⑭ CROSSOVER SYSTEM or SHELL & TUBE SYSTEM:

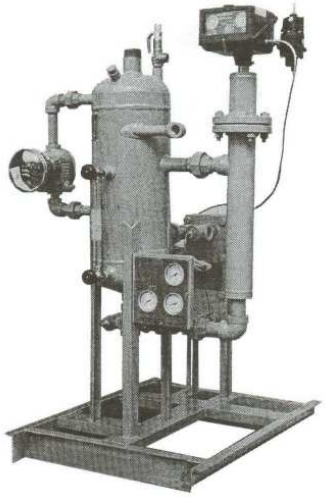
Continuous Blowdown Heat Recovery Systems for Boiler Surface Blowdown.

Most boiler manufacturers and water treatment companies recommend boiler water TDS be maintained at certain levels. The purpose of continuous blowdown is to continuously take boiler water from 4”-6” under the surface where the TDS is at its highest concentration so that it can be replaced with fresh water. While continuous blowdown is the best way in controlling these solids in the boiler the heat lost to drain over time can be a tremendous. Penn Crossover or Shell & Tube Continuous Blowdown Heat Recovery Systems can recover up to 95% of this heat normally lost. Two stages provide the recovery. The first stage uses a Penn Flash Separator where the high pressure condensate flashes to a low pressure steam use such as a feedwater heater or deaerator. The second area a separate heat exchanger that transfers the remaining heat to boiler Make-up water.

Each System Comes Complete skid mounted on a channel frame with the necessary controls. Controls Include:

1. Flash Separator with tangential Inlet to provide 97% quality steam to vent.
2. Plate and Frame or Shell and Tube “U” tube heat exchanger.
3. Externally mounted float type pneumatic level controller and control valve.
4. Tubular glass water level gauge.

CROSSOVER SYSTEM



SHELL & TUBE SYSTEM

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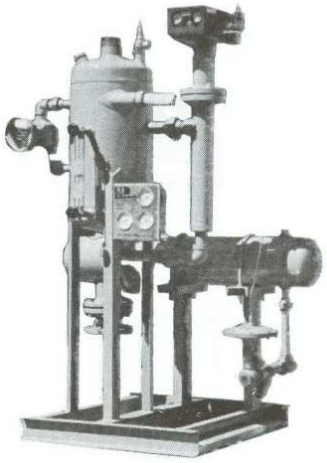

5. Three panel mounted thermometers for makeup inlet, makeup outlet, and blowdown temperature to drain.
6. Safety relief valve set to protect the system controls.
7. Flash Separator bottom Cleanout Valve.
8. Blue Enamel Exterior Finish.
9. Shown with optional High Level Switch.

Crossover or Shell & Tube System Sizing:

Each Shell & Tube or Crossover system is sized individually for each application. For proper selection of a system that will insure maximum heat recovery please present the following detailed information to Penn Separator. With this information Penn can offer a system proposal based on your specific application.

1. **Boiler Output #/hr or hp.**
2. **Boiler Operating Pressure (psig).**
3. **Low Pressure Use in psig.**
4. **Percentage or Amount (gpm) of Continuous Blowdown**
5. **Percent or Amount (gpm) Make-Up Water.**
6. **Temperature of Make-up Water.**

Continuous Blowdown Heat Recovery Systems Suggested Specification:

Furnish and install as shown on drawings. A Penn (CROSSOVER Flash Separator & Plate and Frame) or (Flash Separator Shell & Tube) Continuous Blowdown Heat Recovery System as manufactured by Penn Separator Corp., Brookville, PA.

The system shall provide 90%-95% heat recovery from _____ #/HR. continuous blowdown and shall have a make-up water capacity of _____ gpm. for boiler or boilers operating at a pressure/pressures of _____ psig. flashing to a low pressure de-aerator, feedwater heater, or other low pressure steam use at _____ psig.

