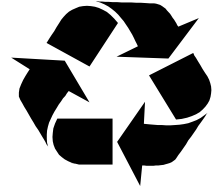




**TOWN OF GREENBURGH**  
**BUREAU OF ENGINEERING**  
177 Hillside Avenue, White Plains, NY 10607  
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Greenburgh Recycles

RICHARD C. FON  
Commissioner of Public Works  
BRIAN E. SIMMONS, P.E.  
Deputy Commissioner of Public Works

KENNETH V. CIOCE, P.E.  
Town Engineer

July 22, 2021

**ADDENDUM NO. 3**

**BOILER PLANT REPLACEMENT - THEODORE D. YOUNG COMMUNITY CENTER**

The attention of the bidders is directed to the following changes, additions, and/or substitutions affecting the above referenced contract (all documents listed below are attached to this addendum):

- **RESPONSE: RFI #1**
- **RESPONSE: RFI #2**
- **UPDATED: Specification(s)**
  - **235216 – Condensing Boilers**
  - **235700 – Heat Exchangers for HVAC**
- **REVISIONS: : See attached drawings for revisions to Sheet(s):**
  - **Sheet MP6.1**
  - **Sheet M7.2**

All provisions of the contract not affected by the foregoing shall remain in full force and effect.

All bidders shall acknowledge receipt and acceptance of this Addendum #3 by signing in the space provided, and submit the signed Addendum with the Bid. Bids submitted without this Addendum may be considered informal, and may be rejected.

Carol Murray  
Assistant Civil Engineer

**Received, acknowledged, and conditions agreed to this \_\_\_ (day) of \_\_\_\_\_ (month), 2021**

**BIDDER:** \_\_\_\_\_



TO: Carol Murray & Andy Viviano  
DATE: 7/19/2021

PROJECT: Boiler Plant Replacement at Theodore D. Young Community Center  
PROJECT #: NTOG0011.00

REQUESTED INFORMATION:

- 1.) The contract documents state to re-pipe a  $\frac{3}{4}$ " HWS/R line to the existing ducted reheat coil. Can a detail be provided showing what new PVF's need to be provided to this new connection?

SUBMITTED BY: Southeast Mechanical Corporation  
568 North Main Street  
Brewster, NY 10509  
845-279-3793  
[estimating@southeastmech.com](mailto:estimating@southeastmech.com)

OLA Response 7/22/21 - A reheat coil piping detail has been added to drawing M7.2.  
Refer to Addendum #3 documents.



TO: Carol Murray & Andy Viviano  
DATE: 7/20/2021

PROJECT: Boiler Plant Replacement at Theodore D. Young Community Center  
PROJECT #: NTOG0011.00

REQUESTED INFORMATION:

- 1.) Page #1 of the boiler specs in the project manual reference the Theodore D. Young project and as you move onto the next pages, the manual references a Saxe Middle School project in Connecticut. Please confirm the boiler specs are correct and the only thing misprinted is the project name.

SUBMITTED BY: Southeast Mechanical Corporation  
568 North Main Street  
Brewster, NY 10509  
845-279-3793  
[estimating@southeastmech.com](mailto:estimating@southeastmech.com)

OLA Response 7/22/21 - This error has been corrected. All other spec sections are correct and are intended for this project. Refer to Addendum #3 documents.

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DOCUMENT 009113 - ADDENDA

1.1 PROJECT INFORMATION

- A. Project Identification: **Theodore D. Young Community Center Boiler Plant Replacement**
- B. Owner: **Town of Greenburgh**
- C. Engineer: **OLA Consulting Engineers, 50 Broadway, Hawthorne, NY 10532.**
- D. Architect Project Number: **TOG0011.00**
- E. Date of Addendum: **July 22, 2021**

1.2 NOTICE TO BIDDERS

- A. This Addendum is issued pursuant to the Instructions to Bidders and Conditions of the Contract. This Addendum serves to clarify, revise, and supersede information in the Project Manual, Drawings, and previously issued Addenda. Portions of the Addendum affecting the Contract Documents will be incorporated into the Contract by enumeration of the Addendum in the Owner/Contractor Agreement.
- B. The Bidder shall acknowledge receipt of this Addendum in the appropriate space on the Bid Form.
- C. The date for receipt of bids is unchanged by this Addendum, at same time and location.

1.3 ATTACHMENTS

- A. This Addendum includes the following attached Documents and Specification Sections:
  - 1. 235216 – Condensing Boilers
  - 2. 235700 – Heat Exchangers for HVAC
- B. This Addendum includes the following attached Sheets:
  - 1. Mechanical Sheet MP6.1, Revised 7/22/21
  - 2. Mechanical Sheet M7.2, Revised 7/22/21

END OF DOCUMENT 009113

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**SECTION 235216 – CONDENSING BOILERS**

**PART 1 - GENERAL**

**1.1 SUMMARY**

- A. Provide all high efficiency condensing boilers as indicated and scheduled on the drawings and in accordance with the Contract Documents.
- B. Section includes:
  - 1. High efficiency packaged, factory-fabricated and assembled, gas fired, fire-tube condensing boilers with associated trim for producing hot water.
  - 2. Boiler manufacturers automatic remote monitoring, alarm, and service alert system
  - 3. Heat Engine Controls including:
    - a. Boiler sequencing and setpoint control
    - b. Boiler isolation valve control
  - 4. Startup, Training and Preventative Maintenance Services

**1.2 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract apply to this Section, including General and Supplementary Conditions and Division 01 Specification Sections.

