**Laars Heating Systems Company – Pennant Models PNCV 500-2000**

SECTION 223400 - FUEL-FIRED, DOMESTIC-WATER HEATERS

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 commercial, finned-tube, gas-fired, domestic-water heaters.
			3. ACTION SUBMITTALS
				1. Product Data: For each type of product, include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.
				2. Sustainable Design Submittals:

Product Data for water heater compliance with ASHRAE's "Advanced Energy Design Guides."

* + - * 1. Shop Drawings: Include diagrams for power, signal, and control wiring.
			1. INFORMATIONAL SUBMITTALS
				1. Coordination Drawings: Equipment room drawing or BIM model, drawn to scale, on which the items described in this Section are shown and coordinated with all building trades.
				2. Product Certificates: For each type of commercial, gas-fired, domestic-water heater.
				3. Domestic-Water Heater Labeling: Certified and labeled by testing agency acceptable to authorities having jurisdiction.
				4. Source quality-control reports.
				5. Field quality-control reports.
				6. Warranty: Standard warranty, shown below.
			2. CLOSEOUT SUBMITTALS
				1. Operation and Maintenance Data: For fuel-fired, domestic-water heaters to include in emergency, operation, and maintenance manuals.
			3. COORDINATION
				1. Coordinate sizes and locations of concrete bases with actual equipment provided.
			4. WARRANTY
				1. Manufacturer’s Warranty: Manufacturer agrees to repair or replace components of fuel-fired, domestic-water heaters that fail in materials or workmanship within specified warranty period. Where “prorated” is indicated, the heater manufacturer will cover the indicated percentage of cost or replacement parts. With “prorated” type, covered cost decreases as age of equipment increases.

Failures include, but are not limited to, the following:

Structural failures.

Faulty operation of controls.

Deterioration of metals, metal finishes, and other materials beyond normal use.

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

Heat Exchanger Failure Due to Thermal Shock: 25 years.

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

Controls and Other components: 1 year.

1. PRODUCTS
	* + 1. PERFORMANCE REQUIREMENTS
				1. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by an NRTL, and marked for intended location and use.
				2. ASHRAE/IES Compliance: Comply with efficiency requirements in ASHRAE 189.1, which supersede requirements in ASHRAE/IES 90.1.
				3. ASME Compliance: Constructed in accordance with ASME Boiler and Pressure Vessel Code, and labeled with ASME HLW stamp.
				4. AHRI: Heater thermal efficiencies shall be determined and listed by AHRI.
				5. CSA Compliance: Test heaters for compliance with the latest edition of ANSI Z21.10.3/CSA 4.3 for gas water heaters.
			2. COMMERCIAL, WATER TUBE TYPE, GAS-FIRED, DOMESTIC-WATER HEATERS
				1. Basis-of-Design Product: Subject to compliance with requirements, provide Laars Heating Systems Company Pennant PNCV, water tube type, gas-fired, domestic-water heater, with Laars Linc control, or comparable product by one of the following:

Raypak, Inc.

RBI; A Division of Mestek, Inc.

Thermal Solutions LLC.

Lochinvar, LLC.

* + - * 1. Description: Packaged commercial, finned-tube, gas-fired, domestic-water heater and controls.
				2. Heater Construction: ASME code with 160-psig (1100-kPa) working-pressure rating for commercial domestic-water heater.
				3. Heater Appurtenances:

Heat Exchanger: Horizontal, straight, finned-copper tubes with glass-lined cast-iron headers.

Combustion Chamber: Interlocking panels of refractory insulation, high-temperature cements, mineral fiber, and ceramic refractory tile for service temperatures of up to 2,000 deg F (1100 deg C).

Burner: Multiple stainless steel burners, suitable for natural or propane gas.

Blower: Factory-mounted centrifugal fan to draw outside air into heater and discharge flue gases into heater vent.

Gas Train: Multiple combination gas valves with manual shutoff per CSA requirements.

Ignition: ANSI Z21.10.3/CSA 4.3, proven hot surface ignition.

Jacket: Sheet metal with snap-in, mechanically fastened, and/or interlocking closures, with powder coat, thermal set textured finish.

Built and CSA certified for indoor or outdoor installations.

CSA certified for category I fan-assisted, and category III vent systems.

Controls: Integrated electronic temperature and ignition control includes:

UL353 rating for high and low limits, such that a separate manual reset control is not required.

Large color touch screen user interface.

Display shall be visible without the removal of any jacket panels.

Firing Rate:

Models 500 and 750: Two-stage firing.

Model 1000: Three-stage firing.

Models 1250, 1500, 1750 and 2000: Four-stage firing.

User configurable staging by adjusting differential, stage delay on/off, and minimum stage on/off.

