

# MADDEN

ENGINEERED PRODUCTS

## Boiler Blowdown Heat Recovery Systems - Operator's Manual

***Reduces Boiler Fuel Consumption  
& Carbon Footprint***



***Type HV – Vertical Type:  
Saves Floor Space***



***Type HC – Horizontal Type:  
Large Capacities***



***Type HVX:  
For Small  
Boiler Systems***

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# General Recommendations

## Installation & Maintenance

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**The Surface Blowdown Line Connection:** Most boilers come with a continuous surface blowdown connection. Typically, an automated blowdown system is now used to control the blowdown based on conductivity and/or total dissolved solids (TDS). Skimming water off the top of the boiler water level with this connection improves boiling efficiency and extends boiler service life. When done so continuously, this is a great opportunity to utilize a Madden heat recovery system to put valuable BTU's back into the boiling process.

If your boiler is not equipped with this connection, contact the boiler manufacturer for their recommendation on how best to add this feature. If the boiler requires field welding, be sure to check with an authorized local inspector for any ASME or related procedures and codes you may need to follow.

**The Surface Blowdown Piping:** From the continuous surface blowdown connection on the boiler, run the appropriate schedule piping to the Madden heat recovery system inlet manifold. It is recommended at least SCH 80 piping be used. An automated blowdown system, or rugged Madden Orifice Meter should be used to control the flow rate of this blowdown. Typically, the nominal blowdown flow rate is 1% to 3% of the boiler room steam production. With fluctuations and start up situations increasing this to 5% to 10%.

***\*NOTE 1\*** - If you are using an Automated TDS/Conductivity blowdown system to control boiler surface flow, it is strongly recommended to adjust this system so it blows down more slowly and continuously, as opposed to repeated 'bursts' of timed blowdown. This promotes efficiency by ensuring BTU's will not rush through the system without being fully recovered in the heat exchanger*

**Make-Up/Feed Water Piping:** The make-up water inlet and outlet connection can be seen on the P&ID's on the following pages. The make-up water should be piped to these connections to allow (2) processes to occur via the heat recovery system's heat exchanger. The first is cooling – assuming your makeup water is 75 degrees F or lower, it will cool the boiler surface waste water blowdown below 140 deg F. The second – it will also pickup anywhere from 3 to 15 degrees F., which would otherwise need to be heated from the D/A and/or Boiler.

If the make-up water flow rate is higher than the Madden heat recovery system's rated capacity, some of the flow should be diverted around the unit; or a globe valve should be used to proportion the make-up water flow rate.

***\*NOTE 2\*** - If make-up water rate flow is not constant (perhaps due to significant condensate return usage), if possible, adjust your controls to sync the makeup water flow with the boiler surface blowdown flow. Stagnant makeup water during surface blowdown can allow the waste drain blowdown to exit above 140 deg F. Continuous makeup flow helps to reduce potential thermal cycling which can enhance the service life for the heat exchanger and ASME vessel. If your heat recovery system will see substantial periods of boiler blowdown without fresh makeup water flow, consider a different cooling water source, or feed condensate from the heat recovery system drain to a bottom blowdown tank or separator, rather than directly to the sewer.*

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**Vent Piping:** The steam vent off the Madden heat recovery system should be connected to a low-pressure steam unit, typically a Deaerator (D/A tank). The steam can be directly piped into the D/A or directly into another low-pressure steam “use”.

A shut off valve and check valve are recommended for this vent line for maintenance purposes. The check valve specifically will aid in performance if the continuous surface blowdown rate cycles or is irregular. This line and the Madden heat recovery system vessel will operate close to the same pressure as the D/A tank operating pressure.

**Drain Piping:** We recommend the floor drain utilize a minimum 1’ slope per 100’ of unobstructed drain. More slope should be added for obstructed or angled draining.

If your Madden heat recovery system utilizes an external Armstrong float trap (opposed to Madden’s standard internal float/drain assembly), the size of the exiting drain line should be one fractional pipe size larger than the Madden heat recovery system’s drain line.

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## STARTUP PROCEDURE

The make-up water flow should first be established. The metering valve can be opened to allow the maximum rated water flow through the Madden heat recovery system’s heat exchanger. Once the cold-water make-up flow has started through the HV series’ lower shell, or the HC series’ u-tube bundle, you can then open the continuous surface blowdown valve to the desired setting.

Your boiler manufacturer or water treatment company, along with boiler water testing for total dissolved solids and/or conductivity, should be used to determine the correct continuous surface blowdown valve setting and flow rate.

