# MEPNN Supplier Scouting Opportunity Synopsis

## **Section 1:** General Information

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| Scouting Number | 2024-273 |
| Item to be Scouted | Heat Exchanger for HVAC |
| Days to be scouted | 30 |
| Response Due By | 10/11/2024 |
| Description | For the construction of the new Energy and Minerals Research Facility (EMRF) for the U. S. Geological Survey (USGS) at the Colorado School of Mines (Mines), 1000 18th Street, Golden, Colorado 80401, provide a packaged high performance Vertical Flooded Steam to Water Heat Exchangers for Building Heat and Domestic Hot Water delivered to the EMRF construction site. This project is federally funded by the President Joe Biden's Bipartisan Infrastructure Law (BIL). Therefore, the material used for construction is required to be compliant with the Build America, Buy America Act (BABAA). This NIST MEP Supplier Report seeks a BABAA compliant Heat Exchangers that meets or exceeds the basis of design. The basis of design is a Maxi-Therm steam to water heat exchangers described herein (including additional information). The basis of design heat exchangers meets or exceeds the design requirements including the strict technical requirements, maximum size requirements, maximum delivery schedule, and the maximum cost parameters enclosed. See also the requirements stated in the enclosed specifications, drawings, dimension and performance requirements, and other documents including warranty requirements. Packaged heat exchanger systems (pre-piped and wired controls assembled on a painted and fabricated equipment steel framed and ready for field piping connections) and associated components and accessories include, but are not limited to, the following: 1. Vertical U-tube. 2. Liquid and Steam piping to be Schedule 40 carbon steel. 3. Liquid Condensate piping to be Schedule 80 carbon steel. 4. Stabilizing pump and isolation valves and stainless steel check valve. 5. Modulating electric control valve on the condensate outlet, fail safe, pre-wired to the control panel. 6. Thermowells, electric temperature sensor, with thermometers located at the liquid inlet and outlet, and condensate outlet. 7. Pressure transmitter on steam inlet, flow sensor on the liquid inlet, overheat butterfly security valve on the steam side, start-up valve on the steam inlet. 8. NEMA 4 UL approved control panel, pre-programmed to include the following: a. Programmable controller with optimal control sequence. b. Factory wiring to all sensors and valves. c. Color HMI graphic interface with different users' access levels. d. Access via the building automation system to all parameters for remote monitoring and remote control. e. BACnet (IP) communication protocols are available. f. IoT ready with data acquisition and secure remote access capabilities (ISO 27001 and ISECOM STAR certified) with OPC US Embedded Server. Internet connectivity must be provided to the panel via an ethernet cable by the customer for remote troubleshooting and monitoring. g. Continuous display and datalogging of liquid inlet, water outlet, condensate outlet temperatures, steam pressure, liquid flow in GPM, condensate control valve and main steam valve position (via the feedback output of the valves) and heat transfer rate in BTU/hr. h. Preprogrammed and adjustable alarms for liquid outlet high and low temperature, condensate outlet high temperature, high and low liquid flow as well as high steam pressure. Sensor/valve failure alarm is also standard. i. The outside disconnect switch to be able to locally shut the power to the panel before opening the door. j. Integral network switch and 120V power supply receptacle to plug in a laptop for easy tech support. Laptop can be plugged in with the control panel door closed for more safety. k. Return to last known state after a power outage. 9. Flanged steam trap on condensate outlet, strainer with 40-mesh and blowdown valve on condensate outlet. |
| Notify Requester Immediately | |
| State item to be used in | Colorado |

## **Section 2:** Technical Information

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| Type of supplier being sought | Manufacturer |
| Reason | BABA |
| Describe the manufacturing processes (elaborate to provide as much detail as possible) | Electronic and mechanical assembly. |
| Provide dimensions / size / tolerances / performance specifications for the item | See information provided. |
| List required materials needed to make the product, including materials of product components | Various, see information provided. |
| Are there applicable certification requirements? | Yes |
| Details | DOMESTIC WATER HEAT EXCHANGER: A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use. B. ASME Compliance: Where ASME-code construction is indicated, fabricate and label heat-exchanger storage tanks to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1. C. Comply with NSF 61, "Drinking Water System Components - Health Effects; Sections 1 through 9" for all components that will be in contact with water<br>BUILDING HEAT EXCHANGER: A. ASMEASME BPVC-VIII-1 - Boiler and Pressure Vessel Code, Section VIII, Division 01 - Rules for Construction of Pressure Vessels. B. ASME Section II – Material Testing. C. ASME Section V – Non-Destructive Testing. D. ASME Section IX – Welding and Brazing Qualifications. E. AHRI Standard 400 – Liquid -to-Liquid Heat Exchangers. F. TEMA Standards – “Standards of the Tubular Exchanger Manufacturers Association". |
| Are there applicable regulations? | No |
| Are there any other stndards, requirements, etc.? | Yes |
| Details | See above. See the enclosed specification requirements including spare parts, warranty, manufacturer qualifications, delivery, storage, and handling. |
| NAICS 1 | 332410 Power boiler and heat exchanger manufacturing |
| NAICS 2 | |
| Additional Technical Comments | See enclosed specification section and Maxi-Therm basis of design information. |

## **Section 4:** Business Information

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| Estimated potential business volume | Limited to one set of equipment. |
| Estimated target price / unit cost information (if unavailable explain) | Maximum total costs are the following: Building Heat system is $326,000 (This includes the product, shipping, start-up, assistance for controls contractor and warranty service.) Domestic Water system is $125,000 (This includes product, shipping, controls, start-up, and warranty service.). Costs include shipping, start up services including commissioning and<br>coordinating the heat exchangers with Building Automation System, and required minimum manufacturer's warranty (see<br>specifications). Costs also include providing approved submittal paperwork required in the specifications. |

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| When is it needed by? | Maxi-Therm lead time is 20 weeks but no later than 2:00 pm local time the on-site at the following dates. Domestic water heat exchanger needed on site 6/17/2025. Building heat exchanger needed on site 5/29/2025. If the schedule has delivery prior to the dates above, the cost of holding equipment until the project can receive the equipment will not be allowed. Provide written manufacturer's submittal at least 90 days before required by manufacturer for review and approval. |
| Describe packaging requirements | Crate and package equipment and components for secure and undamaged transportation and delivery. |
| Where will this item be shipped? | Shipping will be to Golden, Colorado 80401, at the construction site address listed above. |

## Additional Comments

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| Is there other information you would like to include? | |

# SECTION 223500
# DOMESTIC WATER HEAT EXCHANGERS

## PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following heat exchangers:

1. Domestic-water-in-coil, steam-to-liquid vertical flooded instantaneous heat exchangers.

1.3 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
B. Product Data: Provide data with dimensions, locations, and size of tap and performance data, include heat transfer surface area, fouling factors, fluid media and concentrations, materials of construction. Where more than one set of performance parameters are included in the schedule(s) the submittal shall include all multi-variable operating performance data. Include service clearances required for heat exchangers.
C. Shop Drawings:
1. Design Data: Indicate in sufficient detail to verify that heat exchangers meet or exceed specified requirements.
2. Test Reports: Indicate tube bundle pressure tests.
D. Certificates: Certify that products meet or exceed specified requirements. Include certification and stamp documentation as required for compliance with respective pressure vessel codes.
E. Manufacturer's Installation Instructions: Submit manufacturer’s published installation requirements.
F. Operation and Maintenance Data: Include start up and shut down instructions, assembly drawings, and spare parts lists.
G. Warranty: Submit manufacturer's warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

1.4 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacture, assembly, and field performance of heat exchangers with minimum ten years of documented experience.

B. Product Options: Drawings indicate size, profiles, and dimensional requirements of heat exchangers and are based on the specific system indicated. Refer to Division 01 Section "Product Requirements."
C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
D. ASME Compliance: Where ASME-code construction is indicated, fabricate and label heat-exchanger storage tanks to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.
E. Comply with NSF 61, "Drinking Water System Components - Health Effects; Sections 1 through 9" for all components that will be in contact with water.

1.5 COORDINATION

A. Coordinate size and location of concrete bases with Architectural and Structural Drawings.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Provide temporary end caps on all openings, to protect the internals from entry of foreign material.

1.7 WARRANTY

A. See Section 01 78 00 - Closeout Submittals, for warranty requirements. In addition to these requirements, the manufacturer(s) shall provide the following additional extended warranty for the product described:
1. Provide five-year manufacturers limited warranty for steam to liquid vertical flooded type heat exchanger condensate control valve and heat exchanger components.

## PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:
1. Maxi-Therm, (No Substitutions)

2.2 DOMESTIC, STEAM-TO-LIQUID VERTICAL FLOODED HEAT EXCHANGERS

A. General: Provide the type, sizes, capacities, and performance as scheduled on the drawings.
B. Provide steam-to-water packaged heat exchanger factory pre-piped and wired controls assembled on a fabricated equipment skid, ready for field piping connections.
C. The factory-built heat exchanger system shall include the following components and functions:
1. Heat Exchanger: Vertical U-tube
2. Liquid & Steam Piping: Schedule 80 carbon steel

3. Stabilizing pump with, isolation valves and stainless steel check valve.
4. Thermowells, modulating electric control valve on the condensate outlet, electric temperature sensor, with thermometers located at the liquid inlet and outlet, and condensate outlet.
5. Pressure transmitter on steam inlet, flow sensor on the liquid inlet, over heat butterfly security valve on the steam side, start-up valve on the steam inlet,
6. NEMA 4 UL approved control panel, pre-programmed to include the following:
    1) Programmable controller with optimal control sequence.
    2) Factory wiring to all sensors and valves.
    3) Color HMI graphic interface with different users' access levels.
    4) Access via the building automation system to all parameters for remote monitoring and remote control.
    5) BACnet (IP) communication protocols are available.
    6) IoT ready with data acquisition and secure remote access capabilities (ISO 27001 and ISECOM STAR certified) with OPC US Embedded Server. Internet connectivity must be provided to the panel via an ethernet cable by the customer for remote troubleshooting and monitoring.
    7) Continuous display and datalogging of liquid inlet, water outlet, condensate outlet temperatures, steam pressure, liquid flow in GPM, condensate control valve and main steam valve position (via the feedback output of the valves) and heat transfer rate in BTU/hr.
    8) Preprogrammed and adjustable alarms for liquid outlet high and low temperature, condensate outlet high temperature, high and low liquid flow as well as high steam pressure. Sensor/valve failure alarm is also standard.
    9) The outside disconnect switch to be able to locally shut the power to the panel before opening the door.
    10) Integral network switch and 120V power supply receptacle to plug in a laptop for easy tech support. Laptop can be plugged in with the control panel door closed for more safety.
    11) Return to last known state after a power outage.
7. Flanged steam trap on condensate outlet, strainer with 40-mesh and blowdown valve on condensate outlet.

D. Tubes: Vertical U-tube type with 3/4 IN. OD minimum vented, double-wall cupro-nickel (90/10 CuNi) tubes suitable for 150 PSIG working pressure and 375 ºF.
E. Shell: Steel pipe with threaded or flanged piping connections and necessary pipe tap connections, steel saddle and attaching U-bolts, prime coated.
F. Heads: Cast iron or fabricated steel with 304 stainless steel tube sheets; flanged for piping connections.
G. Water Chamber and Tube Bundle: Removable for inspection and cleaning.
H. Design: Heating fluid in shell and heated fluid in tubes.
I. Certification: ASME Certified construction.

J. Accessories:
   1. Two (2) steam traps as drip traps.
   2. Stainless steel vacuum breaker for steam inlet piping.
   3. Stainless steel air vent for the steam inlet piping.
   4. Condensate mixer with integrated check valves.

## PART 3 - EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturer's instructions.
B. Complete installation of heat exchanger(s) in compliance with the piping details shown on the drawings and otherwise as indicated in the contract documents.
C. Connect all inlet/outlet piping connections with unions or flanges, and shut-off valves.
D. Install pipe support or hangers as required, to prevent the weight of the pipe free from imposing stress on the equipment flanges as recommended by the heat exchanger manufacturer.
E. For all heat exchangers, arrange and install piping, valves, controls, gauges, piping specialties, accessories, etc. to allow for easy disassembly of piping connections, with minimal disturbance to equipment and adjacent piping, in order to provide maintenance and service access. This includes tube removal for shell and tube heat exchangers, drawback space for plate and frame exchangers to allow separating of plates for cleaning or replacement; and replacement or removal of brazed plate type heat exchangers.
F. Install heat exchangers on concrete housekeeping pad. Refer to Section 22 05 29.
G. For shell and tube heat exchangers, provide shop fabricated elevated supports stands constructed of ASTM A36 carbon steel to accommodate support cradle supplied by the heat exchanger. Refer to Section 22 05 29 for support stand requirements. Pitch shell to drain condensate completely.
H. Install all temperature, pressure, flow switches, flow meters, wells, taps, etc., and all other pipe connections as required for the Temperature Control Contractor to complete their work.
I. For domestic water side(s) of heat exchangers refer to the following sections for additional requirements:
   1. Section 22 05 19 Meters & Gauges
   2. Section 22 11 16 Domestic Water Piping
   3. Section 23 11 19 Domestic Water Piping Specialties
J. For steam side(s) of heat exchangers refer to the following sections for additional requirements:
   1. Section 23 05 19 Meters & Gauges
   2. Section 23 22 13 Steam & Condensate Piping
   3. Section 23 22 33 Steam Specialties

K. Pipe water relief valves to nearest floor drain, which will not result as a trip hazard.
L. Pipe steam safety relief valves to outside the building and terminate in manner to avoid dangerous discharge to humans. Provide drip pan elbow at relief valve as recommended by the relief valve manufacturer.
M. Pipe drain valves to nearest floor drain, which will not result as a trip hazard.
N. Unless specifically noted otherwise all heat exchangers shall be insulated in accordance with Section 22 07 00 Plumbing Insulation.
O. Where applicable, field install all electrical devices provided by the heat exchanger manufacturer not specified to be factory-installed.
P. Where indicated on drawings, provide heat exchanger with 1-1/4” hot water stabilization piping branch. Minimum developed length, 30’-0”. Refer to manufacturer’s installation data for additional information.

## 3.2 STEAM TO WATER HEAT EXCHANGER TRIM

A. Refer to piping detail on the drawings.
B. Shell: Pressure gauge tapping with pigtail siphon, vacuum breaker
C. Steam Piping: Provide piping as indicated, including control valve with 3-valve bypass, strainer, and pressure gage on inlet; condensate dirt leg, steam trap with 3-valve bypass, strainer, and check valve on outlet; air vent or vacuum breaker on shell.
D. Water Inlet: Thermometer well, pressure gauge tapping, valved drain.
E. Water Outlet: Thermometer well for temperature regulator sensor, ASME rated pressure and temperature relief valve, thermometer well, pressure gauge taps.

## 3.3 FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements, for additional requirements.
B. Provide manufacturer's field representative to test, inspect, instruct, and oversee equipment startup.
C. Inspect for and remove blocks, shipping bolts, and tie-down straps.
D. System Flushing & Cleaning: Do not allow flow thru heat exchanger until the piping systems are flushed and clean free of oils, grease, slag and other contaminates. Provide temporary by-pass piping near piping connections on system side of shut-off valves, to circulate chemical treatment for flushing and cleaning.
E. Operational Test: Place each heat exchanger in to service to confirm it is operating properly.
F. Controls and Safety Switches: Test, adjust, and replace damaged/malfunctioning controls and equipment.
G. Coordinate all temperature control work with the BAS Control Contractor, Section 23 09 93 - Sequence of Operations for HVAC Controls.

H. Malfunctioning Units: Remove, replace, and retest as specified above.

3.4 COMMISSIONING

A. See Section 01 91 13 - General Commissioning Requirements, for commissioning requirements.
B. See Section 23 08 00 – Commissioning of HVAC for additional commissioning requirements.
C. Perform functional tests as required by the Manufacturer and the Commissioning Agent’s written commissioning plan.

3.5 ADJUSTING AND CLEANING

A. Cleaning: Clean factory-finished surfaces free of dust and debris using an approved cleaning solution and drying cloth. Repair any marred or scratched surfaces with manufacturer’s touch-up paint. Unit shall be in “like-new” condition upon turn over to Owner.