Adjustable setpoints:

Domestic water setpoint.

Heater high limit, automatic and manual.

Deg F or deg C display.

PID gain parameters.

Manual staging control.

Pump exercise model.

Anti-short cycle.

Temperature differential.

Pump time delay.

Anti-frost setting.

Control and display shall both hold the heaters configuration and programmed parameters. Each shall be able to upload/download those parameters to the other, allowing for each device to be replaced without reprogramming.

The control shall have a USB connection that will allow the transfer of parameter sets from one heater to another, and will allow a heater’s history data to be transferred to a USB memory device.

The control has a quick start feature allowing programming of the most commonly used subset of parameters.

Dry alarm contacts for ignition failure.

24-V ac control circuit.

Accepts 4-20 mA or 0-10 V dc input signal from external control or building automation system, with automatic remote signal detection, allowing external control of staging or temperature setpoint

The control shall recognize a domestic water sensor (shipped with unit) or a closure from a tank stat as a call for DHW.

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

When heaters are wired together, the controller on the lead unit shall automatically detect and configure all units.

The cascade system shall have built in redundancy, via either a lag unit’s internal setpoint or a configurable redundant leader.

Selectable firing sequence methods for cascade:

Keep each heater at lowest firing rate and stage fire together.

Automatic, alternating-firing sequence for multiple heaters to provide equal run time per heater.

Heater control shall graphically depict the firing rate of each heater in the system.

Heater control shall display information about the following for each heater it is monitoring:

Navigation bar color shall indicate heater status; normal operation, lockout, hold state, communication error. The control shall differentiate between a lockout, a hold, or an alert.

Navigation bar indicates where the user is within the menu structure, and displays brief descriptions of control information.

Heater setpoint.

Domestic water setpoint.

Cascade setpoints.

Heater pump status.

Burner run status.

Status of each stage.

Blower status.

Cascade status.

Indicate active parameters currently in demand.

Real time status of firing rate

Real time temperature and temperature rise.

Displays date and time.

Displays errors and lockout information.

Displays password level access and lock indication for password security.

Icons to access quick start, configure and service menus.

Messages about heater operation shall be indicated by and icon on the home screen that can be touched to display the whole message.

USB icon shall be displayed when USB port is in use.

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

Modbus, and BACnet MSTP protocols standard on controller.

Information available from control protocols:

Inlet water temperature.

Outlet water temperature.

DHW temperature.

Frost protection.

Status for all sensors.

Fan speed.

All setpoints.

Remote control input.

Burner status.

Lockout codes.

Alarm reasons.

Pump status.

Control diagnostics shall include:

Ignition failure.

Safety chain interrupt.

Flow switch.

Low water cutoff.

Manual reset high limit exceeded.

Auto reset high limit exceeded.

DHW high limit exceeded.

Block flue switch fault.

Combustion air switch fault

High gas pressure fault

Low gas pressure fault

Field interlock open.

Temperature sensor errors (open, short or drift).

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

Demand cycles.

Burner cycles.

Pump cycles.

Firing time.

Ten most recent lockouts

Dry alarm contacts for ignition failure.

Water flow switch.

Pressure relief valve: 125 psig (861 kPa).

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

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

On/off toggle switch.

Pump time delay.

Air intake filter.

Automatic, high-temperature-limit cutoff device.

Burner site glass.

Blocked vent safety pressure switch.

Air pressure switch.

* + - * 1. Options - Heater Mounted:

ASME CSD-1

Mounted/wired heater pump.

Cupronickel heat exchanger tubes.

Bronze trim.

ASME HLW construction.

Low water cutoff with manual reset and test button.

Additional automatic reset high limit.

Additional manual reset high limit.

Reversed water connections.

Alternate relief valves.

Low-Temp heater version: Mounted pump, on/off fire, and an automatic mixing (anti-condensing) system, to protect the heat exchanger from excessive condensation due to low return water temperature, associated with low temperature systems down to 70 deg F (21 deg C).

* + - * 1. Options - Field Installed:

BACnet IP / Modbus TCP/IP gateway.

LonWorks gateway.

Side-wall vent terminal.

Side-wall combustion air terminal.

Vent terminal for unit placed outdoors.

Air terminal for unit placed outdoors.

* + - * 1. Support: Steel base or skids.
				2. Capacity and Characteristics:

Recovery:

Model 500: 510 gph (0.54 L/s) at 100°F (56°C) temperature rise.

Model 750: 766 gph (0.81 L/s) at 100°F (56°C) temperature rise.

Model 1000: 1019 gph (1.07 L/s) at 100°F (56°C) temperature rise.

Model 1250: 1276 gph (1.34 L/s) at 100°F (56°C) temperature rise.