After the system has run for at least 15 minutes, check the (3) temperature gauges on the Madden heat recovery system’s nameplate. These units are designed to cool the waste surface blowdown below 140 deg F. at maximum capacities, though typically this temperature will be closer to 100 deg F. The other (2) gauges show the makeup water temperature in and makeup water temperature out (“out” is also piped to the D/A tank). These should simply show an increase from “in” to “out”. Again, typically that is anywhere from a 3 deg. F. to a 10+ deg F. increase. If you see a temperature increase significantly higher than 15 deg F., this is a sign something may be malfunctioning. Call our factory for assistance and confirmation as to whether or not this is an “issue”.

**\*REMINDER / NOTE\*** - If you are utilizing an Automated TDS system to control blowdown flow, it is strongly recommended to blowdown as slowly and continuously as can be programmed into the system.

## Maintenance SUGGESTIONS

Standard Madden heat recovery systems are completely mechanically actuated and require very little oversight and maintenance from the boiler room operator(s). Dependent on water quality, in a typical application the heat exchanger will last over 10 years and the ASME vessels will last over 15 years before one should start to consider replacing either.

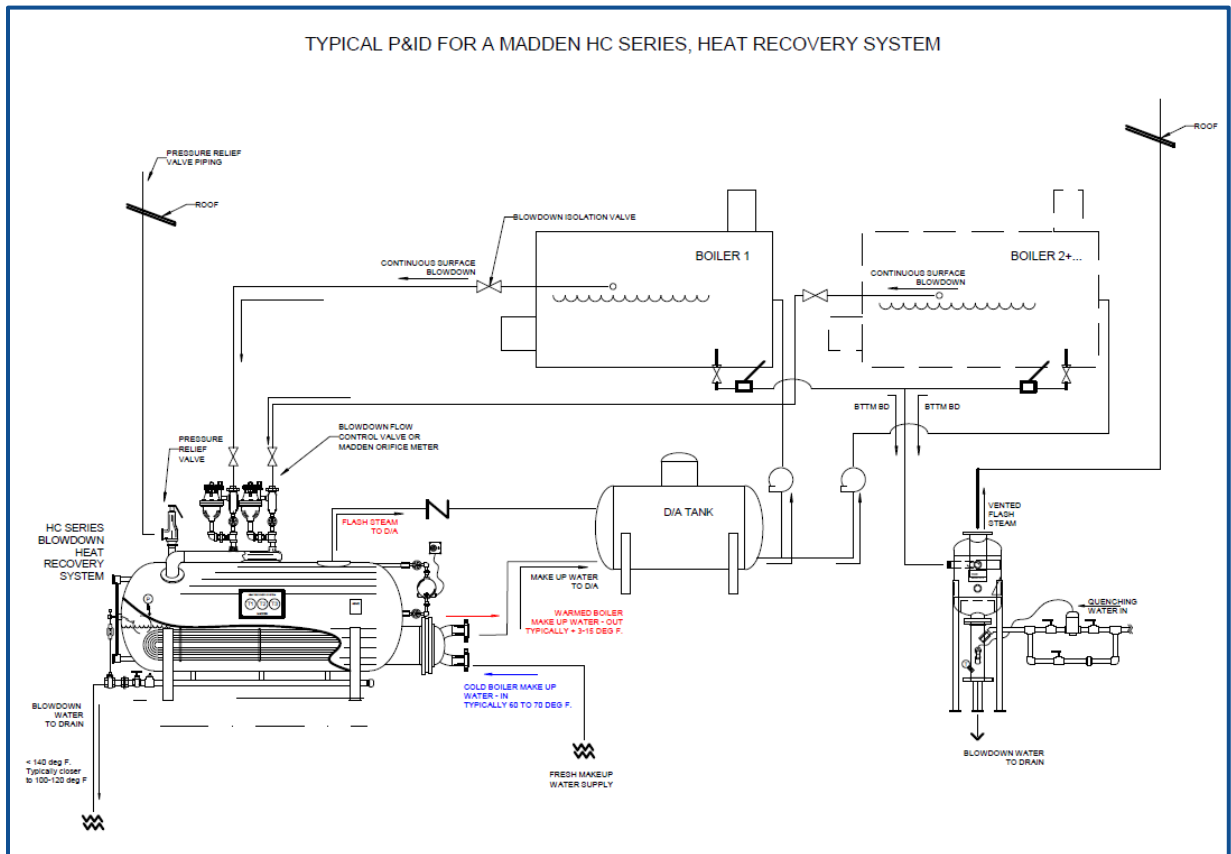
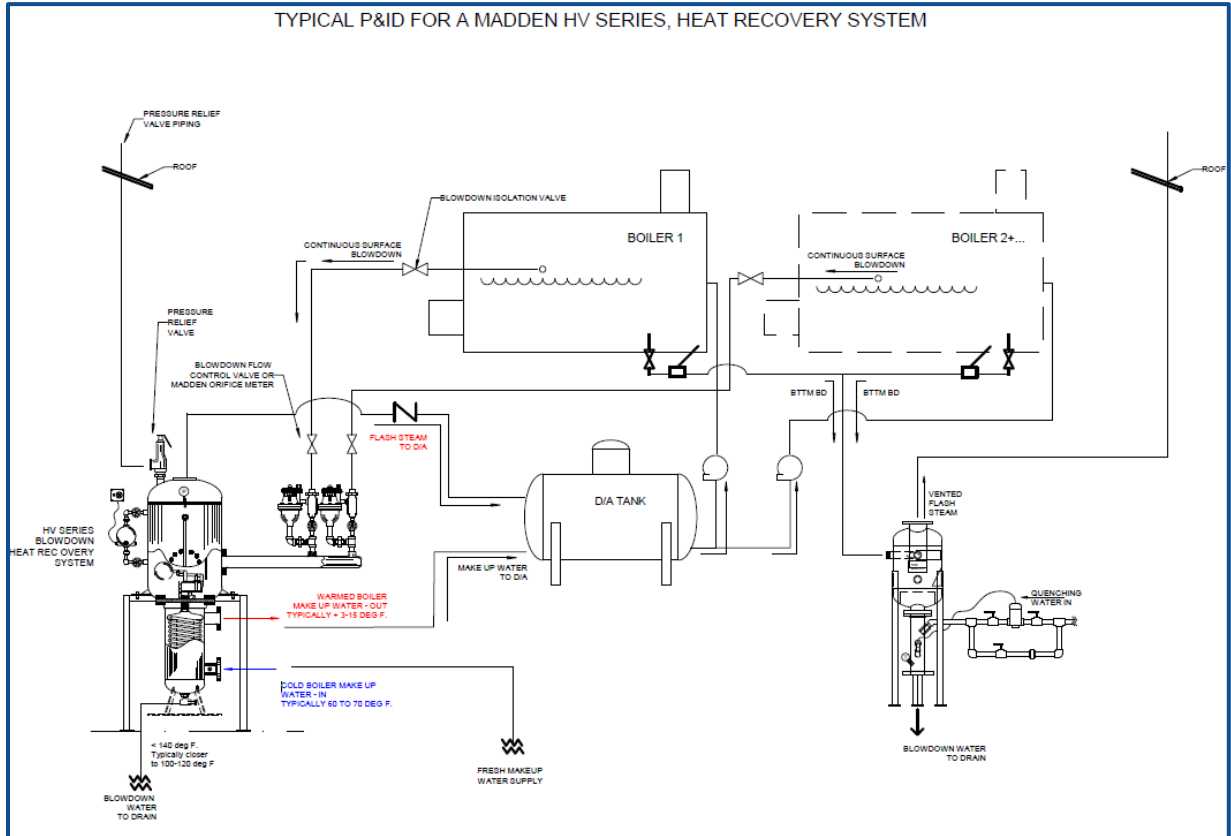
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The following are our recommended good practices for maintaining your Madden H.R.S.:

