**SECTION 235200 – HYDRONIC BOILER PACKAGED SYSTEM**

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 certified to operate at minimum efficiency of 97 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,” a Divisions of California Hydronics Corporation, 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 15xxx ‑ ELECTRICAL REQUIREMENTS FOR MECHANICAL EQUIPMENT.

 B. Motors Starters: Provided with equipment. Refer to Section 15xxx - ELECTRICAL REQUIREMENTS FOR MECHANICAL EQUIPMENT.

2.03 EQUIPMENT REQUIREMENTS

 A. General:

1. The packaged system shall include, as a minimum, the following components:
	1. Two (2) Condensing hot water boilers
	2. Two (2) Secondary system pumps
	3. Expansion tank
	4. Air Separator
	5. System integration panel with local control
	6. Thermometers, gauges, isolation 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 specified.
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. BOILER SKID CONSTRUCTION
6. FIRE-TUBE CONDENSING BOILERS
	1. The boiler shall be a LOCHINVAR FTXL\_\_\_\_\_\_\_\_\_having a modulating input rating of \_\_\_\_\_\_\_\_\_ Btu/Hr, an output of \_\_\_\_\_\_\_\_\_ Btu/Hr and shall be operated on (Natural Gas) (L.P. Gas). The boiler shall be capable of full modulation with a turndown ratio of \_\_\_:1.
	2. The boiler shall bear the ASME "H" stamp for 160 psi working pressure and shall be National Board listed. The boiler shall have a fully welded, stainless steel, fire tube heat exchanger. Multiple pressure vessels in a single enclosure are not acceptable. There shall be no banding material, bolts, gaskets or "O" rings in the pressure vessel construction. The heat exchanger shall be designed for a single-pass water flow to limit the water side pressure drop. Pressure drop shall be no greater than 3 psid at 75 GPM. The condensate collection basin shall be constructed of welded stainless steel. The complete heat exchanger assembly shall carry a ten (10) year limited warranty.
	3. The boiler shall be certified and listed by C.S.A. International under the latest edition of the harmonized ANSI Z21.13 test standard for the U.S. and Canada. The boiler shall comply with the energy efficiency requirements of the latest edition of ASHRAE 90.1 and the minimum efficiency requirements of the latest edition of the AHRI BTS-2000 Standard as defined by the Department of Energy in 10 CFR Part 431. The boiler shall operate at a minimum of 97% Combustion and Thermal Efficiency at full fire as registered with AHRI. The boiler shall be certified for indoor installation.
	4. The boiler shall be constructed with a heavy gauge steel jacket assembly, primed and pre-painted on both sides. The combustion chamber shall be sealed and completely enclosed, independent of the outer jacket assembly, so that integrity of the outer jacket does not affect a proper seal. A burner/flame observation port shall be provided for observing the burner flame and combustion chamber. The burner shall be a premix design constructed of high temperature stainless steel with a woven Fecralloy outer covering to provide smooth operation at all modulating firing rates. The boiler shall be supplied with a negative pressure regulation gas valve and be equipped with a pulse width modulation blower system to precisely control the fuel/air mixture to the burner. The boiler shall operate in a safe condition with gas supply pressures as low as 4 inches of water column. The burner flame shall be ignited by direct spark ignition with flame monitoring via a flame sensor.