The Heat Recovery System shall consist of the following components and accessories:

1. Vertical ASME Code Sec VIII, Div. 1 stamped Flash Separator with connections for tangential inlet with stainless steel wear plate, blowdown overflow type drain, centrally located steam vent to provide a minimum 97% quality steam, and tank clean out connections as well as couplings as required for accessories.

2. Heat Exchanger:

(A) Plate & Frame heat exchanger ASME Code rated with parallel herringbone stainless steel plates held together by zinc plated bolts on EPDM ethylene propylene tapered gaskets. The flow shall enter the heat exchanger through threaded stainless steel connections in opposite directions to provide U values of 3 to 5 times that of conventional heat exchangers. The heat exchanger shall be located on the skid to facilitate cleaning and maintenance.
OR

(B) Shell & Tube "U" Tube type heat exchanger. ASME Code rated with removable (stainless steel or copper) tubes 20 B.W.G., cast iron head, and steel tube sheet. Make-up to enter the head and tubes through NPT connections. The blowdown connections NPT are located on the shell. The heat exchanger shall be located on the skid to facilitate cleaning and maintenance.

3. Externally mounted caged pneumatic level controller with stainless steel float and control valve which maintain the water level in the tank and heat exchanger. A level gauge shall be included to visually monitor this level.

4. Stainless steel gauge panel with three remote thermometers showing temperatures of the makeup inlet, make-up outlet, and blowdown water to drain.

5. A safety relief valve will be provided to limit the systems maximum pressure to protect the components of the system.

6. Clean-out valve located on the bottom of the flash separator and level control piping, provided for periodic cleaning of the flash separator.

7. Optional accessories can include a multiboiler manifold A23M for _____ (No.) of Boilers, a high level or low level alarm switch, pressure gauge, and sample cooler with isolation valves and piping.

The flash separator, heat exchanger, components and accessories shall be assembled on a channel frame in a manner, which allows gravity drainage of the blowdown through the system and to allow easy installation and maintenance. The entire assembled system shall then receive a coat of blue enamel paint and be packaged in a crate for shipment.

Continuous Blowdown Heat Recovery Systems Example of Savings:

Shown below is an Example of savings by using a continuous blowdown heat recovery system on a 300 hp boiler operating at 100 psig with 5% continuous blowdown flashing steam to a 5 psig deaerator:

Steam produced **10,350 #/Hr**. x **5%** Percent Blowdown Rate Gives **517.5 #/hr.** Continuous Blowdown to the Heat Recovery System. Entering at **100** PSIG Flashing to **5 PSIG** in Heat Recovery System gives **11.8%** Flash Steam or **(A) 61 #/hr.** Flash Steam with **(B) 456 #/hr.** Condensate remaining at 228 deg. F.

HEAT RECOVERY FROM FLASH STEAM
(A) **61 #/Hr.** Steam x **1,156 Btu's/# = 70,516 Btu's/Hr.** recovered. / Million Btu's / **80%** Boiler Efficiency x **$ 5.00** Cost Fuel/Million Btu's
ANTICIPATED HOURLY SAVINGS FROM FLASH STEAM ***.....$ .44***

HEAT RECOVERY FROM WASTE WATER ***(228 F - 100 F) DT Change in Temperature Drain Water Inlet and Outlet***
(B) **456 #/Hr** remaining. (A - B) x **128 DT F** = **58,368 Btu's/Hr.** / Million Btu's / **80%** Boiler Eff. X **$ 5.00** Cost of Fuel/ Million Btu's
ANTICIPATED HOURLY SAVINGS FROM WASTE WATER ***.....$ .36***

TOTAL HOURLY SAVINGS FROM CONTINUOUS BLOWDOWN HEAT RECOVERY SYSTEM ***..... $ .80***

This System on a Boiler Operating 24 Hrs. a day 365 days a year would save $ 7,008.00 Per Year. Penn offers a Free Heat Recovery Survey with out obligation. Please submit the above information for your boiler and we will send you the results.