**SECTION 238146 – PACKAGED WATER SOURCE HEAT PUMP SYSTEMS**

PART 1 ‑ GENERAL

1.01 SUMMARY

1. This Section includes hydronic boiler packaged system construction, components, required trim, controls, and accessories necessary for hydronic space heating.

1.02 REFERENCES

1. Comply with applicable Codes/Standards of ANSI, ASME, AGA, NEC, UL, FM, and the State.
2. Section 15185 – Hydronic Pumps and Hydronic Specialties
3. Local air quality district emission requirements.

1.03 QUALITY ASSURANCE

1. Provide factory tests to check construction integrity and control function of the complete system.
2. Boiler shall be condensing type certified to operate at minimum efficiency of 95 percent at 100 percent of firing rate.
3. Installed materials not meeting specification requirements of the Contract Documents will be subject to removal and replacement

1.04 SUBMITTALS

1. Comply with provisions of Section 01 30 00 - Submittals.
2. Manufacturer's descriptive literature, operating instructions, maintenance and repair data.
3. Manufacturer's installation instructions.
4. Detail Drawings showing dimensions and electrical diagrams.
5. Submit boiler start up, testing, and adjusting certificate.

PART 2 ‑ PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

1. Contractor to furnish and install a pre-assembled, pre-piped, hydronic heating equipment package as manufactured by FlowTherm Systems or approved equal. Alternate package system manufacturers must be able to demonstrate a successful history of manufacturing similar systems for a minimum of 10 years.

