**Laars Heating Systems Company – OmniTherm Models ONH 1250-2500**

SECTION 235233 - WATER-TUBE BOILERS

1. GENERAL
   * + 1. RELATED DOCUMENTS
          1. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
       2. SUMMARY
          1. Section includes packaged, factory-fabricated and -assembled, gas-fired, finned water-tube boilers for generating hot water.
       3. ACTION SUBMITTALS
          1. Product Data: For each type of product, include the following:

Construction details, material descriptions, dimensions, and weights of individual components, profiles, and finishes for boilers.

Rated capacities, operating characteristics, and furnished specialties and accessories.

AHRI certified boiler thermal and combustion efficiency.

Temperature and pressure rating, size, and materials of construction for boiler trim components, including piping, fittings, flanges, unions, and valves. Provide valve manufacturer's product data for each valve furnished. For safety valves, include trip and reset settings and flow capacity.

Manufacturer's product data showing size, scale range, and accuracy of thermometers and pressure gages.

Detailed information of controls, including product data with technical performance, operating characteristics, and sequence of operation.

Product data for each motor, including performance, operating characteristics, and materials of construction.

* + - * 1. Sustainable Design Submittals:

Product Data: For energy performance.

* + - * 1. Shop Drawings: For boilers, boiler trim, and accessories.

Include plans, elevations, sections, and attachment details.

Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.

Design calculations and base details, signed and sealed by a qualified professional engineer.

Design Calculations: Calculate requirements for selecting [**vibration isolators and**] seismic restraints and for designing bases.

Base Details: Detail fabrication, including anchorages and attachments to structure and to supported equipment. Include adjustable motor bases, rails, and frames for equipment mounting.

Include diagrams for power, signal, and control wiring. Differentiate between factory and field installation.

Include piping diagrams of factory-furnished piping that indicate size and each piping component.

* + - 1. INFORMATIONAL SUBMITTALS
         1. Coordination Drawings: Plan and elevation views, drawn to scale, indicating equipment manufacturers' service clearances, structure and base attachment, piping, power, controls, and flues. Each view shows a screened background with the following:

Column grids, beams, columns, and concrete housekeeping pads.

Room layout with walls, floors, and roofs, including each room name and number.

Equipment and products of other trades that are located in vicinity of boilers and are part of final installation, such as lighting, fire-suppression systems, and plumbing systems.

* + - * 1. Seismic Qualification Certificates: For boilers, accessories, and components.

Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.

Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.

Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

* + - * 1. Installation instructions.
        2. Source quality-control reports.
        3. Field quality-control reports.
        4. Warranty: Standard warranty, shown below.
        5. Other Informational Submittals:

ASME Stamp Certification and Report: Submit ASME stamp certificate of authorization as required by authorities having jurisdiction, and document hydrostatic testing of piping external to boiler. For Canadian installations, CSA B51 pressure vessel Canadian Registration Number (CRN).

Startup service reports.

* + - 1. CLOSEOUT SUBMITTALS
         1. Operation and Maintenance Data: For boilers, components, and accessories to include in emergency, operation, and maintenance manuals.
         2. Spare Parts List: Recommended spare parts list with quantity for each.
         3. Touch-up Paint Description: Detailed description of paint used in application of finish coat to allow for procurement of a matching paint.
         4. Instructional Videos: Including those that are prerecorded and those that are recorded during training.
      2. MAINTENANCE MATERIAL SUBMITTALS
         1. Tool kit to include the following:

Special tools required to service boiler components not readily available to Owner service personnel in performing routine maintenance.

Lockable case with hinged cover, marked with large and permanent text to indicate the special purpose of tool kit, such as "Boiler Tool Kit." Text size shall be at least 1 inch (25 mm) high.

A list of each tool furnished. Permanently attach the list to underside of case cover. Text size shall be at least 0.5 inch (13 mm) high.