**1.3 SUBMITTALS**

- A. Product Data: Include performance data, operating and maintenance manuals, furnished specialties and accessories.
  - 1. Contractor is responsible for addition engineering costs associated with multiple submittals of alternate products.
  - 2. Boiler submittal shall include boiler manufacturers' vent sizing calculation reports and guaranties. Calculations will be updated based on final as-installed conditions.
  - 3. If submitted material is different from that of the design basis, boiler manufacturer shall incur all costs associated with any design deviation including the need for, or deletion of, draft inducer fans, combustion air fans and overdraft damper systems. These shall be provided with the boiler submittal, boiler manufacturers sizing calculations and guaranty.
- B. Efficiency Curves and Data:

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1. Submit boiler efficiency curves for 100%, 50% and 7% input firing rates at incoming water temperatures ranging from 80°F to 160°F.
  2. Submit boiler efficiency data indicating efficiency gains associated with separated low temperature and high temperature return piping.
  3. Provide exhaust gas O<sub>2</sub> calibration settings and method for continuous verification and operation of O<sub>2</sub> <6%, corresponding to a dewpoint of 122 deg F.
- C. Pressure Drop Curve: Submit pressure drop curve for flows over the full range of boiler application in automatic and manual plant operation.
1. Provide boiler minimum flowrate, and submittal data detailing internal boiler design promoting water flow distribution for efficient heat transfer at the minimum flow rate.
  2. If submitted material is different from that of the design basis, boiler manufacturer shall incur all costs associated with reselection of necessary pumps. Possible differences include, but are not limited to, the pump type, pump pad size, electrical characteristics and piping changes.
- D. Shop Drawings: For boilers, boiler trim and accessories include:
1. Plans, elevations, sections, service clearances, details and attachments to other work
  2. Wiring diagrams for power, signal and control wiring
- E. Warranty: Standard warranty specified in this Section.
- 1.4 QUALITY ASSURANCE
- A. Electrical Components, Devices and Accessories: Boilers must be listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
  - B. AHRI Performance Compliance: Condensing boilers must be rated in accordance with applicable federal testing methods and verified by AHRI as capable of achieving the energy efficiency and performance ratings as tested within prescribed tolerances.
  - C. ASME Compliance: Condensing boilers must be constructed in accordance with ASME Boiler and Pressure Vessel Code, Section IV "Heating Boilers".
  - D. ASHRAE/IESNA 90.1 Compliance: Boilers shall have minimum efficiency according to "Gas and Oil Fired Boilers - Minimum Efficiency Requirements".
  - E. DOE Compliance: Minimum efficiency shall comply with 10 CFR 430, Subpart B, Appendix N, "Uniform Test Method for Measuring the Energy Consumption of Furnaces and Boilers".
  - F. UL Compliance: Boilers must be tested for compliance with UL 795, "Commercial-Industrial Gas Heating Equipment." Boilers shall be listed and labeled by a testing agency acceptable to authorities having jurisdiction.

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- G. NOx Emission Standards: When installed and operated in accordance with manufacturer's instructions, condensing boilers shall comply with NOx emissions of less than 20ppm, corrected to 3% oxygen at all firing rates. Certificate or report of compliance is to be supplied upon request.
- H. Efficiency Verification: Each boiler shall have a minimum AHRI Certified thermal efficiency as scheduled. Boilers that do not meet the basis of design equipment minimum efficiency or are not AHRI Certified shall not be acceptable. Boilers shall provide continuous combustion efficiency verification through O2 monitoring of the combustion gasses. At all boiler firing rates, O2 levels shall be maintained at or below 6%, such that fireside condensing dew point corresponds to no lower than 122 deg F hot water return temperature.

**1.5 DEVICE AND NETWORK**

- A. Factory provided remote monitoring system shall comply with industry standard best practices of layered security for the goal of preventing external shutdown with malicious or other intent and/or network access by persons other than the plant operation staff.
- B. Minimum provisions shall be non-modifiable, one-way (outbound only) communication, and shall include an inbound "Air Gap" security design between the system and the network.

**1.6 COORDINATION**

- A. Coordinate size and location of concrete bases and/or vibration isolation. Cast anchor-bolt inserts into bases. Concrete, reinforcement and formwork requirements are specified in Division 03. For vibration isolation requirements consult local codes and/or acoustical consultant recommendations.

**1.7 WARRANTY**

- A. Standard Warranty: Boilers shall include manufacturer's standard form in which manufacturer agrees to repair or replace components of boilers that fail in materials or workmanship within specified warranty period.

**1. Warranty Period for Fire-Tube Condensing Boilers**

- a. The pressure vessel/heat exchanger shall carry at least ten (10) year from shipment, non-prorated, limited warranty against any failure due to condensate corrosion, thermal stress, mechanical defects or workmanship.
- b. The burner shall be conditionally guaranteed against any failure for five (5) years from shipment.
- c. Manufacturer labeled control panels are conditionally warranted against failure for three (3) years from shipment.
- d. All other components, with exception to the igniter and flame detector, are conditionally guaranteed against any failure for two (2) years.

