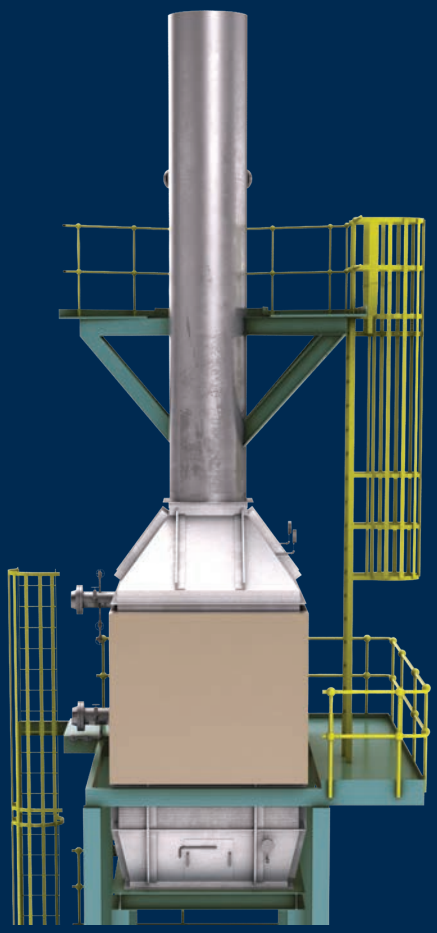
Heat recovery for a variety of fluid heating applications

Cleaver-Brooks leverages our extensive experience and expertise in heat and mass transfer to supply custom waste heat recovery units for gas turbine exhaust, process furnaces and other heat sources for water, glycol mixtures, and thermal oil fluid heaters. Waste Heat Recovery Units (WHRUs) are available in vertical, horizontal or combination gas flow arrangements to conform to any space requirements.

Fluid Heater

Liquid heat for high-pressure applications

These units are specifically designed for minimal fluid pressure drop, proper outlet conditions, and allowable fluid film temperatures. Fluid circuits are properly evaluated to obtain the desired mass flow, fluid velocity and pressure drop.



Features

- Optimized combination of bare and finned tubes to control film temperatures
- Inline or staggered tube arrangements
- Custom designs for high gas side pressure applications
- Heat recovery or supplementary firing to 1,700 °F

Duty
Up to 200 MMBTU/hr
Pressure
Up to 3,500 psig
Gas Flow
Up to 1,000,000+ lb/hr