3.6 SPARE PARTS

A. General: Furnish to Owner, on spare gasket for each flanged connection for each heat exchanger and wrench. Provide the Owner a receipt for spare parts delivered; obtain a signature with date. Include copy of signed receipt with the O & M Manuals.

3.7 TRAINING

A. Training: For heat exchanger type, provide services of manufacturer's technical representative for two (2) hours, to instruct Owner's personnel in operation and maintenance of equipment. Schedule with Owner and provide at least one (1) week notice to Contractor and Engineer of training date.

**END OF SECTION**

# SECTION 23 57 00
# HEAT EXCHANGERS FOR HVAC

## PART 1 - GENERAL

### 1.1 SECTION INCLUDES

A. Plate & Frame Cleanable Gasketed type heat exchangers.
B. Steam-to-liquid vertical flooded type heat exchangers.

### 1.2 RELATED REQUIREMENTS

A. Drawings, all other Sections of Division 23 and General Provisions of the Contract, including General and Supplementary Conditions, as well as Division 01 Specification Sections, apply to this Section.
B. All materials, equipment, fabrication and installation shall meet and comply with all adopted current codes, regulations, standards, etc. as applicable to the product(s) specified in the section, as scheduled on the drawings as well as Division 01 and Division 23 related documents whether called for or not.

### 1.3 REFERENCE STANDARDS

A. ASME BPVC-VIII-1 - Boiler and Pressure Vessel Code, Section VIII, Division 01 - Rules for Construction of Pressure Vessels.
B. ASME Section II – Material Testing.
C. ASME Section V – Non-Destructive Testing.
D. ASME Section IX – Welding and Brazing Qualifications.
E. AHRI Standard 400 – Liquid -to-Liquid Heat Exchangers.
F. TEMA Standards – "Standards of the Tubular Exchanger Manufacturers Association".

### 1.4 SUBMITTALS

A. Product Data: Provide data with dimensions, locations, and size of tap and performance data, include heat transfer surface area, fouling factors, fluid media and concentrations, materials of construction. Where more than one set of performance parameters are included in the schedule(s) the submittal shall include all multi-variable operating performance data. Include service clearances required for heat exchangers.
B. Shop Drawings:
   1. Design Data: Indicate in sufficient detail to verify that heat exchangers meet or exceed specified requirements.
   2. Test Reports: Indicate tube bundle pressure tests.

C. Certificates: Certify that products meet or exceed specified requirements. Include certification and stamp documentation as required for compliance with respective pressure vessel codes.
D. Manufacturer's Installation Instructions: Submit manufacturer's published installation requirements.
E. Operation and Maintenance Data: Include start up and shut down instructions, assembly drawings, and spare parts lists.
F. Warranty: Submit manufacturer's warranty and ensure forms have been completed in Owner's name and registered with manufacturer.
G. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. Refer to Division 01 Section "Operation and Maintenance Data", for additional provisions.
H. Spare Parts
   1. Extra Gaskets: One set of each type and size.
   2. Plate Type Heat Exchanger Tools: One set of wrenches for disassembly.
   3. Provide the Owner a receipt for spare parts delivered; obtain a signature with date. Include a copy of signed receipt with the O & M Manuals.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacture, assembly, and field performance of heat exchangers with minimum ten (10) years of documented experience.
B. In no case shall any manufacturer provide less heat transfer surface area than scheduled on the drawings, regardless of what the calculation indicates. The fouling factors noted on the drawings shall be used to determine heat transfer area.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Provide temporary end caps on all openings, to protect the internals from entry of foreign material.
B. Handle heat exchangers carefully to prevent damage, breaking, denting, and scoring. Do not install damaged units or components; replace with new.
C. Store heat exchangers in clean dry place. Protect from weather, dirt, fumes, water, construction debris, and physical damage.
D. Comply with manufacturer's rigging and installation instructions for unloading heat exchangers and moving them to final location.

1.7 WARRANTY

A. Refer to Division 01 Section "Closeout Procedures", for warranty requirements. In addition to these requirements, the manufacturer(s) shall provide the following additional extended warranty for the product described:

1. Provide 36-month manufacturer warranty for AHRI certified plate and frame heat exchangers from date of turn over to Owner.
2. Provide 60-month manufacturer's warranty for steam to liquid vertical flooded type heat exchanger and condensate control valve and an 18-month warranty for heat exchanger components and performance.

## PART 2 - PRODUCTS

2.1 PLATE AND FRAME GASKETED TYPE HEAT EXCHANGER

A. Manufacturers: The manufacturers listed are subject to compliance of all the requirements within the contract documents; provide the product indicated on Drawings or a comparable product by one of the following:
   1. Ameridex.
   2. Alfa Laval.
   3. Armstrong.

B. General: Provide the type, sizes, capacities, and performance as scheduled on the drawings.

C. Frames: Carbon steel with baked epoxy enamel paint (minimum 3-mil thickness), stainless steel side bolts, and shroud. The frame assembly design shall allow for additional plates as noted in the equipment schedule shown on the drawings. Piping connections shall be provided on the fixed frame, with a movable frame at the opposite end.

D. Plates: Stainless steel Type 304. The plate pack shall be covered with an aluminum shroud in accordance with OSHA.

E. Carrying and Guide Bars: The carrying and guide bar surfaces in contact with the plate pack shall be stainless steel. The bolt lengths shall allow for additional plates as noted in the equipment schedule shown on the drawings. A roller bearing shall be provided on the movable cover for all units with port sizes 3-inch or larger.

F. Gaskets: Provide Nitrile rubber gaskets. Gaskets shall be designed to indicate leakage across the sealing gaskets prior to the intermixing of fluids. Gasket surfaces shall be used for sealing plates, and not for plate alignment.

G. Nozzles: Locate nozzles on fixed end plate. For 4-inch and larger, provide studded port connections to align with ANSI Flange connections. Each studded port shall be lined with a material compatible with the process fluid, to prevent process fluid from coming in contact with the painted cover.

H. Design Rating: 150 PSIG at 200 °F.

I. The heat exchanger shall be designed, constructed, and tested in accordance with Section VIII, Division I of the ASME Pressure Vessel Code, and shall be code stamped. ASME nameplate shall be attached on the face of the fixed cover.

J. The heat exchanger shall be hydrostatically factory tested in accordance with the requirements of the ASME Code Section VIII Div. 1, para. UG-99.

K. Provide the following accessories with the heat exchanger:
   1. Provide Aluminum OSHA Insulated Shroud Enclosure.

~~2. Tie-Rod Protectors.~~
~~3. Tie-Rod Nut Wrench.~~

2.2 STEAM TO LIQUID VERTICAL FLOODED TYPE HEAT EXCHANGER

A. Manufacturers: The manufacturers listed are subject to compliance of all the requirements within the contract documents; provide the product indicated on Drawings or a comparable product by one of the following:
   1. Maxi-Therm, (No Substitutions)

B. General: Provide the type, sizes, capacities, and performance as scheduled on the drawings.

C. Provide steam-to-water packaged heat exchanger factory pre-piped and wired controls assembled on a painted and fabricated equipment steel frame, ready for field piping connections.

D. The factory-built heat exchanger system shall include the following components and functions:
   1. Heat Exchanger: Vertical U-tube
   2. Liquid & Steam Piping: Schedule 40 carbon steel.
   3. Liquid Condensate Piping: Schedule 80 carbon steel.
   4. Stabilizing pump with isolation valves and stainless-steel check valve.
   5. Modulating electric control valve on the condensate outlet, fail safe, pre-wired to the control panel. The valve body shall be of A 216 Gr. WCB cast steel fabrication with ANSI 300 PSIG flanged connections. Control valve shall be provided with digital positioner with position feedback analog output. Actuator to have a manual override.
   6. Thermowells, electric temperature sensor, with thermometers located at the liquid inlet and outlet, and condensate outlet.
   7. Pressure transmitter on steam inlet, flow sensor on the liquid inlet, overheat butterfly security valve on the steam side, start-up valve on the steam inlet,
   8. NEMA 4 UL approved control panel, pre-programmed to include the following:
      a. Programmable controller with optimal control sequence.
      b. Factory wiring to all sensors and valves.
      c. Color HMI graphic interface with different users' access levels.
      d. Access via the building automation system to all parameters for remote monitoring and remote control.
      e. BACnet (IP) communication protocols are available.
      f. IoT ready with data acquisition and secure remote access capabilities (ISO 27001 and ISECOM STAR certified) with OPC US Embedded Server. Internet connectivity must be provided to the panel via an ethernet cable by the customer for remote troubleshooting and monitoring.
      g. Continuous display and datalogging of liquid inlet, water outlet, condensate outlet temperatures, steam pressure, liquid flow in GPM, condensate control valve and main steam valve position (via the feedback output of the valves) and heat transfer rate in BTU/hr.

h. Preprogrammed and adjustable alarms for liquid outlet high and low temperature, condensate outlet high temperature, high and low liquid flow as well as high steam pressure. Sensor/valve failure alarm is also standard.
i. The outside disconnect switch to be able to locally shut the power to the panel before opening the door.
j. Integral network switch and 120V power supply receptacle to plug in a laptop for easy tech support. Laptop can be plugged in with the control panel door closed for more safety.
k. Return to last known state after a power outage.

9. Flanged steam trap on condensate outlet, strainer with 40-mesh and blowdown valve on condensate outlet.

E. Tubes: Vertical u-tube type with 3/4 IN. OD minimum cupronickel (90/10 CuNi) tubes suitable for 150 PSIG working pressure and 375 ºF.
F. Shell: Steel pipe with threaded or flanged piping connections and necessary pipe tap connections, steel saddle and attaching U-bolts, prime coated.
G. Heads: Cast iron or fabricated steel with 304 stainless steel tube sheets; flanged for piping connections.
H. Water Chamber and Tube Bundle: Removable for inspection and cleaning.
I. Certification: ASME Certified construction.
J. Accessories:
1. Two (2) steam traps as drip traps.
2. Stainless steel vacuum breaker for steam inlet piping.
3. Stainless steel air vent for the steam inlet piping.
4. Condensate mixer with integrated check valves.

## PART 3 - EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturer's instructions.
B. Complete installation of heat exchanger(s) in compliance with the piping details shown on the drawings and otherwise as indicated in the contract documents.
C. Connect all inlet/outlet piping connections with unions or flanges and shut-off valves.
D. Install pipe support or hangers as required, to prevent the weight of the pipe free from imposing stress on the equipment flanges as recommended by the heat exchanger manufacturer.
E. For all heat exchangers, arrange and install piping, valves, controls, gauges, piping specialties, accessories, etc. to allow for easy disassembly of piping connections, with minimal disturbance to equipment and adjacent piping, in order to provide maintenance and service access. This includes tube removal for shell and tube heat exchangers, drawback space for plate and frame exchangers to allow separating of plates for cleaning or replacement; and replacement or removal of plate type heat exchangers.

F. Install heat exchangers on concrete housekeeping pad. Refer to Division 23 Section "Common Work Results for HVAC".
G. Install all temperature, pressure, flow switches, flow meters, wells, taps, etc., and all other pipe connections as required for the Temperature Control Contractor to complete their work.
H. For liquid side(s) of heat exchangers refer to the following sections for additional requirements:
   1. Division 23 Section "Meters & Gauges for HVAC Piping."
   2. Division 23 Section "Hydronic Piping."
   3. Division 23 Section "Hydronic Specialties."
I. For steam side(s) of heat exchangers refer to the following sections for additional requirements:
   1. Division 23 Section "Meters & Gauges for HVAC Piping"
   2. Division 23 Section "Steam & Condensate Piping, Valves, & Specialties."
J. Pipe water relief valves to nearest floor drain, which will not result as a trip hazard.
K. Pipe steam safety relief valves to outside the building and terminate in manner to avoid dangerous discharge to humans. Provide drip pan elbow at relief valve as recommended by the relief valve manufacturer.
L. Pipe drain valves to nearest floor drain, which will not result as a trip hazard.
M. Unless specifically noted otherwise all heat exchangers shall be insulated in accordance with Division 23 Section "Mechanical Insulation."
N. Where applicable, field install all electrical devices provided by the heat exchanger manufacturer not specified to be factory-installed.

## 3.2 STEAM TO WATER HEAT EXCHANGER TRIM

A. Refer to piping detail on the drawings.
B. Shell: Pressure gauge tapping with pigtail siphon, vacuum breaker
C. Steam Piping: Provide piping as indicated, including control valve with 3-valve bypass, strainer, and pressure gage on inlet; condensate dirt leg, steam trap with 3-valve bypass, strainer, and check valve on outlet; air vent or vacuum breaker on shell.
D. Water Inlet: Thermometer well, pressure gauge tapping, valved drain.
E. Water Outlet: Thermometer well for temperature regulator sensor, ASME rated pressure and temperature relief valve, thermometer well, pressure gauge taps.

## 3.3 WATER TO WATER HEAT EXCHANGER TRIM

A. Refer to piping detail on the drawings.
B. Water Inlets and Outlets: Thermometer wells, pressure gauge pipe taps.
C. Heated Water Outlet: Thermometer well for temperature regulator sensor, ASME rated pressure and temperature relief valve, valved drain.

3.4 FIELD QUALITY CONTROL

A. Provide manufacturer's field representative to test, inspect, instruct, and oversee equipment startup.
B. Inspect for and remove blocks, shipping bolts, and tie-down straps.
C. System Flushing & Cleaning: Do not allow flow thru heat exchanger until the piping systems are flushed and clean free of oils, grease, slag and other contaminates. Provide temporary by-pass piping near piping connections on system side of shut-off valves, to circulate chemical treatment for flushing and cleaning.
D. Operational Test: Place each heat exchanger in to service to confirm it is operating properly.
E. Controls and Safety Switches: Test, adjust, and replace damaged/malfunctioning controls and equipment.
F. Coordinate all temperature control work with the BAS Control Contractor, Refer to Division 23 Section "Sequence of Operations for HVAC Controls."
G. Malfunctioning Units: Remove, replace, and retest as specified above.

3.5 COMMISSIONING

A. Refer to Division 01 Section "General Commissioning Requirements", for commissioning requirements.
B. Refer to Division 23 Section "Commissioning of HVAC" for additional commissioning requirements.
C. Perform functional tests as required by the Manufacturer and the Commissioning Agent's written commissioning plan.

3.6 ADJUSTING AND CLEANING

A. Cleaning: Clean factory-finished surfaces free of dust and debris using an approved cleaning solution and drying cloth. Repair any marred or scratched surfaces with manufacturer's touch-up paint. Unit shall be in "like-new" condition upon turn over to Owner.

3.7 TRAINING

A. Training: For heat exchanger type, provide services of manufacturer's technical representative for two (2) hours, to instruct Owner's personnel in operation and maintenance of equipment. Schedule with Owner and provide at least one (1) week notice to Contractor and Engineer of training date.

**END OF SECTION**

# EMRF Maxi-Therm Space Heating and Domestic Water Heating NIST MEP Submittal

**Products**: Maxi-Therm MCU 1240G-30F-50P and Maxi-Therm MCDW-50G-100F-50P.

**Dimensions**: Vertical Flooded Heat Exchanger (MCU-1240G-30F-50P) 79"L x 62"W x 122"H.  Domestic Hot Water (MCDW-50G-100F-50P) 57"L x 37"W x 85"H.

