

# OFFICE BUILDING BOILER REPLACEMENT PERFORMANCE CONTRACT PROJECT

This month's B2B will focus on the retrofit/conversion of a commercial office building hot water heating system from a utility company steam system to a new, high-efficiency, condensing boiler system. This energy retrofit project system will receive an energy retrofit performance contract to redesign, build, and take over operation and maintenance of the heating system based on a performance lease agreement to span the boiler's agreed upon useful life cycle of 20 years.

The scope of this building program is to remove the existing underground high-pressure steam supply and condensate return system from a local utility company piped distribution system from below the city street into the building. At this point inside the basement, the steam is converted to a fixed hot water system through two stages of steam pressure reducing valve (PRV) stations. In the place of the steam room, PRVs, and the condensate receiver and pumps, the energy retrofit will include a two-modular, 95 percent condensing boiler package. The existing, oversized pump head circulating pumps will be replaced with more efficient floor-mounted circulators and variable-speed pump motors. A new BAS shall also be replaced with new computerized data collection energy management software, internet access management, and cyber protection software.

The building owner will hire an owner representative to work with this design-build-operate-maintain performance provider (PP). This PP team will include its own in-house commissioning and testing, adjusting, and balancing engineers (CxTAB). The PP firm shall subcontract out the energy and retrofit design professionals as well as the HVAC contractor and place the boiler room O&M operators on-site along with remote energy monitoring/management and the planned maintenance work order system.

The building's facility manager and the consulting HVAC engineer will review the *2015 ASHRAE Handbook — HVAC Application* chapter 3 (Commercial and Public Buildings), chapters 36-43 (Building Operation and Maintenance), and chapter 59 (HVAC Security). In addition, and based on the performance contract, the team is referred to chapter 61 (Smart Building Systems). The PP design team is directed to *2016 ASHRAE Handbook — HVAC Systems and Equipment*, and, more specifically, chapters 1 (HVAC System Analysis and Selection, 32 (Boilers), and *2015 ASHRAE Handbook — HVAC Applications* chapter 58 (Integrated Building Design).

The building's facility manager will provide her own O&M staff assistance to the PP firm's own O&M staff, HVAC subcontractor, and boiler equipment manufacturer's technician at project startup. This month's equipment selection includes two new modular condensing boilers with each natural gas, Energy Star-compliant boiler unit rated at 360 MBH output, and 95 percent thermal efficiency. The boilers are capable of modulating down to 20 percent of rate input. Hot water shall be 160°F HWS and 130°F HWR at peak heating. The boilers shall be furnished and installed with gas trains, 4-inch pressure, and the required gas relief vents. A new boiler room ventilation fan shall be a variable-speed blower system to maintain a positive pressure within the room. This combustion make-up air design shall be configured

via direct outdoor duct terminating at each boiler burner. The boilers themselves shall be BACnet controls with 24-VAC control circuits and a control panel, temperature and pressure gages, temperature sensors (HWS, HWR, flue, and outdoor air), and low-water flow protection.

Each boiler shall be piped to include shutoff valves, an inlet strainer with a blow-off valve, a two-position ATC valve, a circulator, and a balancing valve for fine-tuning flow. One pressure gage shall be used with an individual connection and associated petcocks at the inlet and outlet of the strainer, the inlet and outlet of the pump, and immediately after the balancing valve. A manual air separator shall be located at each boiler along with an in-line separator and automatic water makeup connection located between the boilers and the pumps. One city water backflow preventer will serve the entire heating system.

The boiler-furnished automatic controls shall be a computerized system using wireless technology integrated with the building's control as well as the remote energy management computer system. This system will also interface with the office building's security system managed by the owner's security manager.

Electrical shall be 480/3/60 for 0.5 hp and larger and 120/1/60 for motors less than 0.5 hp. The HVAC subcontractor's ATC subcontractor and electrical subcontractor shall work together to rewire existing power wiring along with the interface of the new boiler controls with the existing building automation.

