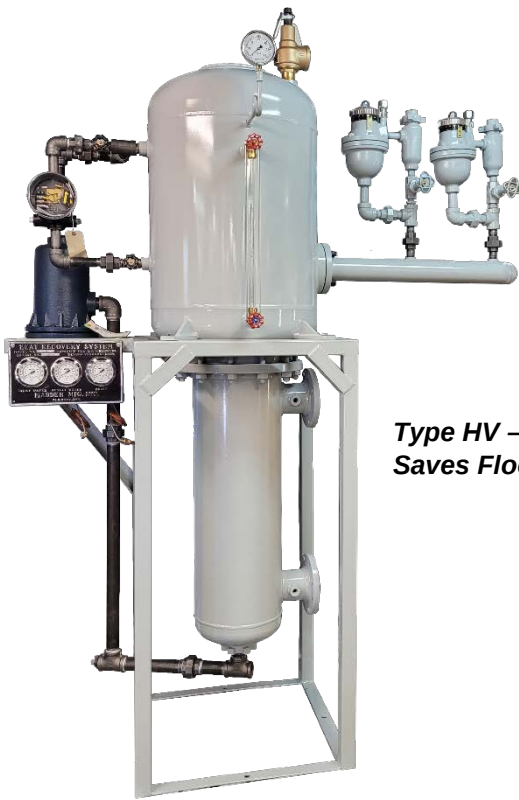


INSTALLATION & MAINTENANCE GUIDELINES

***Reduce 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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MADDEN ENGINEERED PRODUCTS

Boiler Blowdown Heat Recovery Systems

SECTION 1 — INTRODUCTION / SCOPE / PURPOSE / SYSTEM OVERVIEW

1.1 Purpose

Madden Engineered Products Heat Recovery Systems (HRS) are designed to recover thermal energy from continuous surface boiler blowdown. The recovered energy is transferred into boiler make-up water, improving boiler efficiency, reducing fuel cost, and lowering overall operating cost. These systems help facilities reduce environmental impact and carbon footprint by eliminating wasted thermal energy going directly to drain.

1.2 Scope

This manual provides guidance for installation, start-up, operation, maintenance, troubleshooting, and general safe-use practices for Madden HC, HV, and HVX series Heat Recovery Systems.

This manual supplements the reviewed and approved engineering submittal documents provided after receipt of order. As well as completed ASME paperwork. Contact the factory for copies if needed. These documents include:

- System Assembly Drawings
- Marked Individual Ancillary Component Data Sheets
- Ancillary Component Operator Manuals
- ASME Vessel U-1A form
- (If Applicable) ASME calculation packet, MTR's, Welding Procedures, Allowable Nozzle Loads, Seismic Calculations, and Completed System Inspection and Test Plan.

 This manual does NOT override boiler manufacturer instructions, facility engineering standards, water treatment program recommendations, or jurisdictional authority requirements.

1.3 Intended Use

These systems are intended to reclaim heat from continuous surface blowdown of industrial steam boilers.

They are NOT designed for:

- Bottom blowdown discharge
- Large batch dump blowdown events
- Uncontrolled intermittent blowdown spikes
- Condensate return cooling applications outside boiler blowdown scope

Blowdown must be reasonably stable and controlled. Operators choosing to pulse or time-blast blowdown should expect reduced efficiency and potentially increased mechanical wear.

1.4 System Overview

All Madden HC, HV, and HVX models share the same core function:

- Continuous surface blowdown enters the vessel
- Flash steam rises and is directed to a low-pressure steam system (typically a Deaerator)
- Remaining hot liquid is routed through an internal or external heat exchanger coil
- Incoming make-up water absorbs heat energy and is preheated before returning to the boiler system
- Cooled effluent water exits safely to drain

Typical performance expectations:

- Blowdown cooled well below 140°F (60°C) under normal design conditions. Typically ~100°F (38°C)
- Make-up water typically increases 3°F to 15°F (1.6°C to 8.3°C) depending on flow rate balance and temperature differential

Standard HC, HV, and HVX Specifications Overview:

- ASME Vessels are built to ASME Div 1, Sec VIII, BPVC 150 PSI @ 450°F (232°C)
- Materials of Construction: SA516 Gr B carbon steel vessels & 304SS heat exchangers
- Finish: high temperature red oxide primer with gray acrylic enamel top coat

1.5 Operator Responsibility

Operators must understand basic boiler operation, safe handling of hot water systems, and valve logic.

Madden cannot control or assume responsibility for field installation quality, piping choices, or flow control strategy.

Final responsibility for safe piping, sizing, vent discharge routing, utility balancing, and boiler blowdown rate remains with:

- The installing contractor
- The boiler manufacturer
- The facility engineer
- The water treatment company

1.6 General Use Notes & Warnings

- Do NOT isolate or close the steam vent line during boiler operation.
- Do NOT operate this system without make-up cooling water flow first established.
- Do NOT use this system as a batch blowdown cooling device for bottom blowdown.
- Do NOT modify, drill, weld, or repurpose the pressure vessel in any way.
- Do NOT mix third-party internal components or modify linkage components without written approval.

⚠ If unexpected temperatures or unstable behavior occur, the safest immediate action is to close the surface blowdown valve and stabilize conditions before resuming heat recovery flow.

1.7 Lifting, Handling, & Storage (Pre-Installation)

Store indoors whenever possible. Recommended storage environment: dry, covered; protect capillaries and gauges; source freeze protection if stored below 32°F (0°C).

If outdoors: cover with a tarp and ensure paint coating is intact.

