EXHAUST HEAT RECOVERY

Heat Recovery Systems

“Manufacturing Waste Heat Transfer Products To Save Energy”
**EM SERIES**

**DESIGN**
- Stainless cylindrical heat transfer coil design
- American Gas Association Laboratories Design Certified
- Slip fit gas connections
- Quick release tension latches
- Hinged stainless steel access door panels
- Stainless steel internal bypass
- Circulating pump package including: in line circulating pump, (2) inlet and outlet temp. gauges, check valve, 125 psig T&P relief valve, flow control valve, differential pump control

**APPLICATION**
- Combustion Sources: Steam boilers, hot water boilers, dryers, ovens
- Combustion Capacity: 200,000 to 6,400,000 Btu/hr input
- Entering Gas Temps.: 300°F to 700°F
- Heat Sink Types: Boiler feedwater, makeup water, hot water return, hot water storage tank, condensate tank, process water, potable water.

**Miscellaneous:** The EM is a circulating recovery system designed to recover waste heat safely and efficiently. By utilizing the flow control valve to adjust the flow of water to the unit, the EM effectively reduces the stack temperature to 250°F or lower (adjustable with the differential pump control as the burner cycles). They are designed to operate with very low static gas pressure drop for safe, automatic operation on atmospheric or power burners. These 10 lightweight, standard models come complete with a circulating pump package. Standard stack sizes of 8, 10, 12, 14, 16, 20, 24, 28, & 32" diameters are designed to fit most small size combustion sources (optional stack transitions available as required). Like the larger cylindrical units, they are equipped with all the standard design features for specific engineering design needs.

**CRS SERIES**

**DESIGN**
- Cylindrical heat transfer coil design
- Slip fit or flange gas connections (custom designed to fit the stack)
- Hinged stainless steel access door panels
- Quick release tension latches
- Stainless steel internal bypass
- Condensate drain catch ring assembly
- Circulating pump package including: in line circulating pump, (2) inlet and outlet temp. gauges, check valve, 125 psig T&P relief valve, flow control valve, differential pump control

**APPLICATION**
- Combustion Sources: Steam boilers, hot water boilers, dryers, ovens
- Combustion Capacity: 1,000,000 to 15,000,000 Btu/hr input
- Entering Gas Temps.: 300°F to 700°F
- Heat Sink Types: Boiler feedwater, makeup water, hot water return, hot water storage tank, condensate tank, process water, potable water.

**Miscellaneous:** The CRS, complete with a pump package assembly, is an unique system of selection and design. Its objective is to simply reduce the stack temperature to 250°F and the recovered heat to the heat sink. By utilizing the flow control valve to adjust the flow of water to the unit, the CRS effectively reduces the stack temperature to 250°F in many cases lower (adjustable with the differential pump control as the burner cycles). The unit is selected based on flue gas temperatures entering the Btu/hr input to the burner. The basic and unique design features are that the unit is guaranteed to reduce the flue gas temperature to 250°F and custom fit to the existing round stack.

**FTR SERIES**

**DESIGN**
- Internal thermal expansion design
- Header manifold for high liquid flow
- Mounting flanges for bolting to mating flanges or adapters
- Hinged stainless steel access door panels
- Quick release tension latches
- Stainless steel internal bypass
- Optional sootblower assembly

**APPLICATION**
- Combustion Sources: Steam boilers, hot water boilers, hot oil heaters, combustion sources with round stack diameters from 14" to 72"; liquid flow rates 50 to 500 g.p.m.
- Combustion Capacity: 100 to 300,000 acfm
- Entering Gas Temps.: 325°F to 1400°F
- Heat Sink Types: Boiler feedwater, makeup water, process water, hot water return, potable water, thermal fluids, run-around systems

**Miscellaneous:** The FTR can be applied in cold water condensing heat exchangers, confined area restrictions, and is offered in stainless, carbon, or AL-FUSE fin tubing. The many standard models make it possible to size with overall diameter and height constraint considerations. Stack to FTR adapters are required when the same gas connection diameters cannot be met. The unit is selected over the FCR when the liquid side pressure drops are required or when there are large volumes of flue gas available. Flexibility allows specific engineering requirements to be met such as fin spacing for fouling conditions and low gas pressure drops.

