Furnish and install as shown on AERCO International plans and operation and maintenance manuals, with all applicable codes and authorities having local, state and federal jurisdiction, Modulex Series Boiler Model MLX EXT 450 2S. The boiler plant shall consist of \_\_\_\_ hydronic boiler(s) as manufactured by AERCO International, Inc. Each boiler shall be CSA or UL Listed, CSD-1 compliant, ASME coded and stamped, and incorporate a gas train designed in accordance with Factory Mutual. Each boiler shall have an input of 481 MBH with a gross output of 422 to 454 MBH (dependent upon return water temperature) when fired with natural gas. Electrical service to each unit shall be 120V/1/60Hz 15 amp service. The boiler control panel shall be proprietary in design and incorporate the functions of thermal controller, message annunciation and fault diagnostics capabilities. The boiler shall have color touch screen display providing user interface and monitoring of all sensors and interlocks. Each boiler shall have a footprint of *no more than* 30” W, 30” D, and 46” H. The boiler installed weight shall *not exceed* 520 lbs. wet. The boiler shall have an ASME approved relief valve setting of 90 psig.

**Construction**

Boiler modules shall be gas fired (natural gas unit or propane unit), condensing cast sectional design with a modulating forced draft power burner and positive pressure vent discharge.

**Burner, Modulating Gas Valve. and Variable Speed Fan**

The heat exchanger which consists of three (3) thermal modules, shall be capable of a 10.5 to 1 turndown ratio of the firing rate without loss of combustion efficiency. Each thermal module’s premix burner shall be metal fiber mesh covering a stainless steel head, with spark ignition and flame rectification. All burner material exposed to the combustion zone shall be of stainless steel construction. There shall be no moving parts within the burner itself. The burners shall produce <20 ppm of NOx corrected to 3% excess oxygen. A modulating gas valve and variable speed fan shall meter the natural gas and air input, respectively.

**Heat Exchanger**

The heat exchanger is constructed of cast aluminum and shall be capable of handling return water temperatures down to 40 F without any failure due to thermal shock or fireside condensation. It shall be ASME stamped for a working pressure not less than 92 psig. The water tubes shall have a maximum water volume of 3.9 gallons. The boiler water pressure drop shall *not exceed* 10 Ft. of Head at 38 gpm. The boiler water connections shall be 2-1/2” NPT. Inspection openings in the pressure vessel shall be in accordance with ASME Section IV pressure vessel code.

The boiler shall be designed so that the thermal efficiency increases as the boiler firing rate decreases. The heat exchanger shall be cast sectional construction. Access to the fireside of the thermal modules is available by burner removal. Minimum access opening shall be no less than 13.5” x 3.5” per thermal module.

**Exhaust Manifold/Condensate Tray**

The exhaust manifold shall be of stainless steel with a 4“diameter flue connection. The condensate tray shall be of stainless steel and shall have a gravity drain for the elimination of the condensation with P-trap.

**Boiler Controls**

The boiler control system shall consist of a master controller (Ufly Controller) to which individual thermal module controllers are linked as slaves. The entire system shall be CSA or UL Recognized. Each of the thermal module controllers shall consist of a combustion safeguard and flame monitoring system. Individual thermal module controllers shall be field replaceable. The combustion safeguard/flame monitoring system shall utilize spark ignition and a rectification type flame sensor. The boiler control system shall annunciate boiler & sensor status and include extensive self-diagnostic capabilities.

A second master controller (Boiler Communications Module) shall 1) serve as the master controller in the event that the Ufly Controller fails, 2) incorporate a fault relay for simple remote fault alarm, 3) offer a 0 to 10VDC output to control a VFD primary boiler pump and 4) allow third party Building Automation System (BAS) to control and monitor the boiler via Modbus RS-485 communications.

Each boiler shall incorporate dual over-temperature protection with manual reset and a flow switch, both in accordance with ASME Section IV and CSD-1.

**Temperature Control Modes**

The Modulex boiler(s) shall operate in the control modes listed below:

\_\_ 1. Internal Setpoint

\_\_ 2. Indoor/Outdoor Reset

\_\_ 3. 0 to 10VDC Temperature Setpoint

\_\_ 4. Network Temperature Setpoint

\_\_ 5. AERCO Control System (ACS)

The first four control modes refer to independent boiler settings, while the last control mode refers to banks of boilers operated as a system by AERCO supplied ACS system. The following is a description of each control mode.

**Internal Setpoint:** Boiler shall include integral factory wired operating controls to control all operation and energy input of the boiler. Control of discharge water temperature shall be set through an internal setpoint with an adjustment of 68ºF to 180ºF. The individual thermal module controllers shall vary their respective thermal module’s input throughout its full range to maximize the condensing capability of the boiler and without header temperature swings.

The boiler will operate to maintain a constant header temperature outlet to +2ºF. Unit shall operate with an Inverse Efficiency Curve, with known Part Load Value Efficiencies. Maximum efficiency shall be achieved at minimum firing input. Controls shall be fully field adjustable from 68ºF to 180ºF in operation. Main Header outlet temperature shall not be more than +2ºF from setpoint at any point of operation.