Handle with forklift or lifting equipment that is sized appropriately for the system weight. Lift from baseplate, vessel body, or lifting lugs only (if applicable). Do not lift by nozzles or ancillary equipment connections.

1.8 Supplemental Video Reference Resources

Madden provides installation walkthroughs, visual component explanation videos, and general boiler blowdown educational material on the Madden Engineered Products YouTube Channel.

These are highly recommended as visual supplements to this manual, especially for operators new to boiler room work.

SECTION 2 — INSTALLATION REQUIREMENTS

2.1 General Handling and Receiving

- Inspect equipment upon delivery for visible damage
- Verify all components listed in the submittal packet are present
- Protect temperature gauge capillary tubing during handling
- Anchor vessel to floor using the mounting pads or baseplate provided
- Ensure installation is in a clean, accessible location for future inspection

Adequate operator access to the blowdown inlet, thermometers, sight glass, float assembly area, and outlet drain MUST be maintained.

2.2 Boiler Surface Blowdown Piping Guidance

- The blowdown line to the HRS should be Schedule 80 steel at minimum
- The blowdown feed must be controlled — either by automated conductivity system OR fixed orifice meter
- Typical continuous surface blowdown flow = 1% to 5% of boiler steam production. If not otherwise defined by the end user or end user's engineering firm, Madden will size the heat recovery system capacity to handle up to 10% surface blowdown flow for a 2:1 safety factor
- Temporary startup spikes may reach up to 10%+ — this is acceptable if not routine

⚠ Modern recommendation (2020's industry standard):

Slow continuous blowdown produces significantly higher heat recovery than pulsed “blast” TDS-based discharge.

2.3 Make-Up Water Connection Requirements

- Establish make-up water flow before opening blowdown
- Makeup water must be sufficiently cool to function as a heat sink (75°F / 24°C or lower ideal)
- When makeup water demand fluctuates heavily due to condensate return — consider alternate cooling water supply OR diversion strategy to stabilize cooling source

2.4 Vent Piping Requirements

- Vent line must remain unobstructed
- Route vent to Deaerator or other low-pressure steam receiver
- A swing check valve is recommended to avoid reverse steam direction
- Vent line pressure will typically track closely to DA tank operating pressure

2.5 Drain Discharge Recommendations

- Drain exiting fluid must be routed to an approved floor drain or blowdown receiving vessel
- Floor drains should be sloped at minimum 1 ft per 100 ft
- If drain must travel distance / change direction — increase slope proportionally

2.6 Recommended Field Bypass Provision

Not required, but strongly recommended:

- Add block valves and bypass piping
- This allows boiler operation to continue if the HRS requires service

- If bypass used — always route blowdown to a quench tank or blowdown separator, not direct to sanitary drain

2.7 Notes on Flow Control Devices

- Madden Orifice Meters (flow control valves) are preferred where fixed blowdown rate is desired
- Automated TDS blowdown systems should be programmed to prioritize stable continuous flow over timed slugs. Consider installing a manual flow control valve or orifice plate after the TDS control valve if TDS control valve is not modulating.
- Stable flow increases energy recovery AND reduces fatigue cycling on internal surfaces

SECTION 3 — WARRANTY / LEGAL RESPONSIBILITIES

3.1 General Responsibility Assignment

Madden Engineered Products manufactures engineered boiler room auxiliary equipment. The performance, lifecycle, and operating behavior of this equipment is strongly influenced by the boiler room environment in which it is installed, including but not limited to: water treatment program, operator technique, boiler manufacturer control design, field piping method, vent routing, make-up water flow stability, and facility utility balance.

Therefore:

- The owner / facility is responsible for ensuring the system is installed correctly and operated under normal industrial boiler room conditions. Owner shall ensure compliance with local discharge temperature and environmental regulations.
- The installer / piping contractor is responsible for correct piping practices, valve selection, vent routing, support, and service access.
- The boiler manufacturer / boiler control vendor is responsible for determining the correct continuous surface blowdown rate and control logic for that boiler.
- The water treatment provider is responsible for correct chemical control, conductivity strategy, scaling / corrosion mitigation, and blowdown philosophy.

Madden provides mechanical equipment. Madden cannot assume operational control or data-driven decision responsibilities for the user's boiler process.

Improper field modifications (including unapproved orifices, valve substitutions, float assembly changes, capillary probe modifications, or drilling / welding) void warranty.

3.2 Warranty Terms

Except where a different express warranty has been issued in writing for a specific product or project, no warranty of any kind, express or implied, is extended by Madden Engineered Products (Seller) to any party other than the direct purchasing Buyer.

To direct Buyers only, Madden warrants that it will either (at Seller's option):

- Furnish replacement parts freight allowed to the initial domestic destination, OR
- Repair the component

For any item manufactured by Madden which is proven to Madden's satisfaction to be defective in material or workmanship under normal use and service:

- within 18 months from date of shipment, or
- within 12 months from the date the equipment is first placed in use

These terms apply only to Madden equipment manufactured at our Elkhart, Indiana facility.

Ancillary purchased components from outside suppliers are covered only by those manufacturer's original warranty terms (see "Goods of Other Manufacturers" below).

Madden assumes no responsibility for:

- Performance under conditions materially different than normally tested
- Damage due to abrasion, erosion, corrosion, scaling, abnormal thermal cycling, or foreign debris
- Damage caused by oversized or pulsed blowdown events outside normal surface blowdown range
- Any labor cost, field removal, installation, rigging, or troubleshooting cost
- Any freight beyond the original domestic destination
- Any substitution of non-Madden parts or unauthorized modification

The Seller shall not be liable for any cost, loss, or consequential damages beyond the price of goods sold.