# VERTICAL FLOODED HEAT EXCHANGER SCHEDULE

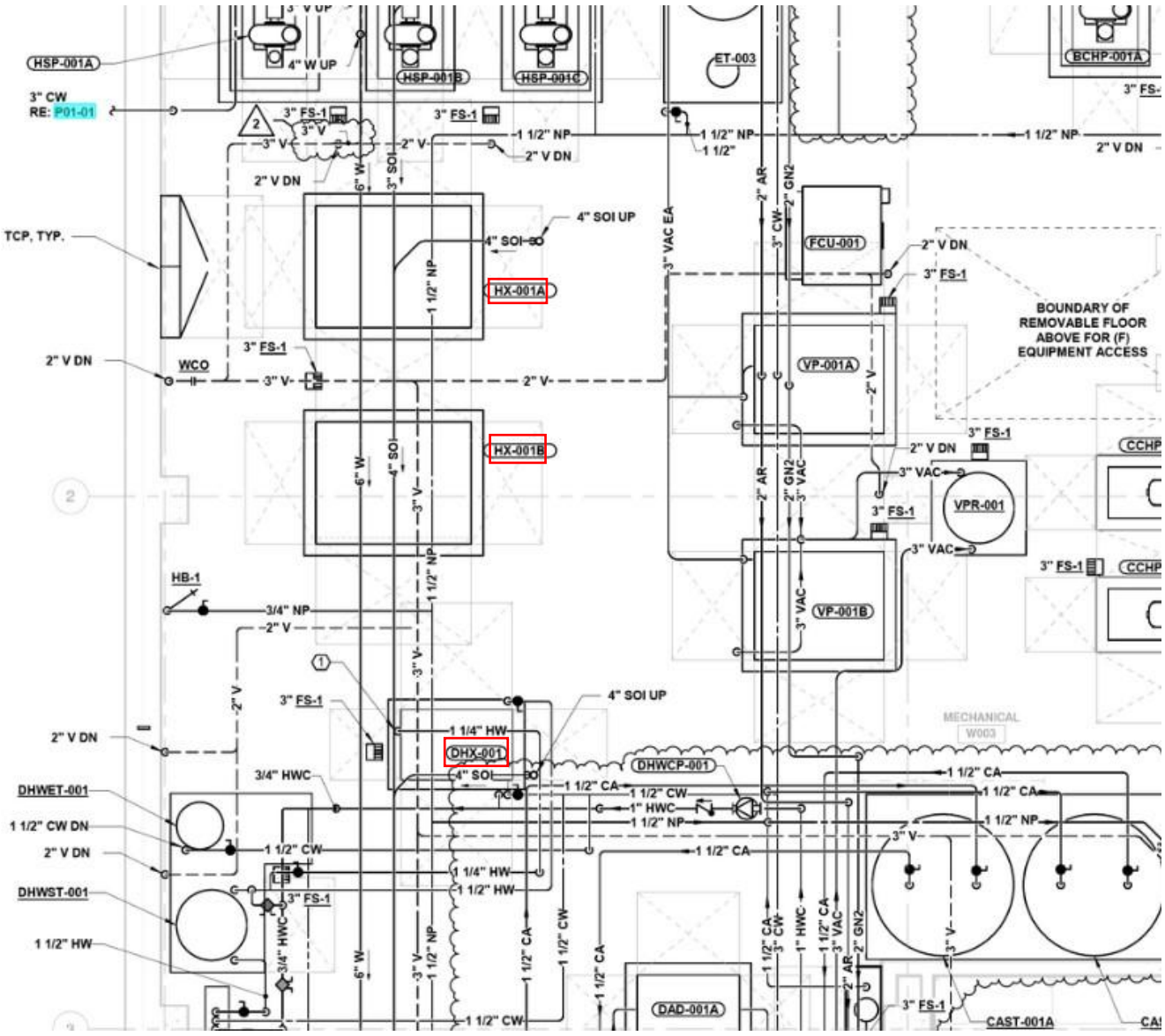
| DESIG. | MFR. | MODEL | SERVICE | TUBE SIDE | | | | | SHELL SIDE | | OPER. WEIGHT (LB) | REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | EWT °F | LWT °F | GPM | MBH | FPD (FT W.C.) | STEAM INLET (PSIG) | LBS/HR | | |
| HX-001A | MAXI-THERM | MCU-1240G-30F-50P | BUILDING HEATING WATER | 150 | 180 | 1,240 | 17,774 | 6.92 | 50 | 17,604 | 6,000 | (1) (2) (3) |
| HX-001B | MAXI-THERM | MCU-1240G-30F-50P | BUILDING HEATING WATER | 150 | 180 | 1,240 | 17,774 | 6.92 | 50 | 17,604 | 6,000 | (1) (2) (3) |
| | | | | | | | | | | | | |

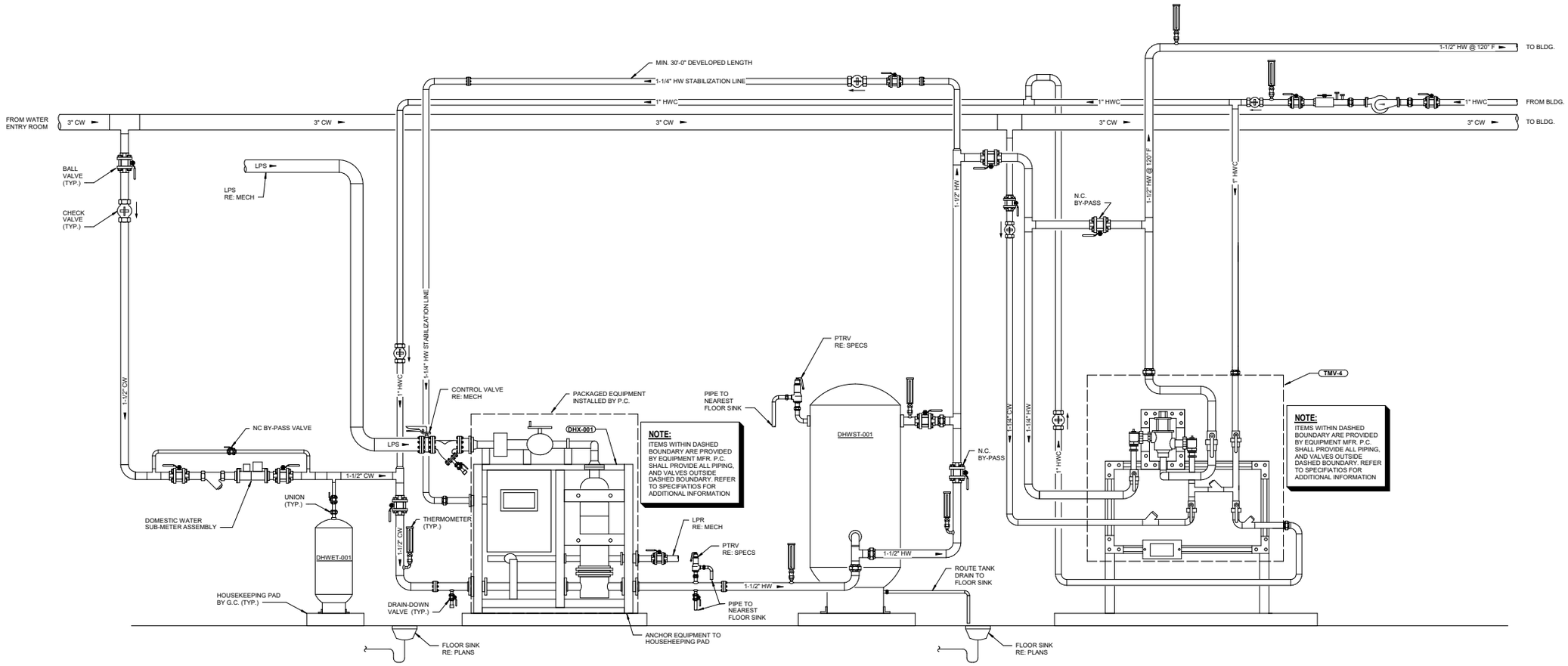
1. EACH HEAT EXCHANGER IS SIZED FOR 100% OF THE BUILDING'S LOAD ALLOWING FOR N+1 REDUNDANCY.
2. HEAT EXCHANGER SIZED FOR USE WITH 30% PROPYLENE GLYCOL IN HEATING WATER.
3. WATER SIDE FOULING FACTOR = 0.0001 HR SQFT DEG F / BTU. STEAM SIDE FOULING FACTOR = 0.00025 HR SQFT DEG F / BTU.

# DOMESTIC HOT WATER GENERATOR (STEAM) SCHEDULE

| DESIG. | MFR. | MODEL | TUBE SIDE | | | | | SHELL SIDE | | THERMAL EFF. | APPROX. OP. WEIGHT (LBS) | REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | EWT °F | LWT °F | GPM | MBH | MAX. P.D. (PSI) | STEAM PRESSURE (PSIG) | LBS/ HR | | | |
| DWHX-001 | MAXITHERM | MCDW-50G-100F-50P | 40 | 140 | 50 | 2,333 | 5 | 50 | 2,500 | 0.98 | 2,000 | (1) (2) |
| | | | | | | | | | | | | |

1. REFER TO MECHANICAL DRAWINGS FOR ADDITIONAL INFORMATION.
2. PRE-PIPED DOUBLE-WALL HEAT EXCHANGER WITH INTEGRATED CONTROLS AND BAS CONNECTIONS.






1 DOMESTIC HOT WATER SYSTEM PIPING SCHEMATIC
SCALE: 1/8" = 1'-0"


Perkins&Will

475 Lincoln Street, Suite100
Denver, CO 80203
t 303.308.0200
f 303.308.0222
www.perkinswill.com

**CONSULTANTS**

CIVIL
JVA
1319 Spruce Street
Boulder, Colorado 80302

LANDSCAPING
Confluence
3457 Ringsby Ct., Suite 223
Denver, Colorado 80216

STRUCTURAL
Martin/Martin
12499 West Colfax Avenue
Lakewood, Colorado 80215

MEP
Shaffer Baucom Engineering & Consulting
3900 S. Wadsworth Boulevard, Suite 600
Lakewood, Colorado 80235

TECHNOLOGY
DATACOM DESIGN GROUP
7600 Burnet Road, Suite 350
Austin, Texas

Facility Operator
Colorado School of Mines
1801 19th Street
Golden, Colorado 80401

OWNER
U.S. Geological Survey
Sunrise Valley Drive
Reston, Virginia 20192

FACILITY LOCATION
Energy & Mineral Research Facility
1000 18th Street
Golden, Colorado 80401

CONTRACTOR
Adolfson & Peterson Construction
797 Ventura Street
Aurora, Colorado 80011


COLORADO REGISTERED GREGORY J. SHAFFER 28149 PROFESSIONAL ENGINEER
1/16/2024

**PROJECT**

**U.S. GEOLOGICAL SURVEY**
Sunrise Valley Drive
Reston, Virginia 20192

**ENERGY & MINERALS RESEARCH FACILITY**
1000 18TH STREET
GOLDEN, CO 80401

COLORADO SCHOOL OF MINES
USGS science for a changing world

**KEYPLAN**

PR-05 - CONFORMED BUIDING PACK - JANUARY 16, 2024

**ISSUE CHART**

| ISSUED | ISSUE | DATE |
|---|---|---|
| 2 | PR-05 - CONFORMED BUILDING PACK | 2024.01.16 |
| 1 | DP-3- INTERIOR PACKAGE | 2023.11.09 |

| | |
|---|---|
| **Job Number** | 221904 |
| **Drawn** | DP / TMH / TW |
| **Checked** | CJ |
| **Approved** | GS |

**TITLE**

**PLUMBING - HOT WATER SYSTEM SCHEMATIC**

**SHEET NUMBER**

**P50-05**

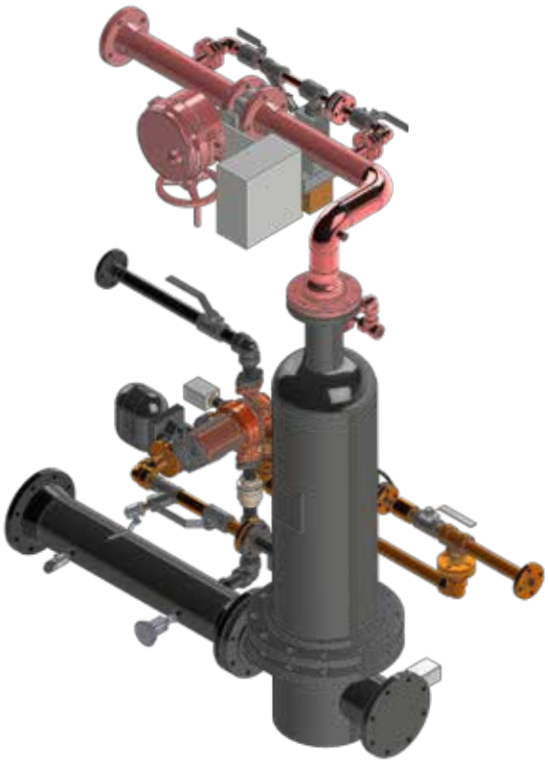
| | |
|---|---|
| SBEC PROJECT #: | 220022 |
| DRAWN BY: | DP/TMH/TW |
| DESIGNED BY: | DH |
| CHECK BY: | CEJ |
| APPROVED BY: | GS |



1/16/2024 6:53:24 PM Autodesk Docs://Mines-SSF/MPF-EMRF-ALL.rvt

# MCU - Simplex

## Building Heat & Process



### Features

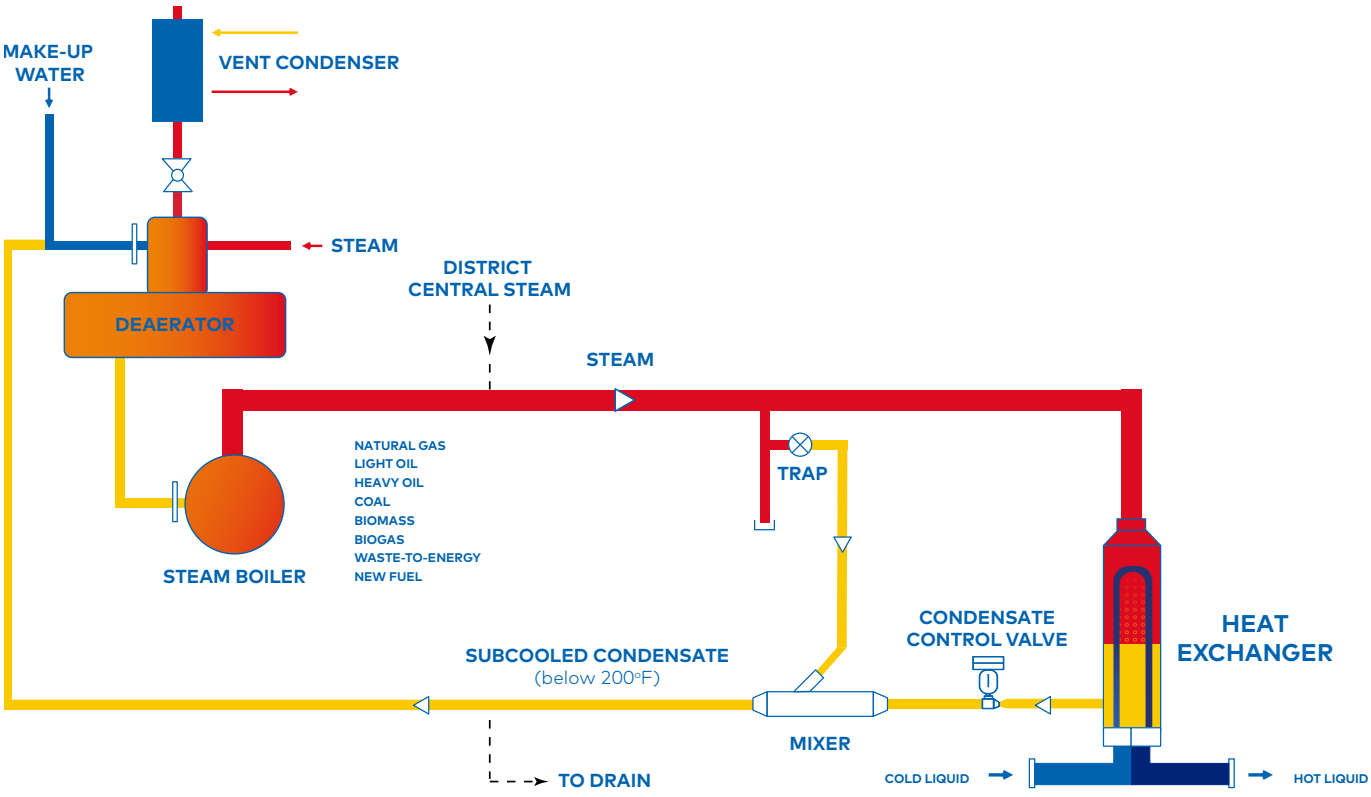
- One vertical flooded U-tube heat exchanger
- Condensate control valve with subcooling condensate return below 200°F, resulting in a 0% flash return system
- Automatic steam start-up and shut-off valve
- Total install costs will be 20% less than any other method
- NEMA 4 control panel with an advanced programmable controller, graphic HMI display including BACnet, Lon, Modbus compatibility and remote access. **We are Internet of Things (IOT) ready with a OPC-UA embedded server**
- 5% to 8% energy savings and reduced carbon footprint
- Liquid stability set point at 2°F

