**Laars Heating Systems Company – NeoTherm Indoor Models NTH 399-850**

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: Include construction details, material descriptions, dimensions of individual components and profiles, finishes for boilers, rated capacities, operating characteristics, and furnished options and accessories.
				2. 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.

Include diagrams for power, signal, and control wiring.

* + - 1. INFORMATIONAL SUBMITTALS
				1. Coordination Drawings: Plans and sections, drawn to scale and coordinated with each other, using input from installers of the items involved.
				2. Source quality-control reports.
				3. Field quality-control reports.
				4. Warranty: Standard warranty, shown below.
				5. Product Certificates:

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).

* + - 1. CLOSEOUT SUBMITTALS
				1. Operation and Maintenance Data: For boilers to include in emergency, operation, and maintenance manuals.
			2. 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. 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 in accordance with Table 6.8.1-6 and other requirements in Ch. 6 of ASHRAE/IES 90.1.
				4. AHRI:

Boiler thermal and combustion efficiencies shall be certified and listed by AHRI.

* + - * 1. CSA Compliance: Test boilers for compliance with the latest edition of ANSI Z 21.13/CSA 4.9.
				2. 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.
				3. Mounting Base: For securing boiler to concrete base.
			1. FLOOR-MOUNTED, WATER-TUBE CONDENSING BOILERS
				1. Basis-of-Design Product: Subject to compliance with requirements, provide Laars Heating Systems Company NeoTherm Indoor Model NTH 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: Stainless steel heat exchangers.
				3. Combustion Chamber: Stainless steel, sealed.
				4. Burner: Forced draft drawing from gas-premixing valve, available for propane.
				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 Train: Equipped with a zero-governing, negative pressure regulator valve and manual shutoff valve.
				2. Vent / Air Piping:

Boiler shall be designed and CSA certified for horizontal and vertical Category IV venting, using up to 100 equivalent feet of PVC, CPVC, polypropylene, 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 PVC, CPVC, galvanized steel, ABS, stainless steel, or polypropylene air pipe material.

* + - * 1. Modulating Range: From 20-100% of full fire (5:1 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:

NTH 399:

20°F delta-T: 39 gpm (2.5 L/s) flow and 22.8 feet (6.9 m) headloss.

Minimum: 12.6 gpm (0.8 L/s) flow and 4.0 feet (1.2 m) headloss.

NTH 500:

20°F delta-T: 48 gpm (3.0 L/s) flow and 22.2 feet (6.8 m) headloss.

Minimum: 15.8 gpm (1.0 L/s) flow and 3.4 feet (1.0 m) headloss.

NTH 600:

20°F delta-T: 58 gpm (3.7 L/s) flow and 30.5 feet (9.3 m) headloss.

Minimum: 19.0 gpm (1.2 L/s) flow and 4.6 feet (1.4 m) headloss.

NTH 750:

20°F delta-T: 72 gpm (4.6 L/s) flow and 38.0 feet (11.6 m) headloss.

Minimum: 23.8 gpm (1.5 L/s) flow and 4.6 feet (1.4 m) headloss.

NTH 850:

20°F delta-T: 81 gpm (5.1 L/s) flow and 34.8 feet (10.6 m) headloss.

Minimum: 26.9 gpm (1.7 L/s) flow and 5.3 feet (1.6 m) headloss.

AHRI Certified Efficiencies:

NTH 399:

Thermal Efficiency = 96.5%

Combustion Efficiency = 96.5%

NTH 500:

Thermal Efficiency = 95.0%

Combustion Efficiency = 95.0%

NTH 600:

Thermal Efficiency = 95.3%

Combustion Efficiency = 96.0%

NTH 750:

Thermal Efficiency = 96.6%

Combustion Efficiency = 96.6%

NTH 850:

Thermal Efficiency = 95.7%

Combustion Efficiency = 95.7%

AHRI Certified Input:

NTH 399: 399,900 Btu/hr.

NTH 500: 500,000 Btu/hr.

NTH 600: 600,000 Btu/hr.

NTH 750: 750,000 Btu/hr.

NTH 850: 850,000 Btu/hr.

