MODEL: GMI _____

1. GENERAL

Note: Equipment options are indicated [in red].

1.1. SUMMARY

A. This section includes high-efficiency, condensing type, stainless steel boilers/water heaters.

1.2. SUBMITTALS

A. In accordance with Contract Documents.

B. Product Data: Submit capacities and accessories included for each model indicated.

C. Shop Drawings: Include dimensions, size and location of water, fuel, electric, air inlet and vent connections, electrical characteristics and weight. Provide wiring diagrams that are specific to this project.

D. Manufacturers Installation Instructions: Submit assembly, support details, connection requirements and include start-up instructions.

E. Maintenance Data: Include in the maintenance manuals, parts list, maintenance guide and wiring diagrams for each boiler/water heater.

F. Factory Test Reports: as specified in this document.

G. Field Test Reports: as specified in this document.

H. Warranty: as specified in this document.

1.3. REFERENCES

A. American Society of Mechanical Engineers

1. ASME Section IV – Boiler and Pressure Vessel Code.
2. ASME CSD-1 – Controls and Safety Devices for Automatically Fired Boilers.
3. National Board Registration Number.
4. CSA – Z21.13 2004 (Gas-fired, low pressure steam and hot water boiler standard).

B. Canadian Standards Association

1. Boiler/Water Heater shall be CSA (C, US), CSA Blue Star and CSA Blue Flame certified.
2. Boiler/Water Heater shall be certified for domestic hot water.

C. National Fire Protection Association:

1. NFPA 70 – National Fuel Gas Code.

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1.4. QUALITY ASSURANCE

A. Comply with NFPA 70 for electrical components and installation.

B. ASME compliance: Fabricate and label boilers to comply with the ASME Boiler and Pressure Vessel Code: Section IV. The boiler/water heater shall bear the ASME “H” stamp and be National Board Listed for 160 psi working pressure and 210°F.

C. ASHRAE/IESNA 90.1 compliance: Boilers shall have minimum efficiency according to “Gas and Oil Fired Boilers-Minimum Efficiency Requirements”.

D. CSA Compliance: The units must be tested in accordance to UL 795, CAN 1-3.1, ANSI Z21.13/ CSA 4.9 and ANSI Z21.10.3/ CSA 4.3. Boiler/Water heaters must be listed and labeled by a testing agency acceptable to authorities having jurisdiction.

E. National Board of Boiler Inspectors.

F. Provide services of manufacturer’s authorized and factory-trained representative to perform the following functions:

1. Inspect and verify installation.
2. Checkout and startup/supervision. Submit startup report.

1.5. WARRANTY

A. General Warranty: The special warranty specified in this Article shall not deprive the owner of other rights the Owner may have under other provisions of the Contract Documents and shall be in addition to; and run concurrent with, other warranties made by the Contractor under requirements of the Contract Documents.

B. Special warranty: Submit a written warranty, executed by the contractor/manufacturer.

1. The heat exchanger shall carry a 20-year non-prorated warranty against thermal shock and 10-year prorated against corrosion and workmanship.
2. All other parts shall have a limited warranty as offered by the respective manufacturers.

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2. PRODUCTS

2.1. MANUFACTURERS

A. Condensing boiler /water heater shall be one of the following or an approved equal:

1. Install and furnish ____ [GMI 800, GMI 1M, GMI 1ML, GMI 1.5M, GMI 1.5ML, GMI 2M, GMI 2ML, GMI 4M, GMI 8M] manufactured by Gasmaster Industries. Refer to the Equipment Schedule in the Contract Drawings for the specific criteria.
2. Subject to compliance with requirements and specifications an approved equal may be considered. The bidder must submit in writing to the engineer any request for a proposed deviation, omission, modification or substitution to this evaluation no later than ten (10) days prior to the bid date. Any additional costs related to providing alternate equipment will be the responsibility of the contractor.

2.2. PACKAGED UNITS

A. HOT WATER BOILER / WATER HEATER

1. The boiler/water heater shall be factory assembled and fire tested, requiring only connection to the water circulating system, gas and electric utilities, exhaust gas vent and drains. Complete operating and maintenance instructions are to be furnished with the unit.
2. The boiler/water heater shall have an input of [800,000 / 1,000,000 / 1,500,000 / 2,000,000 / 4,000,000 / 8,000,000] BTU/hr with a gross output of ____ BTU/hr (dependant upon return water temperature) when fired with natural gas.
3. Boiler/water heater dry weight shall not exceed [1260 / 1260 / 1550 / 1760 / 1850 / 1900 / 1950 / 3450 /5200] lbs.
4. Boiler/water heater shall have an ASME approved relief valve setting of _____ psig.
5. The unit shall have no requirements for flexible connections, vibration absorbent mounting, exhaust silencers or other devices required for sound or vibration attenuation.

