2.1 GENERAL

A. Reference is made to the clause entitled "Buy American Act – Balance of Payments Program – Construction Materials" FAR 52.225-9. Notwithstanding a bidder's right to offer identifiable foreign construction material in its bid pursuant to FAR 52.225-9, the awarding authority does not anticipate accepting an offer that includes foreign construction material.

B. All manufacturers to be considered shall be required to meet or exceed scheduled AHRI capacities and ratings and will be held to strict compliance with these contract specifications. For factory assembled, packaged and firetested boilers, the complete boiler shall be approved as a unit by Underwriters Laboratories.

C. Installing contractor shall include, as part of his contract, all charges and costs for boiler and burner testing, start-up, checkout, adjusting, field and state inspections, including service contracts for systems and equipment as here-in-after specified. Provide signed documentation to the awarding authority for completion of specified procedures.

D. Contractor shall obtain certificate of boiler inspection after boiler installation has been completed and pay all fees associated with such inspection. After receipt of certificate of inspection, installing contractor shall furnish a suitable glass front frame in which to place said certificate. Frame, with inspection certificate inserted therein, shall then be placed on or posted in a suitable location within the boiler room in which the new boilers have been installed.

E. Installing contractor shall obtain from the boiler manufacturer pertinent (O&M) operating, testing, and cleaning instructions for the boilers, burners, controls and safety devices furnished with the Boiler(s).

F. It shall be the responsibility of the installing contractor to deliver O&M manuals, together with complete wiring and piping diagrams, to the owner/user and to obtain a receipt for the instructions. The receipt shall be filed with the installation report.

G. Written notification specifying the name, address, telephone number and available service program of a third party burner service group as herein specified.

2.2 WARRANTY

A. The manufactured heating units, equipped with cast iron/metal push nipple connectors, the boiler manufacturer shall warrant that the cast iron sections of each boiler will be free from defects in material and workmanship under normal usage for a period of ten years from the date of original installation.

1. Burners: The burner manufacturer shall warrant each burner for a period of 15 months from date of shipment.

2.3 PRODUCTS:

A. 3-PASS CAST IRON BOILER – MODEL MPC

1. Hot water boiler shall be a high efficiency, pressurized, cast iron sectional wet base boiler and not require a refractory combustion chamber. It shall be suitable for forced draft firing and capable of achieving a minimum combustion efficiency of 88% fired with No. 2 oil and 85% fired with gas. Thermal efficiency shall be a minimum of 86% with No. 2 oil and 83% fired with gas. Heat transfer shall be enhanced by the addition of removable baffles.

2. Boiler shall be a 3-pass cast iron sectional type design with large combustion chamber and horizontal flue passes with cast fins. Class 20 high silicone content cast iron shall provide resistance to temperature variations and thermal stress. A high-temperature silicone-coated fiberglass rope gasket will be compressed into a cast tongue and groove connection around the perimeter of the section, providing a durable, gas tight seal.

3. Boiler shall have a return mixing tube with drilled openings in each section, allowing proportionate distribution of return water throughout the entire section assembly. Cool return water shall be pre-heated by the hot supply water as it enters the section assembly thereby reducing thermal stress on individual sections without the use of external mixing devices. Boiler supply water temperatures, measured on the supply manifold shall be no less than 130ºF. Return water coming back to the boiler may be no less than 80ºF. System piping shall be sized for a maximum temperature difference between the boiler supply and return water of 40ºF. However, a maxiumum delta T of 80ºF across the boiler is allowable.

4. A single supply water manifold shall be located at the rear of the boiler with eight tappings for the installation of temperature and pressure controls, gauges, probe-type low water cut-offs, and electronic control sensors. A single top rear return connection shall be considered standard equipment.

5. Boiler shall be furnished as a knocked down unit for field erection. Sections shall be assembled using precision machined cast iron push nipples.

   a. [USE FOR FACTORY PACKAGED] Boiler shall be factory assembled and installed on a structural steel frame/base, completely packaged with burner and controls mounted and wired. Section assembly shall be hydrostatically pressure tested @ 120 PSI prior to shipment. Packaged boiler shall be shrink wrapped for protection.

   b. [USE FOR FACTORY PACKAGED AND FIRE TESTED] Boiler shall be factory assembled and installed on a structural steel frame/base, completely packaged with burner and controls mounted and wired. Burner shall be factory fire tested to ensure proper operation before shipment. Boiler jacket shall bear

the UL (Underwriters Laboratories) logo and comply with all UL795 (gas) and UL 726 (oil) safety standards. Section assembly shall be hydrostatically pressure tested @ 120 PSI prior to shipment. Packaged boiler shall be shrink wrapped for protection.

c. [USE FOR FACTORY ASSEMBLED SECTIONS] Cast iron sections shall be factory assembled and installed as a complete block assembly with boiler jacket, burner, and controls shipped separately

6. Cast iron burner swing door shall be lined with lightweight refractory insulation and shall have reversible hinges, allowing a minimum of 90° swing to the left or right side of boiler, allowing unobstructed access to combustion chamber and flue passages. The flue passages and combustion chamber shall be accessible from the front of the boiler for cleaning, and from the back of the boiler to vacuum soot and combustion residue from the fireside.