**maxi-therm.net** | 514.351.1001 | info@maxi-therm.net

# MCU - Simplex

## Technical Diagram

***U.S. PATENT #6,857,467 B2***
***CAN. PATENT #2,416,353***




### All Maxi-Therm basic designs do not require:

- Steam pressure reducing station and no steam safety valve to roof
- Condensate return pump station
- Flash tank
- Steam vents to roof

**maxi-therm.net** | 514.351.1001 | info@maxi-therm.net

# MCU – Simplex Feedback

## Domestic Hot Water & Process

### Features

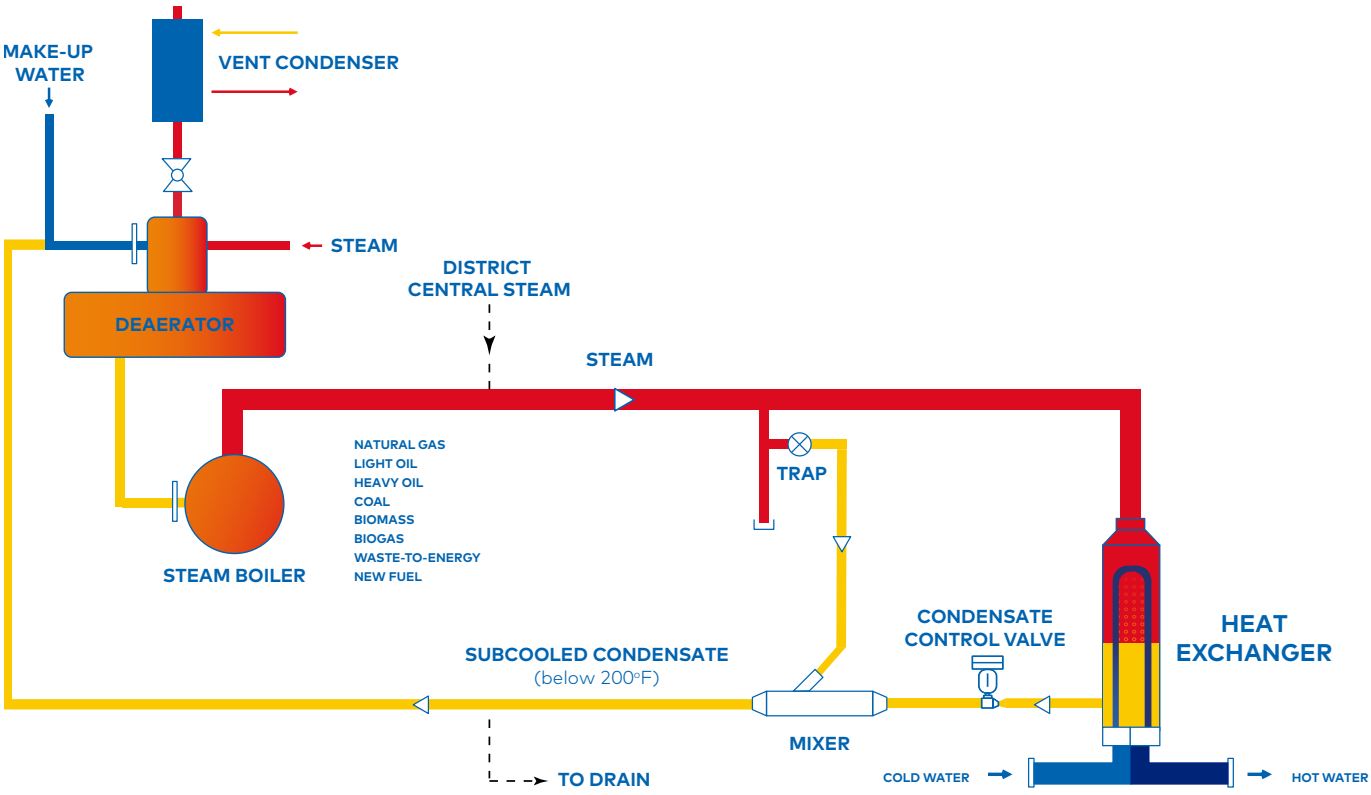
- One vertical flooded U-tube heat exchanger
- Condensate control valve with subcooling condensate return below 200°F, resulting in a 0% flash return system
- Automatic steam start-up and shut-off valve
- Total install costs will be 20% less than any other method
- NEMA 4 control panel with an advanced programmable controller, graphic HMI display including BACnet, Lon, Modbus compatibility and remote access. **We are Internet of Things (IOT) ready with a OPC-UA embedded server**
- 5% to 8% energy savings and reduced carbon footprint
- Liquid stability set point at 2°F

**maxi-therm.net** | 514.351.1001 | info@maxi-therm.net

# MCU – Simplex Feedback

## Technical Diagram

***U.S. PATENT #6,857,467 B2***
***CAN. PATENT #2,416,353***

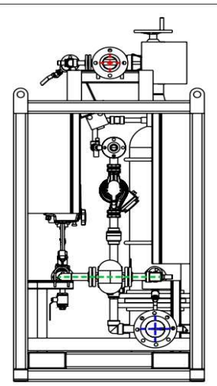



### All Maxi-Therm basic designs do not require:

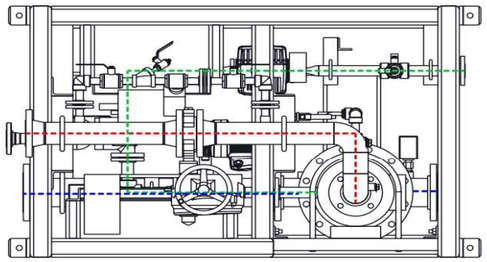
- Steam pressure reducing station and no steam safety valve to roof
- Condensate return pump station
- Flash tank
- Steam vents to roof

**maxi-therm.net** | 514.351.1001 | info@maxi-therm.net

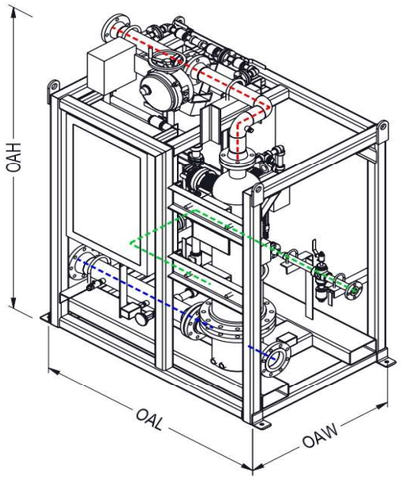
# MCU Simplex for Building Heat or Domestic Hot Water

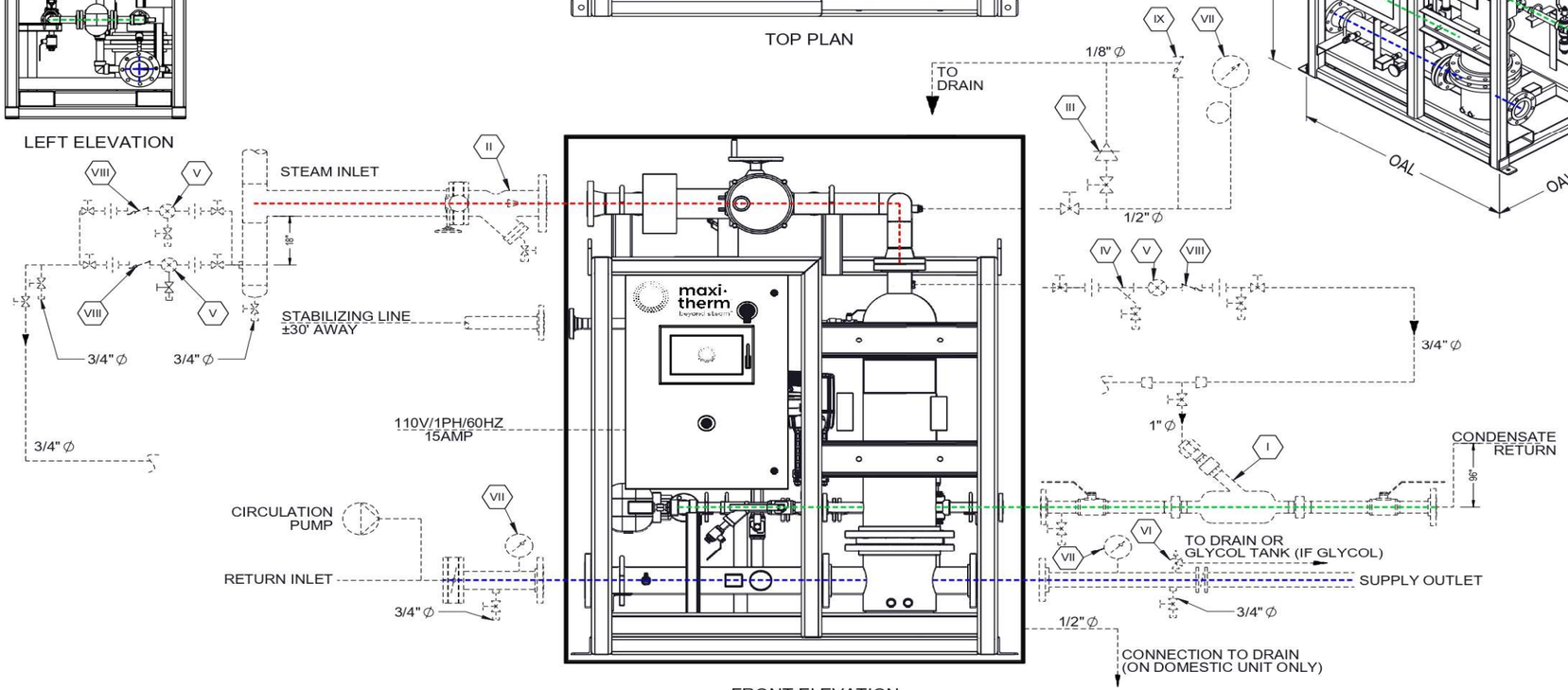


LEFT ELEVATION



TOP PLAN




FRONT ELEVATION

| EQUIPMENT | |
|---|---|
| Condensate Mixer with Integrated Check Valve **by Maxi-Therm** | I |
| Strainer 20 Mesh with Blow Down Valve **by Contractor** | II |
| Air Vent 1/2'' **by Maxi-Therm** | III |
| Strainer with Blow Down Valve **by Contractor** | IV |
| Drip Traps 3/4'' **by Maxi-Therm** | V |
| Pressure Safety Relief Valve **by Contractor** | VI |
| Pressure Gauge and Snubber **by Contractor** | VII |
| Check Valve **by Contractor** | VIII |
| Vacuum Breaker **by Maxi-Therm** | IX |

| Performance Data | |
|---|---|
| Inlet Steam Pressure (PSIG): | 50 |
| Steam Mass Flow (lbs/h): | 16473 |
| Water Flow Rate (US gpm): | 1240 |
| Inlet Water T° (°F): | 150 |
| Outlet Water T°(°F): | 180 |
| Liquid Pressure Drop (PSI): | 3 |

| APPROXIMATED DIMENSIONS (in) | | | | | | | | Approx. Weight (lbs) |
|---|---|---|---|---|---|---|---|---|
| OAL | OAW | OAH | Liquid In/Out | Stabilizing Line | Steam Inlet | Condensate | | |
| 79 | 62 | 122 | 10 | 2,5 | 8 | 2 | | 5900 |

| Model: |
|---|
| MCU-1240G-30F-50P |

| NOTES |
|---|
| STEAM PIPING: CARBON STEEL SCH40<br>LIQUID PIPING: CARBON STEEL SCH40 |
| DO NOT INSULATE UNIT BEFORE START-UP |
| **DIMENSIONAL CHANGES MAY BE REQUIRED DURING FABRICATION. ANY CHANGES WILL BE CONFIRMED PRIOR TO SHIPMENT** |
| THE CIRCULATING PUMP MUST MAINTAIN A CONSTANT FLOW OF 15% OF THE TOTAL FLOW AND MUST PUSH THROUGH THE HEAT EXCHANGER |
| IF THE STEAM PRESSURE AT THE HEAT EXCHANGER IS GREATER THAN THE LIQUID PRESSURE TO BE HEATED, THE LIQUID PRESSURE MUST BE AT A MINIMUM OF 25 PSIG |
| RECOMMENDED CLEARANCE: 36'' ALL AROUND |
| ITEMS SHOWN IN DOTTED LINES MUST BE SUPPLIED & INSTALLED BY CONTRACTOR |

Maxi-Therm
514-351-1001

# EVALUATION: COST COMPARAISON WITH EXCHANGER ON FULL LOAD

| | CONVENTIONAL | MAXI-THERM | M = Million |
|---|---|---|---|
| Pressure | **15** | **50** | PSIG |
| Energy Transferred | 17,774,487 | 17,774,487 | Btu/h |
| Steam Flow | 18801 | 17604 | lbs/h |
| Flash Rate | 4.0 | 0.0 | % |
| Atmospheric Flash Loss | 744.6 | 0.0 | lbs/h |
| Energy to Heat Condensate | 2.131 | 1.725 | MBtu/h |
| Energy to Heat Make Up | 0.170 | 0.000 | MBtu/h |
| Energy to Vaporize | 17.141 | 16.049 | MBtu/h |
| **Total:** | 19.441 | 17.774 | **MBtu/h** |

| | | |
|---|---|---|
| ***Difference = Savings*** | 1.67 | **MBtu/h** |
| | 8.6 | **%** |
| **Boiler Efficiency** | 0.80 | |
| ***Total Savings*** | 2.08 | **MBtu/h** |
| | 10.3 | **%** |

| ***Dollar Savings at*** | | |
|---|---|---|
| ***$10.00*** | ***per 1000 lbs of steam*** | |
| ***2,000*** | ***hrs / year*** | ***$42,073*** |
| ***3,000*** | ***hrs / year*** | ***$63,109*** |

| ***Carbon Footprint Reduction (using natural gas):*** | | |
|---|---|---|
| ***0.05843*** | ***ton of $CO_2$ per Million BTU*** | |
| ***2,000*** | ***hrs / year*** | ***243.5*** tons of $CO_2$ per year |
| ***3,000*** | ***hrs / year*** | ***365.2*** tons of $CO_2$ per year |