* + - 1. WARRANTY
         1. Manufacturer’s Warranty: Manufacturer agrees to repair or replace components of boilers that fail in materials or workmanship within specified warranty period. Where “prorated” is indicated, the boiler manufacturer will cover the indicated percentage of cost of replacement parts. With “prorated” type, covered cost decreases as age of equipment increases.

Warranty Periods: Limited warranty is effective as of the date of installation or 6 months after the date of installation, whichever is first.

Heat Exchanger Failure Due to Thermal Shock: 25 years.

Heat Exchanger Failure Due to Other Than Thermal Shock: 10 years, with years 6 to 10 prorated.

Components Other Than Heat Exchanger: 1 year.

1. PRODUCTS
   * + 1. PERFORMANCE REQUIREMENTS
          1. Indoor and Outdoor Installations: Boiler shall be CSA certified for indoor and outdoor installation.
          2. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
          3. ASME Compliance: Constructed in accordance with ASME Boiler and Pressure Vessel Code, Section IV, and labeled with ASME H-Stamp.
          4. ASHRAE/IES 90.1 Compliance: Boilers shall have minimum efficiency according to "Gas and Oil Fired Boilers - Minimum Efficiency Requirements."
          5. DOE Compliance: Minimum efficiency shall comply with 10 CFR 430, Subpart B, Appendix N.
          6. AHRI: Boiler thermal and combustion efficiencies shall be determined and listed by AHRI.
          7. CSA Compliance: Test boilers for compliance with the latest edition of ANSI Z21.13/CSA 4.9.
          8. Air Quality Compliance: Meets or exceeds the requirements of the most stringent air quality management codes, including but not limited to: SCAQMD, Rules 1146, 1146.1, or 1146.2 and Texas Commission on Environmental Quality (TCEQ) Title 30 Chapter 117, and Rule 117.465.
       2. FINNED WATER-TUBE BOILERS
          1. Basis-of-Design Product: Subject to compliance with requirements, provide Laars Heating Systems Company; OmniTherm Category I/III model ONH or comparable product by one of the following:

Raypak, Inc.

RBI; A Division of Mestek, Inc.

Thermal Solutions LLC.

Lochinvar, LLC.

* + - * 1. Description: Factory-fabricated, -assembled, and -tested boiler, with stainless steel, vertical, finned tube heat exchanger, and set on a steel base, including jacket, flue-gas vent connections, combustion-air-intake connections, water supply and return connections, and controls.
        2. Heat Exchanger:

ASME “H” Stamp.

160psi maximum operating pressure.

Finned 439 stainless steel tubing.

316 stainless steel headers.

Tubes shall be welded to headers.

Baffles and shrouds shall encapsulate the combustion chamber

* + - * 1. Combustion Chamber Internal Insulation:

Stainless steel, sealed.

Foiled insulation blanket surrounding heat exchanger shroud.

Alumina-silica fiber board on top and bottom of heat exchanger.

* + - * 1. Casing:

Jacket: Sheet metal, with snap-in, mechanically fastened, and/or interlocking closures.

Built and CSA certified for indoor and outdoor installations.

Control Compartment Enclosure: Integral to boiler jacket.

Finish: Thermal set powder coat paint with textured finish and/or stainless steel.

Insulation: Foiled insulation blanket surrounding heat exchanger shroud.

Combustion-Air Connection: Inlet air duct collar.

Mounting base to secure boiler.

* + - * 1. Burner: Forced draft, drawing from gas premixing valve, natural gas fuel. Burner shall have a viewing port for observation of burner operation.
        2. Vent: Category I and III CSA vent certification. Factory-mounted centrifugal fan to draw outside air into boiler and discharge flue gases into boiler vent.

Boiler control will prepurge and postpurge the combustion chamber before firing.

Combustion air shall be allowed to be ducted directly to boiler, or use room air.

Ducted air and vent pipes shall not need to be balanced or be taken from the same pressure zone.

Combination condensate drain/trap shall be standard equipment, to allow for inlet water temperature down to 85°F.

