

COMMERCIAL BUILDING CHILLER To Variable Flow Retrofit Construction Management Project

This month's B2B will focus an existing two-story commercial office building receiving an energy grant to retrofit the existing building's air-cooled 160-ton chillers as part of an overall building infrastructure renovation. The office building has its own in-house O&M staff consisting of one technician and an assistant. These two individuals, along with the owner representative, will meet with the design engineer and the construction manager (CM) to discuss specific building standards and how they apply to this project.

The design engineer and the CM's in-house mechanical and electrical coordinator will also outline the specific collection of equipment documents in a manner that will allow for seamless compilation of preventive maintenance (PM) workorders, which will then populate the existing CMMS system so that the required workorders are ready for day one of owner occupancy of the retrofitted chilled water equipment.

It would be very beneficial for the owner representative and the two technicians to review *2015 ASHRAE Handbook — HVAC Applications*, chapter 3 (Commercial and Public Buildings), chapters 36 through 43 (Building Operation and Management), and chapter 59 (HVAC Security) for design guidelines. In addition they should read *2016 ASHRAE Handbook — HVAC Systems and Equipment*, chapter 43 (Liquid-Chilling System) for additional design information pertaining to replacing existing air-cooled chillers with new, more energy-efficient air-cooled chillers.

Based on these design guidelines from ASHRAE, the engineer will meet with the owner's team to discuss specific building standards that need to be applied to this project. With the O&M being performed by in-house staff, the design team needs to know this in advance to adjust their contract specifications pertaining O&M, training, preventive maintenance workorder system, and energy operating budget vs. specifying outsourcing of the O&M.

In the design phase of the project, the owner representative and his O&M technicians will want to contribute information to the design team's writing of the contract specification, and more specifically, to the following activities: service contracts, parts inventory, and as-built drawings requirements. Reviewing the design documents, this O&M staff will want to be assured that equipment serviceability is adequate and safe (e.g., safe access to rooftop equipment).

For a building program it is imperative that the program includes an estimated annual O&M budget in addition to the program's construction budget. The useful service life of air cooled chillers is approximately 16 to 20 years. The same can be said for base-mounted, end suction pumps.

The September B2B project delivery method is construction management with a guaranteed maximum price (GMP) so the CM and his in-house engineering and estimator will be involved in the design phase and be able to contribute to the contract documents. In the construction phase, the O&M staff will want to revisit the issues noted

above. Next comes the startup, TAB, and commissioning phases, and the O&M staff will want to be proactive in following along with the CM's mechanical-electrical in-house coordinator and the subcontractor's startup personnel and receive equipment training from the air-cooled chiller 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 3rd-party CxTAB consultant has completed the water balancing work, the HVAC subcontractor will go through an automatic control system initial dry-run demonstration prior to the CM and his subcontractors demonstrating the system to the CxTAB consultant. The ATC subcontractor should also begin collecting system performance by trending pertinent HVAC system and equipment data by trending the following:

- Outdoor air dry bulb and wet bulb temperature
- In-room air dry bulb and wet bulb temperature
- Chilled water supply and return temperature at each new chiller
- Chilled water supply and return temperature out to the system
- Alarms
- Safety control points

Taking the same approach as the design engineer, the building's O&M personnel will use a series of computer-generated touchscreen project checklists that allows them to confirm that the following facility files have been collected. This process should start at the beginning of construction and not at project closeout, so that the facility files can be inputted into a CMMS workorder system. Touchscreen O&M checklists should include:

- Equipment shop drawings
- O&M manuals, parts list, and lubricants
- Troubleshooting tips
- Seasonal startup and shutdown instructions

The O&M staff will review the contractor-produced piping field fabrication/field coordination drawings prior to fabrication. Touchscreen service checklists should include:

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

The training process will include specific HVAC system and equipment training but also emergency plan training based on failure of one of the two air-cooled chillers. The water balancing of the individual chillers and the primary chilled water and all four of the existing rooftop AHUs, along with the final TAB report, will be included in the preventive maintenance workorder system for rebalancing in a couple of years. In addition, the hydraulic modeling of the entire chilled water system will be updated after the final TAB report. This will require the CxTAB consultant 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 should include:

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



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