**Laars Heating Systems Company – MagnaTherm HTD Models MGV 1600-4000**

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, water tube type, 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 MagnaTherm HTD model MGV with Laars Linc control, vertical-standing, water tube type, gas-fired, domestic-water heater, 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, water tube type, 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, with HLW stamp.
        3. Heater Appurtenances:

Heat Exchanger: Straight stainless steel finned tubes with stainless steel headers.

Combustion Chamber: Stainless steel, sealed.

Burner: Forced draft, drawing from gas premixing valve, for natural gas.

Blower: Operates during burner-firing, prepurge, and postpurge of the combustion chamber.

Gas/Air System: The heater shall have as standard equipment a controlled linkageless modulating valve system, Tru TracTM controlled oxygen trim system, and Laars Linc® burner integrated control system. The controlled components shall communicate with each other to ensure stable, clean combustion, high heat recovery, and consistent efficiency throughout the entire modulating range of the heater, and shall feed information to the display on the heater for set up, informational, and diagnostic purposes. The gas train shall consist of an on/off solenoid valve, on/off pressure regulating valve, fuel modulating damper, air modulating damper, and air/gas mixer.

Oxygen Sensing System: Tru TracTM system that monitors percent of oxygen in the flue gas, and adjusts the blower speed to maintain the proper oxygen content of the gas, ensuring consistent efficiency, clean combustion, and high heat recovery throughout the modulating range. Oxygen content of the flue gases shall be continually monitored and controlled within 2 minutes of heater ignition, and throughout the rest of the firing period.

Modulating Range: From 5-100% of full fire (20:1 turndown), without the use of gas valves that stage, and without affecting the minimum combustion efficiency ratings.

Ignition: ANSI Z21.10.3/CSA 4.3, direct spark ignition with flame sensor that includes flame safety supervision and 100 percent main-valve shutoff.

Jacket: Sheet metal with powder coat, thermal set textured finish or stainless steel.

Built and CSA certified for indoor or outdoor installations.

CSA certified for category IV and category II vent systems.

Controllers: Three controllers that work together to manage system functions; burner integrated control, linkageless modulating valve control, and oxygen trim control.

Temperature Control: Includes the following:

Large color touch screen user interface.

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

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 heater 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 heater parameters, to copy parameters from one heater to another, or to document parameters in a tab deliminated text file.

Control transformer.

Maximum vent temperature cutoff.

Adjustable set points:

Domestic-water set point and offset.

Heater manual and automatic high limits.

Deg F or deg C display.

Cascade setpoint, rotation, and redundancy.

PID gain parameters.

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

Pump exercise mode.

Pump time delay.

Anti-short cycle.

Anti-frost parameters.

Dry alarm contacts for ignition failure.

Pump control for heater pump, with delay.

Spark to pilot ignition.

24-V ac control circuit.

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

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

Selectable firing sequence methods:

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

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

Heater display homescreen shall show:

Intuitive, icon-based menu system.

Visual display of real-time heater status that includes inlet & outlet temperatures, heat temperature rise, flue gas temperature, and firing rate.

Flue gas oxygen percentage

Flue gas carbon dioxide percentage

Time and date.

Set points.

Pump status.

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 heater manufacturer.

Building automation systems shall be able to read:

Inlet water temperature sensor.

Outlet water temperature sensor.

Flue gas temperature sensor.

DHW temperature sensor.

Flame signal.

0-10VDC or 4-20mA input for BAS.

0-10VDC or 4-20mA input for fan speed.

0-10VDC or 4-20mA output for pump.

0-10VDC or 4-20mA output for fan speed.

Safety chain status.

Non-safety chain status.

Demand source.

Digital output status.

Gas valve status.

Pilot valve status.

Fan speed modulation.

Burner modulation.

All lockout codes.

All error codes.

History of demand cycles.

History of pump cycles.

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

History of average, maximum, and minimum firing time.

Modulation sensor.

Cascade firing rates and heater states.

Active set point.

Burner status.

Pump status.