**RTR SERIES**

**DESIGN**
- No pressure welds in the gas stream
- Internal thermal expansion design
- 10 ga. structural exterior
- Stainless steel interior
- 2" factory insulation
- Mounting flanges for bolting to mating flanges or adapters
- Removable access door
- Stainless steel internal bypass
- Header manifold for high liquid flow
- Compression fittings for tube replacement
- Condensate drain catch ring assembly

**APPLICATION**
- Combustion Sources: Steam boilers, hot water boilers, generally having rectangular or square stacks
- Combustion Capacity: To 40,000 pph (50,000,000 Btu/hr input approx.)
- Entering Gas Temps.: 300°F to 1250°F
- Heat Sink Types: Boiler feedwater, makeup water, hot water return, hot water storage tank, condensate tank, process water, potable water.

**Miscellaneous:** The RTR fin tube materials are available in stainless steel, carbon steel, 316 stainless tube and carbon steel fin, or AL-FUSE with special fin spacings when specified. Combustion sources with round exhausts require optional stack transitions. The internal gas bypass can be used to temper or maintain water temps when too much heat is available. The economizer can be used in conjunction with cold water or condensing applications.
**UTR-1 SERIES**

**U-TUBE RECOVERY**

**DESIGN**
- Internal thermal expansion design
- 2" thickness
- Factory installation
- Hardshell 10 ga. structural exterior

**Optional compression fitted tube to header attachment**
**Removable core assembly**
**Removable inspection door**
**Header manifold for high liquid flow and low static head**

**APPLICATION**
- **Combustion Sources:** Incinerators, thermal oxidizers, catalytic converters, boilers, hot oil heaters.
- **Combustion Capacity:** 200 to 50,000 scfm
- **Entering Gas Temp.:** To 1600°F
- **Heat Sink Types:** process water, boiler feedwater, ethylene glycol, thermal transfer fluids

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**ESG SERIES**

**EXHAUST STEAM GENERATOR**

**DESIGN**
- Skid mounted packaged forced circulation water tube design
- Size ranges from 20 to 350 Boiler horsepower
- Operating steam pressures ranging from 3 psig to 250 psig
- 98% dry steam at saturated steam temperatures
- 5 minute startup to operating steam pressure
- Large steam flash drum assembly allowing for wide load fluctuations to prevent low water shut down
- 1/3 the weight of conventional waste heat boilers
- 1/2 the size of conventional waste heat boilers
- Component designed requiring no welding for ease of maintenance
- Stamped in accordance with the latest edition of the ASME code and National Board
- Fully automatic for supplemental or primary steam output service
- "Explosion proof" heat transfer exchanger within the exhaust gas
- Full modulating internal exhaust bypass designed to easily accept dual engine exhausts
- Lowest "pich point" (operating steam temperature to final leaving exhaust temperature) offering greater efficiency

**APPLICATION**
- **Combustion Sources:** Gas engines (reciprocating, turbo charged, naturally aspirated, and rotary), diesel engines, incinerators, thermal oxidizers, catalytic converters, boilers, hot oil heaters.
- **Combustion Capacity:** 1000 to 50,000 scfm
- **Entering Gas Temp.:** 600-1600°F
- **Heat Sink Types:** supplemental steam demand and/or primary steam source for steam heating or process steam.

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**HRS-A SERIES**

**HEAT RECOVERY SILENCER-AXIAL**

**DESIGN**
- Stainless steel exterior
- Internal thermal expansion design
- Cylindrical heat transfer coil design
- Optional stainless steel internal bypass
- Sound attenuation
- Optional "1" factory insulation
- Optional circulating pump

**APPLICATION**
- **Combustion Sources:** Gas engines (reciprocating, turbo charged, naturally aspirated, rotary), diesel engines, boilers
- **Combustion Capacity:** 15 to 150 kw (20 to 200 scfm)
- **Entering Gas Temp.:** To 1250°F
- **Heat Sink Types:** Engine jacket water, process water, boiler water, ethylene glycol