**How does the Maxi-Therm system save so much?**

***1. It condenses steam and extracts heat from the condensate.***

***2. It consumes less steam because it extracts energy from condensate.***

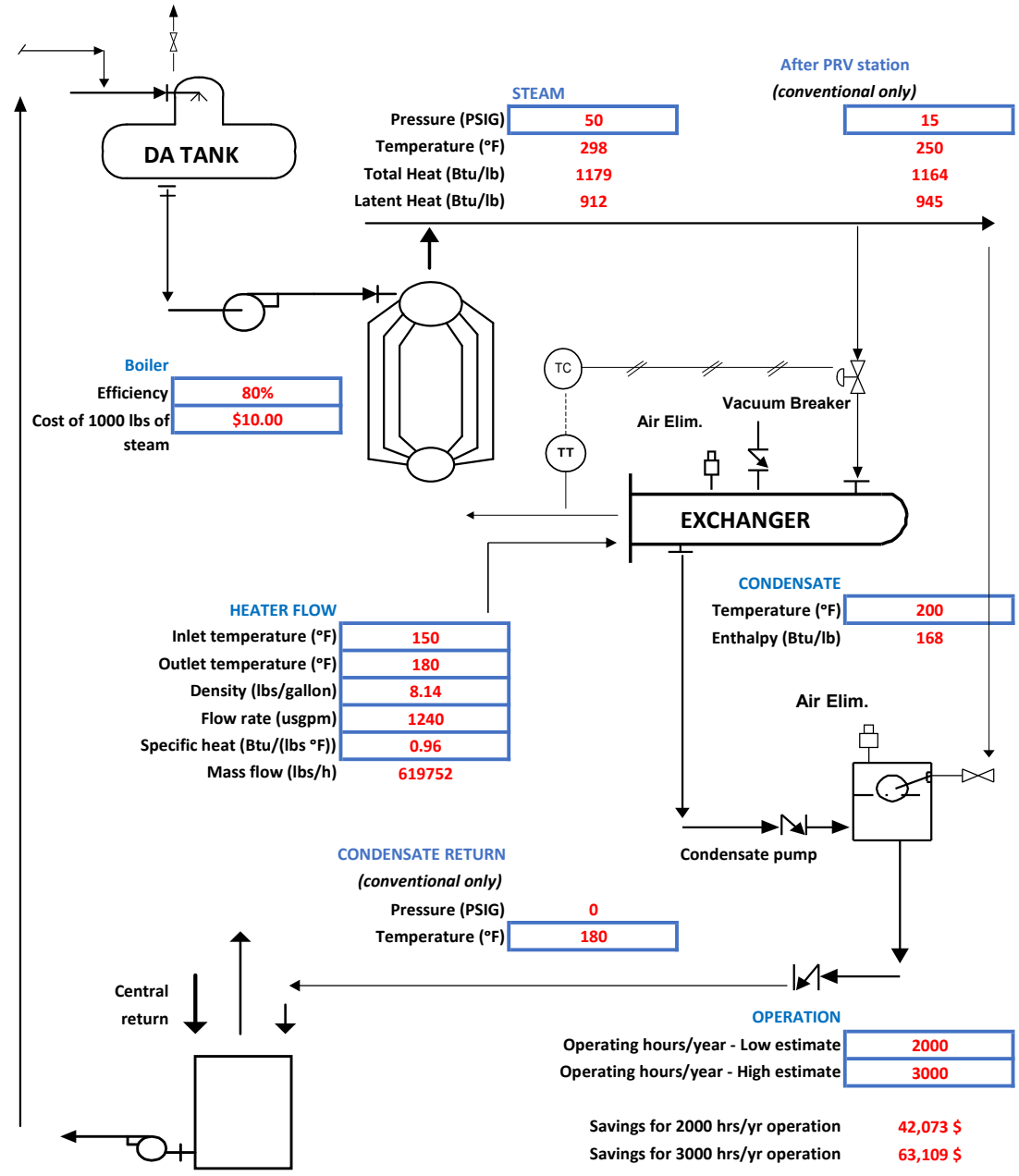
***3. It creates NO FLASH STEAM.***

***4. The conventional system does create flash steam.***

***5. The boiler and DA tank have to heat up the water lost by flash steam.***

maxi therm
beyond steam™

# DATA INPUT FORM




| STEAM | | After PRV station (conventional only) |
|---|---|---|
| Pressure (PSIG) | 50 | 15 |
| Temperature (°F) | 298 | 250 |
| Total Heat (Btu/lb) | 1179 | 1164 |
| Latent Heat (Btu/lb) | 912 | 945 |

| Boiler | |
|---|---|
| Efficiency | 80% |
| Cost of 1000 lbs of steam | $10.00 |

| HEATER FLOW | |
|---|---|
| Inlet temperature (°F) | 150 |
| Outlet temperature (°F) | 180 |
| Density (lbs/gallon) | 8.14 |
| Flow rate (usgpm) | 1240 |
| Specific heat (Btu/(lbs °F)) | 0.96 |
| Mass flow (lbs/h) | 619752 |

| CONDENSATE | |
|---|---|
| Temperature (°F) | 200 |
| Enthalpy (Btu/lb) | 168 |

| CONDENSATE RETURN (conventional only) | |
|---|---|
| Pressure (PSIG) | 0 |
| Temperature (°F) | 180 |

| OPERATION | |
|---|---|
| Operating hours/year - Low estimate | 2000 |
| Operating hours/year - High estimate | 3000 |

| | |
|---|---|
| Savings for 2000 hrs/yr operation | 42,073 $ |
| Savings for 3000 hrs/yr operation | 63,109 $ |

| | |
|---|---|
| $CO_2$ Emissions using natural gas (ton of $CO_2$ per Million BTU) | 0.05843 |

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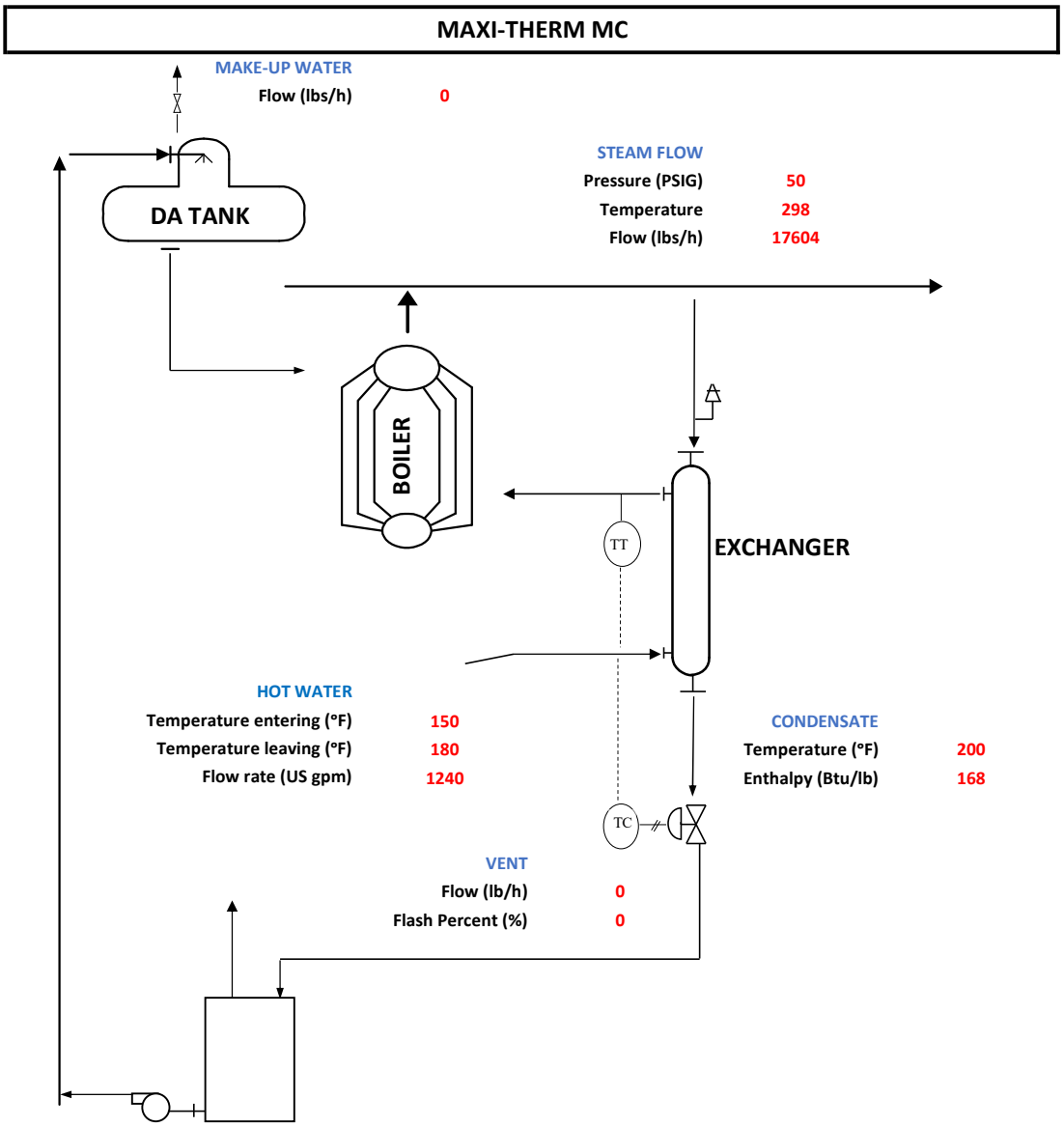
beyond steam™

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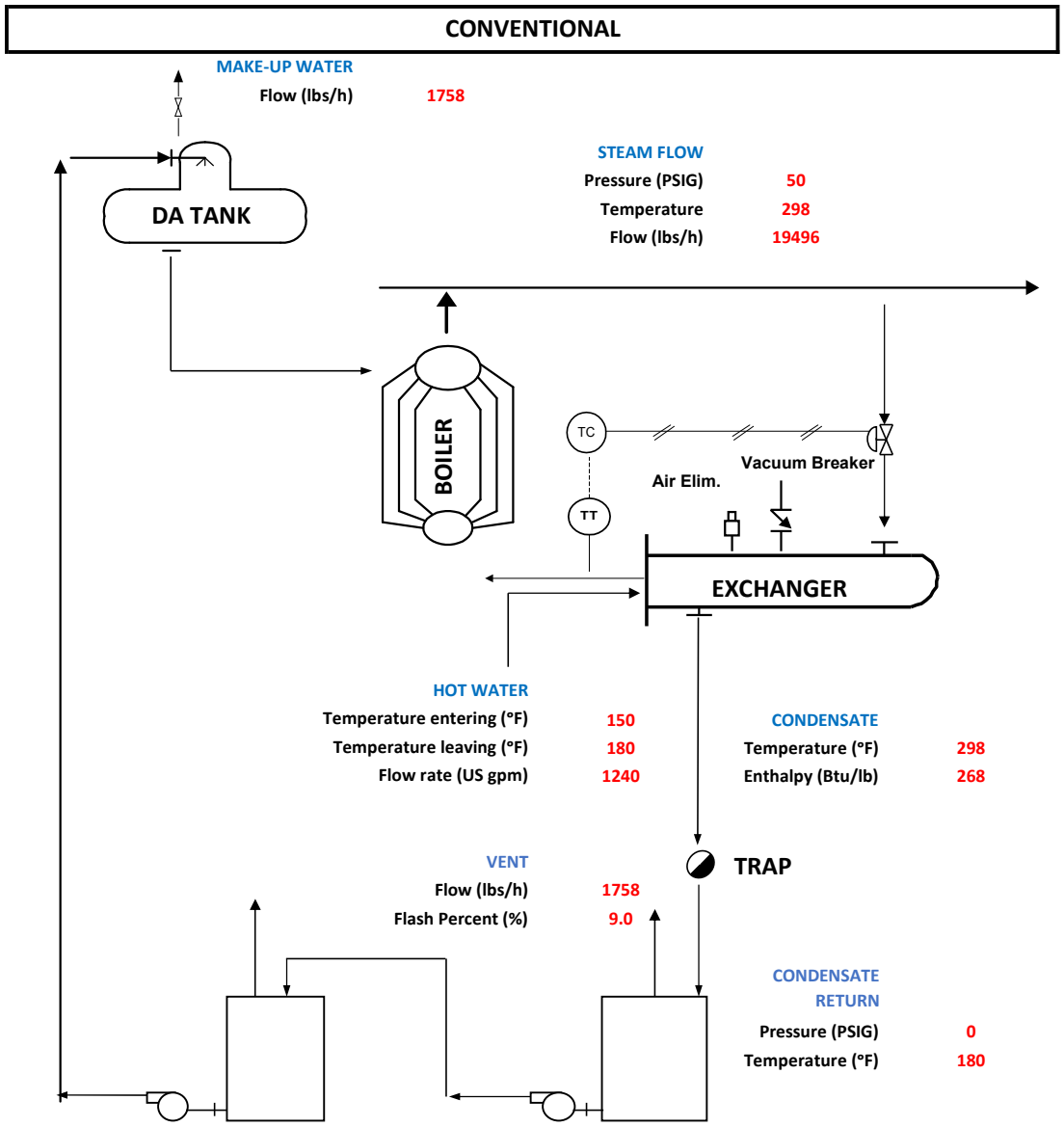
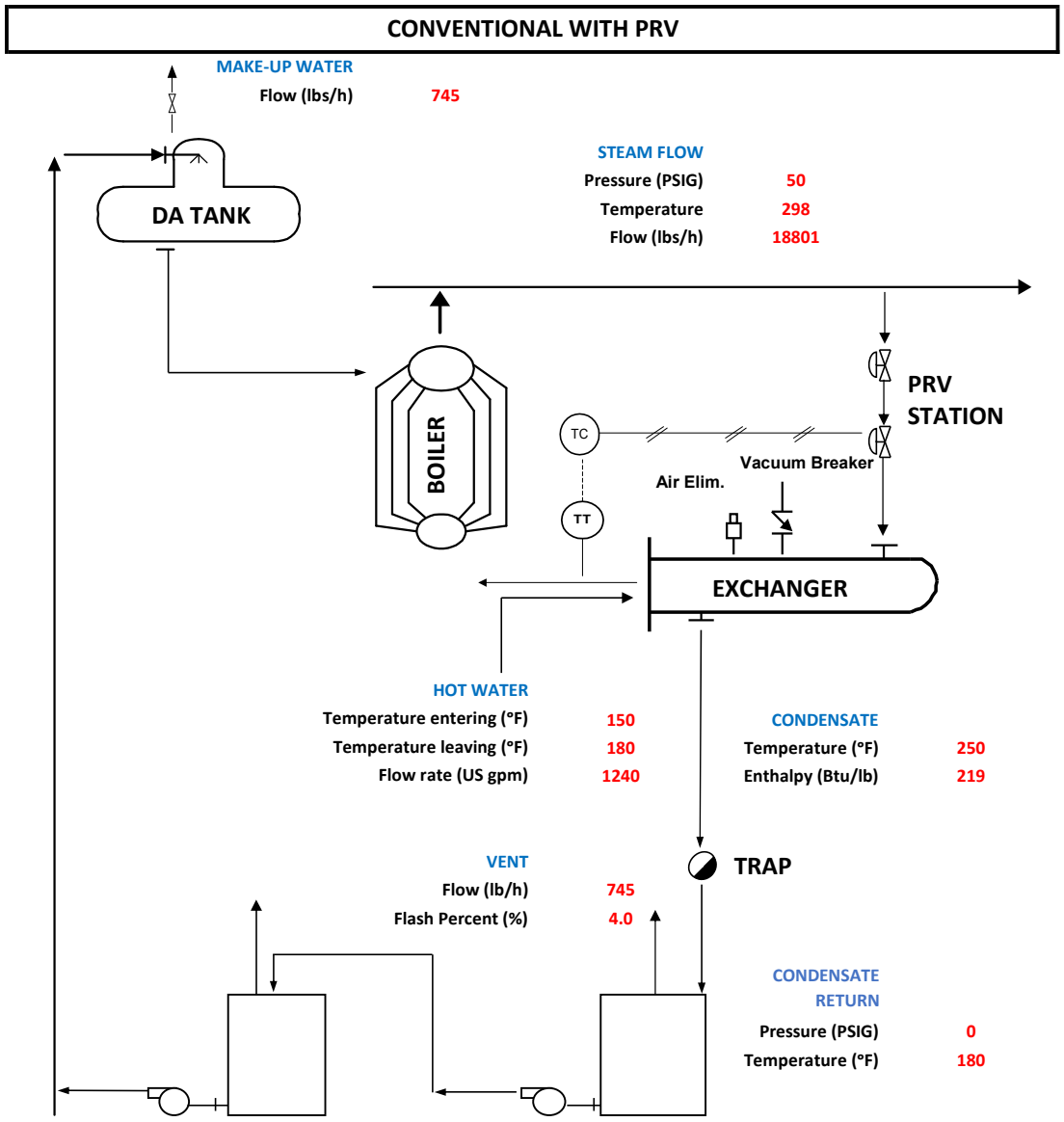
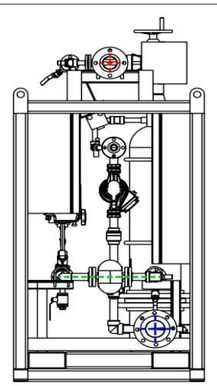
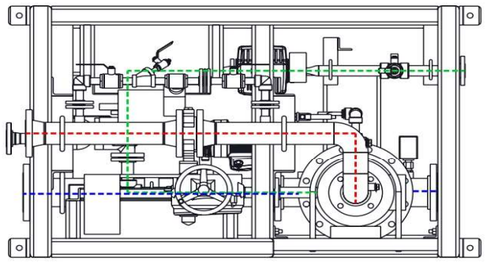

