

CORPORATE BUILDING BOILER REPLACEMENT DESIGN-BID-BUILD PROJECT

This month's B2B will focus on the retrofit of an iconic 1950s building's steam-to-hot water heating system. The existing system receives its high-pressure steam from a district heating system serving several downtown commercial buildings. This steam is reduced to low-pressure steam to serve steam-to-hot water convertors within this building.

The scope of this building program is to remove the utility steam system within the building and cap the supply and pumped condensate return pipes at the entrance/exit of the building. The energy retrofit building program is to furnish and install a series of high-efficiency, hot water condensing boilers and remove the steam-to-hot water heat exchangers and condensate pump and receiver sets. The building owner shall hire an owner representative along with a 3rd-party TAB and commissioning consultant. Design team shall include the HVAC design engineer as the prime consultant with structural, plumbing, electrical, and estimating consultants.

The building's facility manager and the consulting HVAC engineer will review the *2015 ASHRAE Handbook — HVAC Application*, chapter 3. The scope of work is to complete the work starting at the end of the heating season and will be completed prior to the next heating season. The design engineer is directed to *2016 ASHRAE Handbook — HVAC Systems and Equipment* and more specifically chapters 1 (HVAC System Analysis and Selection) and 32 (Boilers). It is also recommended that the design team and the owner's team review *2015 ASHRAE Handbook — Commercial and Public Buildings*, chapter 3, and Building Operation and Maintenance chapters 36 through 43, and chapter 59 on HVAC Security.

Project delivery method shall be design-bid-build (DBB). The building's facility manager will provide her own O&M staff assistance to the general contractor's subcontractors and boiler equipment manufacturer's technician at project startup. For this month's equipment, selection is six modular condensing boilers to replace the existing four shell-in-tube steam-to-hot water heat exchangers that serve the existing 2-pipe heating system. Each boiler unit shall be 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. The boilers shall be furnished and installed with gas trains, 4-in pressure, and 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 makeup air design shall be via direct outdoor duct terminating at each boiler.

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. Water pressure relief valve is piped to funnel

floor drain adjacent to each boiler. Each boiler's controls shall be capable of variable speed pumping to maintain constant Delta T and to stage on and off of units. Boiler venting shall be sidewall and not exceed 24 ft.

The boiler furnished automatic controls shall be a computerized system utilizing wireless technology integrated with the building's control. This system will also interface with the office building's security system managed by the owner's security manager.

The HVAC subcontractor's ATC subcontractor and electrical subcontractor shall work together to rewire existing power wiring along with interface of 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), design development (DD) drawings and specifications, and contract documents (CD) in sync with the commissioning consultant's commissioning plan.

The water balancing consultant's TAB plan shall be coordinated with the HVAC design engineer to work in sync to produce an as-built hydraulic model of the entire hot water 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. This staff shall observe equipment startup, DBB contractor and subcontractors' punchlist, and the commissioning system demonstration.

The DBB 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 CxTAB firm shall complete the following:

- TAB system flow diagram of entire (new and existing) hot water system with gpm and pump heads indicated as each boiler is sequenced on (maximum of six boilers on) 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 GPMs 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)

- Project Engineer Owner Representative IPD Manager
- Construction Manager General Contractor Design-Build Contractor Facility Manager HVAC Subcontractor
- ATC Subcontractor State Energy Department 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 Boilers Pumps Chillers Fans Air Handlers
- Terminal Units Piping System Sheet Metal System TAB
- Commissioning Others: _____

HVAC CONTRACT DRAWING INSTALLATION CHECKLIST

- Process Equipment Owner Furnished Equipment Structural
- Electrical Plumbing Fire Protection HVAC Infection Control ATC Boilers Pumps Chillers Fans Air Handlers Terminal Units Piping System Sheet Metal System
- Equipment Room Tel-Data Others: _____

HVAC STARTUP CHECKLIST

- Process Equipment Owner Furnished Equipment Structural
- Electrical Plumbing Fire Protection HVAC Infection Control ATC Boilers Pumps Chillers Fans Air Handlers Terminal Units Piping System Sheet Metal System
- Equipment Room Tel-Data Others: _____

COMMISSIONING FPT - Functional Performance Test

- Process Equipment Owner Furnished Equipment Structural
- Electrical Plumbing Fire Protection HVAC System
- Infection Control ATC Boilers Pumps Chillers Fans
- Air Handlers Terminal Units Piping System Sheet Metal System Equipment Room Tel-Data
- Others: _____