Goods of Other Manufacturers: Components sourced outside Madden are not warranted by Madden directly. Madden will make good faith effort to assist Buyer in securing remedies available from the component OEM.

This warranty is in lieu of all other warranties expressed or implied, including merchantability or fitness for a particular purpose.

SECTION 4 — STARTUP PROCEDURES

4.1 Initial Conditions Before Start

Before introducing blowdown:

- Makeup water flow **MUST** be established first
- Confirm vent line is open and not restricted
- Confirm all vessels are anchored, probe gauges installed, sight glass installed, and all drain paths are unobstructed
- Confirm correct rotation of any motorized makeup pumps (if applicable) upstream of this system
- Open makeup water valve fully to allow maximum design coil flow

4.2 Bringing System Online

1. Establish steady make-up water flow through the heat exchanger coil.
2. Slowly open the continuous surface blowdown valve from the boiler.
3. Allow system to stabilize for 10–15 minutes.
4. Confirm temperature readings:
 - o Blowdown drain temperature should be below 140°F (60°C)
 - o Makeup water outlet should show an increase vs inlet (typically 3°F–15°F / 1.6°C–8.3°C)

If make-up water outlet temperature rise exceeds ~15°F (8°C), consult factory — this may indicate low cooling flow, abnormal thermal cycling, or malfunction.

4.3 Advisory if Using Automated Conductivity Blowing Controls

- ⚠ Automated TDS control should be tuned for continuous stable bleed, not cyclic blast valves.
- ⚠ Stable bleed = higher energy recovery performance + lower wear.
- ⚠ If the boiler control logic cannot allow stable bleed — contact water treatment vendor for conductivity proportional tuning options.

SECTION 5 — OPERATING RECOMMENDATIONS

5.1 Normal Operation Summary

Once a steady balance is established between boiler surface blowdown and make-up water flow, normal operation should require very minimal day-to-day operator interaction.

These systems are mechanically actuated and are designed to operate continuously with minimal maintenance intervention.

5.2 Recommended Operating Practices

- Maintain continuous blowdown strategy whenever possible
- Maintain consistent makeup water flow whenever blowdown flow is present
- Keep vent line open at all times during boiler firing
- Avoid step-change flow shifts whenever possible
- Use data from the three thermometers as the primary performance indicator

5.3 Temperature Gauge Interpretation

- Drain Temperature Gauge: should reliably remain below 140°F (60°C) under normal design conditions
- Makeup Water IN vs Makeup Water OUT: should show an observable temperature rise, typically 3°F–15°F (1.6°C–8.3°C)

If drain temperature begins to encroach toward 140°F / 60°C:

- Check makeup water flow
- Check vent restriction or backpressure
- Check blowdown flow stability

5.4 Vent Backpressure and DA Optimization

Vent backpressure should be limited to the allowable low-pressure steam operating envelope for the receiving device (typical DA operating pressure ranges).

If condensate return into DA increases system pressure, it may affect flash steam routing performance.

5.5 Notes for Small Boiler Rooms (HVX Series Use Case)

HVX systems are the simplest heat recovery solution and provide excellent ROI for smaller seasonal or low-load boiler applications.

Ideal candidates include:

- Schools
 - Small industrial plants
 - Steam sterilizer boiler rooms
 - Food / beverage craft production sites
 - Small energy/utility low demand systems
-

SECTION 6 — MAINTENANCE & INSPECTION PRACTICES

6.1 General Expectations

These systems are designed for long life service with minimal intervention. Internal coils/U-Tubes typically last well over 10 years under normal industrial boiler room conditions. ASME vessels routinely exceed 15+ years service life in properly treated water systems.

Most wear accelerators correlate strongly with:

- Poor water treatment
- Pulsed / erratic blowdown slugs
- Excessive scaling or solids migration
- Neglected DA venting backpressure problems

6.2 Annual Recommended Inspection

- Shut down boiler
- Allow vessel to cool and fully drain
- Remove cleanout access or coil inspection access
- Visually inspect coil or U-Tube bundle for scaling, pitting, or abnormal deposits
- Brush or wipe coil surfaces lightly (soft wire brush only if needed)
- Reinstall access and leak test on startup

6.3 Sight Glass and Float Assembly Care

- Verify sight glass valves operate smoothly
- Inspect float linkages and drain linkage connections
- Verify no binding at stuffing box or external mechanical linkage points (HC series especially)

6.4 Determining When Service is Needed

Use the thermometer data trends over time:

- If drain temp rises consistently above 140°F (60°C) → service coil
- If makeup water temperature rise decreases toward zero → possible tube failure or heat transfer loss
- If all three temps begin converging to similar value → likely tube breach or internal crossover

⚠ If any severe temperature abnormality:
Shut down blowdown temporarily and investigate.

6.5 Replacement Parts

Use genuine Madden parts only.

Third party component substitution can alter calibration, clearances, thermal response range, or mechanical safety.

6.6 Preventing Unnecessary Service Events

- Maintain stable blowdown flow
 - Maintain stable system venting
 - Protect float assemblies during shutdown and startup transitions
 - Maintain water treatment target chemistry
-

SECTION 7 — TROUBLESHOOTING

7.1 General Troubleshooting Approach

Nearly all performance deviations trace back to one of the following three conditions:

- Unstable / improper blowdown flow rate
- Inadequate / low / absent makeup water flow
- Restricted or incorrect vent routing

Always check these three categories first before assuming internal fault.