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

* + - * 1. Trim

Controller:

Modulating operating.

Large color touchscreen

Ignition.

Manual reset high limit.

Safety Relief Valve: ASME rated, 75psi.

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

Water Flow Switch (models 399-850).

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 (500-850)

Boiler pump included

Low water cutoff

High & low gas pressure switches

Alarm bell for ignition failure with silencing switch

Automatic reset high limit

30psi pressure relief valve

50psi pressure relief valve

60psi pressure relief valve

125psi pressure relief valve

150psi pressure relief valve

Options – Field Installed:

Low water cutoff

High & low gas pressure switches

Boiler pump

BACnet gateway

LON gateway

Vari-prime® variable speed boiler pump control

Concentric vent terminal

Concentric flush-mount vent terminal

Condensate neutralizer kit

Common vent kit (399-500)

* + - * 1. CONTROLS

Boiler operating controls shall include the following devices and features:

Large color touch screen user interface

Screen cleaning mode that allows user to clean screen without activating touch screen.

Quick start menu option.

Modulates from 20 percent to 100 percent of full fire (5:1 turndown)

Control transformer.

Maximum vent temperature cutoff.

Water flow switch.

Dry alarm contacts for ignition failure.

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

On/off toggle switch, lighted.

Adjustable set points.

Boiler temperature

Domestic water temperature

Boiler high limit.

Deg F or deg C display.

PID parameters.

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

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.

Direct spark ignition

24-V control circuit.

Accepts 4-20 mA or 0-10 V modulation signal from external control or building automation system, with automatic remote signal detection.

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.

Selectable firing sequence methods:

Keep each boiler at lowest firing rate and modulate together to maximize efficiency.

Each boiler brought to high fire before additional boilers fired.

Provides equal runtime for boilers.

Boiler control shall display the following system information:

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

Outdoor temperature displayed.

System temperature displayed.

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

Icon color shall indicate boiler status; normal operation, lockout, standby, hold state, communication error.

Domestic hot water.

Burner control.

Demand.

Modulation.

Inlet temperature.

Blower.

Domestic water pump.

Boiler pump.

System pump.

Flame detection.

Statistics.

Vent temperature limit.

Frost protection.

Three levels of password protection:

User level.

Installer level.

OEM level.

Information available from Modbus connection:

Inlet water temperature.

Outlet water temperature.

Flue gas temperature.

DHW temperature.

DHW priority.

System temperature.

Frost protection.

Warm weather shutdown.

Status for all sensors.

Fan speed.

All setpoints.

Remote control input.

Burner status.

Lockout codes.

Alarm reasons.

Domestic water pump status.

Boiler pump status.

System pump status.

Control diagnostics shall include:

Ignition failure.

Grounded flame rod.

Safety chain interrupt.

Boiler high limit exceeded.

Domestic water high limit exceeded.

Temperature rise limit exceeded.

Flue gas temperature limit exceeded.

Pressure sensor fault.

Combustion pressure fault.

Blocked air intake.

Sensor errors (open or short).

Control voltage high or low.

Modulation fault.

Pump fault.

AC input phases reversed.

Fan speed proving rate failure.

Control shall have a clock with battery backup and runtime indicators for:

Burner runtime.

Burner cycle count.

Boiler pump.

DHW pump.

System pump.

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.

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, polypropylene, stainless steel, or ABS. Air pipe diameter may be:

NTH 399 and NTH 500: Up to 100 equivalent feet of 4” diameter pipe.

NTH 600, NTH 750 and NTH 850: Up to 100 equivalent feet of 6” diameter pipe, or up to 40 equivalent feet of 4” diameter pipe.

Exhaust vent is Category IV. Exhaust vent material in the U.S. must be stainless steel UL 1738, CPVC or PVC sch 40 ANSI/ASTM F441, or polypropylene ULC S636 Class 2C. Vent pipe material in Canada must be ULC S636 certified. Vent pipe diameter may be:

NTH 399 and NTH 500: Up to 100 equivalent feet of 4” diameter pipe.

NTH 600, NTH 750 and NTH 850: Up to 100 equivalent feet of 6” diameter pipe, or up to 40 equivalent feet of 4” 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**