- **The drain valve and line:** Madden heat recovery systems are self-draining, the operator does not need to worry about utilizing a clean out drain throughout the year; however, for added service life, it is a good idea to occasionally flush your system of any natural sludge accumulation that might not quite naturally drain. Ideally one would do this at least once a year during a shutdown.
- **The exchanger coil or u-tube bundle:** at least once a year it is recommended the unit be completely drained and an operator visually inspect the coil/tubes for wear. It is extremely unlikely this will be noticeable until at least 5 years of operation. If there is noticeable sludge or encrusting on the heat exchanger, a wire brush should be the “heaviest” tool required to adequately clean the unit.
  - **Note 1:** after your first-year inspection, if the heat exchanger is in good condition, this is a good sign you will not need to repeat this process every year. Use your discretion, but it should then be safe to repeat after another 5+ years.
  - **Note 2:** the temperature gauges can then be monitored to determine if the heat exchanger needs service. As long as your waste drain gauge shows 140 degrees or less, and the “IN” and “OUT” temperatures show an increase, your heat exchanger is performing as it should. If all the temperatures appear to be the same, this is a good sign a hole is beginning to wear somewhere in the assembly, allowing the processes to mix together.
- **(OPTIONAL) Bypass Piping – to be performed by installing contractor:** it is ideal to add valves and piping to be able to bypass the Madden heat recovery system during maintenance. This would allow the boiler to continue operating while reviewing your system. If you choose to do this, be sure to send the heat recovery system drain line to a quench tank as opposed to piping straight to a floor sewer drain.
  - **Note:** Again, these units should be relatively “hands free”. A bypass valve and line are NOT crucial. Most applications will be fine year in and year out, allowing you to observe the condition of the equipment once a year during a shut down.