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**PART 2 - PRODUCTS**

**2.1 MANUFACTURERS**

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. AERCO International, Benchmark Series.
  - 2. Fulton Endura
  - 3. Engineer Approved Equal.
    - a. Determined to be a performance and construction equal to the Basis of Design.
- B. For manufacturers other than Basis-of-Design: All costs associated with system design changes, including redesign, additional components, coordination and costs borne by other trades, engineering drawings, and filings with the local building department shall be borne entirely by the installing mechanical contractor.
- C. Manufacturer and their local Sales and Support agent shall have a minimum of 15 years' experience in the design, manufacture, and operation of condensing, modulating boiler systems. Alternate manufacturers shall provide a reference list with a minimum of 5 similar installations that have been in continuous use for 5 or more years, contact name and phone number, and model of equipment provided.
- D. Single Source Responsibility: Additional equipment specified herein including boiler sequencers, motorized isolation valves and controls, draft controls and sensors, interlock controllers, communication equipment, and Life Safety Panels and sensors shall be provided by, and are the responsibility of the boiler manufacturer and boiler system startup supplier.

**2.2 FIRETUBE BOILER CONSTRUCTION**

- A. Description: Boiler shall be natural gas fired, fully condensing, fire tube design. Power burner shall have full modulation to the minimum firing rate as Scheduled, and discharge into a positive pressure vent. Boiler efficiency shall increase with decreasing load (output), while maintaining setpoint. Boiler shall be factory-fabricated, factory-assembled and factory-tested, fire-tube condensing boiler with heat exchanger sealed pressure-tight, built on a steel base, including insulated jacket, flue-gas vent, combustion-air intake connections, water supply, return and condensate drain connections, and controls.
- B. Heat Exchanger: The heat exchanger shall be constructed of 439 stainless steel fire tubes and tubesheets, with a single pass combustion gas flow design. The fire tubes shall be no larger than 5/8" OD and designed for enhanced turbulent flow at low fire. The pressure vessel/heat exchanger shall be welded construction. The heat exchanger shall be stamped in accordance with ASME Section IV, and shall bear the ASME "H" stamp, and shall be registered with the National Board. For long term durability, heat exchanger material shall withstand hydronic water pH greater than 8.5 and less than 6.0 without degradation. When using glycol, standard



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glycol formulations shall be acceptable. Aluminum and cast iron heat exchangers are not acceptable.

- C. Pressure Vessel: The pressure vessel shall be constructed of SA53 carbon steel. The single pass design shall include baffles to maintain efficiency during low flow conditions. Inspection openings in the pressure vessel shall be in accordance with ASME Section IV pressure vessel code. The boiler shall be designed so that the thermal efficiency increases as the boiler firing rate decreases. Pressure drop shall not exceed maximum as Scheduled.
- D. Delayed Ignition Survival: For maximum safety in the event of gas valve and control system failure or vandalism, the boiler shall withstand UL testing requirements for Delayed Ignition survival and re-ignition.
- E. Bypass Return: The boiler shall include a separate HWR connection for the bypass/high temperature return to avoid reducing condensing efficiency due to blending high and low temperature returns. The boiler shall be able to operate under any combination and temperature of return flows (including zero flow on either connection) provided the specified minimum flow of the boiler is achieved. The boiler tubes shall be baffled to avoid blending of the returns in the condensing zone of the heat exchanger.
- F. Modulating Combustion Control System: Burners rated for 75 BHP or less shall be capable of a 20 to 1 turndown ratio and burners rated for more than 75 BHP shall be capable of a 15 to 1 turndown ratio. This ratio or greater must be achieved without loss of combustion efficiency or staging of gas valves. Air-fuel combustion control systems requiring boiler derating due to venting and/or combustion air layout will not be accepted.
  - 1. The burner shall produce less than 14 Ng/J or 20 ppm of NO<sub>x</sub> corrected to 3% oxygen. The burner shall be metal fiber mesh covering a stainless steel body with pilot ignition system and flame rectification. All burner material exposed to the combustion zone shall be of stainless steel construction. There shall be no moving parts within the burner itself.
  - 2. The modulating combustion control system shall meter the air and fuel input independent of chamber and/or outlet pressure. The modulating motor must be linked to both the gas valve body and air valve body with a single linkage. The linkage shall not require any field adjustment. Mechanical linkages and/or pressure biased gas valves are not acceptable.
  - 3. A variable speed pre-mix blower shall be used to ensure complete mixing of air and fuel.
  - 4. The system shall utilize an automotive grade O<sub>2</sub> sensor that measures and controls the oxygen content in the exhaust gases. The O<sub>2</sub> sensor shall be located in the dry combustion chamber. Alternate systems that locate the sensor where they will be exposed to wet corrosive exhaust shall be provided with five (5) spare sensors per boiler (one per year per burner for the burner warranty period).
  - 5. When scheduled for applications or jurisdictions that require ultra-low NO<sub>x</sub> emissions less than 9 ppm, condensing boilers shall comply without the use of additional components, custom burner or custom burner components. When installed and operated in accordance with manufacturer's instructions, condensing boilers shall comply with NO<sub>x</sub> emissions of

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less than 9ppm, corrected to 3% oxygen at all firing rates. Certificate or report of compliance is to be supplied upon request.