7.2 Common Symptoms & Likely Causes

Symptom	Likely Cause	Corrective Action
(1A) Drain temperature rising above 140°F (60°C)	Blowdown rate too high OR Vent restriction.	Increase makeup flow, reduce blowdown slightly, verify vent open
(1B) Drain temperature rising above 140°F (60°C)	Coil or U-Tube bundle heat exchanger failure/damage, blowdown water mixing with makeup water	Perform coil/u-tube bundle inspection for holes. Repair or replace heat exchanger
No measurable temperature increase between makeup inlet and outlet	Coil fouled OR Tube failure causing cross mixing	Perform coil inspection / cleaning or coil replacement
Sporadic discharge behavior / water level instability	Pulsed blowdown strategy OR float linkage friction	Switch to stable continuous control + inspect linkage
Steam visibly escaping to drain / sewer	Major internal mixing	Shut down immediately and investigate for internal breach
Vent line hammers	Vent line too long, poor slope, condensate pooling	Re-pipe vent routing / add adequate slope
System overflowing / doesn't drain	Internal (or optional external) level control float trap failure. Drain valve is plugged, or float control is stuck.	Perform float control inspection / cleaning. Perform drain valve inspection / cleaning.

7.3 When to Contact the Factory

- Drain cannot be consistently held below 140°F (60°C)
- Temperature spread steadily collapsing / converging
- Visible carryover steam escape into drain system
- Mechanical linkage failure or binding
- Internal mixing suspected

We will request temperature readings (3 gauges), boiler steaming rate, site photos, and blowdown control method. This data allows fast root cause determination.

SECTION 8 — COMMISSIONING CHECKLIST

This checklist should be completed before system is put into continuous service.

General Installation Verification

- Vessel anchored securely
- Sight glass installed and valves free moving
- Temperature gauges installed in correct ports
- Relief valve installed on vessel top port
- Vent line connected and unobstructed
- Drain path unrestricted

Piping & Flow Path

- Surface blowdown line is Schedule 80 min
- Flow controlled via orifice meter or stable automated TDS control
- Makeup water line piped to coil circuit
- Makeup water available and sufficiently cool
- No isolation valves accidentally closed in primary flow paths

Functional Commissioning

- Establish makeup flow FIRST
- Slowly introduce continuous blowdown
- Stabilize 10–15 minutes
- Verify temperature readings within expected ranges
- Confirm quiet / smooth discharge / no hammer / no surging

If all above checks pass → system is ready for normal continuous operation.

SECTION 9 — OPTIONAL ACCESSORIES / VARIATIONS & NOTES

Common optional variations and accessories include:

- High level alarm switch
- External float trap option (HVX)
- Customized connection nozzle sizes for special boiler room retrofits
- Material upgrades on exchanger coils (stainless steel substitution)
- Integration with DA feedwater economizer packages
- Integration into packaged skid assemblies with chemical feed system tie-ins

When optional equipment is provided, separate individual component sheets are included in the submittal packet. Those documents take precedence for component-level service.

HV, HC, & HVX SPECIFIC START UP GUIDES AND P&IDs ON FOLLOWING PAGES...

HV SERIES

START UP & INSTALLATION INSTRUCTIONS

A. System Installation:

Once system is at the installation site, anchor the baseplate securely to the floor.

Use the assembly drawing for installation location of the Madden supplied components:

1. Install the Kunkle Relief Valve onto the coupling on the top vessel. Vent pipe must exit the building.
2. Screw the Pressure Gauge into the Steam Gauge Syphon and install onto the 1/4" NPT coupling on the top vessel.
3. Install the Sight Glass and Valves between the two 3/4" NPT couplings on the top vessel. See the Water Gauge and Gauge Glass Installation Instructions.
4. Connect the Madden Nameplate with 3 pre-mounted thermometers onto the nameplate brackets with the 4 supplied bolts.
5. Insert the 3 thermometer probes into the correct couplings as listed on the assembly drawing:
 - a. Insert the union connections of the thermometer probe assembly into the 3 couplings.
 - b. Insert the probe with capillary tube attached to the gauge in the *first* position on the nameplate into the correct coupling on the lower vessel inlet.
 - c. Insert the probe with capillary tube attached to the gauge in the *second* position on the nameplate into the correct coupling on the lower vessel outlet.
 - d. Insert the probe with capillary tube attached to the gauge in the *third* position on the nameplate into the correct coupling on the blowdown drain at the bottom of the lower vessel.
6. If the vessel has an optional high level alarm switch, the alarm should be hooked up by an electrician. Wiring diagram included.

B. Piping connections:

The contractor must furnish and install all related piping. This system requires a minimum of six connections as described on the assembly drawing provided in your sales order submittal packet. Shut off valves must be installed between the boiler and the flow control valves if using Madden Orifice Meters for the flow control.

⚠ VENT PIPING NOTE: it is recommended to use a swing type check valve from the HC upper vessel vent line and the D/A tank. SEE TYPICAL P&ID AT THE END OF THIS MANUAL.

C. The components of the Heat Exchanger System:

1. Vertical Heat Exchanger Bottom Vessel with heat exchanger coils –
Copper coils with bronze manifolds or stainless-steel coils with stainless-steel manifolds
2. Flash Tank Top Vessel
3. Float Valve – Interior of the Flash Tank
4. Gauge Panel – Includes 3 Thermometers
5. Manifold – For Inlet Flow Control
6. Ancillary Equipment: Sight Glass, Valves & Rods, Pressure Gauge & Syphon Tube and Safety Relief Valve
7. Optional – High Level Alarm

HC SERIES

START UP & INSTALLATION INSTRUCTIONS

A. System Installation:

Once system is at the installation site, anchor the footpads securely to the floor.

