

# FEDERAL OFFICE BUILDING BOILER REPLACEMENT PERFORMANCE CONTRACT PROJECT

This month's B2B will focus on the retrofit of a federal office building hot water boiler system. The existing system receives 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 agreed-upon boiler useful life cycle of 20 years.

The scope of this building program is to remove the existing 30-year-old boiler and replace it with new high-efficiency condensing boilers, and remove the oversized hot water pumps with primary-secondary, variable speed drive pumps. The BAS will also be replaced with new computerized data collection energy management software, internet access management, and cyber protection software.

The building owner (federal agency) shall hire an owner representative to work with this design-build-operate-maintain Performance Provider (PP). This PP team will include their own in-house commissioning and testing, adjusting, and balancing engineers (CxTAB). The PP firm will subcontract out the energy and retrofit design professionals, subcontract the HVAC contractor, and place on site the boiler room O&M operators 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 through 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 design engineer is directed to *2016 ASHRAE Handbook — HVAC Systems and Equipment* and more specifically chapters 1 (HVAC System Analysis and Selection) and chapter 32 (Boilers).

The building's facility manager will provide her own operating and maintenance 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 six new modular condensing boilers, with each boiler unit rated at 360 MBH output, 95% thermal efficiency, Energy Star compliant, natural gas, and capable of modulating down to 20% of rate input. Hot water shall be 160°F HWS and 130°F HWR at peak heating, and 110°F HWS and 80°F HWR at low load.

A new boiler room ventilation fan shall be a variable-speed blower system to maintain a positive pressure within the room. This combustion makeup air design shall be via direct outdoor duct terminating at each boiler burner. The boilers themselves shall be BACnet controls with 24 VAC control circuit and control panel, temperature and pressure gages, temperature sensors (HWS, HWR, flue, and outdoor air), and low-water flow protection.

Hot water pumping shall be a new primary-secondary with in-line circulators at each boiler. Secondary pumps shall also be new vertical,

floor-mounted type with VFD motors and configured for lead-lag automatic control sequence. Each boiler shall be piped to include shut-off valves, inlet strainer with blow-off valve, 2-position ATC valve, circulator, and balancing valve for fine-tuning flow.

The boiler furnished automatic controls shall be a computerized system utilizing 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.

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

The water balancing consultant's TAB plan shall be coordinated with the PP's HVAC design engineer to work in sync to produce an as-built hydraulic model of the entire hot water heating system to assure continuous system performance and to also assure the peak pumping performance. The facility manager shall have her O&M personnel review the documents throughout the design phase and receive introduction training of the new equipment and energy management plan. This staff shall observe equipment startup, PP subcontractors' punchlist, and the commissioning system demonstration.

## **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 integrating manufacturer's boiler furnished ATC into an integrated overall ATC submittal.

## **A 3rd-party commissioning and testing, adjusting, and balancing (CxTAB) firm shall complete the following:**

- TAB system flow diagram of entire (new and existing) hot water system, with gmp and pump heads indicated as each boiler is sequenced on (maximum of six boilers) each piece of new and existing equipment.
- TAB system flow diagram of entire supply and return water system drawing upon data from the hydraulic model, with gpm and pressure drops at each piece of process cooling equipment and at major branch runouts.
- Commissioning functional performance test of the boiler retrofit system, from off to maximum of six boilers on.

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



The design engineer shall check off the boxes from the list of 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 of the folder. 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 & Energy Management subcontractors
- Federal Energy Department  Energy Engineer  ASHRAE
- Piping Subcontractor  Sheet Metal Subcontractor  3rd-Party CxTAB Consultant  3rd-Party TAB Consultant  Equipment Manufacturers  Building Inspector
- Others: (insert list) \_\_\_\_\_

**HVAC CONTRACT SPECIFICATION CHECKLIST**

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

**HVAC STARTUP CHECKLIST**

- Data Center Process Equipment  Owner Furnished Equipment
- Structural  Electrical  Plumbing  Fire Protection  HVAC  Infection Control  ATC  ATC & 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)**

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