

Back2Basics

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Office Building Boiler Retrofit Design-Build Project

This month's B2B will focus on an existing three-story private office building described in chapter 3 of the 2015 *ASHRAE Handbook — HVAC Applications* titled Commercial and Public Buildings, and specifically regarding replacing two antiquated boilers and their factory furnished automatic control. To select the optimum boiler equipment for the application, the designer is directed to 2016 *ASHRAE Handbook*, chapter 32 (Boilers), as well the 2015 handbook, chapters 36 through 43, pertaining to Building Operation and Management.

Project delivery method shall be a single-source, design-build (D-B) approach, with the prime D-B firm being a mechanical contracting firm having in-house HVAC engineering and a service department capable of installation startup and commissioning of the equipment and system. The owner of this office building has received an energy grant from the local utility (gas and electric) company to improve/reduce electrical and gas consumption. The owner will continue to outsource the O&M staff. The energy retrofit project will have a 3rd-party owner representative to interact with the D-B firm and utility company representative to provide heating and BAS commissioning of the installation.

For this month's equipment/system selection, a 3-modular condensing boiler shall replace two firetube boilers that serve a 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 train, 4-in pressure, and required gas relief vent(s).

Boiler fans shall be variable speed blower system, 24 VAC control circuit and control panel, temperature and pressure gages, automatic HWS shutoff valve, temperature sensors (HWS, HWR, flue, and outdoor air), low water flow protection, and water pressure relief valve piped to funnel floor drain adjacent to each boiler. Boilers shall operate using 30% polypropylene glycol and 3-unit controls shall be capable of variable speed boiler pumping to maintain constant Delta T along with staging on and off of units. Boiler venting shall be sidewall and not exceed 24 ft. A new combustion makeup air design shall be from within room via direct outdoor duct terminating at boiler.

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 shutoff valves, strainer with blow-off valve, and 2-position ATC valve. Each pump shall be piped to include shutoff valves, strainer with blow-off valve, 2-position ATC valve, circulator, and balancing valve for fine-tuning flow. One pressure gage shall be used with individual connection and associated petcocks at pump inlet, pump outlet, and immediately after balancing valve. An 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 secondary pumps. There will be one city water backflow preventer to serve the entire heating system.

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.

In addition to the D-B performance specification, the D-B firm shall provide the owner with the following BAS submittal:

- HVAC interface to existing HVAC equipment/systems;
- Electrical wiring drawings;
- Complete list of equipment, parts, and materials;
- BAS schematic, including terminal identification for all wiring;
- Sequences of operation along with required computer programmed software and hardware;
- Mutually agreed upon trending and energy management programs uploaded and trending beginning at startup;
- O&M training;
- System demonstration using the 3rd-party commissioning consultant's functional performance test (FPT) documents;
- One full year O&M service contract, along with an additional two-year service contract including seasonal startup and shutdown by the D-B firm.

Once the concept documents are agreed upon, the D-B team shall produce a concept phase scope of work including a basis of design, system flow diagrams for heating and electrical systems, and a guaranteed D-B cost including all soft costs (e.g., engineering) for owner review and approval.

Prior to the completion of the concept documents, the hospital will have provided the D-B team with the utility company requirements and a commissioning plan.

The building owner's project representative, utility company representative, the 3rd-party commissioning consultant, and the building's security manager will sign-off on the concept documents so that the D-B can begin this fast-track process.

The outsourced O&M facility group shall participate in the "build" phase of the project, observing equipment startup, air and water balancing, automatic controls, and commissioning system demonstration.

The D-B shall include the following shop drawing submittal phase

- Equipment submittals - Startup sheets - Troubleshooting sheets - O&M manuals, parts, and lubricants - ATC submittal including interface with existing ATC system - HVAC subcontractor shall include piping field fabrication drawings and specifications.

The D-B owner representative shall provide TAB services as follows

- TAB system flow diagram of entire new, up to but not including, the existing heating system with GPMs. Flow diagram shall also indicate head pressure indicated at each boiler and at each pump based on one, two, and three pumps on and finishing with a TAB final report.
- Cx functional performance test of boilers-pumps heating system, based on the Cx documents and finishing with a Cx final report.

Refer to the current Facility File for additional information pertaining to completing the B2B test.

OFFICE BUILDING BOILER RETROFIT DESIGN-BUILD PROJECT CONSTRUCTION PHASE – ENGINEER’S PUNCLIST

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 the 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 Architect Owner Representative IPD Manager Construction Manager General Contractor Design-Build Contractor Facility Manager HVAC Subcontractor BAS Subcontractor State Energy Department ASHRAE Piping Subcontractor Sheet Metal Subcontractor Utility Company Representative 3rd-Party Commissioning Consultant Equipment Manufacturers Building Inspector Others: (insert list) _____

HVAC/BAS CONTRACT SPECIFICATION CHECKLIST (check the appropriate boxes)

Division 1 Project Closeout BOMA Equipment Owner Furnished Equipment Structural Electrical Plumbing Fire Protection HVAC Infection Control BAS Boilers Pumps Chillers Fans Air Handlers Terminal Units Piping System Sheet Metal System TAB Commissioning Others: (insert list) _____

HVAC/BAS CONTRACT DRAWING INSTALLATION CHECKLIST (check the appropriate boxes)

BOMA Equipment Owner Furnished Equipment Structural Electrical Plumbing Fire Protection HVAC Infection Control BAS Boilers Pumps Chillers Fans Air Handlers Terminal Units Piping System Sheet Metal System Equipment Room Tel-Data Others: (insert list) _____

HVAC STARTUP CHECKLIST (check the appropriate boxes)

BOMA Equipment Owner Furnished Equipment Structural Electrical Plumbing Fire Protection HVAC Infection Control BAS Boilers Pumps Chillers Fans Air Handlers Terminal Units Piping System Sheet Metal System Equipment Room Tel-Data Others: (insert list) _____

COMMISSIONING FPT (FUNCTIONAL PERFORMANCE TEST) (check the appropriate boxes)

BOMA Equipment Owner Furnished Equipment Structural Electrical Plumbing Fire Protection HVAC System Infection Control System BAS System Central HVAC Air System Heating System Air Conditioning System Boilers Pumps Chillers Fans Air Handlers Terminal Units Piping System Sheet Metal System Equipment Room Tel-Data Others: (insert list) _____

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