**Laars Heating Systems Company – NeoTherm XTR Models NT2H 0399-1500**

SECTION 235216 - CONDENSING 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 gas-fired, water-tube condensing boilers, trim, and accessories 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 showing compliance with ASHRAE 90.1.

* + - * 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, non-prorated.

Components Other Than Heat Exchanger: 1 year.

1. PRODUCTS
   * + 1. PERFORMANCE REQUIREMENTS
          1. 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.
          2. ASME Compliance: Constructed in accordance with ASME Boiler and Pressure Vessel Code, Section IV, and labeled with ASME H-Stamp.
          3. ASHRAE/IES 90.1 Compliance: Boilers shall have minimum efficiency according to "Gas and Oil Fired Boilers - Minimum Efficiency Requirements."
          4. DOE Compliance: Minimum efficiency shall comply with 10 CFR 430, Subpart B, Appendix N.
          5. AHRI: Boiler thermal and combustion efficiencies shall be determined and listed by AHRI.
          6. CSA Compliance: Test boilers for compliance with the latest edition of ANSI Z21.13/CSA 4.9.
          7. 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. FLOOR-MOUNTED, WATER-TUBE CONDENSING BOILERS
          1. Basis-of-Design Product: Subject to compliance with requirements, provide Laars Heating Systems Company NeoTherm XTR Model NT2H Series boiler, 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, stainless steel water-tube, condensing boiler with heat exchanger sealed pressure tight, built on a steel base, including powder coat, thermal set jacket; flue-gas vent; combustion-air intake connections; water supply, return, and condensate drain connections; and controls.
        2. Heat Exchanger: ASME “H” Stamped stainless steel heat exchanger.
        3. Combustion Chamber: Stainless steel, sealed.
        4. Burner: Forced draft drawing from gas-premixing valve, available for natural gas.
        5. Blower: Operates during burner-firing , prepurge, and postpurge of the combustion chamber.

Motors: Comply with NEMA designation, temperature rating, service factor, and efficiency requirements for motors specified in Section 230513 “Common Motor Requirements for HVAC Equipment.”

Motor Sizes: Large enough so driven load will not require motor to operate in service factor range above 1.0.

* + - * 1. Gas/Air System: The boiler shall have as standard equipment the Laars X-TracTM efficient dual-venturi combustion system, with two independently controlled air and gas injection ports for wide, responsive control range.
        2. Vent / Air Piping:

Boiler shall be designed and CSA certified for horizontal and vertical Category IV venting. Up to 150 equivalent feet of vent pipe may be used. Vent pipe material in the U.S. must be stainless steel UL 1738, PVC sch 40 UL1738 / ULC S636 / ANSI/ASTM D1785 / ANSI/ASTM D2665, CPVC sch 40 UL1738 / ULC S636 / ANSI/ASTM F441, or polypropylene UL1738 / ULC S636.

Air may be taken from the room, or ducted directly to the boiler using up to 150 equivalent feet of PVC, CPVC, galvanized steel, stainless steel, or polypropylene air pipe material.

* + - * 1. Modulating Range: From 10-100% of full fire (10:1 turndown), without the use of gas valves that stage.
        2. Ignition: Spark ignition, with flame sensor with 100 percent main-valve shutoff and flame safety supervision.
        3. Casing:

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

Control Compartment Enclosures: Integral to boiler jacket.

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

* + - * 1. Capacities and Characteristics:

Heating Medium: Hot water.

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

Safety Relief Valve Setting: 75 psig (516 kPa).

Entering-Water Temperature: Minimum 40 deg F (4.4 deg C)>.

Leaving-Water Temperature: Maximum 195 deg F (90.5 deg C)>.

Water Flow and Headloss:

NT2H 0399:

20°F delta-T: 38 gpm (2.4 L/s) flow and 10.8 feet (3.3 m) headloss.

Minimum: 13 gpm (0.8 L/s) flow and 1.2 feet (0.4 m) headloss.

NT2H 0500:

20°F delta-T: 48 gpm (3.0 L/s) flow and 12.0 feet (3.7 m) headloss.

Minimum: 16 gpm (1.0 L/s) flow and 1.3 feet (0.4 m) headloss.

NT2H 0650:

20°F delta-T: 62 gpm (3.9 L/s) flow and 12.2 feet (3.7 m) headloss.