* + - * 1. Gas Train: Valve body combines gas shut off with fuel-air ratio controlled pressure regulator, combining air/gas ratio control with the fuel/air mixer to the boiler.

Boiler shall be designed to operate with natural gas supply pressure of 4-10.5” w.c..

Gas valve shall have a separate touchscreen display that allows valve parameters to be saved or loaded to the system memory from a USB device.

Information that can be saved shall be A/F curve, valve configuration data, and log files.

Valve touchscreen display shall allow for valve settings adjustment, configurations of optional components, and combustion setup of the boiler.

Valve diagnostics available via the valve touchscreen shall include lockout history, active faults, and customizable trends in graph form.

Advanced gas valve setup shall be available for cases where customization of the valve characteristics would be beneficial to the job.

* + - * 1. Ignition: ANSI Z21.13/CSA 4.9, direct spark ignition with flame sensor that includes flame safety supervision and 100 percent main-valve shutoff.
        2. Hot-Water Boiler Trim:

Safety Relief Valve: 75 psig (517kPa) ASME rated.

Pressure and Temperature Gauge: Minimum 3-1/2-inch- (89-mm-) diameter, combination water-pressure and -temperature gauge in compliance with ASME pressure vessel code.

Burner site glass.

Air intake filter.

Water flow switch.

Manual reset high limit.

Automatic reset high limit.

Low water cutoff with manual reset and test.

On/off toggle switch.

Built-in condensate drain/trap.

Drain valve: Minimum NPS 3/4 (DN 20) hose-end valve.

Options - Boiler Mounted:

ASME CSD-1.

Additional auto and manual reset high limits.

Alarm bell with silence switch.

Alternate relief valves.

BACnet IP / Modbus TCP/IP gateway.

LonWorks gateway.

Waterway flange kit.

Options - Field Installed:

BACnet IP / Modbus TCP/IP gateway.

LonWorks gateway.

High and low gas pressure switches with manual reset.

Condensate neutralizer kit.

Condensate pump.

* + - * 1. Controls:

Temperature Control: Includes the following:

Large color touch screen user interface.

Quick start mode to access the most common parameters.

Screen settings timeout, allowing user to choose the amount of time the touch screen backlight remains lit, and/or the touch screen remains unlocked, after user interaction has ceased.

Allows access to history of boiler operations, demand cycles, burner cycles, pump cycles, 10 most recent lockout conditions, unit temperatures and firing statistics.

Factory reset to default settings.

Restart and recalibrate/realign the display.

USB connection that allows the user to upload and download boiler parameters, to copy parameters from one boiler to another, or to document parameters in a tab deliminated text file.

Control transformer.

Maximum vent temperature cutoff.

Adjustable set points:

Two independent heat demands

Indirect domestic-water set point and offset.

Outdoor reset parameters, including enable/disable, minimum and maximum outdoor temperature, and minimum or maximum water temperature.

Warm weather shutdown.

Boiler manual and automatic high limits.

Cascade setpoint, rotation, and redundancy.

Priorities of both heat demands, domestic water demand, external demand and cascade demand.

PID gain parameters.

Boiler pump exercise mode.

System pump exercise mode.

DHW pump exercise mode.

Boiler pump time delay.

System pump time delay.

DHW pump time delay.

Anti-short cycle.

Anti-frost parameters

Deg F or deg C display.

Dry alarm contacts for ignition failure.

Pump control for boiler pump, system pump, and indirect DHW pump, with delay.

Spark to pilot ignition.

24-V ac control circuit.

Accepts 4-20 mA or 0-10 V dc signal from external control or building automation system, for user-selectable set point or firing rate control.

Cascade and lead-lag up to 8 boilers without additional controllers.

Boiler display home screen shall show:

Intuitive, icon-based menu system.

Visual display of real-time boiler status that includes inlet & outlet boiler temperatures, system temperature, indirect domestic water temperature, heat temperature rise, flue gas temperature, and firing rate.