7. Rear flue collector, with test tapping, shall be constructed of cast iron and shall be concealed under a highly insulated boiler jacket.

8. Boiler shall be equipped with a flange mounted flame retention type burner. Input, output and combustion efficiency shall be certified to efficiency test procedures specified in the AHRI 1500 standard. Boiler efficiencies must meet AHRI 1500 requirements.

9. Boiler shall be constructed for 80 PSI water working pressure in accordance with the ASME Section IV Rules for Construction of Heating Boilers. Individual sections shall have been subjected to a hydrostatic pressure test of 200 PSIG at the factory before shipment and they shall be stamped or cast with the ASME ‘H’ symbol.

10. The boiler shall be provided with a heavy duty 20 gauge steel jacket with modular 4-inch thick insulation and have a rust resistant powder coat finish. The boiler jacket shall contain a concealed electrical chaseway for power and limit circuit wiring within the top jacket panels, providing a clean finished look when the jacket is installed. Individual lift-off jacket side panels may be installed after system piping and allow ease of access to the boiler sections.

11. Boiler trim shall include:

a. One (1) 3-1/2” inch dia. combination pressure-temperature gauge.

b. Safety high limit aquastat; auxiliary safety high limit aquastat with manual reset (must specify on order); low fire hold aquastat (LHL and full modulation burners only).

c. (USE FOR LOW/HIGH/LOW OR FULL MODULATION) Firing rate controller.

d. Dial type stack thermometer, minimum 3" dial face, ½" NPT connection.

e. ASME Section IV safety relief valve sized to exceed the gross output of the boiler which shall be factory set to relieve pressure at (30) (50) (80) PSI water working pressure.

f. One (1) low water cutoff device with manual reset, to comply with CSD-1 requirements. Boiler shall be fitted with a probe type LWCO located above the lowest safe permissible water level established by the boiler manufacturer. LWCO shall be UL listed and FM approved, suitable for commercial hydronic heating service at 80 PSI.

2.4 Boiler Control System (SBC Boiler Control)

A Scope of Supply
Supply a boiler control system to provide safety interlocks and water temperature control. The control system shall be fully integrated into the burner control cabinet and incorporate single and multiple boiler control logic, inputs, outputs and communication interfaces. The control system shall coordinate the operation of up to eight (8) fully modulating hot water boilers and boiler pumps. The control system shall simply control boiler modulation and on/off outputs based on the boiler water supply temperature and an operator-adjusted setpoint. However, using parameter menu selections, the control system shall allow the boiler to respond to remote system water temperature and outside air temperatures with domestic hot water priority (DHWP) and warm weather shut down (WWSD) or building automation system (BAS) firing rate demand, remote setpoint or remote start/stop commands.

B Boiler Control
Using PID (proportional-integral-derivative) based control, the remote system water temperature shall be compared with a setpoint to establish a target boiler firing rate. If the secondary loop GPM is greater than the primary loop GPM, firing rate is increased in response to the decrease in secondary loop temperature. When the remote system temperature is near the boiler high limit temperature, the boiler supply sensor shall limit the maximum boiler supply temperature to prevent boiler high limit trips. Alternately, using parameter menu selections, the control system shall allow the boiler to respond directly to boiler supply temperature and setpoint to establish a target boiler firing rate while remote system water temperature is used for display purposes only. Each boiler's fuel flow control valve shall be mechanically linked to the air flow control device to assure an air rich fuel/air ratio. All the automated logic required to ensure that pre-purge, post-purge, light-off, and burner modulation shall be provided.

C Hot Water Temperature Setpoint
When the controller is in the local control mode, the control system shall establish the setpoint based on outside air temperature and a reset function curve, or be manually adjusted by the operator. When

enabled, the setpoint shall be adjusted above a preset minimum setpoint upon sensing a domestic hot water demand contact input. When in remote mode, the control system shall accept a Modbus or 0-10Vdc remote setpoint or firing rate demand signal from an external BAS.

D Multiple Boiler Sequence

Multiple boilers shall be modulated in "unison" (all at the same firing rate) through the peer to peer or Modbus communication networks. When in peer to peer communication, boiler sequencing shall be accomplished through the SBC peer to peer network. When in Modbus communication, boiler sequencing shall be accomplished through a boiler staging control. The control system shall utilize both water temperature and boiler firing rate percent to start and stop the boilers and shall minimize the total number of boilers in operation. The control system shall start and stop boilers when the water temperature is outside the adjustable temperature limit for longer than the adjustable time delay. In order to minimize temperature deviations, the control system shall start and stop the next boiler when the "lead" boiler is at an adjustable firing rate limit for longer than the adjustable time delay. The control system shall monitor both boiler lockout and limit circuits to automatically skip over those boilers that are powered down for maintenance, tripped or otherwise will not start. When rotation is enabled the lead boiler shall automatically rotate every 1 to 168 hours. The boiler shall be run at low fire for warm-up for a preset low fire hold time. When enabled, warm weather shut down control logic shall prevent boiler operation.