Burner run time.

Building automation systems shall be able to read and write:

DHW demand.

DHW set point.

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.

Safety satisfied.

DHW pump.

Auxiliary power output.

Auxiliary dry contact.

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

Inlet water temperature.

Outlet water temperature.

Flue gas 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.

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.

Automatic reset high limit.

Low water cutoff with manual reset and test.

Built-in condensate trap.

On/off toggle switch, lighted.

Air filter.

* + - * 1. Options - Heater 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.

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

Recovery:

MGV 1600: 1,825 gph (1.92 L/s) at 100°F (56°C) temperature rise.

MGV 2000: 2,281 gph (2.4 L/s) at 100°F (56°C) temperature rise.

MGV 2500: 2,851 gph (3.0 L/s) at 100°F (56°C) temperature rise.

MGV 3000: 3,421 gph (3.6 L/s) at 100°F (56°C) temperature rise.

MGV 3500: 3,992 gph (4.2 L/s) at 100°F (56°C) temperature rise.

MGV 4000: 4,562 gph (4.8 L/s) at 100°F (56°C) temperature rise.

Fuel Gas Input:

MGV 1600: 1,600 Mbh (469 kW).

MGV 2000: 1,999 Mbh (586 kW).

MGV 2500: 2,499 Mbh (732 kW).

MGV 3000: 3,000 Mbh (878 kW).

MGV 3500: 3,500 Mbh (1025 kW).

MGV 4000: 4,000 Mbh (1171 kW).

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

AHRI Certified Thermal Efficiency:

MGV 1600: 96.0 percent.

MGV 2000: 96.0 percent.

MGV 2500: 96.0 percent.

MGV 3000: 95.0 percent.

MGV 3500: 96.0 percent.

MGV 4000: 96.0 percent.

Available Voltages:

MGV 1600:

120-V ac, single phase, 60 Hz.

208-V ac, single phase, 60 Hz.

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

MGV 2000:

120-V ac, single phase, 60 Hz.

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.

MGV 2500:

208-V ac, three phase, 60 Hz.

480-V ac, three phase, 60 Hz.

600-V ac, three phase, 60 Hz.

MGV 3000:

208-V ac, three phase, 60 Hz.

480-V ac, three phase, 60 Hz.

600-V ac, three phase, 60 Hz.

MGV 3500:

208-V ac, three phase, 60 Hz.

480-V ac, three phase, 60 Hz.

600-V ac, three phase, 60 Hz.

MGV 4000:

208-V ac, three phase, 60 Hz.

480-V ac, three phase, 60 Hz.

600-V ac, three phase, 60 Hz.

* + - * 1. Duct Connections: Install flue-venting kit and combustion-air intake:

For heater placed indoors:

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 or ABS. Air pipe length and diameter may be:

MGV 1600: Up to 100 equivalent feet of 6 inch diameter pipe.

MGV 2000 and MGH 2500: Up to 100 equivalent feet of 8 inch diameter pipe.

MGV 3000 and MGH 3500: Up to 100 equivalent feet of 10 inch diameter pipe.

MGV 4000: Up to 100 equivalent feet of 12 inch diameter pipe.

Exhaust vent may be Category IV or Category II.

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

MGV 1600, MGV 2000 and MGH 2500: Up to 100 equivalent of 8 inch diameter pipe.

MGV 3000 and MGH 3500: Up to 100 equivalent of 10 inch diameter pipe.

MGV 4000: Up to 100 equivalent of 12 inch diameter pipe.

Category II vent must be sized to achieve negative draft. Vent pipe material in the U.S. must be stainless steel UL 1738, CPVC sch 40 ANSI/ASTM F441, or polypropylene ULC S636 Class 2C. Vent pipe material in Canada must be ULC S636 certified. Typically, Category II vent will be:

MGV 1600 and MGH 2000: 14 inch diameter.

MGV 2500 and MGH 3000: 18 inch diameter.

MGV 3500 and MGH 4000: 22 inch diameter.

For heaters 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**