Time and date.

Set points.

Status of all pumps.

Active demands.

Lockouts and alerts.

Message system.

Quick start, configure, and service menu shortcuts.

Three levels of password protection: user level, installer level, and OEM level.

Control shall have BACnet MSTP and Modbus RTU on board, standard. Optional gateways for BACnet IP and LonWorks shall be available from the boiler manufacturer.

Building automation systems shall be able to read:

Boiler and system inlet water temperature sensor.

Boiler and system outlet water temperature sensor.

System temperature sensor.

Flue gas temperature sensor.

DHW temperature sensor.

Outdoor sensor.

Flame signal.

Safety chain status.

Non-safety chain status.

Demand source.

Digital output status.

Gas valve status.

Pilot valve status.

All lockout codes.

All error codes.

History of demand cycles.

History of pump cycles.

History of average, maximum, and minimum boiler outlet temperature.

History of average, maximum, and minimum firing time.

Cascade boiler states.

Active set point.

Burner status.

Pump status.

Burner run time.

Building automation systems shall be able to read and write:

Boiler, DHW and cascade demands.

Setpoints for heat demands, DHW, and cascade.

P, I, and D parameters.

Control diagnostics and service accessibility shall include the following digital inputs:

Flow switch.

Low water cutoff.

Manual reset high limit.

Thermal cutout.

High gas pressure switch.

Low gas pressure switch.

Additional high limit.

Condensate level.

Spare (for user-supplied item).

Control diagnostics and service accessibility shall include the following digital outputs:

Run.

Alarm.

Main gas valve.

Boiler pump.

System pump.

DHW pump.

Auxiliary output 1.

Auxiliary output 2.

Control diagnostics and service accessibility shall include the following analog inputs:

Inlet water temperature.

Outlet water temperature.

Flue gas temperature.

Boiler temperature.

DHW temperature.

Flame signal.

DMS voltage/current.

Control diagnostics and service accessibility shall include the following analog outputs:

Pump speed percent.

Fan speed percent.

Mixing valve percent.

Auxiliary percent.

Control shall have a clock with battery backup.

The control shall differentiate between a lockout, a hold, or an alert. If an issue occurs, the system will display a message icon on the control screen. The user shall be able to tap the icon to be presented with a more detailed explanation of the issue.

* + - * 1. Capacities and Characteristics:

Heating Medium: Hot water.

Design Water-Pressure Rating: 160 psig (1100 kPa).

Safety Relief Valve Setting: 75 psig (517 kPa).

Entering-Water Temperature: Minimum 85 deg F (29 deg C).

Leaving-Water Temperature: Maximum 210 deg F (99 deg C).

Water-Flow and Headloss:

20°F delta-T:

Model ONH1250: 106 gpm (6.7 L/s) flow and 23.6 feet (7.2 m) headloss.

Model ONH1500: 126 gpm (8.0 L/s) flow and 33.0 feet (10.1 m) headloss.

Model ONH1750: 147 gpm (9.3 L/s) flow and 18.4 feet (5.6 m) headloss.

Model ONH2000: 167 gpm (10.5 L/s) flow and 24.4 feet (7.4 m) headloss.

Model ONH2500: 207 gpm (13.1 L/s) flow and 33.7 feet (10.3 m) headloss.

Minimum:

Model ONH1250: 53 gpm (3.4 L/s) flow and 6.2 feet (1.9 m) headloss.

Model ONH1500: 63 gpm (4.0 L/s) flow and 9.0 feet (2.7 m) headloss.

Model ONH1750: 74 gpm (4.7 L/s) flow and 3.8 feet (1.2 m) headloss.

Model ONH2000: 83gpm (5.3 L/s) flow and 5.9 feet (1.8 m) headloss.

Model ONH2500: 104 gpm (6.6 L/s) flow and 9.8 feet (3.0 m) headloss.

AHRI Certified Thermal Efficiency:

Model ONH1250: 84.8 percent.