B. STRUCTURAL CHARACTERISTICS

1. The heat exchanger shall be a single pass water tube design.
2. The section containing water (heat exchanger) shall be constructed of **316/316L stainless steel** tubes with minimum wall thickness of 0.065” / 0.0049”.
3. The heat exchanger shall employ a concentric coil, counter-flow design for maximum heat transfer. **There shall be no secondary heat exchanger or heat exchange surfaces.**

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4. The heat exchanger should be fully enclosed in a 304 stainless steel liner jacket with 2" of insulation separating it from the outer jacket. The unit's housing (casing) should comprise of inside and outside panels constructed from 14 and 18 gauge steel plates.
5. There shall be absolutely no moving parts within the casing; all moving parts should be mounted outside the heat exchanger casing.

C. FUEL BURNING EQUIPMENT

1. The burner shall be a forced convection, modulating burner with camnetic regulating assembly. The material of construction for the burner chassis is die cast aluminum.
2. The burner shall be located at the front of the boiler/water heater (centerline) and shall fire horizontally into the combustion chamber.
3. The entire control sequence shall be monitored by an electro-mechanical primary flame safeguard.
4. Flame supervision is accomplished using UV or flame rod detection.
5. An observation port shall be located on the burner to allow for observation of the burner flame.
6. Full frontal access port shall be provided for the control area.
7. The burner shall be equipped with one (1) high gas pressure switch with manual reset.
8. The sound level of the boiler/water heater should not exceed 85 dB.
9. Burner operation shall be full modulation with minimum 3:1 turn down ratio.
10. The unit will have the capability of sealed, direct or conventional venting.

D. Gas Train

1. Gas train shall be UL/FM/CSA/CSD-1/ [GE-GAP] compliant.
2. The gas train shall be certified to take 7-14 "wc or 1-2 psig of inlet gas pressure.
3. The gas train shall include at least the following:
    1. Two (2) safety shutoff valves.
    2. Two (2) manual shutoff valves.
    3. One (1) lubricated manual shutoff valve.
    4. One (1) main gas regulator.
    5. One (1) pilot gas regulator.
    6. One (1) low gas pressure switch (manual reset).
    7. Six (6) pressure test ports.

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E. Electrical Input

1. The electrical input to each unit shall be [120v/1ph/60Hz, 208-230v / 460v / 575v / 3ph/60 Hz].

F. Boiler/water heater trim and controls

1. The boiler/water heater shall be equipped with the following safety features.
    1. Low water cut off switch with manual reset
    2. ASME stamped pressure relief valve
    3. Manual reset high temperature limit cut-off switch
    4. Outlet water temperature sensor
    5. Pressure gage
    6. Flow switch (optional)

2. The boiler manufacturer shall provide each unit with an integral factory pre-wired control panel. The control panel shall contain the following items all pre-wired to a numbered terminal strip:
    1. One (1) main disconnect switch with time delay fuses.
    2. One (1) burner “on-off” switch.
    3. One (1) remote/local switch.
    4. All necessary control switches, relays, timers, terminal strips, indicators etc.
    5. Control transformer with overload fuse protection.
    6. Temperature controller to adjust set points and control operating parameters. LED display to indicate boiler/water heater set point, sensor values such as outlet water temperature and outdoor air.

3. The boiler/water heater control module should consist of a PID (Proportional Integral Differential) Controller to maintain the boiler/water heater set point and control the firing rate. The controller must have the following capabilities:
    1. Maintain single set point.
    2. Reset the set point based on outdoor air temperature.
    3. Boiler shutdown based on outdoor air temperature.
    4. Night Setback function to enable dual set point.
    5. Programmable Low Fire Hold to minimize short cycling.
    6. Auto/Manual operation.

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7. The boiler/water heater control shall be capable of accepting 0-20 mA / 4-20 mA / 0-10 Vdc / 0-1 Vdc remote external analog signal to control the set point/firing rate.
8. LED display showing current set points, sensor values, differential set points and any fault codes.