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**HRS-R SERIES**

**HEAT RECOVERY SILENCER-RADIAL**

**DESIGN**
- Sound attenuation
- Optional temperature indicating control panel
- Factory insulation
- Internal thermal expansion design
- Horizontal / vertical exhaust flow connection
- Full exhaust bypass assembly
- Optional modulating damper actuator
- Optional exhaust transitions / expansion joints

**APPLICATION**
- **Combustion Sources:** Gas engines (reciprocating, turbo charged, naturally aspirated, rotary), diesel engines, boilers
- **Combustion Capacity:** 200 to 4000 kw
- **Entering Gas Temp.:** To 1250°F
- **Heat Sink Types:** Engine jacket water, process water, boiler water, ethylene glycol

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**BOILER ECONOMIZER**

**Design**
- Internal thermal expansion design
- Stainless steel internal bypass

**Application**
- Combustion Sources: Steam boilers, hot water boilers
- Combustion Capacity: 40 to 800 Bhp
- Entering Gas Temps.: 300°F to 700°F
- Heat Sink Types: Boiler feedwater, makeup water, hot water return, hot water storage tank, condensate tank, process water, potable water

**Miscellaneous:**
The B-Series type boiler economizer is comprised of 14 standard models. An “off the shelf” unit, it is designed primarily for boilers with round stacks. The standard stack connections can easily be altered to fit specific boiler stacks with 10” to 34” maximum diameters alleviating the cost of stack adapters. The units come standard either with 4 or 6 lpi spacings for operating with No. 2 fuel oil and/or natural gas depending on the efficiency of the combustion. With its lightweight design and exclusive AL-FUSE heat transfer surface, installation is fast and costs are kept to a minimum.

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**FIN COIL RECOVERY**

**Design**
- Internal thermal expansion design
- Cylindrical heat transfer coil(s) design

**Application**
- Combustion Sources: Steam boilers, hot water boilers, hot oil heaters, combustion sources having round stacks from 4” to 36” diameter and a maximum liquid flow of 50 g.p.m.
- Combustion Capacity: 50 to 10,000 scfm
- Entering Gas Temps.: To 1400°F
- Heat Sink Types: Boiler feedwater, makeup water, process water, potable water, thermal fluids, run-around systems

**Miscellaneous:**
The FCR is a more custom designed heat exchanger which can be adapted to cold water condensing heat exchangers, confined area restrictions, and is offered in stainless carbon, or AL-FUSE fin tubing. Flexibility allows specific engineering requirements to be met such as fin spacing for fouling conditions and low gas pressure drops.

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**INCINERATOR TUBE RECOVERY**

**Design**
- 10 ga. structural exterior
- High temperature alloy interior
- 4” factory insulation
- High temperature alloy internal bypass
- No pressure welds in the gas stream
- Internal thermal expansion design

**Application**
- Combustion Sources: Incinerators, thermal oxidizers, catalytic converters
- Combustion Capacity: Full load conditions
- Entering Gas Temps.: 1250°F to 2000°F
- Heat Sink Types: Process water, boiler feedwater, hot water return, potable water, hot oil

**Miscellaneous:**
The ITR is specifically designed for high temperature exhausts. All gas side surfaces in contact with the exhaust are stainless and/or high temp. alloy. Combustion sources with round exhausts require optional stack transitions. Special fin spacing specifications can be offered dependent on fouling conditions. The internal gas bypass can be used to bypass heat (up to 70% dependent on the application) and temper water and/or the exiting gas temperatures.

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**U-TUBE RECOVERY**

**Design**
- Herdshell 10 ga. structural exterior
- Stainless steel interior
- 1” thickness factory insulation
- Condensate drain catch ring assembly
- Individual gas connection sizes and design
- Sound attenuation
- Removable core assembly
- Header manifold for high liquid flow and low static head

**Application**
- Combustion Sources: Gas engines (reciprocating, turbo charged, naturally aspirated and rotary), diesel engines
- Combustion Capacity: 15 to 300kw
- Entering Gas Temps.: To 1600°F
- Heat Sink Types: Engine jacket water, process water, boiler water, ethylene glycol, thermal transfer fluids

**Miscellaneous:**
The UTR is applied where both rectangular configuration and heat transfer surface vs. performance is critical. The UTR can be located within the engine to meet space limitations. Flexible exhaust gas connection locations and sizes allow the UTR to adapt easily to an OEM package's design needs. The capability of removing the internal core assembly without disturbing the exhaust gas connections, makes cleaning and inspecting the fin tube easy, especially when operating with various fuel oils. Optional insulation thicknesses available upon request.
"Cain Industries is dedicated to design and production of the highest quality, fuel-saving, Exhaust Heat Recovery Systems."