Model ONH1500: 83.9 percent.

Model ONH1750: 84.1 percent.

Model ONH2000: 83.4 percent.

Model ONH2500: 83.4 percent.

AHRI Certified Combustion Efficiency:

Model ONH1250: 84.2 percent.

Model ONH1500: 83.3 percent.

Model ONH1750: 83.4 percent.

Model ONH2000: 84.0 percent.

Model ONH2500: 84.0 percent.

AHRI Certified Input:

Model ONH1250: 1,250,000 Mbh (366 kW).

Model ONH1500: 1,500,000 Mbh (440 kW).

Model ONH1750: 1,750,000 Mbh (513 kW).

Model ONH2000: 1,999,900 Mbh (586 kW).

Model ONH2500: 2,499,900 Mbh (733 kW).

Available Voltages:

Model ONH1250:

120-V ac, single phase, 60 Hz.

Model ONH1500:

120-V ac, single phase, 60 Hz.

208-V ac, single phase, 60 Hz.

220/240-V ac, single phase, 60 Hz.

Model ONH1750:

120-V ac, single phase, 60 Hz.

208-V ac, single phase, 60 Hz.

220/240-V ac, single phase, 60 Hz.

Model ONH2000:

120-V ac, single phase, 60 Hz.

208-V ac, single phase, 60 Hz.

220/240-V ac, single phase, 60 Hz.

Model ONH2500:

208-V ac, single phase, 60 Hz.

220/240-V ac, single phase, 60 Hz.

208-V ac, three phase, 60 Hz.

480-V ac, three phase, 60 Hz.

600-V ac, three phase, 60 Hz.

Gas Pressure: 4 to 10.5 in. w.c. (984 to 2584 Pa).

NOx Emissions: Meets the most stringent NOx requirements.

* + - 1. SOURCE QUALITY CONTROL
         1. Test and inspect factory-assembled boilers, before shipping, in accordance with latest edition o the ASME Boiler and Pressure Vessel Code.
         2. Burner and Hydrostatic Test: Factory adjust burner to eliminate excess oxygen, carbon dioxide, oxides of nitrogen emissions, and carbon monoxide in flue gas and to achieve performance requirements indicated.

1. EXECUTION
   * + 1. EXAMINATION
          1. Before boiler installation, examine roughing-in for concrete equipment bases, anchor-bolt sizes and locations, and flue; piping; controls; and electrical connections to verify actual locations, sizes, and other conditions affecting boiler performance, maintenance, and operations.

Boiler locations indicated on Drawings are approximate. Determine exact locations before roughing-in for flue, piping, controls, and electrical connections.

* + - * 1. Examine areas where boilers will be installed for suitable conditions.
        2. Proceed with installation only after unsatisfactory conditions have been corrected.
      1. BOILER INSTALLATION
         1. Install boilers on cast-in-place concrete equipment base(s). Comply with requirements for equipment bases and foundations specified in Section 033000 "Cast-in-Place Concrete."
         2. Install gas-fired boilers according to NFPA 54.
         3. Assemble and install boiler trim, components, and accessories that are not factory installed.
         4. Install control and electrical devices furnished with boiler that are not factory mounted.
         5. Install control and power wiring to field-mounted control and electrical devices furnished with boiler that are not factory installed.
         6. Perform boil-out and cleaning procedures according to manufacturer's written instructions after completion of hydrostatic testing and before performing other field tests. Following boil-out and cleaning procedures, boiler shall be washed and flushed until water leaving boiler is clear.
      2. PIPING CONNECTIONS
         1. Piping installation requirements are specified in other Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
         2. Where installing piping adjacent to boiler(s), allow space for service and maintenance.
         3. Install condensate drain piping from equipment drain connection to nearest floor drain, or, if a neutralization system is used, to the condensate-neutralization unit and from neutralization unit to nearest floor drain. Piping shall be at least full size of connection. Install piping with a minimum of 2 percent downward slope in direction of flow.
         4. Connect gas piping to boiler gas-train inlet with dirt leg, shutoff valve, and union or flange. Piping shall be at least full size of gas-train connection. Provide a reducer if required.
         5. Connect hot-water piping to supply- and return-boiler connections with shutoff valve and union or flange at each connection.
         6. Install piping from safety relief valves to nearest floor drain.
         7. Install piping from safety valves and drip-pan elbows. Extend piping from safety valves and terminate to vent outdoors, where required by local jurisdiction. Extend piping from drip-pan elbow drain to nearest floor drain.
         8. Install piping from equipment drain connection to nearest floor drain. Piping shall be at least full size of connection. Provide an isolation valve if required.
         9. Hot equipment drains connected to sanitary drainage system shall be cooled before discharging into the system if required to comply with more stringent of governing code requirements and requirements indicated.