2.02 MOTORS AND CONTROLS

 A. Motors: Provided with equipment. Refer to Section 26XXXX ‑ ELECTRICAL REQUIREMENTS FOR MECHANICAL EQUIPMENT.

 B. Motors Starters: Provided with equipment. Refer to Section 26XXXX - ELECTRICAL REQUIREMENTS FOR MECHANICAL EQUIPMENT.

2.03 EQUIPMENT REQUIREMENTS

 A. General:

1. The packaged system shall include, as a minimum, the following components:
	1. Closed loop fluid cooler
	2. Gas-fired hot water boiler(s)
	3. Condenser water pump(s)
	4. Air purger with automatic air vent
	5. ASME expansion tank
	6. NEMA 3R control panel with single point power
	7. Conductivity monitoring / chemical feed system
	8. Thermometers, gauges, isolation valves, check valves, and inter-connecting piping.
2. All components shall be mounted on a structural steel baseplate covered with ¼” steel decking. The entire assembled unit shall be primed with red oxide and finished with a heavy coat of exterior-grade industrial enamel. It is acceptable to provide the packaged system as multiple skids which are field installed directly adjacent to one another with factory-supplied interconnecting piping and electrical.
3. The package(s) shall be designed to supply, monitor, and control the hydronic circulation loop within the specified flow and temperature conditions of the system.
4. The Package(s) shall be UL Listed according to Standard #508A for control panels and UL Standard #778 for Pumping Systems.
5. Performance: Refer to Schedule on Drawings.
	1. WATER SOURCE HEAT PUMP SKID CONSTRUCTION
6. FLUID COOLER
	1. Evapco LSWE or approved equal forced draft, factory-assembled, counter-flow centrifugal fan design closed circuit cooler.
	2. Pan Fan Section constructed of heavy gauge mill hot-dip galvanized steel. All galvanized steel is coated with a minimum of 2.35 ounces of zinc per square foot of area (G-235 designation). Pan-Fan section includes centrifugal fans and drives mounted and aligned at the factory. All fan components are located in the dry entering air stream. During fabrication, all panel edges are coated with a 95% pure zinc-rich compound.
	3. IBC compliant The unit structure is designed, analyzed, and constructed in accordance with the latest edition of International Building Code (IBC) for: Ip = 1.00, Sds = 3.2g, z/h=0, P = 288 psf.
	4. Make up float valve assembly with brass float valve and adjustable, unsinkable, foam-filled plastic float.
	5. Pan strainer type 304 stainless steel with large area removable perforated screens.
	6. Fan discharge cowls G-235 hot-dip galvanized steel cowls provided on each fan discharge extending within the pan to increase fan efficiency and prevent water from entering fans.
	7. Access G-235 hot-dip galvanized steel circular access doors held in place by wingnuts.
	8. Close-coupled centrifugal pump with mechanical seal. The pump is installed in a vertical position so that water will drain from the pump when the cold water basin is emptied. Pump motor is totally enclosed with protective canopy for outdoor operation.
	9. Fan wheels are forwardly curved centrifugal type of hot-dip galvanized steel factory installed into the pan/fan section. They are statically and dynamically balanced for vibration free operation. Fan housings have compound curve inlet rings for efficient air entry.
7. HYDRONIC BOILER B-1
	1. The boiler shall be a Laars NeoTherm Model NTH\_\_\_\_\_\_, rated at \_\_\_\_\_\_\_\_\_\_ BTU/hr input and \_\_\_\_\_\_\_\_\_\_ BTU/hr output. The boiler shall modulate 10-100% of full fire. The unit(s) shall be design-certified to comply with the current edition of the Harmonized ANSI Z21.13 / CSA 4.9 Standard for Gas-Fired Low Pressure Steam and Hot Water Boilers. The unit(s) shall be designed and constructed in accordance with the ASME Boiler & Pressure Vessel Code, Section IV requirements for 160 psi (1103 kPa) maximum working pressure, and shall bear the ASME "H" Stamp and be listed by the National Board.
	2. The boiler shall be listed with AHRI (Air Conditioning, Heating and Refrigeration Institute). The boiler shall have a minimum combustion efficiency of 95%. The unit(s) shall be constructed to comply with the efficiency requirements of the latest edition of ASHRAE Standard 90.1.
	3. The boiler shall be certified for placement outdoors, where freezing conditions do not exist. The boiler must meet ANSI Z21.13-2013, section 5.26 boilers for outdoor installations.
	4. The boiler shall be equipped with an ASME certified pressure relief valve set at 75psi 517 (kPa). Optional pressure relief valves with settings of 30psi (207kPa), 50psi (345 kPa), 60psi (413 kPa), 125psi (861 kPa) or 150psi (1034 kPa) shall be available.
	5. The water tube heat exchanger shall be stainless steel, rated for 160 psi (1103 kPa) working pressure. The heat exchanger shall be a low water volume design, welded construction, with no gaskets, o-rings, or bolts in the header. Heat exchanger shall be accessible for visual inspection and cleaning of all internal surfaces. The boiler shall be fully condensing design with built-in condensate drain and trap. The heat exchanger shall have a limited ten-year warranty.
	6. Each boiler shall be fully test fired, (with water, gas, and venting connected), and all safety components tested, at the factory.
	7. The boiler shall be sealed combustion. The heater jacket shall be a unitized shell finished with acrylic thermo-set paint baked at not less than 325°F (163°C). The frame shall be constructed of galvanized steel for strength and protection. Chamber shall include a sight glass for viewing flame. Boiler sides and back shall be certified for zero clearance to combustible surfaces.
	8. Boiler shall operate on 4-13" W.C. gas pressure, and shall need no component changes to operate at high altitude, up to 10,000 feet.
	9. The boiler shall use a premix burner with a stainless steel woven metal fiber wrap, and a negative pressure gas valve to burn cleanly, with NOx emissions not exceeding 10ppm. The boiler shall meet the emissions requirements of SCAQMD 2012.
	10. The boiler shall be designed for vertical or horizontal Category IV venting, up to 100 equivalent feet with 4" PVC, CPVC or stainless steel vent material. Air may be taken from the room, or ducted directly to the boiler, using up to 100 equivalent feet of 4" ABS, PVC, CPVC or galvanized pipe. The boiler shall be shipped with PVC sidewall vent and air terminals, for use with horizontal systems. The first section of CPVC vent pipe shall be shipped with each boiler.
	11. The boiler control shall be an integrated electronic PID temperature and ignition control with large touchscreen and color display and shall control the boiler operation and firing rate. The boiler display shall be visible without the removal of any jacket panels or control panels. The control shall have the ability to control the boiler pump, system pump and indirect domestic water pump, each with delay and exercise features.
	12. The control shall have built-in outdoor reset feature with customizable reset curves, based on the outdoor temperature and desired system water temperature. The boiler shall be shipped with the outdoor reset sensor, as standard equipment.
	13. The control shall have dry alarm contacts for ignition failure. The control shall monitor flue gas temperature and shall stop the boiler from firing if temperature is excessive.
	14. Allowable control adjustments shall include: enable/disable; boiler temperature setpoint; manual firing rate control; pump delay time; pump exercise interval; outdoor reset selection; warm weather shutdown; and anti-shortcycle feature.
	15. The boiler controller shall be able to cascade and lead-lag the boilers without an additional system controller. The burners shall be controlled to keep each one in the lowest firing rate possible, based on system demand, to maximize efficiency.
	16. In addition to adjustable parameters, the master display shall also be able to show information about the following for each boiler it is monitoring:

• burner control

• demand and modulation

• inlet temperature

• fan speed

• domestic water pump

• domestic hot water temp

• boiler pump

• system pump

• flame detection

• statistics

• stack limit

• frost protection

* 1. The control shall have the ability to accept a 4-20mA or 0-10VDC input connection from an external control or building automation system, to modulate the flame.
	2. The controller shall be able to send information through a BACnet connection, including (but not limited to) inlet and outlet water temperatures, stack temperature, status of sensors, fan speed, set points, remote control input, burner status, lockout codes, alarm reasons, system pump status, boiler pump status and domestic water pump status.
	3. Control diagnostics shall include, at a minimum, the following: ignition failure, grounded flame rod, safety chain interrupt, boiler high limit exceeded, domestic water high limit exceeded, temperature rise limit exceeded, stack limit exceeded, pressure sensor fault, combustion pressure fault, blocked air intake, sensor errors (open or shorted), 24VAC voltage low or high, modulation fault, pump fault, AC input phases reversed, and fan speed proving rate failure.
1. PRIMARY BOILER PUMP(S)
	1. Bell and Gossett 60 Series inline circulator, cast iron body with bronze impeller, 3-piece design with bearing frame, flexible coupling, mechanical seal, and TEFC motor.
2. CONDENSER WATER LOOP PUMP(S)

The condenser water loop pumps shall have performance conditions as per equipment schedule and shall be:

* 1. Bell & Gossett Series 1510 base-mounted or 1531 close-coupled end suction pumps with cast iron body and stainless steel impeller with standard mechanical seal, TEFC Premium Efficient motor rated for VFD operation.
1. AIR PURGER
	1. Inline Air Purger for commercial hydronic systems to effectively control and eliminate entrained air. The purger is designed with an embossed flow indicator arrow to assure proper installation. Cast iron construction rated for 150 psig working pressure at 450 deg F.
2. CONTROL PANEL

The control panel shall provide a single point power connection for all packaged equipment, PLC system control, variable frequency drives, and BACnet communication. The panel shall include:

* Single point power connection with non-fused main power disconnect
* NEMA 1 OR NEMA 3R enclosure
* PLC controller with 6” color touchscreen HMI
* VFDs for condenser water loop pumps with through-the-door power disconnects
* Wire-to-Water Power Optimization of condenser water loop pumps
* Hand-Off-Auto selector switch with green “Run” light and red “Fail” light for each condenser water loop pump
* Local-Off-Remote system selector switch to allow for local “stand alone” operation or remote system enable/disable.
* GFCI power outlet, 120V/1ph, 15 amps
* BACnet field server to provide BMS interface to all equipment
* System differential pressure transmitter (shipped loose for field installation by others)