Use the assembly drawing for installation location of the Madden supplied components:

1. Install the Kunkle Relief Valve onto the coupling on the top of the vessel. Vent pipe must exit the building.
2. Screw the Pressure Gauge into the Steam Gauge Syphon and install onto the 1/4" NPT coupling on the vessel.
3. Install the Sight Glass and Valves between the two 3/4" NPT couplings on the vessel. See the Water Gauge and Gauge Glass Installation Instructions.
4. Connect the Madden Nameplate with 3 pre-mounted thermometers onto the nameplate brackets with the 4 supplied bolts.
5. Insert the 3 thermometer probes into the correct couplings as listed on the assembly drawing:
 - a. Insert the union connections of the thermometer probe assembly into the 3 couplings.
 - b. Insert the probe with capillary tube attached to the gauge in the *first* position on the nameplate into the correct coupling on the inlet.
 - c. Insert the probe with capillary tube attached to the gauge in the *second* position on the nameplate into the correct coupling on the outlet.
 - d. Insert the probe with capillary tube attached to the gauge in the *third* position on the nameplate into the correct coupling on the blowdown drain at the bottom of the vessel.
6. Install Keckley #62 Globe Valve on the discharge/drain line. Linkage is included to connect to the stainless-steel float controller.
7. If the vessel has an optional high level alarm switch, the alarm should be hooked up by an electrician. Wiring diagram included with order submittal packet.

B. Piping connections:

The contractor must furnish and install all related piping. This system requires a minimum of six connections as described on the assembly drawing provided in your sales order submittal packet. Shut off valves must be installed between the boiler and the flow control valves if using Madden Orifice Meters for the flow control.

⚠ VENT PIPING NOTE: it is recommended to use a swing type check valve from the HC upper vessel vent line and the D/A tank. SEE TYPICAL P&ID AT THE END OF THIS MANUAL.

C. The components of the Heat Exchanger System:

1. Horizontal Flash Tank with Integral Heat Exchanger
2. U-Tube Bundle with Stainless-Steel Tubes
3. Float Valve
4. Gauge Panel – Includes 3 Thermometers
5. Manifold – For Inlet Flow Control
6. Ancillary Equipment: Sight Glass, Valves & Rods, Keckley Globe Valve, Pressure Gauge & Syphon Tube and Safety Relief Valve
7. Optional – High Level Alarm

D. Occasional Start Up Leaking Issue with HC Systems: reference the HC011AS stuffing box kit. This device links and seals the HC series internal SS float level control and the external drain globe valve. This assembly ships “snug” from the factory to ensure start up temperatures do not cause the internal packing to overtighten, keeping the actuating linkage from turning. IF AN OPERATOR NOTICES A MINOR LEAK DURING STARTUP from this component, tighten the outer nut, NOT the nut closest to the vessel. This typically seals the system. See document HC_Stuffing-Kit_Packing-Assembly_HC011AS.pdf (website) for more details.

HVX SERIES

START UP & INSTALLATION INSTRUCTIONS

A. System Installation:

Once system is at the installation site, anchor the baseplate securely to the floor.

Use the assembly drawing for installation location of the Madden supplied components:

1. Install the Kunkle Relief Valve onto the coupling on the top vessel. Vent pipe must exit the building.
2. Screw the Pressure Gauge into the Steam Gauge Syphon and install both onto the 1/4" NPT coupling on the top, front side of the ASME vessel.
3. Install the Sight Glass and Valves between the two 3/4" NPT couplings. See the Water Gauge and Gauge Glass Installation Instructions in your Equipment Databook.
4. Connect the Madden Nameplate with 3 pre-mounted thermometers onto the nameplate brackets with the 4 supplied bolts.
5. Insert the 3 thermometer probes into the correct couplings as listed on the assembly drawing:
 - a. Insert the union connections of the thermometer probe assembly into the 3 couplings.
 - b. Insert the probe with capillary tube attached to the gauge in the *first* position on the nameplate into the correct coupling on the vessel makeup water inlet.
 - c. Insert the probe with capillary tube attached to the gauge in the *second* position on the nameplate into the correct coupling on the vessel makeup water outlet.
 - d. Insert the probe with capillary tube attached to the gauge in the *third* position on the nameplate into the correct coupling on the blowdown drain at the bottom of the vessel. This is part of the external liquid level control drainer's piping.
6. If the vessel has an optional high level alarm switch, the Mercoid switch should be installed on the side of the vessel. The switch comes pre-plumbed with unions and on the vessel will be open gate valves to connect to. The alarm box should be hooked up by an electrician. Wiring diagram included in your Equipment Databook.

B. Piping connections:

The contractor must furnish and install all related piping. This system requires a minimum of six connections as described on the assembly drawing provided with your sales order submittal packet. Shut off valves must be installed between the boiler and the flow control valves if using Madden Orifice Meters for the flow control.

⚠ VENT PIPING NOTE: it is recommended to use a swing type check valve from the HVX upper vessel vent line and the D/A tank. SEE TYPICAL P&ID AT THE END OF THIS MANUAL.