Minimum: 21 gpm (1.3 L/s) flow and 1.3 feet (0.4 m) headloss.

NT2H 0800:

20°F delta-T: 77 gpm (4.9 L/s) flow and 13.3 feet (4.1 m) headloss.

Minimum: 26 gpm (1.6 L/s) flow and 1.5 feet (0.6 m) headloss.

NT2H 0999:

20°F delta-T: 96 gpm (6.1 L/s) flow and 15.0 feet (4.6 m) headloss.

Minimum: 32 gpm (2.0 L/s) flow and 1.8 feet (0.5 m) headloss.

NT2H 1500:

20°F delta-T: 144 gpm (9.1 L/s) flow and 35.2 feet (10.7 m) headloss.

Minimum: 48 gpm (3.0 L/s) flow and 4.0 feet (1.2 m) headloss.

AHRI Certified Efficiencies:

NT2H 0399:

Thermal Efficiency = 96.7%

Combustion Efficiency = 98.5%

NT2H 0500:

Thermal Efficiency = 96.6%

Combustion Efficiency = 98.4%

NT2H 0650:

Thermal Efficiency = 96.5%

Combustion Efficiency = 98.2%

NT2H 0800:

Thermal Efficiency = 96.4%

Combustion Efficiency = 98.0%

NT2H 0999:

Thermal Efficiency = 96.3%

Combustion Efficiency = 97.7%

NT2H 1500:

Thermal Efficiency = 96.0%

Combustion Efficiency = 97.0%

AHRI Certified Input:

NT2H 0399: 399,900 Btu/hr (117 kW).

NT2H 0500: 500,000 Btu/hr (147 kW).

NT2H 0650: 650,000 Btu/hr (190 kW).

NT2H 0800: 800,000 Btu/hr (234 kW).

NT2H 0999: 999,000 Btu/hr (293 kW).

NT2H 1500: 1,500,000 Btu/hr (440 kW).

Electrical: 120-V ac, single phase, 60 Hz.

* + - * 1. Trim

Controller:

Laars Linc® operating / modulation burner integrated control

Large color touchscreen

Manual reset high limit

Safety Relief Valve: ASME rated, 75psi.

Pressure and Temperature Gauge: Minimum 2-1/2-inch- (64-mm-) diameter, combination water-pressure and -temperature gauge in compliance with ASME Pressure code.

Water Flow Switch.

Air filter.

Boiler Air Vent: Manual.

Drain Valve: Minimum NPS 3/4 (DN 20) valve in compliance with ASME pressure vessel code.

Condensate Trap: Primeless condensate trap with overflow protection.

Options – Boiler Mounted:

ASME CSD-1

Boiler pump included

Low water cutoff

30psi pressure relief valve

50psi pressure relief valve

60psi pressure relief valve

125psi pressure relief valve

150psi pressure relief valve

Options – Field Installed:

Kit for outdoor placement

Pump housing for outdoor placement

Alarm bell with silence switch

CSD-1 field install kit

Low water cutoff with manual reset and test button

High & low gas pressure switches

Additional auto-reset high limit

Boiler pump

Pump contactor

BACnet gateway

LON gateway

PVC concentric vent terminal

CPVC concentric vent terminal

Concentric flush-mount vent terminal

Condensate neutralizer kit

* + - * 1. CONTROLS

Boiler operating/modulating control shall be Laars Linc® and shall include the following devices and features:

Large color touch screen user interface with intuitive icon displays.

Clearly labelled terminal strip for field wiring connections.

Quick start menu option to access basic functionality.

Configuration menu option to access all available parameters.

Service menu to access all available service screens.

Modulates from 10 percent to 100 percent of full fire (10:1 turndown)

BACnet MSTP and Modbus RTU on board, via RS 485 connections.

USB functionality that allows:

Download of parameters from one boiler to another.

Upload of parameters to a thumb drive.

Upload history data from a boiler in tab deliminated text file.

Control transformer.

Maximum vent temperature cutoff.

Water flow switch.

Dry contacts for ignition failure alarm.

Dry contacts for run status.

Manual reset high limit stops burner if operating conditions rise above maximum boiler design temperature.

On/off toggle switch, lighted.