Provide a temperature-controlled non-potable domestic cold water source to cool hot equipment drains to deliver a discharge temperature that meets the requirements of the installation.

* + - 1. FLUE CONNECTIONS
         1. Boiler Intake and Exhaust Vent Piping: Install flue-venting and combustion-air intake.

For boilers placed indoors:

Intake air may be taken from the room, or ducted to the boiler with up to 100 equivalent feet of pipe. Air pipe material may be PVC, CPVC, galvanized steel, polypropylene or ABS. Pipe diameter may be:

Model ONH1250: 6 inch.

Model ONH1500: 6 inch.

Model ONH1750: 8 inch.

Model ONH2000: 8 inch.

Model ONH2500: 8 inch.

Exhaust vent may be Category III or Category I.

Category III vent may be up to 100 equivalent feet of pipe. Vent pipe material must be stainless steel UL 1738, and properly sealed. Vent pipe diameter may be:

Model ONH1250: 6 inch.

Model ONH1500: 6 inch.

Model ONH1750: 8 inch.

Model ONH2000: 8 inch.

Model ONH2500: 8 inch.

Category I vent must be sized to achieve negative draft. The vent system must conform to the National Fuel Gas Code (ANSI Z223.1-Latest edition) in the U.S., or to CSA B149.1 (latest edition) in Canada. Vent pipe diameter will typically be:

Model ONH1250: 12 inch.

Model ONH1500: 12 inch.

Model ONH1750: 14 inch.

Model ONH2000: 14 inch.

Model ONH2500: 16 inch.

For boilers placed outdoors, use air intake and exhaust vent accessories from boiler manufacturer.

* + - * 1. Install easily accessible test ports for field testing of flue gas from each boiler.
      1. ELECTRICAL POWER CONNECTIONS
         1. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."
         2. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."
      2. CONTROLS CONNECTIONS
         1. Install control and electrical power wiring to field-mounted control devices.
         2. Connect control wiring between boilers and other equipment to interlock operation as required, to provide a complete and functioning system.
         3. When external control is used, connect control wiring between boiler control interface and external control system. Comply with applicable requirements in Section 230923 “Direct Digital Control (DDC) System for HVAC” and Section 260523 “Control-Voltage Electrical Power Cables.”
      3. FIELD QUALITY CONTROL
         1. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.
         2. Perform the following tests and inspections:

Perform installation and startup checks according to manufacturer's written instructions.

Hydrostatic Leak Test: Repair leaks and retest until no leaks exist.

Operational Test: Start units to confirm proper motor rotation and unit operation. Adjust air-fuel ratio and combustion.

Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

Check and adjust initial operating set points and high- and low-limit safety set points of fuel supply, water level, and water temperature.

Set field-adjustable switches and circuit-breaker trip ranges as indicated.

* + - * 1. Boiler will be considered defective if it does not pass tests and inspections.
        2. Prepare test and inspection reports.
        3. Occupancy Adjustments: When requested within 2 months of date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to two visits to Project during other-than-normal occupancy hours for this purpose.

**END OF SECTION 235216**