The design team, along with the owner's input, shall produce conceptual drawings, basis of design (BofD), and design development working in sync with the HVAC subcontractor to produce coordinated contract drawings and specifications — all followed by as-built documents. The TAB and commissioning consultant's commissioning engineers shall produce their work plans too.

The facility manager shall have her O&M personnel review the documents throughout the design phase and receive introductory training of the new equipment and energy management plan.

## **The PP team shall include the following during the shop drawing submittal phase:**

- Equipment submittals – Startup sheet - Troubleshooting sheets - O&M manuals, parts, and lubricants - ATC and energy management submittal including one complete ATC submittal that integrates the manufacturer's boiler furnished ATC into an integrated overall ATC submittal.

## **A third-party CxTAB firm shall complete the following:**

- A TAB system flow diagram of the entire (new and existing) hot water system with gpm and pump heads indicated at each piece of new and existing equipment.
- A TAB system flow diagram of the entire supply and return water system drawing upon data from the hydraulic model with gpm and pressure drops at each piece of heating equipment and at major branch runouts.
- A commissioning functional performance test of the boiler retrofit system from "Off" to maximum capacity "On."

Refer to The Facility File for additional information pertaining to completing the B2B test. **ES**



The design engineer shall check off the boxes from the list of the company’s standardized field observation checklists below that he will need to upload on to his tablet computer prior to heading out to the construction site to complete his final HVAC inspection and punchlist. These checklists will be touchscreen type. When the engineer returns to the office or he sends the completed checklists

via the internet to the office, the completed checklists shall be automatically downloaded to the company’s computer server and placed in the job folder’s “Project Closeout” section. The completed checklists, along with associated digital photographs taken at the time of the field visit, will automatically be electronically sent to the following individuals and departments.

**TEAM CORRESPONDENCE DIRECTORY CHECKLIST**

*(Check the appropriate boxes)*

- Owner Representative  PP Project Manager  IPD Manager
- Construction Manager  General Contractor  Design-Build Contractor  Facility Manager  HVAC Subcontractor  ATC Subcontractor  ATC and Energy Management Subcontractors
- Federal Energy Department  Energy Engineer  ASHRAE
- Piping Subcontractor  Sheet Metal Subcontractor  Third-party CxTAB Consultant  Third-party TAB Consultant  Equipment Manufacturers  Building Inspector
- Others: *(insert list)* \_\_\_\_\_

**HVAC CONTRACT SPECIFICATION CHECKLIST**

- Division 1 Project Closeout  Office Equipment  Owner Furnished Equipment  Structural  Electrical  Plumbing  Fire Protection  HVAC  Infection Control  ATC  ATC and Energy Management  Boilers  Pumps  Chillers  Fans  Air Handlers  Terminal Units  Piping System  Sheet Metal System  TAB  Commissioning  Security  Others: \_\_\_\_\_

**HVAC CONTRACT DRAWING INSTALLATION CHECKLIST**

- Division 1 Project Closeout  Office Equipment  Owner Furnished Equipment  Structural  Electrical  Plumbing  Fire Protection  HVAC  Infection Control  ATC  ATC and

- Energy Management  Boilers  Pumps  Chillers  Fans  Air Handlers  Terminal Units  Piping System  Sheet Metal System  TAB  Commissioning  Security  Others: \_\_\_\_\_

**HVAC STARTUP CHECKLIST**

- Office Equipment  Owner Furnished Equipment  Structural  Electrical  Plumbing  Fire Protection  HVAC  Heating System  Infection Control  ATC  ATC and Energy Management  Boilers  Pumps  Chillers  Fans  Air Handlers  Terminal Units  Piping System  Sheet Metal System  TAB  Equipment Room  Tel-data  Others: \_\_\_\_\_

**COMMISSIONING FPT (Functional Performance Test)**

- Office Equipment  Owner Furnished Equipment  Structural  Electrical  Plumbing  Fire Protection  HVAC  Infection Control  ATC  ATC and Energy Management System  Boilers  Pumps  Chillers  Fans  Air Handlers  Terminal Units  Heating System  Air Conditioning System  Equipment Room  Tel-data System  Others: \_\_\_\_\_