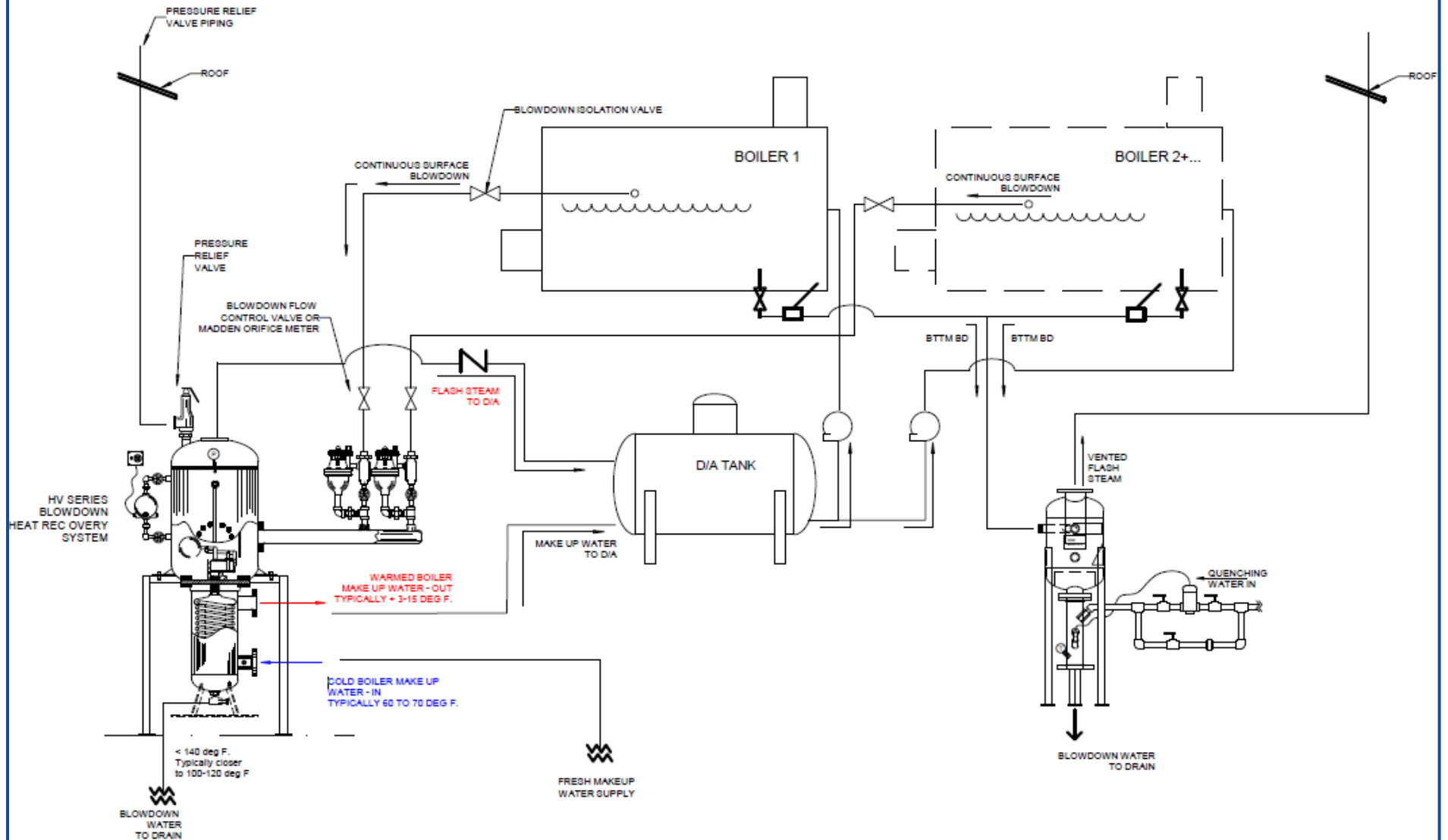
C. The components of the Heat Exchanger System:

1. Vertical Heat Exchanger – Interior of vessel, copper coil is standard for higher BTU transfer efficiency.
2. Float & Drain Valve – Exterior liquid lever drain trap.
3. Nameplate and Gauge Panel – Includes 3 Thermometers
4. Ancillary Equipment: Sight Glass, Valves & Rods, Pressure Gauge & Syphon Tube and Safety Relief Valve
5. (Optional) Manifold – For Inlet Flow Control
6. (Optional) – High Level Alarm

MAKEUP WATER FLOW RATE NOTE: The HVX15 is designed to recover 90% of BTU's from the surface blowdown (max 1,500 PPH rate) via flash steam and makeup water heat exchange. It is also designed to reduce the waste condensate below 120 deg F with at least 75 deg F makeup water (cooling water). It is intended to be the most cost effective heat recovery for small boiler rooms with low surface blowdown and makeup water rates. The max flow rate through the makeup water connections and coil is 30 GPM, but ideally < 20 GPM to increase coil service life. If your surface blowdown rate is < 1,501 PPH, but your makeup water requirements are > 30 GPM, we recommend diverting a portion of the main makeup water line to this unit. Then run the preheated makeup water discharge from the HVX to an independent feed connection on the D/A or preheating feed tank (not back into the pressurized main makeup water line).