Max-Flow® Series

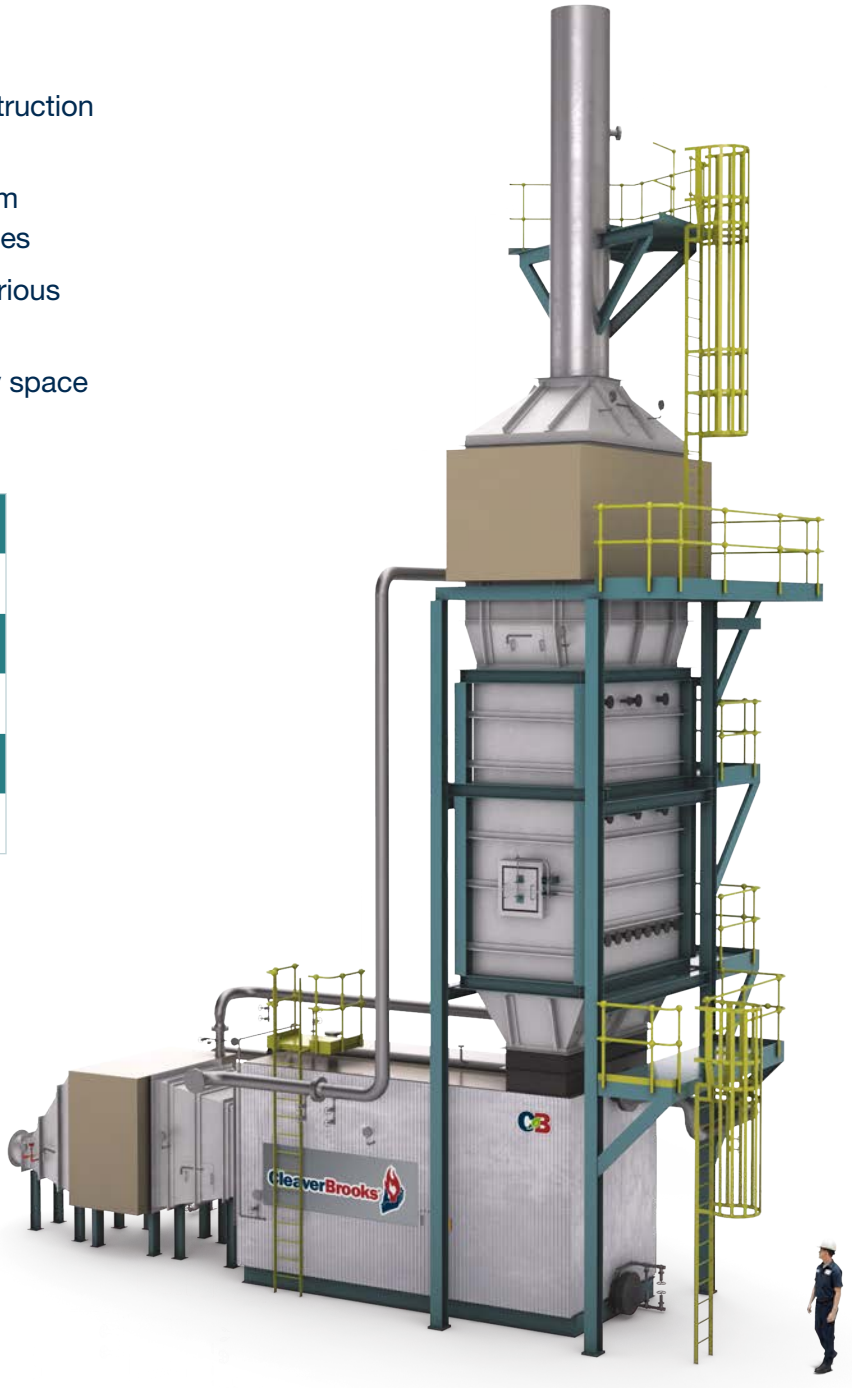
High-temperature fluid heating

Available in a shop-assembled package, Cleaver-Brooks Max-Flow Thermal Fluid Heater (TFH) and High Temperature Hot Water (HTHW) generators are engineered to be highly efficient. Either can be fitted with a register burner or designed to recover heat from turbine exhaust and supplemented with a duct burner. This is a forced-circulation design that will last for years to come.

Features

- Fluid-cooled membrane wall construction extends throughout the boiler
- Optimized flow pattern controls film temperature and local heat flux rates
- Combination of bare tubes and various degrees of finned tubes
- Vertical or horizontal outlet fits any space requirement

Duty
20 to 200 MMBTU/hr
Pressure
Up to 2,300 psig
Gas Flow
Forced Circulation



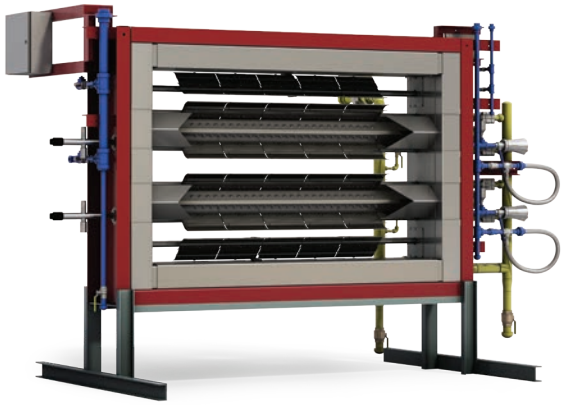
Auxiliary Components

Duct Burners

Supplemental firing for waste heat applications

Natcom® Duct Burners can supplement waste heat with an innovative flame stabilizer system when additional steam is required for heat or process needs. Duct burners can fire a variety of gaseous fuels, including natural gas, LFG, digester gas, refinery gas and H2, as well as fuel oil.

We offer a complete control system for the waste heat boiler, duct burner and SCR, or a stand-alone burner management system (BMS) for the duct burner.



SCR & CO Catalyst

Reduce NOx by up to 95 percent, down to 1 ppm

Selective Catalytic Reduction (SCR) is a post-flue gas treatment capable of reducing NOx emissions from a variety of boiler systems. Computational Fluid Dynamics (CFD) analysis allows us to predict flue gas distribution and optimize the SCR design. The CO Catalyst converts both CO and hydrocarbons to carbon dioxide and water vapor.

Our SCR and CO Catalyst are designed with an optimum temperature window for maximum NOx and CO reduction. The integrated Cleaver-Brooks control system and SCR ensure fast response and minimal ammonia slip for increased operational flexibility.

Freestanding Stacks

Exhaust solutions for any application

Cleaver-Brooks engineers single- and double-wall freestanding stacks, which are available in carbon, COR-TEN® and stainless steel. Our integrated waste heat boiler solutions offer integral stack dampers, silencers and bypass stacks.

The power of total integration.

The **Power of Total Integration** is how Cleaver-Brooks delivers the world's broadest range of integrated, sustainable boiler plant solutions. In addition to our products, this includes our global representative and service network, training resources, and trusted expertise that add significant value to your Cleaver-Brooks investment.

Click or scan the QR code with a smartphone camera to access Waste Heat resources

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Printed in the USA
CB-8612
09/2021