4. The boiler/water heater should be compatible with BACnet. The BACnet communication panel shall be a separate panel installed on the unit and interfaced with the boiler/water heater control panel. The BACnet interface shall be configured for operation over an EIA-485 network utilizing MS/TP. The following inputs, outputs and value points should be available:

- Boiler safety loop alarm
- Boiler Lock-Out alarm
- Burner-on status
- Boiler in Local/ Remote control status
- Boiler discharge temperature
- Boiler firing rate status
- Outside air temperature
- Boiler remote operation
- Boiler reset
- Boiler temperature set point
- Boiler Enable/Disable
- Boiler temperature set point (Lower limit)
- Boiler temperature set point (Upper limit)
- Boiler firing rate
- Boiler operation on Outdoor Air Temperature Heating slope
- Outdoor air temperature minimum value
- Outdoor air temperature maximum value
- Discharge water temperature @ item 16
- Discharge water temperature @ item 17
- Alarm presence condition
- Boiler run time
- Boiler model and serial number

5. The boiler/water heater manufacturer shall provide a boiler sequencing controller to cascade boilers into service and properly modulate their firing rates to maintain the desired hot water supply temperature. The controller shall have the capability of sequencing a total of _____ (__) Gasmaster condensing boilers. The controller must have the following features/capabilities:

1. Boiler/water heater target temperature:
   - The controller shall modulate the boilers/water heaters to maintain the supply water temperature.
   - The supply water temperature will be based on boiler reset, an external 0-10 V (dc) signal, DHW requirements or a set point temperature.

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2. Setback:
   - The supply water temperature can be reduced when the building is unoccupied.

3. Combustion air or alarm contact:
   - The controller should have an isolated contact that can be used as either a combustion air damper contact or an alarm contact.

4. Boiler rotation:
   - The controller to change the firing order of the boilers to ensure that all the boilers that are being rotated have equal run time.

5. Running time:
   - The control should display the accumulated running time of each boiler.

6. Boiler modulation:
   - The controller should be capable of sequential modulation of the boilers so that when the first boiler does not have enough capacity to satisfy the load the second boiler is turned on. Subsequent boilers are turned on as the load on the system increases.
   - The controller should be capable of parallel modulation of the boilers so that the load is shared equally by all the units and efficiency is optimized.

7. Outdoor air reset control:
   - The controller shall establish a desired set point based on the minimum and maximum water and outdoor air temperature parameters and the heating curve setting.
   - The Warm Weather Shut Down (WWSD) function disables the heating system during warm outdoor weather.

8. Domestic hot water priority:
   - The controller shall be capable of changing the boiler set point from a heating temperature to another set point to satisfy the DHW system and then return to the heating mode.

9. External input:
   - The controller shall be capable of accepting 0-20 mA / 4-20 mA / 0-10 Vdc / 0-1 Vdc remote external analog signal to control the set point.

10. Pump exercising:
    - To protect the pump from seizing during a long period of inactivity, it is forced to run for 10 seconds at least once every three (3) days.

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G. Venting

1. Shall be AL 29-4C, positive pressure type vent material. Single wall vent is acceptable where allowed by local code. Other materials approved by the authority having jurisdiction may be used if found acceptable by the manufacturer.

2.3. PERFORMANCE

A. Boiler/Water heater shall have an output rating within the range of 88%-99.8% of input energy depending on inlet water temperature.

B. The standards listed in Section 1.3 of this document shall be used to determine the required efficiency.

3. EXECUTION

3.1. EXAMINATION

A. Examine area to receive boiler/water heater for compliance with requirements for installation tolerances and other conditions affecting boiler/water heater performance. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2. INSTALLATION

A. Install the Boiler/Water heater in accordance with manufacturer's printed instructions and Local Boiler Safety Jurisdiction.

B. Maintain manufacturer's recommended clearances around and over equipment, and as required by local Codes.

C. There shall be no requirement for special concrete bases or vibration absorbent mountings.

D. Arrange all electrical conduit, piping, exhaust vent and air intake with clearances for burner removal and service of all equipment.

3.3. CONNECTIONS

A. There shall be no requirements for any sort of flexible connections on the water side.

B. Connect exhaust vent to water heater vent connection, full size of outlet.

C. All connections should be carried out in compliance with local building codes and the authority having jurisdiction.

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3.4. FIELD QUALITY CONTROL

A. Engage a factory authorized service representative to supervise the field assembly of components and installation of boilers, including piping and electrical connections.

B. Hydrostatically test assembled boiler and piping, according to applicable sections of the ASME Boiler and Pressure Vessel Code.

3.5. CLEANING

A. Flush and clean boiler/water heater upon completion of installation, in accordance with manufacturer's start-up instructions.

B. MUST isolate boiler/water heater when any cleaning or testing of system piping is being performed.

3.6. COMMISSIONING

A. Engage a factory-authorized service representative to provide startup service.

B. Verify that electrical wiring installation complies with manufacturer's submittal and installation requirements. Do not proceed with boiler/water heater startup until wiring installation is acceptable to equipment installer.

C. Complete manufacturer's installation and startup checklist.

3.7. DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel on procedures and schedules related to startup and shutdown, troubleshooting, servicing and preventive maintenance.

B. Furnish services for manufacturer's technical representative, as specified.

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