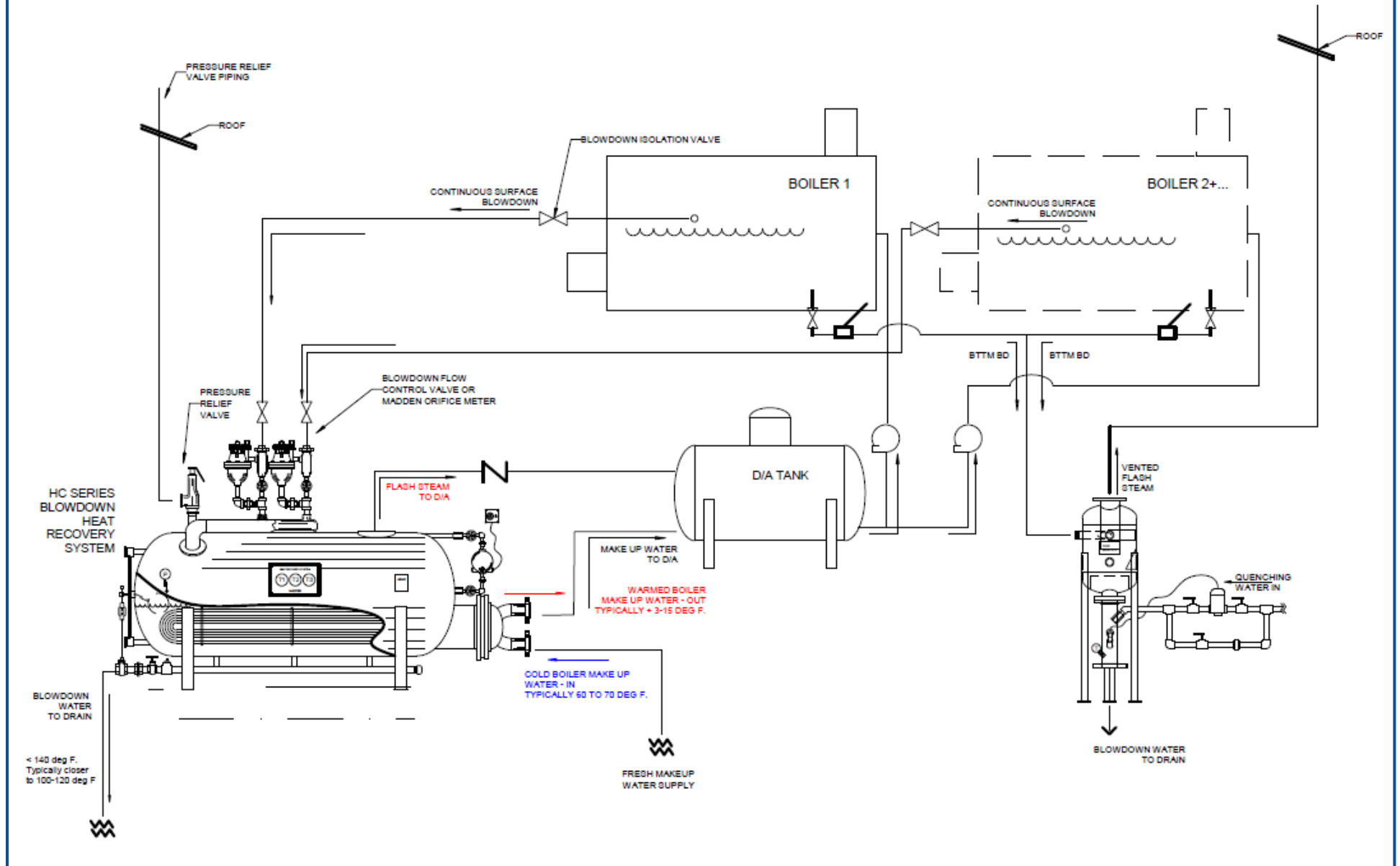
Typical P&ID's for HV SERIES Heat Recovery Systems