CONVENTIONAL
MAKE-UP WATER
Flow (lbs/h) 1758
DA TANK
STEAM FLOW
Pressure (PSIG) 50
Temperature 298
Flow (lbs/h) 19496
BOILER
TC
TT
Air Elim.
Vacuum Breaker
EXCHANGER
HOT WATER
Temperature entering (°F) 150
Temperature leaving (°F) 180
Flow rate (US gpm) 1240
CONDENSATE
Temperature (°F) 298
Enthalpy (Btu/lb) 268
TRAP
VENT
Flow (lbs/h) 1758
Flash Percent (%) 9.0
CONDENSATE RETURN
Pressure (PSIG) 0
Temperature (°F) 180


CONVENTIONAL WITH PRV
MAKE-UP WATER
Flow (lbs/h) 745
DA TANK
STEAM FLOW
Pressure (PSIG) 50
Temperature 298
Flow (lbs/h) 18801
BOILER
TC
TT
PRV
STATION
Vacuum Breaker
Air Elim.
EXCHANGER
HOT WATER
Temperature entering (°F) 150
Temperature leaving (°F) 180
Flow rate (US gpm) 1240
CONDENSATE
Temperature (°F) 250
Enthalpy (Btu/lb) 219
TRAP
VENT
Flow (lb/h) 745
Flash Percent (%) 4.0
CONDENSATE RETURN
Pressure (PSIG) 0
Temperature (°F) 180

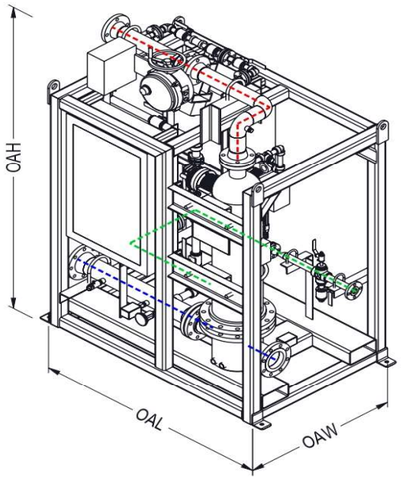
# MCU Simplex for Building Heat or Domestic Hot Water

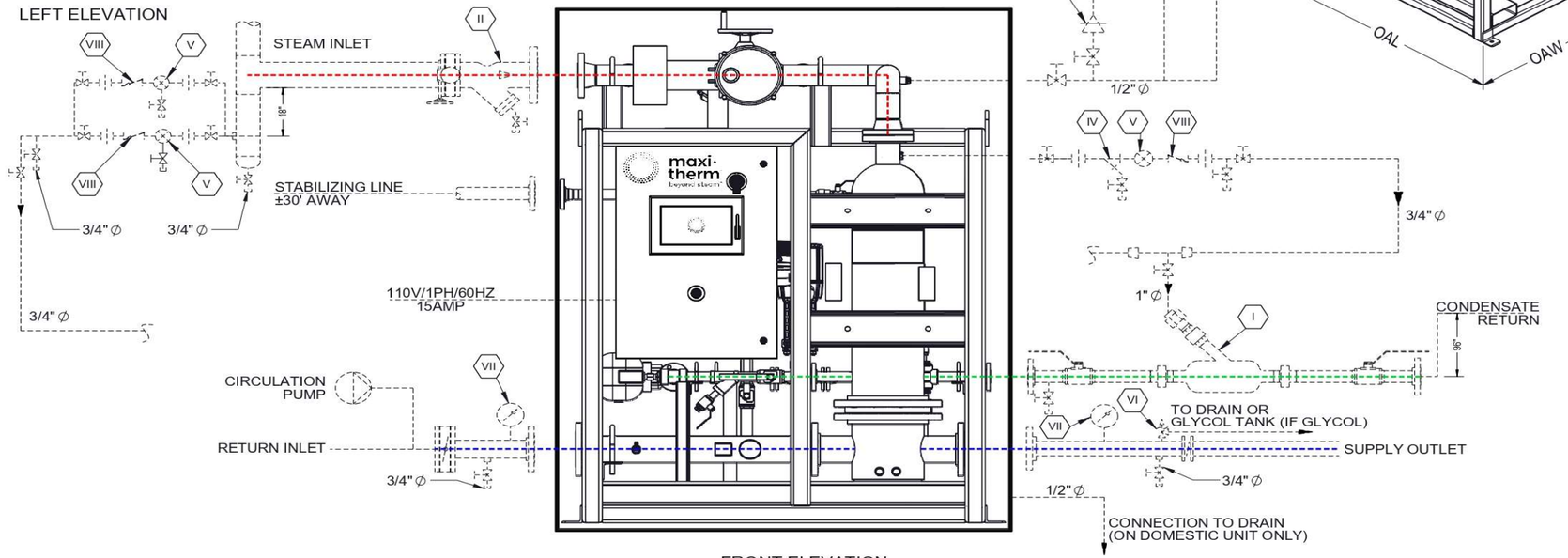


LEFT ELEVATION



TOP PLAN




FRONT ELEVATION

| Performance Data | |
|---|---|
| Inlet Steam Pressure (PSIG): | 50 |
| Steam Mass Flow (lbs/h): | 2475 |
| Water Flow Rate (US gpm): | 50 |
| Inlet Water T° (°F): | 40 |
| Outlet Water T°(°F): | 140 |
| Liquid Pressure Drop (PSI): | 5 |

| APPROXIMATED DIMENSIONS (in) | | | | | | | | Approx. Weight (lbs) |
|---|---|---|---|---|---|---|---|---|
| OAL | OAW | OAH | Liquid In/Out | Stabilizing Line | Steam Inlet | Condensate | | |
| 57 | 37 | 85 | 2 | 1,25 | 3 | 1,25 | | 1800 |

| Model: |
|---|
| MCDW-50G-100F-50P |

maxi·therm™
beyond steam™

| EQUIPMENT | |
|---|---|
| Condensate Mixer with Integrated Check Valve **by Maxi-Therm** | I |
| Strainer 20 Mesh with Blow Down Valve **by Contractor** | II |
| Air Vent 1/2'' **by Maxi-Therm** | III |
| Strainer with Blow Down Valve **by Contractor** | IV |
| Drip Traps 3/4'' **by Maxi-Therm** | V |
| Pressure Safety Relief Valve **by Contractor** | VI |
| Pressure Gauge and Snubber **by Contractor** | VII |
| Check Valve **by Contractor** | VIII |
| Vacuum Breaker **by Maxi-Therm** | IX |

| NOTES |
|---|
| STEAM PIPING: CARBON STEEL SCH40<br>LIQUID PIPING: CARBON STEEL SCH40 |
| DO NOT INSULATE UNIT BEFORE START-UP |
| **DIMENSIONAL CHANGES MAY BE REQUIRED DURING FABRICATION. ANY CHANGES WILL BE CONFIRMED PRIOR TO SHIPMENT** |
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| RECOMMENDED CLEARANCE: 36'' ALL AROUND |
| ITEMS SHOWN IN DOTTED LINES MUST BE SUPPLIED & INSTALLED BY CONTRACTOR |

Maxi-Therm
514-351-1001

# EVALUATION: COST COMPARAISON WITH EXCHANGER ON FULL LOAD

| | CONVENTIONAL | MAXI-THERM | M = Million |
|---|---|---|---|
| Pressure | **15** | **50** | PSIG |
| Energy Transferred | 2 499 000 | 2 499 000 | Btu/h |
| Steam Flow | 2643 | 2475 | lbs/h |
| Flash Rate | 4,0 | 0,0 | % |
| Atmospheric Flash Loss | 104,7 | 0,0 | lbs/h |
| Energy to Heat Condensate | 0,300 | 0,243 | MBtu/h |
| Energy to Heat Make Up | 0,024 | 0,000 | MBtu/h |
| Energy to Vaporize | 2,410 | 2,256 | MBtu/h |
| **Total:** | 2,733 | 2,499 | **MBtu/h** |

| | | |
|---|---|---|
| ***Difference = Savings*** | 0,23 | **MBtu/h** |
| | 8,6 | **%** |
| **Boiler Efficiency** | 0,80 | |
| ***Total Savings*** | 0,29 | **MBtu/h** |
| | 10,3 | **%** |

| ***Dollar Savings at*** | | |
|---|---|---|
| ***$10,00*** | ***per 1000 lbs of steam*** | |
| ***2 000*** | ***hrs / year*** | ***$5 915*** |
| ***3 000*** | ***hrs / year*** | ***$8 873*** |

| ***Carbon Footprint Reduction (using natural gas):*** | | |
|---|---|---|
| ***0,05843*** | ***ton of $CO_2$ per Million BTU*** | |
| ***2 000*** | ***hrs / year*** | ***34,2*** tons of $CO_2$ per year |
| ***3 000*** | ***hrs / year*** | ***51,3*** tons of $CO_2$ per year |

**How does the Maxi-Therm system save so much?**

***1. It condenses steam and extracts heat from the condensate.***

***2. It consumes less steam because it extracts energy from condensate.***

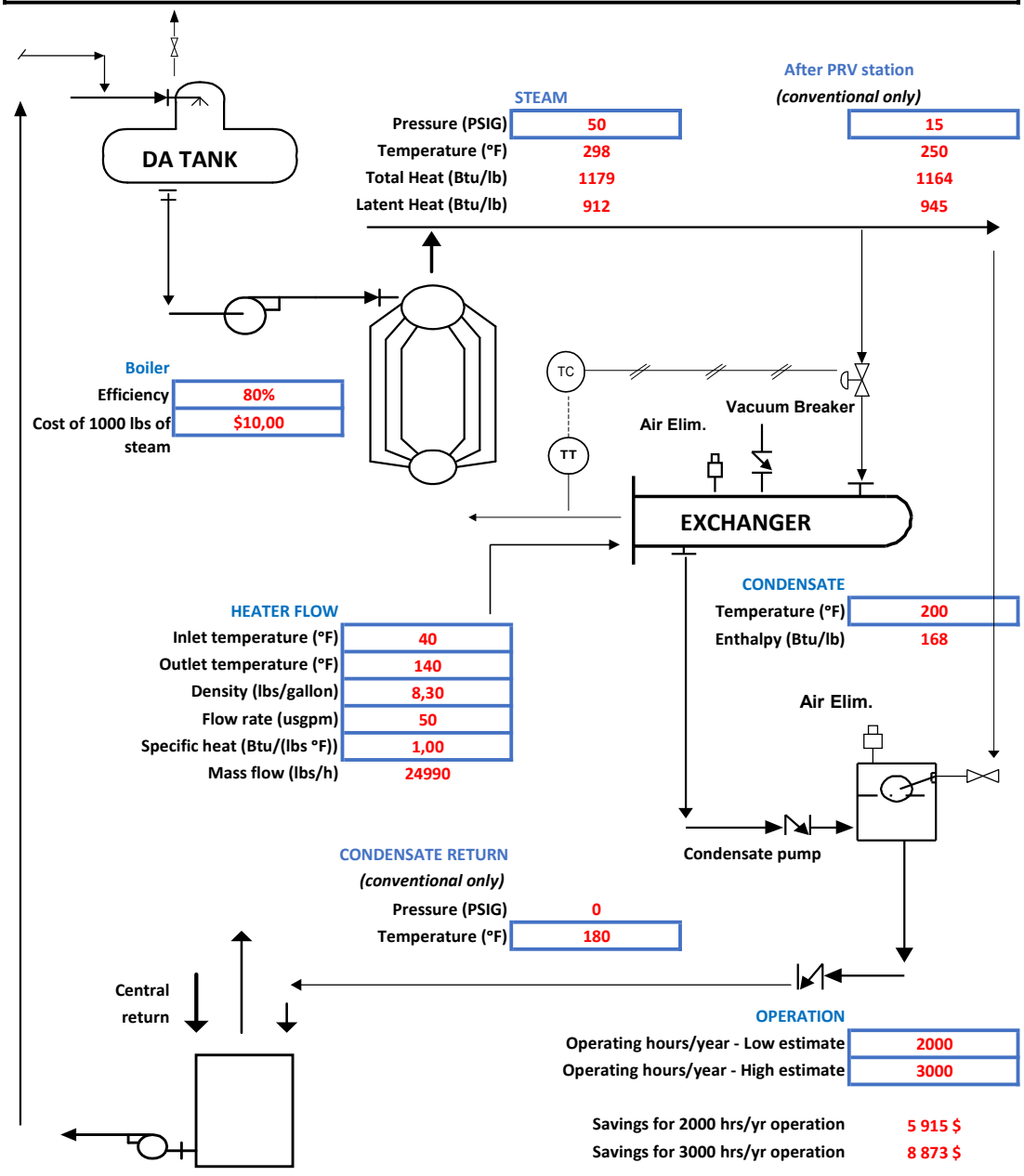
***3. It creates NO FLASH STEAM.***

***4. The conventional system does create flash steam.***

***5. The boiler and DA tank have to heat up the water lost by flash steam.***

maxi therm
beyond steam™

# DATA INPUT FORM




| STEAM | | After PRV station (conventional only) |
|---|---|---|
| Pressure (PSIG) | 50 | 15 |
| Temperature (°F) | 298 | 250 |
| Total Heat (Btu/lb) | 1179 | 1164 |
| Latent Heat (Btu/lb) | 912 | 945 |

**OPERATION**

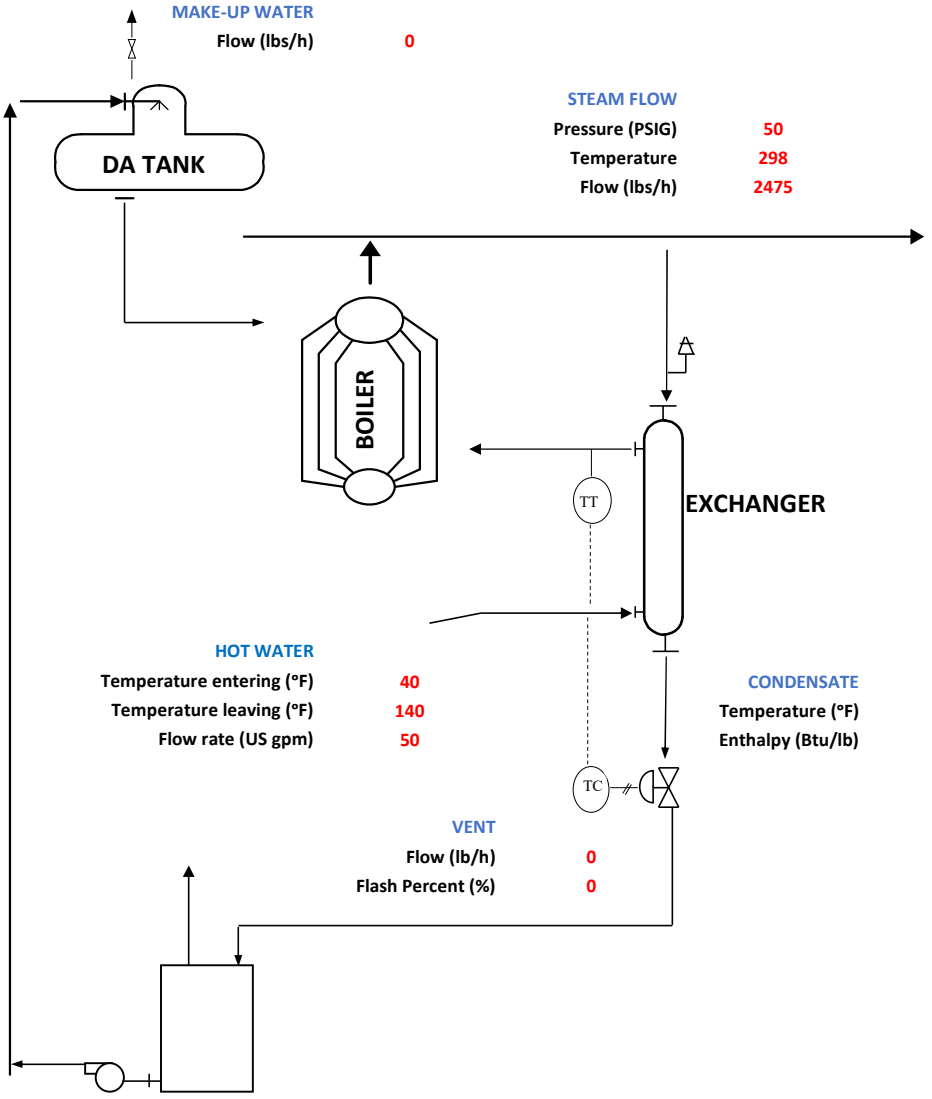
| | |
|---|---|
| Operating hours/year - Low estimate | 2000 |
| Operating hours/year - High estimate | 3000 |