6. Boiler manufacturer shall furnish independent draft controls as required for reliable independent boiler operation into commonly vented and/or combustion air systems. Boilers shall be approved for independent manual operation at minimum rated input when installed in a common vented system.
- G. Gas Train: Provide ventless gas train components in accordance with FM/CSD-1 requirements.
- H. Exhaust Manifold: The exhaust manifold shall be of corrosion resistant cast aluminum or 316L stainless steel. The exhaust manifold shall have a collecting reservoir and a gravity drain for the elimination of condensation.
- I. Blower: The boiler shall include a speed controlled fan to operate during the burner firing sequence and pre-purge the combustion chamber.
  1. Motors: Blower motors that are not integrated into the burner blower assembly shall comply with requirements specified in Division 23 Section "Common Motor Requirements for HVAC Equipment."
    - a. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require a motor to operate in the service factor range above 1.0.
- J. Ignition: Ignition shall be via spark ignition with 100 percent gas valve shutoff and electronic flame supervision.
- K. Combustion Air: The boiler shall be designed such that the combustion air is drawn from the inside of the boiler enclosure, decoupling it from the combustion air supply and preheating the air to increase efficiency.
  1. Combustion air must pass through a factory installed filter with adequate airflow verified by a differential pressure switch. The filter shall be washable and re-usable, or manufacturer shall provide five (5) replacement filters per boiler (one per year per burner for the burner warranty period).
- L. Enclosure: The enclosure shall be fully removable, allowing for easy access during servicing.
- M. Boiler Trim shipped loose for field installation shall include but not be limited to:
  1. ASME pressure relief valve;
  2. Pressure-Temperature compound gauge on boiler outlet connection;
  3. Boiler automatic isolation valve (one per boiler) shall be lug style, butterfly type with a minimum 175 PSI shutoff and may be used as boiler service valve. Actuators shall be two-position, include adjustable limit switch for proof of operation, and be furnished with manual operator.

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4. Wafer style check valves (two per boiler) for boiler applications utilizing separate bypass return connection.
5. Condensate traps, manufactured from only non-corrosive materials. In order to guarantee flue gasses cannot leak into the boiler room, the traps shall be float-type traps NO EXCEPTIONS. All condensate piping must be CPVC or 316L stainless steel.
6. Condensate neutralizing kit (one per boiler or larger centralized unit). Each kit shall be suitable for no less than 12 months continuous operation at full condensing rate. Neutralizing media shall be bag mounted for replacement without disconnecting neutralizer body, or shall be provided in refillable tanks. Boiler supplier shall include condensate neutralizer for chimney and horizontal breeching.

### 2.3 FIRETUBE BOILER CONTROLS

- A. Refer to Division 23, Section “Instrumentation and Control of HVAC.”
- B. For safety, the boiler connections to line voltage shall be made in a separate enclosure from the low voltage controls and system input/output connections. The entire system shall be Underwriters Laboratories recognized.
- C. The control panel shall be comprised of modular circuit boards using surface-mount technology, mounted on a motherboard, and furnished in a single enclosure. Each board shall be individually field replaceable.
- D. The control panel hardware shall support both RS-485 (BACnet or Modbus protocol), and network communications (CAT-V or CAT-VI).
- E. The controls shall annunciate boiler and sensor status and include extensive self-diagnostic capabilities that incorporate separate status messages and separate fault messages for diagnostics and troubleshooting. Diagnostic codes shall not be a substitute for descriptive messaging.
- F. For enhanced reliability, the control system shall include the following minimum operational functions that will override system sequencing commands that result in nuisance and/or safety faults:
  1. Setpoint High Limit: Setpoint high limit allows for a selectable maximum boiler outlet temperature and acts as temperature limiting governor.
  2. Setpoint Low Limit: Allow for a selectable minimum operating temperature.
  3. Failsafe Mode: Failsafe mode allows the boiler to switch its mode to operate from an internal setpoint if its external control signal is lost, rather than shut off. This is a selectable mode, enabling the control can shut off the unit upon loss of external signal, if so desired.
- G. The boiler control system shall incorporate the following additional features for enhanced external system interface:
  1. Start contact

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2. Analog output feature to enable simple monitoring of temperature setpoint, outlet temperature or fire rate
  3. Remote interlock circuit for immediate shutdown
  4. Delayed interlock circuit for delayed shutdown
  5. Fault relay for remote fault alarm
- H. Flue Pressurization Controls: The boiler controller shall provide a flue pressurization function to enable leak testing of the flue system.
- I. Each boiler shall include an electric, single-seated combination safety shutoff valve/regulator with proof of closure switch in its gas train. Each boiler shall incorporate dual over-temperature protection with manual reset, in accordance with ASME Section IV and CSD-1.
- J. Boiler shall include standard O<sub>2</sub> trim system to maintain dewpoint at 122 deg F or higher, and to dynamically optimize combustion efficiency. The O<sub>2</sub> system shall measure the oxygen content of the exhaust gasses in real-time, and make combustion adjustments as necessary to maintain optimal O<sub>2</sub> levels and maximize the exhaust dew point.
1. Combustion adjustments shall compensate for wind load and draft effects on combustion, partial blockage of combustion air filters, and variations in combustion maintenance settings due to air temperature, pressure, humidity, and gas BTU content.
  2. Output of O<sub>2</sub> information shall be displayed on the boiler control panel, shall be available as a standard monitored point through the BMS, and via the factory supplied automatic remote monitoring system.
  3. The O<sub>2</sub> trim systems shall be self-diagnostic and provide status, warnings and alarms. These shall include but not be limited to:
    - a. General system status and error messages
    - b. Warning when excessive trimming is occurring
    - c. Warning when O<sub>2</sub> sensor has fallen out of calibration
  4. The boiler may utilize an internal or external O<sub>2</sub> monitoring systems. External systems shall be Hayes-Cleveland Series A-10050 or Preferred Instruments ZP Series, integrated into the boiler combustion control system.
    - a. For oxygen sensors requiring annual replacement, the replacement oxygen sensors shall be covered under manufacturer's warranty for five (5) years for each boiler.

