

BOILER RETRO-COMMISSIONING PROJECT USING A PERFORMANCE CONTRACT

This month's Facility File focuses on the March Back2Basics retrofit of a campus-wide hot water boiler system covering 40 buildings with primary-, secondary-, and tertiary-pumping based on a performance lease agreement to retro-commission the system with a guaranteed operating savings. The university will hire an owner representative to work with a design-build-operate-maintain performance contractor (PC). The university will retain its boiler plant facility manager (FM). The PC firm will have in-house design/energy engineers and place the boiler plant O&M operators, remote energy monitoring/management, and the planned maintenance work order system on-site.

The university's FM and the outsourced O&M staff should review the *2015 ASHRAE Handbook — HVAC Applications*, chapters 36-43 (Building Operation and Maintenance), chapter 59 (HVAC Security), and chapter 61 (Smart Building Systems). They shall also review the *2016 ASHRAE Handbook — HVAC Systems and Equipment*, chapters 1 (HVAC System Analysis and Selection) and 32 (Boilers). The PC design/energy engineer shall complete a campus-wide hydraulic model of the primary-, secondary-, and tertiary-pumping systems working with the university's FM and existing university O&M staff.

The university FM will provide her own building O&M staff to assist the PC firm's boiler plant staff, subcontractor, and boiler equipment service technicians at project startup. This will assist the PP team in understanding intricacies of owning, operating, and managing this energy retrofit and retro-commissioning project.

With all these design guidelines, the PC engineer shall meet with the university's FM to discuss specific building standards that need to be applied. In particular, the O&M personnel shall review with the PC team the need to adjust its standard contract specifications pertaining to O&M, training, preventive maintenance work order systems, and the energy operating budget.

In the design phase of the project, the PC owner's O&M team will want to contribute information to the design team's writing of the contract specification: service contracts, parts inventory, and as-built drawings requirements. Reviewing the design documents, this O&M team will want to be assured that equipment serviceability is adequate and safe (e.g., boiler room ventilation and gas code ventilation).

For this energy retrofit and retro-commissioning performance contract program, as well as a business plan to continue to successfully manage the building central hot water heating system, the PC's energy engineer shall calculate an O&M budget in addition to the program's construction budget. The performance contract will be signed for 15 years, but the central plant equipment's useful service life can last much longer if it's proactively maintained over the life of this heating plant.

In the construction phase, the O&M team will want to revisit the issues noted earlier during the design phase. Next comes the startup, TAB, and commissioning phases, where the O&M team will want to

be proactive in following along with the PC's mechanical-electrical coordinator and the subcontractor's startup personnel. At this time, the O&M team will receive equipment retraining from the boiler manufacturer's startup technician and system training using the O&M manuals and contract drawings (that will eventually become the as-built drawings). **ES**

Once the startup has been completed and the ATC subcontractor and third-party Cx and TAB consultant has completed the water balancing work, the HVAC subcontractor shall go through an automatic control system and energy management program initial dry-run demonstration prior to the final functional performance test, owner acceptance of the project, and beginning of system trending, monitoring, and measuring of the heating system. These tests will be benchmarked to the original energy management plan. The PC's energy engineer shall begin collecting system performance by trending pertinent HVAC system and equipment data by trending the following:

- Outdoor air dry bulb and wet bulb temperature
- Primary heating water supply (HWS) and return temperature (HWR)
- Secondary HWS and HWR temperature
- Primary HWS and HWS gage pressure
- Secondary HWS and HWR gage pressure
- Individual building HWS and HWR temperatures and gage pressures
- Alarms and safeties
- Boiler control points

Taking the same approach as the PC's design engineering, the PP's O&M personnel shall use a series of computer-generated touchscreen project checklists that allows her staff to confirm that the following facility files have been collected. This process shall begin at the start of construction and not at project closeout so that the facility files can be inputted into the PC's off-site CMMS system. Touchscreen O&M checklists should include:

- Equipment shop drawings
- O&M manuals, a parts list, and lubricants
- Troubleshooting tips
- Seasonal change-over procedures
- Startup and shutdown instructions

The PC's O&M personnel shall review the contractor-produced piping and field fabrication/field coordination drawings prior to fabrication. Touchscreen service checklists shall include:

- Location of shutoff valves, ATC valves, and balancing valves
- Strainers
- Equipment and control devices
- Access for servicing equipment.

The training process shall include specific heating system and equipment training but also emergency plan training due to the heating event. The water balancing of the primary-secondary water system (new and existing equipment), along with the final TAB report, shall be included in the preventive maintenance work order system to routinely assure continuous system performance. In addition, the hydraulic modeling of the entire system shall be updated after the final TAB report. This will require the CxTAB engineer to provide the water balancing reports along with the associated system flow diagrams noting quantities and pressures for rebalancing if necessary as part of the project closeout documents. Touchscreen training checklists shall include:

- Equipment
- System
- Emergency plan
- Automatic controls
- Energy management



AMANDA PAROLISE

Amanda Parolise is project manager consultant with BuildingSmart Software LLC. Reach her at amckew@yahoo.com.