Controls multiple heat demands; two space heating and one indirect domestic water.

Adjustable set points.

Boiler temperature

Domestic water temperature

Boiler manual reset high limit.

Boiler automatic reset high limit.

Minimum and maximum boiler temperature rise limits.

Minimum and maximum temperature between which the system will modulate.

Deg F or deg C display.

PID parameters.

Manual firing rate control (forced min or max firing rate).

Flue temperature limitation.

Priority feature allows the user to set priorities for each heat demand.

Pump exercise mode.

Anti-short cycle.

Integrates indirect domestic water heating.

Indirect water heater priority.

DHW temp sensor included.

Recognizes DHW sensor or closure from tank stat.

Multiple pump control for boiler pump, system pump, and indirect domestic water pump, each with delay.

Vari-Prime® boiler pump control via user-selectable fixed boiler temperature rise, wired and programmed for use with variable speed pumps.

Spark to pilot ignition

24-V control circuit.

Accepts 4-20 mA or 0-10 V signal from external control or building automation system that can be programmed as a remote setpoint or remote firing rate signal.

Anti-short cycle feature.

Boiler control shall display information about the following for each boiler it is monitoring:

Space heating loop 1 setpoint.

Space heating loop 2 setpoint.

Domestic hot water setpoint (when sensor is used).

Space heating loop 1 temperature.

Space heating loop 1 temperature.

Domestic hot water temperature (when sensor is used).

Status of all pumps.

Boiler status that includes; running or standby, actual firing rate, target firing rate, outside air temperature (when sensor is used), and flame signal.

Inlet and outlet water temperature.

Boiler temperature rise.

System temperature inlet and outlet (when system sensor is used).

Icon that displays which heat demands are active.

Error and lockout codes.

Date & time.

Locked / unlocked status of control.

Outdoor Reset:

Customizable reset curves based on outdoor temperatures and desired system water temperature.

Warm weather shutdown.

Outdoor air temperature sensor included.

Cascade and lead-lag up to eight boilers without additional controllers, via RS 485 connections.

Cascade keeps each boiler at the lowest firing rate, with boilers modulating together to maximize efficiency, while satisfying the heat demand.

Rotation setup options include:

Run time mode – Chooses which unit fires first, based on run time hours.

Recurrence mode – adjust the hour and minute of the day for rotation, and how many days to wait for rotation, of the lead boiler.

Boiler control shall display the following system information:

Graphically depict the firing rate of each boiler in the system.

Boiler sequence order shown with each boiler in the system.

Auto-reset or lockout of individual boilers.

Target cascade power for the system, and for each boiler.

Actual cascade power for the system, and for each boiler.

System temperature displayed.

Redundancy feature that allows the user to choose how to treat a loss of communication with the lead unit:

Boiler internal setpoint - Continue to operate lag units in the same manner as when the communication stopped, via their internal setpoints.

Redundant lead – A lag unit will assume lead responsibilities.

Disabled – Lag units will no longer work to satisfy the heat demand.

User-programmable cascade base load values.

Three levels of password protection:

User level.

Installer level.

OEM level.

Service screens shall include:

Burner.

Digital inputs, including:

CH1.

CH2.

DHW.

Flow switch.

Low water cutoff.

Manual reset high limit.

Thermal cutout.

High gas pressure.

Low gas pressure.

Additional high limit.

Condensate level

Spare

Digital outputs, including:

Run.

Alarm.

Safety satisfied.

Boiler pump.

System pump.

DHW pump.

Auxiliary power output.

Auxiliary dry contact.

Analog inputs, including:

All temperature sensor readings.

Flame signal.

Voltage or current control signals.

Analog outputs, including:

Pump speed.

Fan speed.

Auxiliary.

Screen restart and recalibrate.

History.

Restart.

Factory default reset.

Pilot test.

Information available from BACnet / Modbus connection:

All control setpoints.

All temperature sensor readings.

Flame signal

Voltage or current external input

Blower speed

Safety chain status.

Non-safety chain status.

Demand source.

Digital output status.

Gas and pilot valve status.

Status of all pumps.

Pump speed output.

Firing rate.

Lockout codes.

Error codes.

All history parameters.

Lead-lag system – state of each boiler.

Outdoor reset / warm weather shutdown status.