## 2.4 ELECTRICAL POWER

- A. Controllers, Electrical Devices and Wiring: Electrical devices and connections are specified in Division 26 sections.

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- B. Single-Point Field Power Connection: Factory-installed and factory-wired switches, motor controllers, transformers and other electrical devices shall provide a single-point field power connection to the boiler.
- C. Service Disconnects: If required by Code or contract documents, shall be furnished and installed by the Electrical Contractor.
- D. Power shutdown contactors and/or shunt trip breakers for complete power disconnect during emergency switch and/or Life Safety system activation shall be furnished and installed by the Electrical Contractor.
- E. Boiler Electrical Characteristics: Refer to drawing Schedules.

**2.5 SOURCE QUALITY CONTROL**

- A. Burner and Hydrostatic Test: Factory adjust burner to eliminate excess oxygen, carbon dioxide, oxides of nitrogen emissions and carbon monoxide in flue gas while maintaining combustion efficiency. Perform ASME hydrostatic testing.
- B. Test and inspect factory-assembled boilers, before shipping, according to ASME Boiler and Pressure Vessel Code.
  - 1. If boilers are not factory assembled and fire-tested, the local vendor is responsible for all field assembly and testing.
- C. Allow Owner access to source quality-control testing of boilers. Notify Architect fourteen days in advance of testing. All travel cost associated with Owner (or their representative) to witness the factory fire test. Include cost for up to two persons.

**2.6 SECURE REMOTE MONITORING, ALARM, AND SERVICE ALERT SYSTEM**

- A. Independent from any plant monitoring and controls, each boiler shall include not less than five (5) year subscription to factory-supplied online access to real time operation and status of the boiler plant from any computer, tablet or mobile device. Standard email reports and operational warning and alarms shall be provided upon internet connection (by others) and setup.
- B. Remote monitoring system shall utilize customer's existing or new network using non-modifiable, one-way (outbound) design with no special hardware or firewall configuration changes necessary. Layered security approach includes "Air-Gap" technology implemented as a serial-to-ethernet bridge with inbound communications to the boiler physically and programmatically disabled, or equal.
- C. Remote monitoring system shall be user configurable to send reports and email warnings to specific user or maintenance groups and personnel.
- D. The customizable dashboard shall provide features and capability included but not limited to:
  - 1. Optimization and Efficiency
    - a. Efficiency status and trends

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- b. Estimated savings calculator
- c. Efficiency and performance optimization recommendations
- 2. Maintenance and Service
  - a. Maintenance alerts and scheduling
  - b. Warning and error messages
  - c. Manage and store startup, maintenance and service documentation
- 3. Plant Operation
  - a. Weekly or monthly performance and status reports
  - b. Manage multiple boiler plants or buildings

**2.7 HEAT ENGINE CONTROLS**

- A. Furnish and install heat engine controls that shall interface, monitor, control and maintain efficient operation of all hot water boilers directly involved in the production and distribution of heating hot water (and domestic hot water as applicable per contract documents).
- B. The heat engine controls shall include the following general functions, further specified herein:
  - 1. Boiler sequencing at maximum boiler thermal efficiency;
  - 2. Boiler isolation valve controls and integration;
  - 3. Boiler plant BMS communication.
- C. Boiler Sequencing Logic:
  - 1. The controller shall vary the firing rate and energy input of each individual boiler throughout its full modulating range to maximize the condensing capability and thermal efficiency output of the entire heating plant. The sequencer shall control the boiler outlet header temperature within +2°F (adjustable). The controller shall provide accurate temperature control for rapidly changing loads such as Domestic Hot Water Generation.
  - 2. Sequencing shall occur near individual boiler minimum firing rates where boiler thermal efficiency is maximized, in accordance with manufacturers published efficiency curves. The sequencer shall run the highest number of available boilers at the lowest firing rate required to satisfy the load.
  - 3. The sequencer shall have the following field selectable control modes:
    - a. Constant Setpoint: fixed temperature control setpoint on the sequencer shall be fully field adjustable from 50°F to 190°F in operation.

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- b. Outdoor Reset: Adjustable inverse ratio in response to outdoor temperature to control the main header temperature. Header high and low temperature clamping shall be included
    - c. Remote Setpoint: The sequencer will vary the header temperature setpoint based on the command of the BMS, either by analog input or communication signals.
  - 4. Loss of external communication and/or remote sensor will result in boilers operating in local, constant setpoint mode, or shut down (user configurable).
- D. Boiler Isolation Valve Sequencing:
  - 1. When boilers are inactive, one or more boiler isolation valves will be piloted open to permit HW flow to avoid deadheading pumps.
  - 2. As boilers are staged online, all open boiler valves on inactive boilers will be piloted closed.
- E. Boiler Plant Communication Points: When communicating with the BMS, the following points are available to the BMS via RS485, BACnet or Modbus protocols (see controls specification for required protocol):
  - 1. Number of Boilers Active
  - 2. Number of Boilers Firing
  - 3. Controller Firing Rate Command %
  - 4. Outside Air Temperature
  - 5. HWS Temperature
  - 6. HWS Setpoint Temperature
  - 7. Individual Boiler Status
  - 8. Individual Boiler Firing Rate
  - 9. Individual Boiler Outlet Temperature
  - 10. Individual Boiler Fault Code
  - 11. Individual Boiler Cycles
  - 12. Individual Boiler Run Hours
  - 13. Individual Boiler Exhaust O2 Level
  - 14. Individual Boiler Exhaust Temperature