It is a fact that a minimum of one quarter of every fuel dollar is wasted, when instead, much of it can be recovered. Cain Industries recovers the heat and transfers the usable Btu's to water, glycol, special fluids, or steam. Listed below are some of the combustion sources that would benefit from a Cain heat recovery system.

**Combustion Sources:**

- Industrial hot water or steam boilers: $0.25
- Commercial hot water or steam boilers: $0.30
- Dryers: $0.30
- Reciprocating gas engines: $0.35
- Diesel engines: $0.35
- Ovens: $0.40
- Furnaces: $0.80
- Incinerators: $100
- Catalytic converters: $100

**VERSATILITY**

Since 1978, Cain Industries has produced high quality waste heat transfer products. We are dedicated to the reduction of fuel usage and pollution - worldwide. Our expertise makes us the natural choice for both the retrofit and OEM client. We set ourselves apart from others by producing products to serve a broad spectrum of markets: The Diesel and Gas Cogeneration market, the Boiler Exhaust market, and the Fume Incineration market. As the only manufacturer in all of these markets, Cain Industries has the greatest selection of products and system applications available.

We have become leaders in this industry by replacing old technology with the most recent technological advancements. Using elaborate computer programs, Cain Industries has developed and manufactured twelve product lines with over 1,350 dependable heat transfer products. Our unique designs increase efficiency and performance, while making installation, service, and maintenance more cost effective.

We are also dedicated to a primary investment in our associates, their manufacturing technology, quality improvements, and innovative cost reductions to meet the customer's budget. It is by these means, that we will achieve absolute customer satisfaction. The success of Cain Industries is a direct result of our simple philosophy: to produce the highest quality products, and provide unmatched customer service.

**FAST PAYBACK**

The words "safely and economically recover waste heat" also mean "no-risk return on investment" which is exactly what Cain Industries heat recovery systems represent. By installing a fuel saving economizer on a combustion source, the Btu recovered pays for all the equipment installed, usually in 12 to 18 months (or an equivalent return on investment of 75 to 100% annually). This means recapturing approximately 50% of the wasted $S for every fuel dollar spent. The exact payback period for your installation will depend on local fuel costs and the number of hours of usage.

**ADVANTAGES**

Depending on fuel type, temperatures, flow size requirements, performance and specification, Cain Industries can propose a specific cost effective exchanger to economize your fuel bills. Listed below are just a few design features which clearly speak for themselves and far exceed the capabilities of other economizer manufacturers:

- **Internal, stainless steel, exhaust bypass** for stack corrosion control, tempering exit temperatures, and/or protection against exhaust backpressure buildup due to fouling.
- **Stainless steel hinged access doors** for ease of routine inspection and/or cleaning.
- **Quick release, adjustable tension latches** requiring no tools, which lock the access doors in place.

**Three types of available fin tube materials:**

1. TP316 stainless steel tube and AL-FUSE™ fin metallurgically bonded.
2. SA178 carbon steel tube and fin, Nickel Braze/welded or standard frequency welded.
3. TP316 stainless steel tube and TP304 stainless steel fin, Nickel Braze/welded or standard frequency welded.

- **No weld/removable tubes** with no pressure welds in the gas stream, for easy tube replacement.
- **Round or rectangular design configurations** as standard model selections.
- **Custom computer design** for special multiple order OEM requirements.
- **ASME & National Board** designed and certified by Cain Industries.

**OPTIONAL COMPONENTS**

Depending on the application, Cain Industries offers a variety of ancillary equipment, such as timed automatic sootblowers, factory insulation, circulating pumps, thermometers, remote indicating controllers, modulating damper actuators, and stack-to-economizer transitions, to meet the needs of each specific installation.