Model 1500: 1531 gph (1.61 L/s) at 100°F (56°C) temperature rise.

Model 1750: 1786 gph (1.88 L/s) at 100°F (56°C) temperature rise.

Model 2000: 2040 gph (2.15 L/s) at 100°F (56°C) temperature rise.

Fuel Gas Input:

Model 500: 500 Mbh (147 kW).

Model 750: 750 Mbh (220 kW).

Model 1000: 999 Mbh (293 kW).

Model 1250: 1,250 Mbh (366 kW).

Model 1500: 1,500 Mbh (439 kW).

Model 1750: 1,750 Mbh (513 kW).

Model 2000: 1,999 Mbh (583 kW).

Inlet Gas Pressure: 4- to 13 in. wg (995 to 3235 Pa).

AHRI Certified Thermal Efficiency: 85.0 percent.

Available Voltages:

120-V ac, single phase, 60 Hz.

* + - * 1. Heater Intake and Exhaust Vent Piping: Install flue-venting kit and combustion-air intake.

For heaters placed indoors:

Intake air may be taken from the room, or ducted to the heater with up to 50 feet of, and up to three elbows. Air pipe material may be single-wall galvanized steel, 24 gauge minimum, insulated or non-insulated, sealed with permanent duct tape or aluminum tape. Air pipe diameter may be:

Model 500: 6 inch.

Model 750: 8 inch.

Model 1000: 8 inch.

Model 1250: 12 inch.

Model 1500: 12 inch.

Model 1750: 12 inch.

Model 2000: 12 inch.

Exhaust vent may be Category III or fan-assisted Category I.

Category III vent may be up to 50 feet of pipe, and up to three elbows. Vent pipe material must comply with UL Standard UL1738, such as type 29-4C stainless steel, either insulated or non-insulated. Vent pipe diameter may be:

Model 500: 6 inch.

Model 750: 8 inch.

Model 1000: 8 inch.

Model 1250: 10 inch.

Model 1500: 10 inch.

Model 1750: 12 inch.

Model 2000: 12 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. It must be sized as a fan-assisted Category I system.

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

Comply with all heater manufacturer’s installation instructions.

* + - 1. SOURCE QUALITY CONTROL
				1. Factory Tests: Test and inspect assembled domestic-water heaters specified to be ASME-code construction, in accordance with ASME Boiler and Pressure Vessel Code.
				2. Hydrostatically test commercial domestic-water heaters to minimum of one and one-half times pressure rating before shipment.
				3. Domestic-water heaters will be considered defective if they do not pass tests and inspections.
				4. Assembled heater must be factory tested for safety and functionality; heater filled with water, fired throughout firing range, with all burner safety components proven. Results recorded for future reference.
				5. Prepare test and inspection reports.
1. EXECUTION
	* + 1. DOMESTIC-WATER HEATER INSTALLATION
				1. Commercial, Domestic-Water Heater Mounting: Install commercial domestic-water heaters on concrete base. Comply with requirements for concrete base specified in Section 033000 "Cast-in-Place Concrete."
				2. Install domestic-water heaters level and plumb, in accordance with layout drawings, original design, and referenced standards. Maintain manufacturer's recommended clearances. Arrange units so controls and devices needing service are accessible.
				3. Install gas-fired, domestic-water heaters in accordance with NFPA 54.
				4. Assemble and install any additional or optional heater trim.
				5. Fill domestic-water heaters with water.
				6. Charge domestic-water expansion tanks with air to required system pressure.
			2. PIPING CONNECTIONS
				1. Comply with requirements for domestic-water piping specified in Section 221116 "Domestic Water Piping."
				2. Comply with requirements for gas piping specified in Section 231123 "Facility Natural-Gas Piping."
				3. Drawings indicate general arrangement of piping, fittings, and specialties.
				4. Where installing piping adjacent to fuel-fired, domestic-water heaters, allow space for service and maintenance of water heaters. Arrange piping for easy removal of domestic-water heaters.
			3. IDENTIFICATION
				1. Identify system components. Comply with requirements for identification specified in Section 220553 "Identification for Plumbing Piping and Equipment."
			4. FIELD QUALITY CONTROL
				1. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
				2. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.
				3. Perform tests and inspections in accordance with manufacturer’s written instructions..
				4. Tests and Inspections:

Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.

Operational Test: After electrical circuitry has been energized, start units to confirm proper operation.

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

* + - * 1. Domestic-water heaters will be considered defective if they do not pass tests and inspections.
				2. Prepare test and inspection reports.
			1. DEMONSTRATION
				1. Train owner's maintenance personnel to adjust, operate, and maintain the domestic-water heaters.

**END OF SECTION 223400**