CONTROL SEQUENCE OF OPERATION

The controller shall stage the operation of the various components of the package in accordance with the following sequence.

|  |  |  |
| --- | --- | --- |
| LOOP TEMP. INCREASING | LOOP TEMPERATURE  | LOOP TEMP.DECREASING |
| Tower Fan runs at high speed, Spray pump on |  95F | Tower High Speed Fan Pump on |
|  |  90F | Tower High Speed Fan off, Low Speed Fan on and Spray Pump on. |
| Tower Fan runs at Low Speed, Spray pump on |  85F |  |
| Tower Spray Pump starts |  80F | Tower low speed Fan off and Spray Pump on. |
|  |  75F | Spray Pump off |
| Boiler off  |  70F |  |
|  |  65F |  |
| Boiler and Boiler Pump on  |  60F | Boiler and Boiler Pump on |

Temperature set points shall be field adjustable to suite specific job conditions.

1. EXPANSION TANK

The boiler heating package shall include an ASME Section VIII rated expansion tank. Bell & Gossett B-LA Series bladder style construction with a one-piece replaceable heavy duty butyl bladder. The tank shall have an NPT system connection with a charging valve connection to facilitate on-site charging of the tank to meet system requirements.

1. CHEMICAL POT FEEDER

A chemical pot feeder with isolation and bypass valves shall be provided. The pot feeder shall have a maximum operating temperature of 200 o F at 200 PSI. The pot feeder shall have ¾” NPT connections and shall have a capacity of 2 gallons.

1. SEDIMENT SEPARATOR

Provide centrifugal sediment separator with manual purge valve

1. CONDUCTIVITY MONITORING/CHEMICAL FEED SYSTEM

Provide with chemical metering pump, conductivity sensor, and automatic blowdown valve designed to provide proportional chemical feed to the cold water basin. Chemicals and chemical storage container provided by others.

1. ISOLATION VALVES

Isolation valves shall be provided to service of all major components of the boiler heating package. These valves will facilitate the removal of a component for servicing without the need of draining the heating water from the system piping.

1. The following items shall be single point connections
	1. Power
	2. Condenser Water Supply
	3. Condenser Water Return
	4. Cold Water Make-up
	5. Drains
2. Hydrostatic Test: Shop-assembled pressure parts of the boiler shall be hydrostatically tested at the factory at a pressure of 1‑1/2 times the design pressure. A manufacturer's Data Report to confirm compliance with ASME Code requirements shall be furnished by the boiler manufacturer.
3. Functionality Test: Perform a factory functional test of all system electrical components and skid wiring prior to shipment.

PART 3 ‑ EXECUTION

3.01 FIELD ASSEMBLY REQUIREMENTS

1. Place and mount skid on a level concrete equipment pad
2. Make utility and system connections as described in item 2.04.J of this section.
3. Boiler Venting – each boiler shall be vented according to manufacturer’s recommendation and shall conform to the requirements of the National Fuel Gas Code (American Standard Z223.1-Latest Edition).
4. Gas Regulator and Gas Train Vents – Pipe through roof to atmosphere

3.02 INSTALLATION

1. Install boiler on concrete pad as instructed by manufacturer.
2. Provide services of manufacturer's representative to supervise rigging, hoisting, and installation of the boiler.
3. Coordinate electrical and control work.
4. Install ship loose items, such as sensors, sight glasses, safety valves, and gauges.
5. Pipe safety valves to floor drain.

3.03 START UP

1. Provide services of manufacturer's representative to inspect boiler after installation is complete and submit report prior to start up, verifying installation is in accordance with specifications and manufacturer's recommendations.
	1. The package manufacturer shall provide the services of a trained technician to assist in starting up, adjustment and operation of boiler and firing equipment and all other equipment furnished by the boiler manufacturer. In addition, the technician shall perform requisite field tests and instruct the Owner's operating personnel in the proper operation and maintenance of the unit.

END OF SECTION