**FREE SAVINGS ANALYSIS**

Upon review of your application, you can expect our proposal within 24 hours. It will include professionally engineered details showing equipment costs, savings analysis, computer-generated economizer performance, 2d dimensional drawings, flow schematics, warranty and performance guarantee.

**EASE OF INSTALLATION**

The selection of a Cain Industries economizer results in the most economical design to install and maintain. Design advantages such as compactness and lightweight construction allow for installation at the very lowest cost.

**GUARANTEED PERFORMANCE**

All economizers are guaranteed to meet or exceed the anticipated performance specifications.
# Savings Comparison Analysis

Four examples of typical combustion source types, and the results with a Cain Industries heat recovery system applied.

## Data without a Cain System
- **Combustion Source:** Hot Water Boiler
- **Heat Sink:** Return Water
- **Waste Exhaust Temp.:** 510°F
- **Water Temp., Inlet:** 130°F
- **Btu/hr Burner Input:** 6,437,000
- **Fuel Type:** Natural Gas
- **Excess Air:** 10%
- **Combustion Efficiency:** 75%
- **Fuel Cost Per Btu:** $0.40
- **Annual Operating Hours:** 6,000

## Performance with a Cain System
- **Model Selection:** C700
- **Circulating Water Flow:** 30 gpm
- **Final Exhaust Temp.:** 220°F
- **Water Temp., Outlet:** 180°F
- **Pressure Drop, Water:** 1.0 psi
- **Fuel Type:** Natural Gas
- **Excess Air:** 8%
- **Combustion Efficiency:** 78%
- **Fuel Cost Per Btu:** $0.40
- **Annual Operating Hours:** 6,000
- **Payback:** 13.3 months
- **Annual Return on Investment:** 90%
- **Annual Savings:** $17,930

## Data without a Cain System
- **Combustion Source:** 1,250 kW Engine
- **Heat Sink:** 90% Ethylene Glycol
- **Waste Exhaust Temp.:** 96°F
- **Water Temp., Inlet:** 195°F
- **SCFM:** 3,907
- **Fuel Type:** Natural Gas
- **Excess Air:** N/A
- **Combustion Efficiency (relative):** 78%
- **Fuel Cost Per Btu:** $0.40
- **Annual Operating Hours:** 6,000

## Performance with a Cain System
- **Model Selection:** Hcrs-336220/35
- **Circulating Liquid Flow:** 173 gpm
- **Final Exhaust Temp.:** 330°F
- **Water Temp., Outlet:** 232°F
- **Pressure Drop, Water:** 2.5 psi
- **Fuel Type:** Natural Gas
- **Excess Air:** N/A
- **Combustion Efficiency (relative):** 78%
- **Fuel Cost Per Btu:** $0.40
- **Annual Operating Hours:** 6,000
- **Payback:** 7.9 months
- **Annual Return on Investment:** 118%
- **Annual Savings:** $88,080

## Data without a Cain System
- **Combustion Source:** 1,700 kW Engine
- **Heat Sink:** Process Steam
- **Waste Exhaust Temp.:** 78°F
- **Water Temp., Inlet:** N/A
- **SCFM:** 5,222
- **Fuel Type:** Natural Gas
- **Excess Air:** N/A
- **Combustion Efficiency (relative):** 78%
- **Fuel Cost Per Btu:** $0.40
- **Annual Operating Hours:** 6,000

## Performance with a Cain System
- **Model Selection:** ESG-620/0110/S5
- **Operating Steam Pressure:** 150 PSIG
- **Final Exhaust Temp.:** 428°F
- **Boiler Horsepower:** 68 BHP
- **Equivalent Evaporation:** 2,339 gph
- **Pressure Drop, Exhaust:** 1.5 psi
- **Excess Air:** N/A
- **Combustion Efficiency (relative):** 78%
- **Fuel Cost Per Btu:** $0.40
- **Annual Operating Hours:** 6,000
- **Payback:** 19.5 months
- **Annual Return on Investment:** 61%
- **Annual Savings:** $69,790

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**MARKET SPECIFIC PRODUCT LINES**

- **Exhaust Heat Recovery**
- **Gas & Diesel Cogeneration Systems**
- **Boiler Economizer Systems**
- **Fume Incineration Systems**

Your Authorized Cain Representative

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