| | |
|---|---|
| Savings for 2000 hrs/yr operation | 5 915 $ |
| Savings for 3000 hrs/yr operation | 8 873 $ |

| | |
|---|---|
| $CO_2$ Emissions using natural gas (ton of $CO_2$ per Million BTU) | 0,05843 |

maxi therm
beyond steam™

# MAXI-THERM MC




maxi therm
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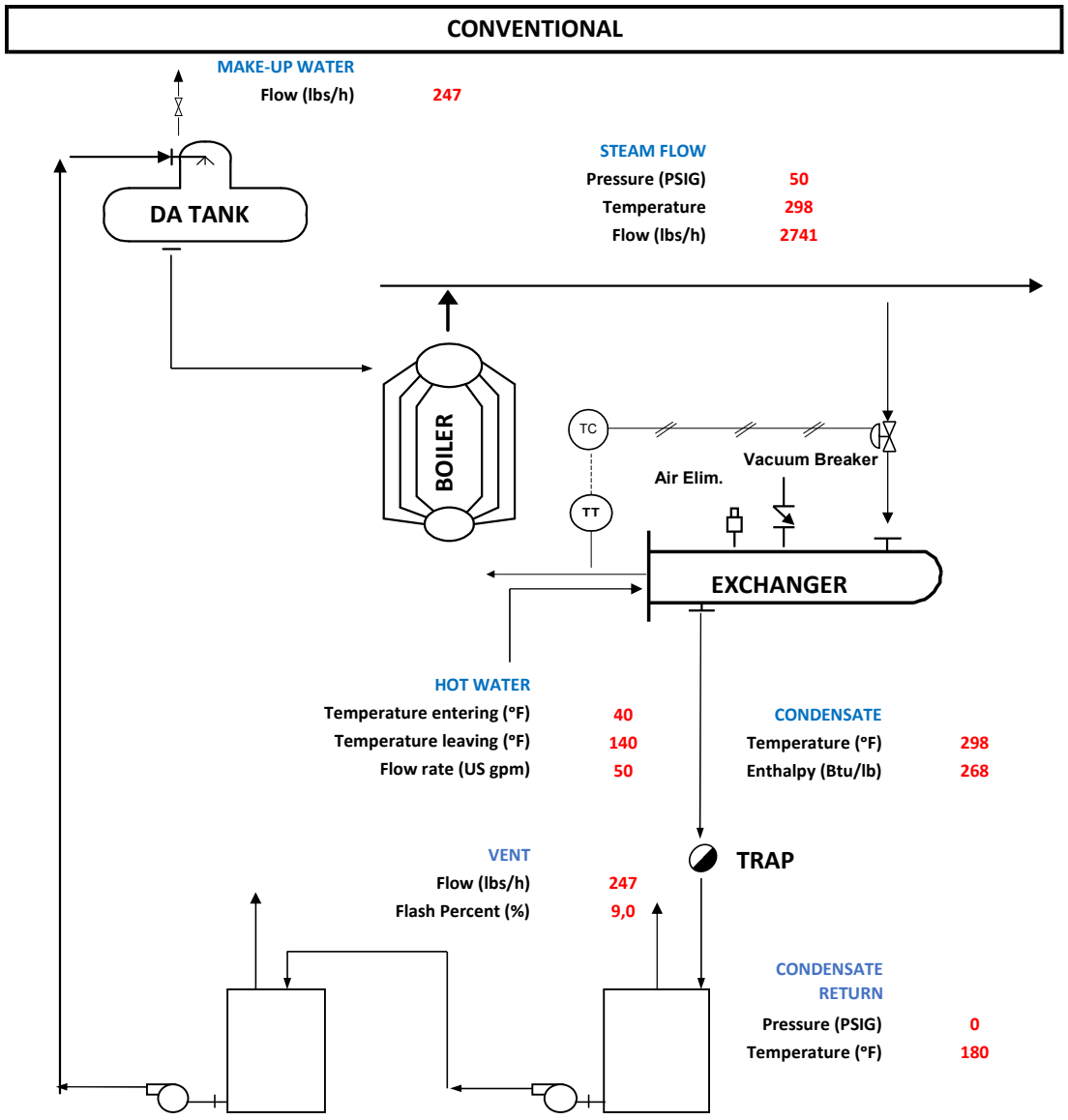


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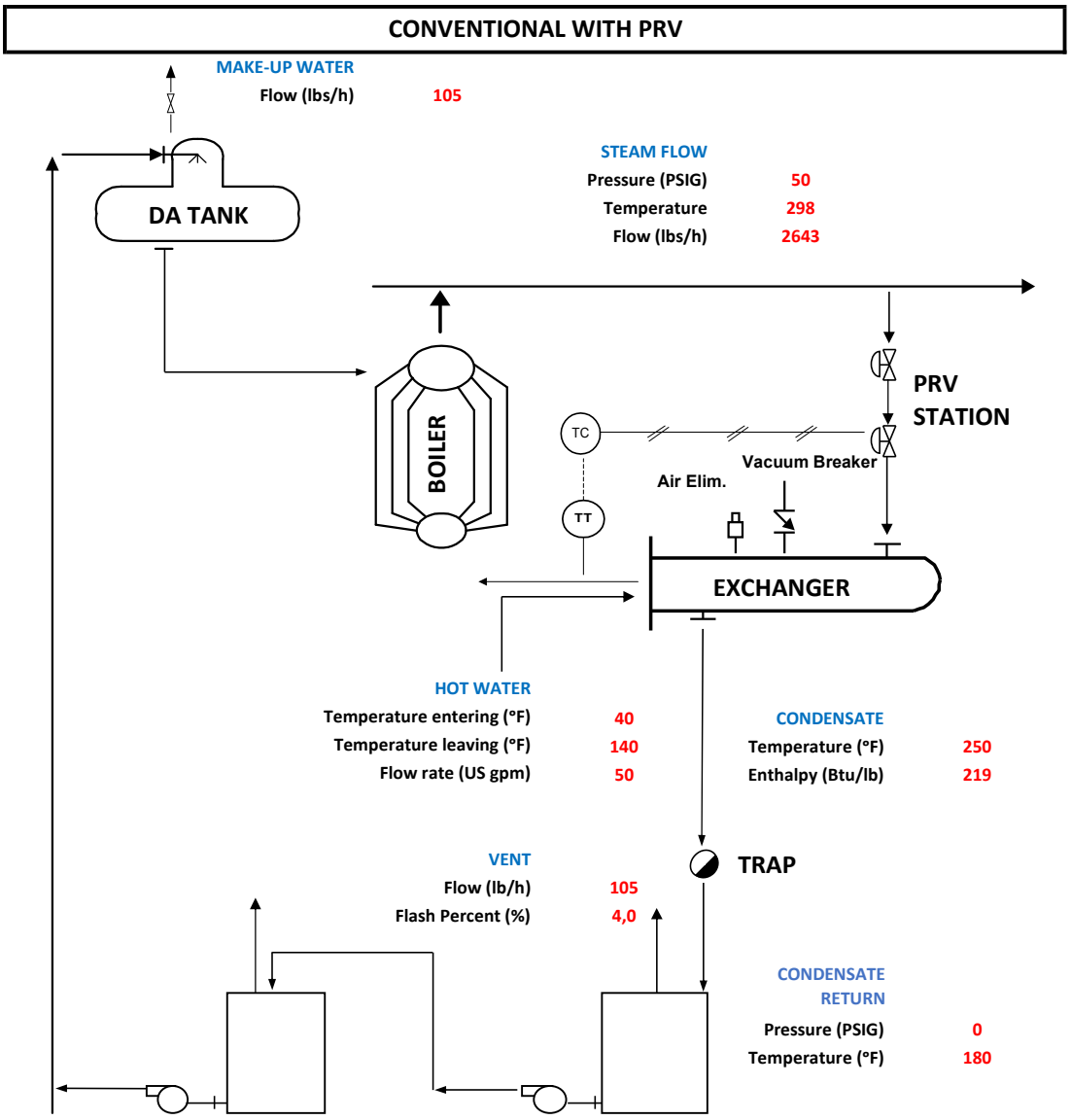
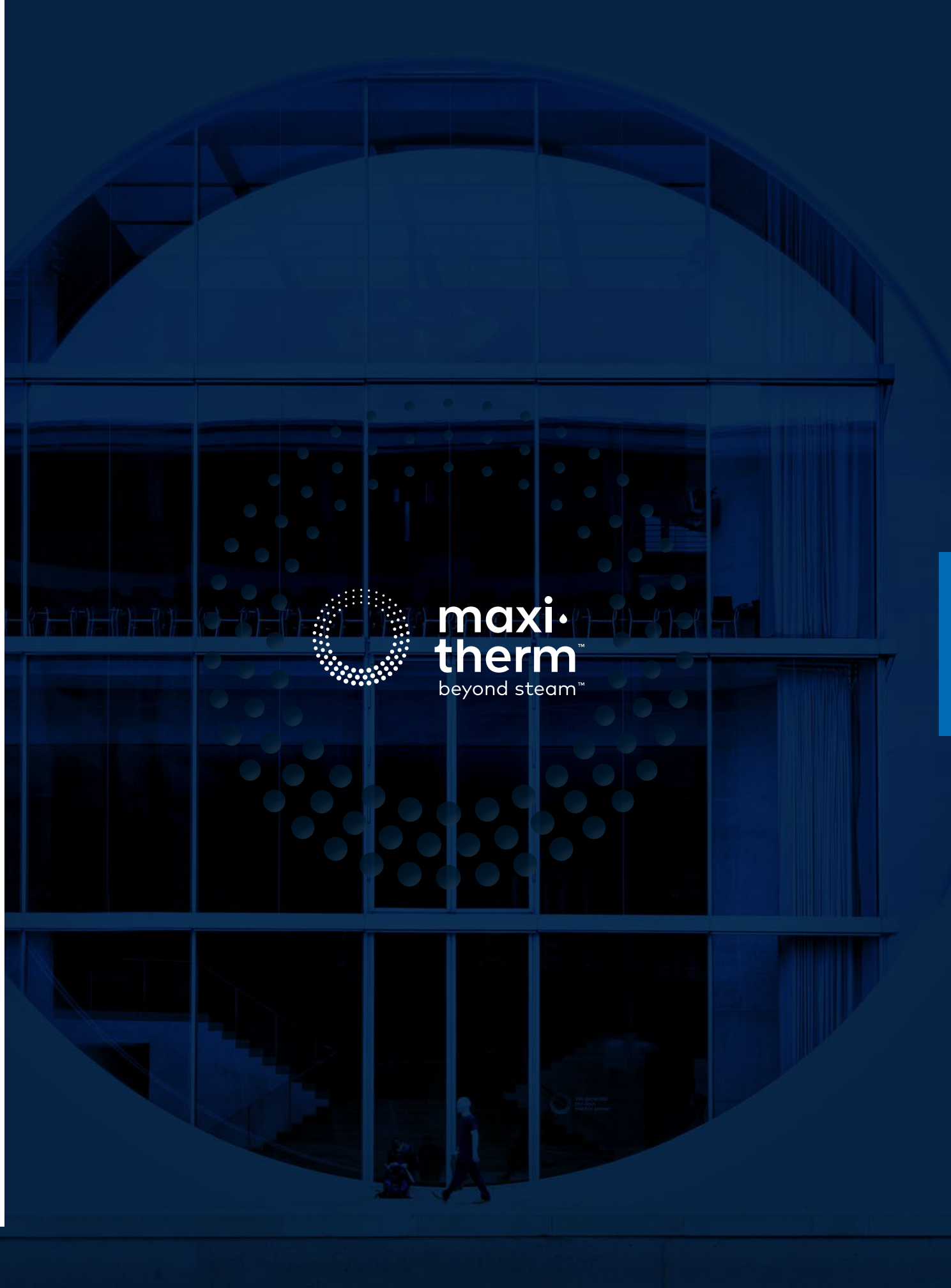
beyond steam™


CONVENTIONAL WITH PRV
MAKE-UP WATER
Flow (lbs/h) 105
DA TANK
STEAM FLOW
Pressure (PSIG) 50
Temperature 298
Flow (lbs/h) 2643
BOILER
TC
TT
PRV
STATION
Vacuum Breaker
Air Elim.
EXCHANGER
HOT WATER
Temperature entering (°F) 40
Temperature leaving (°F) 140
Flow rate (US gpm) 50
CONDENSATE
Temperature (°F) 250
Enthalpy (Btu/lb) 219
VENT
Flow (lb/h) 105
Flash Percent (%) 4,0
TRAP
CONDENSATE RETURN
Pressure (PSIG) 0
Temperature (°F) 180



AN ENLIGHTENING

# dream



## WE BELIEVE IN A WORLD THAT CAN UNITE AND STRIVE

for an unprecedented level of self-sustainability.

After spending 30 years working in the industrial and institutional side of steam optimization, I needed a new challenge and a higher purpose. So when my wife Jacqueline suggested in 1998 to start our own business, I didn't hesitate and decided to take a leap of faith. I secured a bank loan and began setting up a world-class research and development laboratory. We put together a team of experts who believed in my ambition and we tested, re-tested and enhanced European methods until we finally came up with a truly unique and innovative concept in 2004.

We reached our first significant milestone when we were granted US and Canadian patent rights in 2004. The following year, my visionary instincts were recognized by ASHRAE, as I received a coveted Technology Award.

In 2005, we founded Maxi-Therm Inc., and today I am proud to say that our dedicated team works with highly qualified staff resources from 21 exclusive US partners to continuously innovate in the steam solutions market.

**Jacqueline Labrosse Lach**
Co-Founder

**Raymond Lach**
CEO & Founder

maxi·therm™
beyond steam™

# rethinking

## THE STATUS QUO

# vision

The goal at Maxi-Therm was to put together a team of passionate, visionary people dedicated to finding innovative ways of using steam for building heat and domestic hot water. What started as a small business has grown into a large company with exclusive representation in most major US cities. Our people are human, engaged and committed to the vision of contributing to a more sustainable world.

"We are all Maxi-Therm."

- Walter Kuzia

# OUR CAPACITY

- **5 PATENT DESIGN CONCEPTS**
  Maxi-Therm is an innovative package solution manufacturer with four patent design concepts, as well as an international patent pending zero-lag feature.

- **STRUCTURAL & SEISMIC DESIGN FEATURES**
  Maxi-Therm package solutions are engineered with structural and seismic design features. Our service capacity includes local certified tech and engineering in New Jersey, Massachusetts and Chicago.

- **BRAINSTORMING TEAM**
  Our engineering group employs a brainstorming team consisting of specialized senior professionals who continuously update and modernize our concepts, both mechanically and electronically.