TYPICAL P&ID FOR A MADDEN HV SERIES, HEAT RECOVERY SYSTEM



Typical P&ID for HC SERIES Heat Recovery Systems

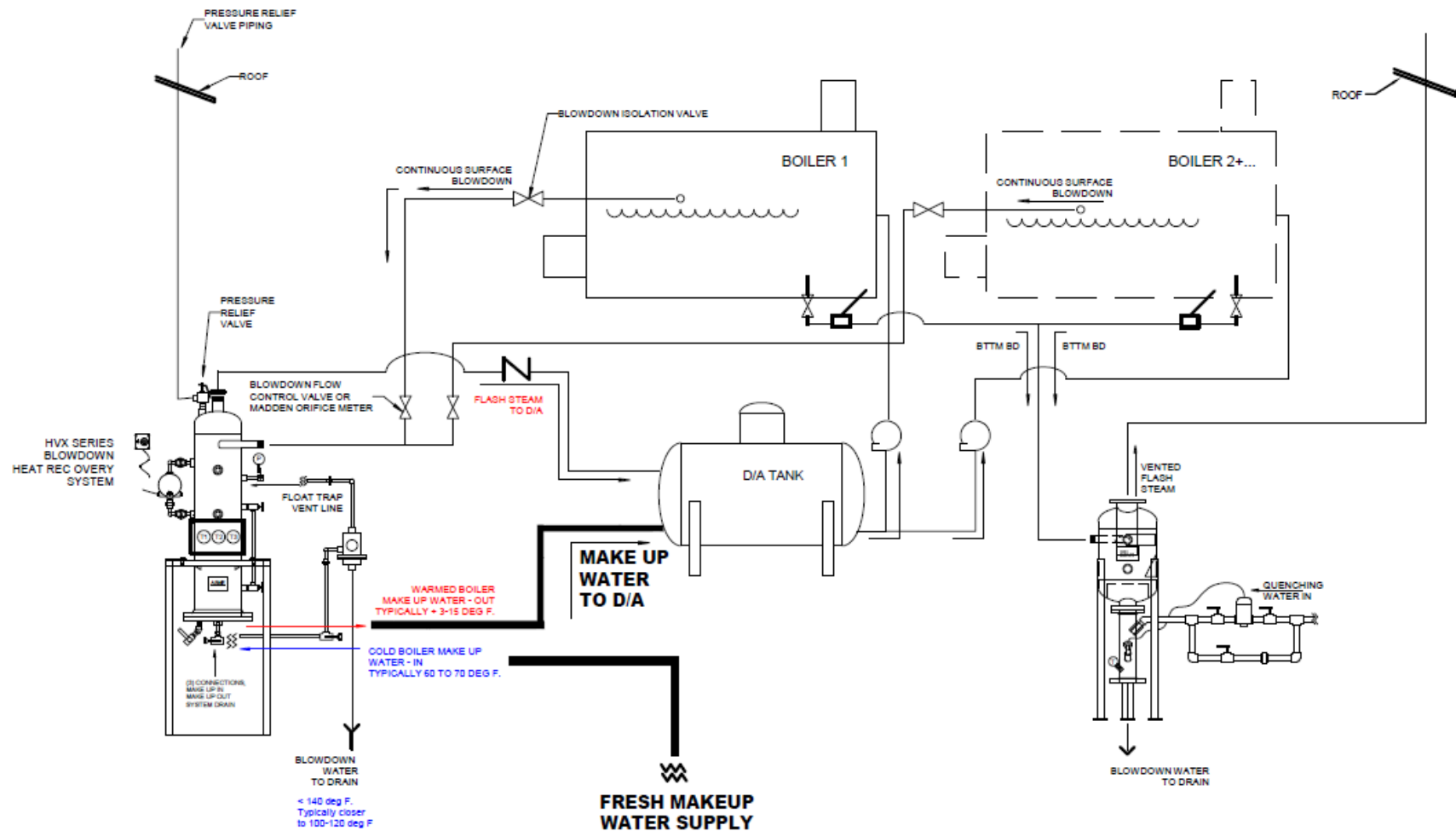
TYPICAL P&ID FOR A MADDEN HC SERIES, HEAT RECOVERY SYSTEM



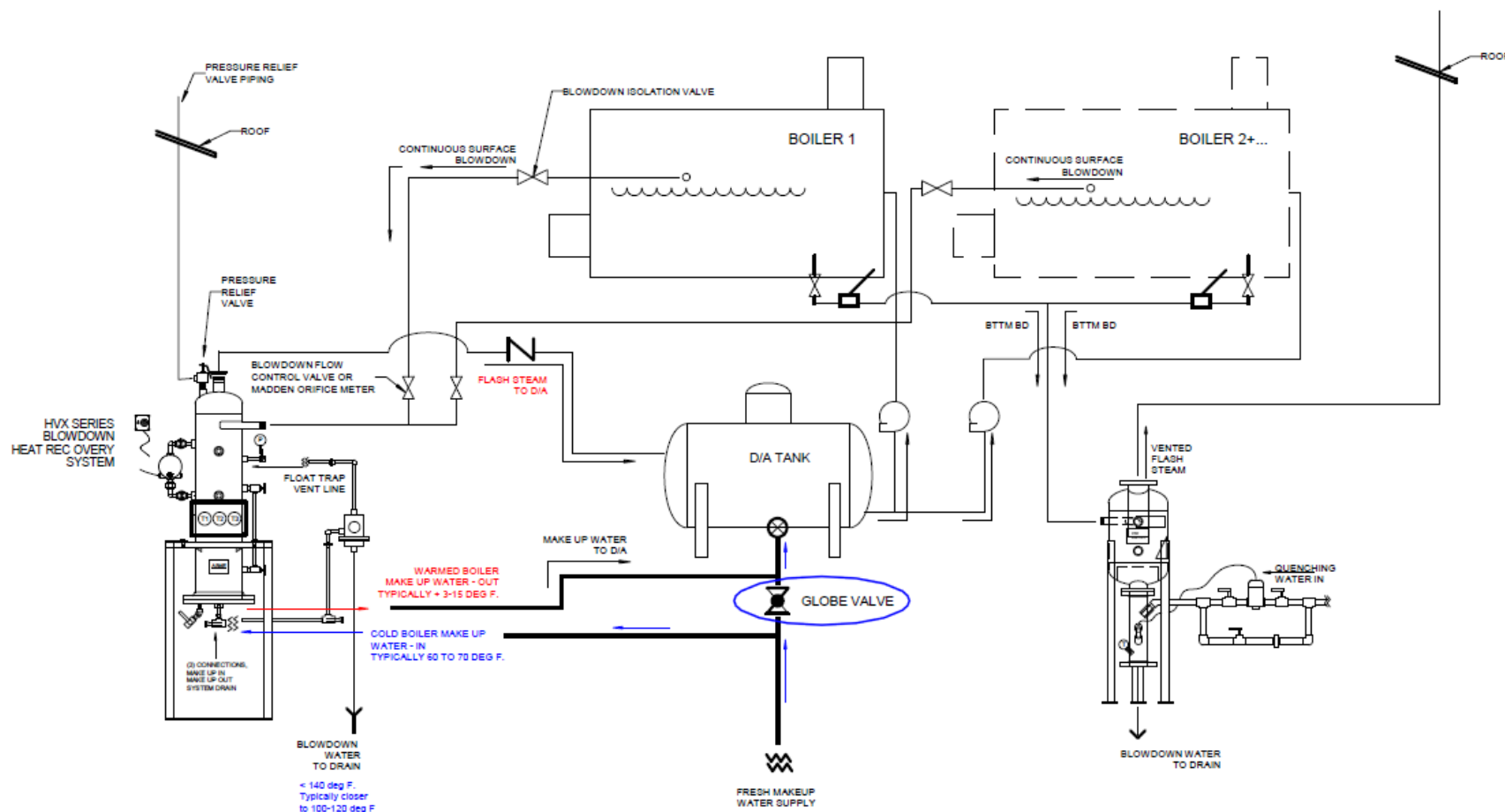
Typical P&ID for HVX SERIES Heat Recovery Systems (2 PAGES)

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.



****** 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.