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**2.8 BOILER EXHAUST AND COMBUSTION AIR**

- A. Exhaust Vent: Must be UL Listed for use with Category II, III and IV appliances and compatible with condensing flue gas service with operating temperatures up to 230°F. UL listed vents constructed of stainless steel or polypropylene must be used.
- B. Combustion-Air Intake: Boilers shall be capable of drawing combustion air from the outdoors via a metal or PVC duct connected between the boiler and the outdoors, subject to local codes and restrictions. The boiler shall be designed such that the combustion air is drawn from the inside of the boiler enclosure through a filter, decoupling it from the combustion air supply and preheating the air to increase efficiency.
- C. Common vent and common combustion air must be an available option for boiler installation. Consult manufacturer for common vent and combustion air sizing.
- D. Follow guidelines specified in manufacturer's venting guide. The boiler manufacturer must provide a letter indicating they have reviewed, approved and are responsible for the proper operation of the boilers into the venting system, with calculations attached to the approval letter. Initial factory calculations based on contract documents must be provided in the boiler equipment submittal.
- E. Upon installation completion and prior to startup, as-built flue system drawings shall be provided by the contractor to the boiler manufacturer for final calculations of the actual installation.
- F. When required by the Boiler Manufacturer, provide overdraft control damper(s) and controller equivalent to OBD/VIC as manufactured by US Draft Company, for materials of construction and controls flexibility. The boiler supplier shall have single point responsibility for:
  - 1. Material cost of draft inducer, control panel and sensors;
  - 2. Proper operation, startup, testing, and commissioning of Draft Inducer system.
  - 3. Unless shown on Contract Documents, all costs of furnishing and installing the system to the Mechanical, Electrical and Controls contractor shall be the responsibility of the Mechanical Contractor.
- G. When required by the boiler manufacturer, provide draft inducer fan(s) and controller equivalent to CB-EX/VIC as manufactured by US Draft Company, for materials of construction and controls flexibility. The boiler supplier shall have single point responsibility for:
  - 1. Material cost of draft inducer, control panel and sensors;
  - 2. Proper operation, startup, testing, and commissioning of Draft Inducer system.
  - 3. All costs of installation to the Mechanical, Electrical and Controls contractor shall be the responsibility of the Mechanical Contractor.
- H. Proper condensate neutralization must be provided for the venting system. When multiple boilers are common vented the base of the vertical chimney stack must include a drain that is



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pipd with a trap to a dedicated condensate neutralizer prior to draining. All condensate piping shall be CPVC or 316 Stainless steel.

### **PART 3 - EXECUTION**

#### **3.1 EXAMINATION**

- A. Before boiler installation 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 boiler performance, maintenance and operations.
  - 1. Final boiler locations indicated on Drawings are approximate. Determine exact locations before roughing-in for piping and electrical connections.
- B. Examine mechanical spaces for suitable conditions where boilers will be installed.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

#### **3.2 BOILER INSTALLATION**

- A. Install boilers level on concrete bases. Concrete base is specified in Division 23 Section "Common Work Results for HVAC," and concrete materials and installation requirements are specified in Division 03.
- B. Install boilers in accordance with the manufacturers minimum service clearances.
- C. Install gas-fired boilers according to NFPA 54.
- D. Assemble and install boiler trim.
- E. Install electrical devices furnished with boiler but not specified to be factory mounted.
- F. Install line voltage and control wiring to field-mounted electrical devices.
- G. Provide CAT6 ethernet cable connected to the building internet service for boiler monitoring service.

#### **3.3 CONNECTIONS**

- A. Piping installation requirements are specified in other Division 23 Sections. Drawings indicate general arrangement of piping, fittings and specialties.
- B. Install piping adjacent to boiler to permit service and maintenance. All piping locations must conform to boiler service clearances.
- C. Install piping from equipment drain connection to nearest floor drain. Piping shall be at least full size of connection. Provide an isolation valve if required.

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- D. Connect gas piping to boiler gas-train inlet with unions. Piping shall be at least full size of gas train connection and have a full-port manual isolation valve installed. All field installed fittings and valves must be outside of boiler jacketing. Gas piping shall be sized for a pressure drop no greater than ½" W.C. at full load. If incoming gas pressure is above equipment limits a lock-up style gas regulator must be installed on the gas supply.
- E. Connect hot-water piping to supply and return boiler tapings with manual shutoff valve and union or flange at each connection.
- F. Install piping from safety relief valves to 18" A.F.F.
- G. Boiler Venting:
  - 1. Install vent and combustion-air intake kit.
  - 2. Venting must be at least full size of boiler connections. Comply with requirements in Division 23 Section "Breechings, Chimneys and Stacks."
  - 3. Install venting system according to manufacturer's guidelines, using recommended sealant for each flue connection.
- H. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."
- I. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

**3.4 FIELD QUALITY CONTROL**

- A. Perform tests and inspections and prepare test reports.
  - 1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies and equipment installations, including connections, and to assist in testing.
- B. Tests and Inspections
  - 1. Perform installation and startup checks according to manufacturer's written instructions.
  - 2. Perform hydrostatic test. Repair leaks and retest until no leaks exist.
  - 3. Start units to confirm proper motor rotation and unit operation. Adjust air-fuel ratio and combustion.
  - 4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
    - a. Check and adjust initial operating set points and high- and low-limit safety set points of fuel supply, water level and water temperature.