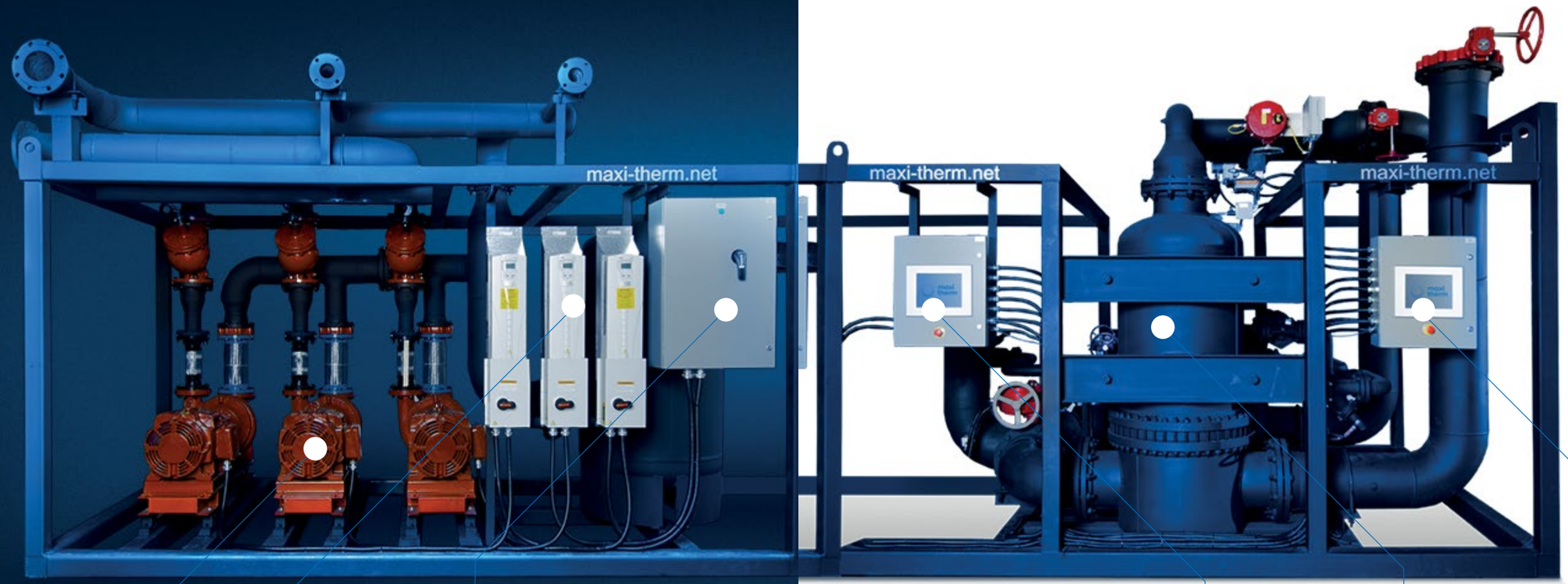
- **15,000 SQ FT**
  Maxi-Therm has four manufacturing and engineering facilities totalizing 15,000 sq ft to assist customers in purchasing the highest quality products and services. One of our facilities meets ISO 9001 quality management and quality assurance standards.

STEAM HAS ALL THE

# answers

# THE ANSWERS

The Ultimate Package using high or low pressure steam, fully redundant zero lag system with only one steam inlet connection, one condensate outlet that can react positively to a back pressure, one liquid inlet and one liquid outlet connection, no steam pressure reducing station, and no steam vents to roof.




Circulating pumps
50 HP

VFD variable
frequency drives

Main disconnect power

Primary control panel with remote access connected to building management system – BMS

**IoT ready**

2200 US gpm heat exchangers (2)
20°F rise
85 PSIG steam pressure

Secondary control panel with remote access connected to building management system – BMS

**IoT ready**

# ATYPICAL design

Any innovative system is only as effective as it is simple to use. That's why we've designed a control panel that makes every step easy to manage. A NEMA 4 and UL certified control panel with an advanced programmable controller that allows the user to set-up all the options. An intuitive, easy-to-use GRAPHIC HMI display including BACnet, LonWorks, and Modbus compatibility. Remote access capability allows advanced and real-time technical support. An Uninterruptible Power Supply (UPS) switches to battery mode to prevent any downtime in the event of an electricity outage.




An intuitive
easy-to-use
HMI display

We are
**Internet of Things (IoT)**
ready with a OPC-UA
embedded server

# ad van tages

Since 2002, our ground-breaking technology allows us to flood the steam heat exchanger and stabilize the liquid outlet temperature. We proudly manufacture high-efficiency steam-to-liquid vertical flooded units for building heat and domestic use, transferring both steam's latent and sensible heat in a 0% flash return system, even at very high steam pressure, and taking into account super-heated steam.

# 20%
LESS ON TOTAL INSTALLED COSTS

## LESS MAINTENANCE
No steam pressure reducing station, no steam relief valve, no condensate pumping station.

# 40%
SPACE SAVING

## A CLOSED LOOP
No steam vents to roof, no flash tanks.

# 5 TO 16%
LESS ENERGY CONSUMPTION AND CARBON FOOTPRINT REDUCTION

## STABILITY OF LIQUID SET POINT TEMPERATURE
# +/-2°F

# Steam is more efficient than people think.

Over the last several years, as customers chose the natural gas line available to install condensing boilers, they have become aware of the short life cycle of some major components, as well as the high maintenance costs to maintain the operation of these condensing boilers.

Maxi-Therm has simplified the steam-to-liquid solution to a point where there is only one moving part, a very small condensate control valve, meaning that steam is in fact far more efficient than people think.

Moreover, since 2012 the US Department of Energy recommends installing a saturated steam turbogenerator to not only control the reduced steam pressure required, but also to generate electrical power.

# why?

REASON 1

## SAFETY

Have you ever noticed how quickly we fix water leaks from a heating loop compared to a leak in a steam line? If you don't fix your water leak, you will likely end up with a major mess in your mechanical room. If a natural gas leak occurs, the repair will be considered an emergency, no matter the cost. However, the same steam leak can be present for years before it requires special attention.

REASON 2

## THE MAXI-THERM ADVANTAGE

By avoiding pressure-reducing stations, condensate pump stations, big control valve stations on the steam side and the need for steam safety valves to the roof, we can cut the typical maintenance budget of a conventional steam system by more than 75%.

REASON 3

## FUEL BACK-UP

Dual fuel burners are typically used in case of a natural gas shortage. However, assuming you don't need dual fuel, is it a good idea to rely on natural gas for the next 15 years? If one day it makes more sense to use another fuel by having a central plant, you will be able to change the burner or boiler and keep the same steam network system for building heat, domestic hot water and steam to steam.

REASON 4

## DISTRICT CENTRAL STEAM HEATING SYSTEM

If you're considering buying steam energy for building heat from a district central steam heating plant or other source, you should take a look at our systems that integrate a steam turbogenerator or a steam motor to generate electrical power and add a steam absorption chiller to produce more electrical power in the summer.


# UNIVERSITIES

VANDERBILT UNIVERSITY | DUKE UNIVERSITY | EASTERN WASHINGTON STATE UNIVERSITY UNIVERSITY OF NORTH CAROLINA | MONTCLAIR STATE UNIVERSITY | UNIVERSITY OF CHICAGO HARVARD UNIVERSITY | PENN STATE UNIVERSITY | YALE UNIVERSITY | UNIVERSITY OF PENNSYLVANIA WEST WASHINGTON STATE UNIVERSITY | COLORADO SCHOOL OF MINES | UNIVERSITY OF NEW MEXICO | UNIVERSITY OF VERMONT | GRAND VALLEY STATE UNIVERSITY | CENTRAL MICHIGAN STATE UNIVERSITY | TOWSON UNIVERSITY | UNIVERSITY OF COLORADO | UNIVERSITY OF WISCONSIN MADISON | OHIO STATE UNIVERSITY | LOYOLA UNIVERSITY CHICAGO

# HOSPITALS

WISTAR CANCER CENTER | ST-VINCENT | WAUKESHA | PROVIDENCE ALASKA | PENN MEDICINE CHILDREN'S HOSPITAL OF PHILADELPHIA | MARTHA JEFFERSON | LUTHERAN GENERAL KING'S DAUGHTER | JOHN HOPKINS | JERSEY SHORE MEDICAL | BOSTON CHILDREN'S HOSPITAL ELKHART GENERAL | BALL MEMORIAL | ADVOCATE GOOD SHEPHERD | RUSH COPLEY

# PROCESS

COCA-COLA | MILLERCOORS | ARTISAN MEAT | BAE LOGISTICS | COOPER'S HAWK VINEYARDS

# PHARMACEUTICAL

MERCK | TELIGENT | WYETH AYERST | B. BRAUN | PFIZER | ALNYLAM

# NUCLEAR

ONTARIO POWER GENERATION

# THE BRAINSTORMING team

Our engineering group employs a brainstorming team consisting of specialized senior professionals who continuously update and modernize our concepts, both mechanically and electronically.

Our regular two-day brainstorming sessions take place in inspiring locations, far away from the office, which allows us to come up with fresh ideas about our common passion: steam.

**“I AM SURROUNDED BY WONDERFUL PEOPLE”**
– Raymond Lach



## RAYMOND LACH
CEO & founder

Raymond Lach started in the steam business in 1970 and worked for 24 years as a rep for Armstrong Machine Works in Michigan. With the help of his wife Jacqueline, he then founded a company with a team of experts to meet specified industry requirements in steam-to-liquid package solutions.

From 1998 to 2004, Raymond explored the European method of flooded design, enhanced its concept and was granted US and Canadian patent rights in 2004.

In 2005, Raymond founded Maxi-Therm and today works with a highly qualified staff of exclusive US partners to continuously innovate in the steam solutions market.

BRAINSTORMING

# team professionals

## PATRICK LACH

Vice President Sales & Business Development.

**Maxi-Therm**

## GABRIEL COSSETTE

Vice President Operations & Engineering.

**Maxi-Therm**

## WALTER KUZIA

U.S. Shareholder & Exclusive MTI Distributor, Connecticut and Massachusetts.

**Little Inc**

## JEFF BAILEY

U.S. Shareholder & Exclusive MTI Distributor, Applied Thermal Solution Inc, New Jersey and Philadelphia.

**Maxi-Therm Service Department**

## CHRIS LITTLE

Co-owner Little Inc & Exclusive MTI Distributor, Boston, MA.

**Director of Maxi-Therm Service Department in the US**

## TONY RANALLO

Co-owner BoilerSource & Exclusive MTI Distributor, Chicago, IL.

**Maxi-Therm Service Department**

## ROBERT KNOX

Regional Sales Manager, Colorado.

**Maxi-Therm**

## MARIE-HÉLÈNE BOUCHARD

Software & Controls Engineer.

**Maxi-Therm**

## MAXIME MÉNARD

Software & Controls Engineer.

**Maxi-Therm**

# we are


## OUR PARTNERS

Our success depends in large part on having exclusive local partners representing our products in every US state. Our reps are dedicated people working on steam projects led by owners who've been in the business for generations. Together we strive to go Beyond Steam.

# here

## OUR SERVICE CENTERS

Our service centers are located in Boston, Chicago and New Jersey. Our service capacity includes certified technicians who support local staff for the initial start-up and warranty period.

# world class

## TRAINING

Headquartered in Montreal, Canada, Maxi-Therm is the proud owner of a leading-edge laboratory that is unique in the industry. Equipped with a 1,000,000 BTU/h capacity 100 psig steam boiler, this is where we test and demonstrate the performance and stability of temperature setpoint of our latest innovations.

We also invite our customers to a 1 ½ day technical seminar on steam applications, including our innovative products like the vertical flooded concept and the steam-to-steam generator for humidification or sterilization, and to learn about our steam turbogenerator that generates electrical power.



"Thanks so much for inviting me up to the Maxi-Therm seminar! The learning content, the hand-out materials and the hands-on lab were all outstanding. I felt at ease in the more intimate setting to learn and ask questions. I appreciated your open and honest approach to what the products are about, the inventive spirit that constantly seeks to improve or customize products to perfectly fit an application, and personal investment and sacrifice that stand behind the Maxi-Therm products."

**- Testimonial from attendee**

"I would like to thank everyone at Maxi-Therm for the opportunity to attend your Montreal seminar. I found the information covered by you and your team in the subject of steam management extremely educational and insightful. The expertise and professionalism conducted during the class is among the very best, and dialog between colleagues was extremely informative. In my opinion, systems created at Maxi-Therm are innovative and cutting edge. As for the hospitality, it is world class and has left me knowing that the people at Maxi-Therm are not only at the top of their profession, but they are also the top among hosts. Thank you once again."

**- Testimonial from attendee**

# how?

At Maxi-Therm, we're committed to innovation in heat transfer, and the coveted ASHRAE Technology Award we've received shows it's paying off.

Our innovative, efficient steam-to-water heat exchanger technology optimizes the net output energy produced by steam, as opposed to conventional shell-and-tube heat exchangers. By modulating the condensate, the flooded vertical heat exchanger varies the exchange surface. The energy input of the flooded vertical heat exchanger is 85% of the conventional horizontal heat exchanger for the same net energy produced. The exchanger has a stable temperature set-point by modulating the condensate, not the steam.

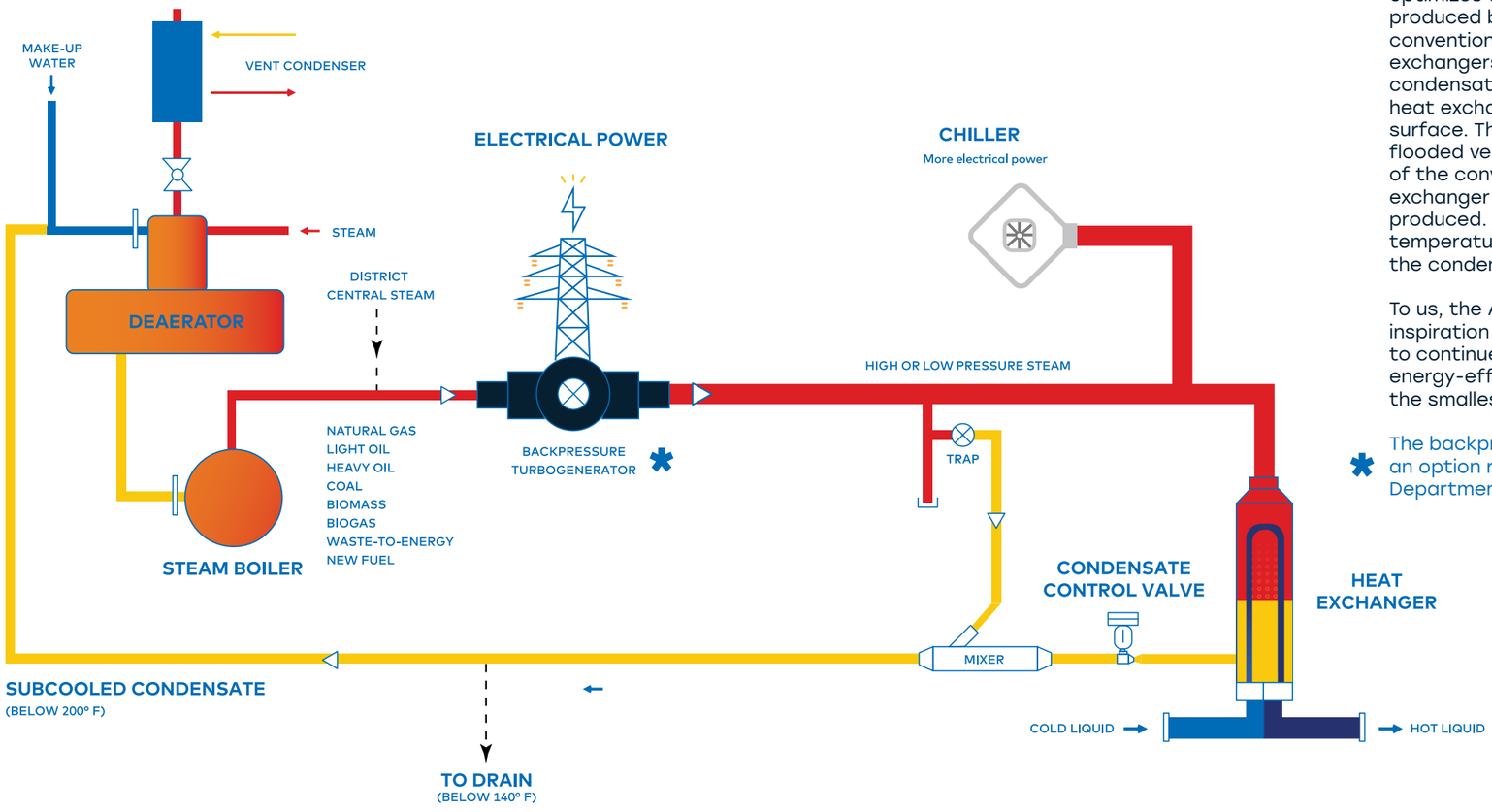
To us, the ASHRAE award is an inspiration to continue innovating, to continue searching for low-cost, energy-efficient solutions that leave the smallest possible footprint.

✱ The backpressure turbogenerator is an option recommended by the U.S. Department of Energy.

2005 ASHRAE Technology Award

ASHRAE Technology Award, June 2005.

Flooded Steam-to-Water Vertical Heat Exchanger



# imagine

## A SOLUTION

more energy-efficient than ever, integrating a control panel with remote access connected to building management system – BMS – IoT ready, at a low installation cost, and one that leaves the smallest possible footprint.

Others have imagined what it might be like.
We've made it happen.

# Welcome to maxi·therm™

## We are IoT ready

7559 M.B. Jodoin | Montreal, QC H1J 2H9 | **maxi-therm.net**