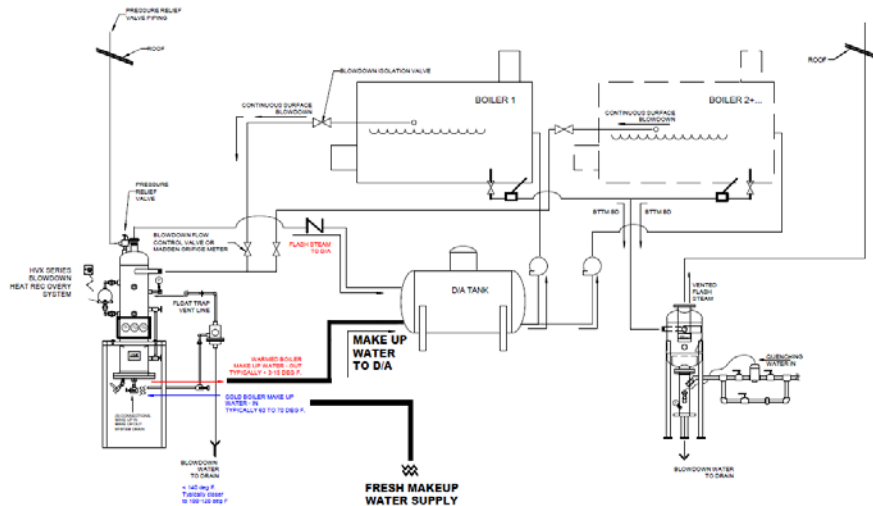
***TYPICAL Piping and Installation Diagrams for HV, HC & HVX series heat recovery systems are on the following pages...***

# Typical P&ID's for Heat Recovery Systems



**MADDEN HVX SERIES P&ID**

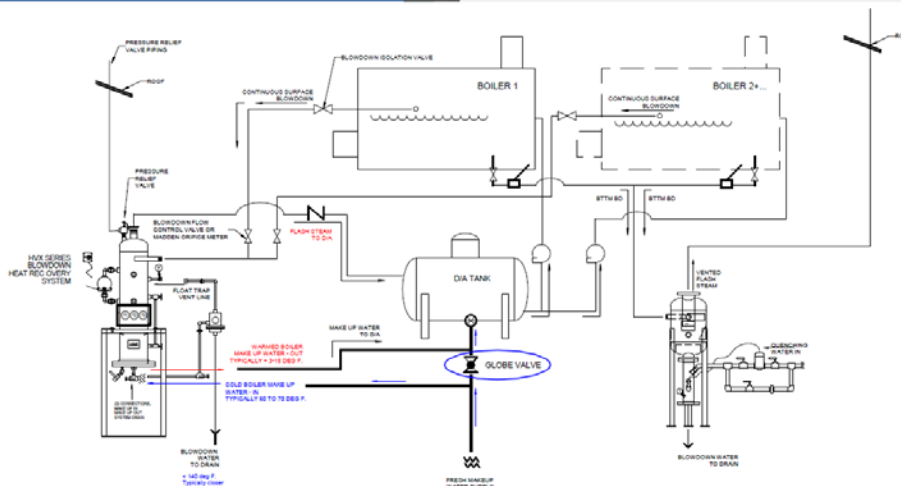
**FOR MAKE UP WATER FLOWS < 20 GPM**



\* In the HVX heat recovery system design, the makeup water passes through a single 7/8" OD copper coil. If your boiler room's makeup water flow rate requirement is less than 20 GPM or 10,015 PPH, passing 100% of this flow through the Madden HVX unit is appropriate. However, if the boiler(s) may call for significantly higher makeup flow rates for extended periods of time, you'll want to consider a piping adjustment. At 20+ GPM flow rates, the resulting 10+ FPS velocity through the coil will reduce the heat exchanger's intended service life.

**MADDEN HVX SERIES P&ID**

**FOR MAKE UP WATER FLOWS > 20 GPM**



\*\* The simplest way to help increase the heat exchanger coil's service life, is to continue running the main makeup water line straight to the D/A tank, then diverting only part of the flow to the HVX system.

Add a globe valve, or similar flow control valve, between the outgoing and incoming HVX water line. This will allow the operator to throttle the main makeup water flow until he or she sees enough flow is also passing through the HVX system to ensure the boiler waste water drains below 140 deg F.

If for any reason this is not acceptable in your boiler room, please then consider going "up" to our HV30 heat recovery system design as this style can handle much higher makeup water flow rates - which passes through the shell side opposed to the coil.

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