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- b. Set field-adjustable switches and circuit-breaker trip ranges as indicated.
  - c. Verify sensor operation for CO, methane, and flood detectors. Verify break glass operation.
  - d. Verify heat engine controls sensor(s) operation. Check and adjust initial operating set points and all connected operating sequences
  - e. Verify applicable BMS and Network communication.
- C. Remove and replace malfunctioning units and retest as specified above.
- D. Occupancy Adjustments: When requested within 2 months of date of Substantial Completion, provide on-site assistance adjusting system to suit actual occupied conditions. Provide up to two visits to Project during other than normal occupancy hours for this purpose.
- E. Performance Tests: The boiler manufacturer is expected to provide partial load thermal efficiency curves. These thermal efficiency curves must include at least three separate curves at various BTU input levels. If these curves are not available, it is the responsibility of the boiler manufacturer to complete the following performance tests:
  - 1. Engage a factory-authorized service representative to inspect component assemblies and equipment installations, including connections, and to conduct performance testing.
  - 2. Boilers shall comply with basis of design equipment performance requirements, as determined by field performance tests. Adjust, modify, or replace equipment to comply.
  - 3. Perform field performance tests to determine capacity and efficiency of boilers.
    - a. Test for full capacity.
    - b. Test for boiler efficiency at low fire, 50, and 100 percent of full capacity. Determine efficiency at each test point.
  - 4. Repeat tests until results comply with basis of design equipment.
  - 5. Provide analysis equipment required to determine performance.
  - 6. Provide temporary equipment and system modifications necessary to dissipate the heat produced during tests if building systems are not adequate.
  - 7. Notify Architect in advance of test dates.
  - 8. Document test results in a report and submit to Architect.
- F. Three Year Preventative Maintenance Service Contract:
  - 1. Boiler manufacturer shall provide a Three-Year Preventive Maintenance Service Contract with a local factory trained service agency. The service agency shall inspect and adjust (as required) the boilers and control system semi-annually, in compliance with the

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manufacturers published recommendations. All consumable items in each boiler shall be supplied and replaced at no charge to owner during this time period.

2. The Preventative Maintenance Service Contract shall include the following work to be performed during each visit:
  - a. Check general operation and condition of each unit and note any deficiencies found, including gauges, monitors, indicators, operating controls, vent or intake air ducts and firing rate control.
  - b. Sensors provided with each unit will be tested, including SSOV leakage test, flame failure, flame signal strength, low water cut off and alarm, high water temp, low air flow, high gas pressure, low gas pressure, and safety pressure relief valve.
  - c. Check condition of air/fuel valve on each unit, including valve purge position switch and valve ignition position switch.
  - d. Adjust gas supply as required.
  - e. Check condition of condensate lines, float trap and replace condensate neutralizer cartridge.
  - f. Check and record sequencer settings. Verify that cycling rate is <2 cycles/hr. Higher cycling rates generally reflect system operational issues.
  - g. Install new spark igniters on each unit.
  - h. Install new flame detectors on each unit.
  - i. Clean combustion air filter, replaced as needed.
  - j. Test and/or Replace O2 sensor as per manufacturers IOM
  - k. Perform combustion calibration on each unit through all firing rates according to manufacturers prescribed flue gas concentrations. Each calibration shall include a time/date print out of results.
  - l. Verify operation of boiler motorized isolation valve and valve controller.
  - m. Verify operation of life safety panel and sensors. Replace sensor cartridges as per manufacturer's recommendations.
  - n. Review factory monitoring data and trending with Operations personnel to recommend boiler and HW system optimization and setpoint adjustment.

3.5 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate and maintain boilers. Refer to Division 01 Section "Demonstration and Training."

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END OF SECTION 235216

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SECTION 235700 - HEAT EXCHANGERS FOR HVAC

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes brazed-plate and gasketed-plate heat exchangers.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
  - 1. Include rated capacities, operating characteristics, and furnished specialties and accessories.
- B. Shop Drawings: Signed and sealed by a qualified professional engineer. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
  - 1. Design Calculations: Calculate requirements for selecting seismic restraints and for designing bases.
  - 2. Base Details: Detail fabrication, including anchorages and attachments to structure and to supported equipment.

1.4 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Equipment room plan or BIM model, drawn to scale, showing the items described in this Section, and coordinated with all building trades.
- B. Sample Warranty: For manufacturer's warranty.

1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For heat exchangers to include in emergency, operation, and maintenance manuals.

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1.6 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of heat exchangers that fail in materials or workmanship within specified warranty period.
1. Failures include, but are not limited to, the following:
    - a. Structural failures, including heat exchanger, storage tank, and supports.
    - b. Faulty operation of controls.
    - c. Deterioration of metals, metal finishes, and other materials beyond normal use.
  2. Warranty Periods: From date of Substantial Completion.
    - a. Plate Heat Exchangers:
      - 1) Brazed-Plate Type: One year(s).
      - 2) Gasketed-Plate Type; One year(s).