**Indoor/Outdoor Reset:** Boiler shall include integral factory wired operating controls to control all operation and energy input of the boiler plant. The individual thermal module controllers shall vary their respective thermal module’s input throughout its full range to maximize the condensing capability of the boiler and without header temperature swings. The boiler will operate to vary header temperature setpoint on an inverse ratio in response to outdoor temperature to control discharge temperature +2ºF.

Unit shall operate with an Inverse Efficiency Curve, with known Part Load Value Efficiencies. Maximum efficiency shall be achieved at minimum firing input.

**0VDC to 10VDC Temperature Setpoint:** Boiler shall include integral factory wired operating controls to control all operation and energy input of the boiler. The individual thermal module controllers shall vary their respective thermal module’s input throughout its full range to maximize the condensing capability of the boiler without header temperature swings.

The boiler will operate to vary header temperature setpoint linearly as an externally applied 0 VDC to 10 VDC signal is supplied to the Ufly Controller. Unit shall operate with an Inverse Efficiency Curve, with known Part Load Value Efficiencies. Maximum efficiency shall be achieved at minimum firing input. Main Header outlet temperature shall not be more than +2ºF from setpoint at any point of operation.

**Network Temperature Setpoint:** Boiler shall include integral factory wired operating controls to control all operation and energy input of the boiler. The individual thermal module controllers shall vary their respective thermal module’s input throughout its full range to maximize the condensing capability of the boiler without header temperature swings.

The boiler will operate to vary header temperature setpoint as an external communication utilizing the MODBUS protocol is supplied to the boiler’s Boiler Communications Module (BCM) via the RS-485 port. Unit shall operate with an Inverse Efficiency Curve, with known Part Load Value Efficiencies. Maximum efficiency shall be achieved at minimum firing input. Main Header outlet temperature shall not be more than +2ºF from setpoint at any point of operation.

**AERCO Control System (ACS):** The Boiler Manufacturer can supply as part of the boiler package the AERCO Control System (ACS) to control all operation and energy input of the multiple boiler heating plant. The ACS shall be comprised of a microprocessor-based control utilizing the MODBUS protocol to communicate with the boilers’ Boiler Communication Module via the RS-485 port. One ACS controller shall have the ability to operate up to 32 AERCO boilers.

**Controls Interoperability**

The Boiler Communications Module (BCM) and the AERCO ACS shall utilize the MODBUS open protocol to interface with third party Building Automation Systems (BAS).

Controls interface with BACnet, LonWorks, and N2 shall utilize an optional AERCO Communications Gateway to act as a MODBUS interface/translator between the BAS and either the RS-485 port of the BCM or the RS-232 port of the AERCO ACS. The AERCO Communications Gateway shall be comprised of a microprocessor-based control utilizing the MODBUS protocol to communicate with the Boilers via the RS-485. Non-volatile backup of all point mappings and programs shall be internally provided as standard. Connection between Gateway and individual boilers or to the AERCO ACS shall be “daisy chain” with shielded, twisted-pair, low voltage wiring for ease of installation.

**INSTALLATION**

All aspects of installation of Boiler Plant shall be in strict accordance with manufacturer's instructions. The vent system *must conform to* all manufacturer’s recommendations and shall utilize UL listed stainless steel AL-29-4C, Polypropylene, PVC, or CPVC Positive Pressure venting materials. The vent must be sized in accordance with AERCO’s recommendations.

Boiler plant piping shall be field constructed of materials as specified. Each boiler shall have individually isolating shutoff valves by installing contractor for service and maintenance. Each natural gas boiler shall require a minimum gas pressure of 3.5“ W.C. at 481 scfh (full load rated capacity). For applications with gas supply pressure greater than 10.5” W.C., each boiler shall be provided with an individual supply gas regulator by installing contractor for proper gas regulation.

The boiler shall be constructed with a heavy gauge powder coated steel jacket assembly. The jacket shall be designed and sealed for outdoor installations. The combustion air shall be sealed and completely enclosed, independent of the outer jacket assembly, so that integrity of the outer jacket does not affect combustion stability.

**WARRANTY**

The pressure vessel/heat exchanger of the boiler shall carry a non-prorated 10-year warranty against failure due to condensate corrosion, thermal stress, mechanical defects or workmanship. All other components, with the exception of “consumables” such as, but not limited to igniters, igniter

gaskets, flame detectors, flame detector gaskets, and burner gaskets, shall carry a 5-year warranty against failure due to defective materials or workmanship. A Warranty Certificate must be issued to the owner from the manufacturer and a copy of warranty must be submitted for engineer’s approval.

**FIELD SERVICES**

Contractor shall provide the services of a local factory authorized representative to supervise all phases of equipment startup. A letter of compliance with all factory recommendations and installation instructions shall be submitted to the engineer with operation and maintenance instructions.