E User Interface

A panel front-mounted English language, two line, sixteen character LCD message display shall be provided to display numeric data, startup and shutdown sequence status, alarm, system diagnostic, first-out messages and boiler historical information. Historical information shall include the last ten lockout and alarm conditions, number of boiler cycles, boiler hours and last ten low boiler return temperature events. When boiler return water temperature is below a minimum setpoint a low temperature events shall be stored with time, date, "lowest temperature for event" and "duration below setpoint" data. A panel mounted red alarm light shall annunciate alarm messages. Alarm conditions requiring a manual reset shall be annunciated by a flashing red light. At a minimum, the boiler system shall display the following:

1. Numeric Display with Engineering Units:

    a. Boiler Supply Water Temperature

    b. Boiler Return Water Temperature

    c. Remote System Temperature (when required by contract drawings)

    d. Outside Air Temperature (when required by contract drawings)

    e. Firing Rate %

    f. Boiler Temperature Setpoint

g. Mixing Valve % (when required by contract drawings)

2. Status, Startup And Shutdown Sequence English language Messages:

   a. Boiler disabled

   b. Warm Weather Shutdown

   c. Lockout

   d. Pump Purge

   e. Limit Hold

   f. Purge / Pilot Ignition

   g. Low Fire / Pilot Ignition

   h. Main Burner Ignition

   i. Boiler Running

   j. Fan Post Purge

   k. Pump Cooldown

   l. Standby

3. Alarm, System Diagnostic, First-Out English language Messages: (numeric code numbers shall not be acceptable):

   a. Low Water Level (when required by contract drawings)

   b. Low Water Flow (when required by contract drawings)

   c. Fuel Limit (gas pressure or oil temperature)

   d. High Boiler Supply Temperature Limit

   e. Low Return Water Temperature

   f. Low Air Flow

g. Flame Safeguard Internal Fault

h. High Supply Temperature

i. Supply Temperature Sensor Fault

j. Return Temperature Sensor Fault

k. Outside Air Temperature Sensor Fault

l. Remote System Temperature Sensor Fault

m. Remote Input Signal Fault

n. Modbus Communication Fault

o. Memory Fault

F Flame Safeguard (FSG)
An industrial duty microprocessor-based FSG shall provide: safety interlocks, flame monitoring protection and timed sequences. Sequences shall include forced draft fan start and stop, furnace purge, burner light-off and shutdown and post-purge. FSG components shall be fully integrated for automatic sequencing of light-off and shutdown.

G Boiler Pump Sequence
Include primary water pump control to allow boiler warm-up to the return water temperature before the boiler start; continue water flow for an adjustable cool down period after the boiler has stopped; and ensure water is always moving past the remote system temperature sensor even after the last boiler has been stopped. The pump shall immediately stop if any trips occur during pre-purge, pilot, or main flame trial for ignition.

H Flue Gas Condensate Protection
Include alarms and control logic to help prevent corrosion in the boiler due to sustained flue gas condensation. These features become increasingly important as we add energy savings modulation and outdoor air reset functions. Provide a 4-20mAdc, 3 way mixing valve control output based on PID control, measured boiler return temperature and minimum return temperature setpoint or measured boiler return and supply temperature difference and differential setpoint. If the boiler return water temperature drops below setpoint or the differential temperature is excessive the valve shall open to allow hot boiler supply water to blend with cold return water temperature. The valve repositions toward 0% recirculation after return water temperature increases above setpoint. Low boiler return water temperature shall be alarmed using an alarm message, indicating light and an alarm contact output. Excessively low boiler return temperature events shall be stored with boiler historical data.

I Mixing Valve (when required by contract drawings)
In order to prevent low return water temperature, provide an electric actuated three-way mixing valve with a 4-20 mAdc input control signal and slow (1 minute) travel time for each boiler. If the boiler return water temperature is below 130 ° F (adjustable), the valve shall slowly jog closed causing boiler supply water to blend with the return water. When the return water temperature returns to an acceptable range, the boiler supply valve shall slowly jog open.

J Communication
Include an RS485 modbus slave or peer-to-peer communications data highway on each boiler control system. When peer-to-peer communication is enabled the data highway shall allow the connected boilers to exchange signals as required to provide coordinated fully modulating lead/lag functions. It shall not be required to wire individual control signals between boilers. When modbus communication is enabled the data highway shall allow individual boiler limits, lockout, boiler and system temperatures and firing rate status to be readable and water setpoint, boiler firing rate, and start/stop command to be readable and writable. Lead lag function will be accomplished through an external boiler sequencing control when SBC is on the Modbus network. Provide all equipment capabilities specified in this paragraph, even if a connecting SCADA (Supervisory Control And Data Acquisition system, typically a desk top personal computer) system is not included in this project.

K Quality Assurance
The boiler control system shall be supplied as part of a factory assembled, tested burner control cabinet.