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 brief description of the issue on the control screen. The user shall be able to tap the display to be presented with a more detailed explanation of the issue.

The user shall be able to choose how long the control will remain unlocked after interaction with control has stopped.

Burner Operating Controls: To maintain safe operating conditions, burner safety controls limit burner operation.

Burner operating control shall be integral to the boiler control.

1. EXECUTION
   * + 1. EXAMINATION
          1. Examine roughing-in for concrete equipment bases, anchor-bolt sizes and locations, and piping and electrical connections to verify actual locations, sizes, and other conditions affecting performance of the Work.

Final boiler locations indicated on Drawings are approximate. Determine exact locations before roughing-in for piping and electrical connections.

* + - * 1. Examine mechanical spaces for suitable conditions where boilers will be installed.
        2. Proceed with installation only after unsatisfactory conditions have been corrected.
      1. BOILER INSTALLATION
         1. Install floor-mounted 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 any optional boiler trim.
         4. Install electrical devices furnished with boiler but not specified to be factory mounted.
         5. Install control wiring to field-mounted electrical devices.
      2. PIPING CONNECTIONS
         1. Comply with requirements for hydronic piping specified in Section 232113 "Hydronic Piping."
         2. Drawings indicate general arrangement of piping, fittings, and specialties.
         3. When installing piping adjacent to boiler, allow space for service and maintenance of condensing boilers. Arrange piping for easy removal of condensing boilers.
         4. 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.
         5. Connect gas piping to boiler gas-train inlet with union. Piping shall be at least full size of gas-train connection. Provide a reducer if required.
         6. Connect hot-water piping to supply- and return-boiler tappings with shutoff valve, and union or flange at each connection.
         7. Install piping from safety relief valves to nearest floor drain.
      3. DUCT CONNECTIONS
         1. Boiler Intake and Exhaust Vent Piping:

Install flue-venting kit and combustion-air intake:

Intake air may be taken from the room, or ducted to the boiler. When ducted, air pipe material may be PVC, CPVC, galvanized steel, stainless steel or polypropylene. Air pipe diameter may be:

NT2V 0399: Up to 150 equivalent feet of 4 inch diameter pipe.

NT2V 0500: Up to 150 equivalent feet of 4 inch diameter pipe.

NT2V 0650: Up to 150 equivalent feet of 6 inch diameter pipe.

NT2V 0800: Up to 150 equivalent feet of 6 inch diameter pipe.

NT2V 0999: Up to 150 equivalent feet of 6 inch diameter pipe.

NT2V 1500: Up to 150 equivalent feet of 8 inch diameter pipe.

Exhaust vent is Category II or Category IV. Vent pipe material in the U.S. must be stainless steel UL 1738, PVC sch 40 UL1738 / ULC S636 / ANSI/ASTM D1785 / ANSI/ASTM D2665, CPVC sch 40 UL1738 / ULC S636 / ANSI/ASTM F441, or polypropylene UL1738 / ULC S636. Vent pipe material in Canada must be ULC S636 certified. Category II vent pipe is typically 12” diameter pipe, but must be sized per the job. Category IV vent pipe diameter and length may be:

NT2V 0399: Up to 150 equivalent feet of 4 inch diameter pipe.

NT2V 0500: Up to 150 equivalent feet of 4 inch diameter pipe.

NT2V 0650: Up to 150 equivalent feet of 6 inch diameter pipe.

NT2V 0800: Up to 150 equivalent feet of 6 inch diameter pipe.

NT2V 0999: Up to 150 equivalent feet of 6 inch diameter pipe.

NT2V 1500: Up to 150 equivalent feet of 8 inch diameter pipe.

Comply with all boiler manufacturer’s installation instructions.

* + - 1. ELECTRICAL CONNECTIONS
         1. Connect wiring in accordance with Section 260519 "Low-Voltage Electrical Power Conductors and Cables."
         2. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."
         3. Install electrical devices furnished by manufacturer, but not factory mounted, according to NFPA 70 and NECA 1.
      2. CONTROL CONNECTIONS
         1. Install control and electrical power wiring to field-mounted control devices.
         2. Connect control wiring in accordance with 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. Tests and Inspections:

Perform installation and startup checks in accordance with manufacturer's written instructions.

Leak Test: Hydrostatic 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**