* 1. The boiler shall utilize a 24 VAC control circuit and components. The control system shall have a factory installed display for boiler set-up, boiler status, and boiler diagnostics. All components shall be easily accessed and serviceable from the front and top of the jacket. The boiler shall be equipped with a temperature/pressure gauge; high limit temperature control with manual reset; ASME certified pressure relief valve set for 50 psi (standard); outlet water temperature sensor with a dual thermistor to verify accuracy; system supply water temperature sensor; outdoor air sensor, flue temperature sensor with dual thermistor to verify accuracy; low water cut off with manual reset, blocked drain switch and a condensate trap for the heat exchanger condensate drain.
	2. Each boiler shall have a motorized automatic isolation valve with manual override that is controlled by the boiler controller. The boiler controller shall operate the isolation valve(s) in conjunction with the boiler to 1) assure flow through at least one firing boiler at all times and 2) prevent flow through the offline boiler(s).
	3. The boiler shall feature the “SMART SYSTEM™” control which is standard and factory installed with 128 x 128 resolution display, password security, outdoor air reset, pump delay with freeze protection, pump exercise, ramp delay featuring six steps, domestic hot water prioritization with limiting capabilities, USB drive for simple uploading of parameters and a PC port connection for connection to a local computer for programming and trending. A secondary operating control that is field mounted outside or inside the appliance is not acceptable. The boiler shall have alarm contacts for any failure, runtime contacts and data logging of runtime at given modulation rates, ignition attempts and ignition failures. The boiler shall have a built-in “Cascade” with leader redundancy to sequence and rotate while maintaining modulation of up to eight boilers of different Btu inputs without utilization of an external controller. The internal “Cascade” function shall be capable of lead-lag, efficiency optimization, front-end loading, and rotation of lead boiler every 24 hours. The boiler shall be capable of remote communication via optional CON-X-US™ Remote Connectivity with the capability of historical trending and sending text message or email alerts to notify the caretaker of a boiler alarm and remote programming of onboard boiler control. The boiler shall be capable of controlling an isolation valve (offered by manufacturer) during heating operation and rotation of open valves in standby operation for full flow applications. The control must have optional capability to communicate via Modbus protocol with a minimum of 46 readable points. The boiler shall have an optional gateway device which will allow integration with LON or BacNet protocols.
	4. The “SMART SYSTEM™” control shall increase fan speed to boost flame signal when a weak flame signal is detected during normal operation. A 0-10 VDC output signal shall control a variable speed boiler pump (offered by manufacturer) to keep a fixed Delta T across the boiler regardless of the modulation rate. The boiler shall have the capability to receive a 0-10 VDC input signal from a variable speed system pump to anticipate changes in system heat load in order to prevent flow related issues such as erratic temperature cycling.
	5. The boiler shall be installed and vented as required by the boiler manufacturer.
	6. The boiler shall have an independent laboratory rating for Oxides of Nitrogen (NOx) to meet the requirements of South Coast Air Quality Management District in Southern California and the requirements of Texas Commission on Environmental Quality. The manufacturer shall verify proper operation of the burner, all controls and the heat exchanger by connection to water and venting for a factory fire test prior to shipping.
	7. The boiler shall operate at altitudes up to 4,500 feet above sea level without additional parts or adjustments.
	8. The boiler shall be constructed in accordance with the following code requirements as standard equipment.
		1. CSD1 / Factory Mutual / GE Gap
1. SECONDARY HEATING LOOP PUMP(S)

The secondary heating loop pumps shall have performance conditions as per equipment schedule and shall be:

* 1. Systems up to 1,000 MBH input – Goulds eSV Series vertical multi-stage, all 304SS wetted parts, mechanical seal, TEFC Premium Efficient motor rated for VFD operation.
	2. System exceeding 1,000 MBH input – Bell & Gossett Series 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 SEPARATOR
	1. A centrifugal air separator, Bell & Gossett Rolairtrol shall be furnished and installed as part of the boiler heating package. The separator shall have inlet and outlet connections tangential to the vessel shell. The vessel shell diameter shall be three times the nominal inlet / outlet pipe diameter.
	2. The separator shall have an internal steel air collector tube with 5/32” diameter perforations and 63% open area designed to direct accumulated air to the expansion tank via an NPT vent connection at the top of the unit.
	3. The air separator must be designed, constructed and stamped for 125 PSIG at 350o F in accordance with Section VIII, Division I of the ASME Board and Pressure Vessel Code Inspectors.
2. SYSTEM INTEGRATION PANEL WITH LOCAL CONTROL

A System Integration Panel will 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 enclosure
* PLC controller with 6” color touch screen HMI
* VFDs for secondary system pumps
* Wire-to-Water Power Optimization of secondary system pumps
* Through-the-door power disconnects for secondary system pumps
* Circuit breaker disconnects for each boiler
* Hand-Off-Auto selector switch with green “Run” light and red “Fail” light for each secondary system pump
* Local-Off-Remote system selector switch to allow for local “stand alone” operation or remote system enable/disable.
* BACnet field server to provide BMS interface to all equipment
* System differential pressure transmitter (shipped loose for field installation by others)
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. 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. Cold Water Make-up
	3. Hot Water Supply
	4. Hot Water Return
2. Natural gas supply piping to each appliance by installing contractor
3. Vents for gas pressure regulators and water relief valves shall be individually piped by installing contractor.
4. 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.
5. 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