PART 2 - PRODUCTS

2.1 GASKETED-PLATE HEAT EXCHANGERS (SERVING POOL WATER)

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
1. Armstrong Fluid Technology.
  2. Bell & Gossett; a Xylem brand.
- B. Configuration: Freestanding assembly, consisting of frame support, top and bottom carrying and guide bars, fixed and movable end plates, tie rods, individually removable plates, and one-piece gaskets. Floor-mounted heat exchangers must have integral legs with mounting feet.
- C. Construction: Fabricate and label heat exchangers to comply with ASME Boiler and Pressure Vessel Code, Section VIII, "Pressure Vessels," Division 1.
- D. Frame:
1. Capacity to accommodate 20 percent additional plates.
  2. Painted carbon steel with provisions for anchoring to support.
- E. Top and Bottom Carrying and Guide Bars: Painted carbon steel, aluminum, or stainless steel.
- F. End-Plate Material: Painted carbon steel.
- G. Tie Rods and Nuts: Steel or stainless steel.
- H. Plate Material: 0.017 inch (0.5 mm) thick before stamping; Titanium.

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- I. Gasket Materials: Nitrile rubber.
- J. Piping Connections: Factory fabricated of materials compatible with heat-exchanger shell. Attach tapings to shell before testing and labeling.
  - 1. NPS 2 (DN 50) and Smaller: Threaded ends in accordance with ASME B1.20.1.
  - 2. NPS 2-1/2 (DN 65) and Larger: Flanged ends in accordance with ASME B16.5 for steel and stainless steel flanges and in accordance with ASME B16.24 for copper and copper-alloy flanges.
- K. Enclose plates in solid stainless steel removable shroud.

## 2.2 BRAZED-PLATE HEAT EXCHANGERS (SERVING DOMESTIC HOT WATER)

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - 1. Armstrong Fluid Technology.
  - 2. Bell & Gossett; a Xylem brand.
- B. Configuration: Brazed assembly, consisting of embossed or pressed stainless steel plates brazed together and two end plates, one with threaded nozzles and one with pattern-embossed plates. Floor-mounted heat exchangers must have factory-furnished integral legs with mounting feet.
- C. Construction: Fabricate and label heat exchangers to comply with ASME Boiler and Pressure Vessel Code, Section VIII, "Pressure Vessels," Division 1.
- D. End-Plate Material: Type 316 stainless steel.
- E. Threaded Nozzles: Type 316 stainless steel.
- F. Plate Material: Type 316 stainless steel.
- G. Brazing Material: Copper.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine areas for compliance with requirements for installation tolerances and for structural rigidity, strength, anchors, and other conditions affecting performance of heat exchangers.
- B. Examine roughing-in for heat-exchanger piping to verify actual locations of piping connections before equipment installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.



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3.2 INSTALLATION OF HEAT EXCHANGER, GENERAL

A. Equipment Mounting:

1. Install floor-mounted heat exchangers on cast-in-place concrete equipment bases. Install all heat exchangers level and plumb in accordance with manufacturer's recommendations. Comply with requirements for equipment bases and foundations specified in Section 033000 "Cast-in-Place Concrete."

3.3 PIPING CONNECTIONS

- A. Comply with requirements for piping specified in Section 232113 "Hydronic Piping" and Section 232116 "Hydronic Piping Specialties." Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Maintain manufacturer's recommended clearances for tube removal, service, and maintenance.
- C. Install piping adjacent to heat exchangers to allow space for service and maintenance of heat exchangers. Arrange piping for easy removal of heat exchangers.
- D. Install shutoff valves at heat-exchanger inlet and outlet connections.
- E. Install pressure-relief valves on heat-exchanger outlet piping before any isolation valves.
- F. Pipe pressure-relief valves, full size of valve connection, to floor drain.
- G. Install thermometer on each heat-exchanger fluid inlet and outlet piping. Comply with requirements for thermometers specified in Section 230519 "Meters and Gages for HVAC Piping."
- H. Install pressure gauges on each heat-exchanger fluid inlet and outlet piping. Comply with requirements for pressure gauges specified in Section 230519 "Meters and Gauges for HVAC Piping."

3.4 CLEANING

- A. After completing system installation, including outlet fitting and devices, inspect exposed finish. Remove burrs, dirt, and construction debris, and repair damaged finishes.
- B. Isolate heat exchangers from piping before flushing piping. If a valve is used to isolate equipment, its closure shall be capable of sealing against test pressure without damage to valve. Install blind flanges in flanged joints to isolate equipment.
- C. Flush heat-exchanger piping systems with clean water; then remove and clean or replace strainer screens before reopening flow to heat exchangers.

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3.5 FIELD QUALITY CONTROL

- A. Perform tests and inspections with the assistance of a factory-authorized service representative:
- B. Tests and Inspections:
  - 1. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
  - 2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- C. Heat exchanger will be considered defective if it does not pass tests and inspections.
- D. Prepare test and inspection reports.

END OF SECTION 235700





SCALE: NTS



SEAL	SCALE	PROJECT NO.
	AS NOTED	NTOG0011.00
	DRAWN BY	DRAWING NO.
	TO / AC	
CHECKED BY		
	JK	M7.2
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