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Campus Retrofit: Administration Building HVAC Replacement Construction Management Project

This month's Facility File will focus on the B2B secondary test for a campus administration building's renovation from 2-pipe fan coil units and primary outdoor ventilation air active chilled beams connected to the existing outdoor AHU distribution. The college has its own in-house O&M staff, and the design engineer will meet with the college's facility manager and the O&M staff to discuss specific building standards that need to be applied 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 make seamless the compilation of the preventive maintenance (PM) work orders to populate the existing CMMS system that will be workorder-ready on day one of owner occupancy of the renovated building.

It would be very beneficial for the college's project manager and facility manager to review 2015 *ASHRAE Handbook — HVAC Applications*, chapter 7 (Educational Facilities), and 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 5 (In-Room Terminals), chapter 6 (Radiant Heating and Cooling), and chapter 20 (Room Air Distribution Equipment) for information regarding active chilled beam design engineering.

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

In the design phase of the project, the college's facility manager and his O&M staff 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 drawing requirements. Reviewing the design documents this O&M staff will want to be assured that equipment serviceability is adequate and safe (e.g., chilled beams over occupied space).

For the continued successful management of the existing central chiller plant and the administrative building's HVAC systems, it is imperative that the program include an O&M budget in addition to the program's construction budget. The equipment life of chilled beams should be identified by the beam manufacturer, but for this example, a useful service life is approximately 20 years.

The September B2B project delivery method is construction management (CM) 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 during the design phase. Next comes the startup, TAB, and commissioning phases. 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 to receive equipment training from the chilled beam manufacturer's startup technician and system training using the O&M manuals and contract drawings (which will eventually become the as-built drawings).

Once the startup has been completed and the ATC subcontractor and third-party commissioning and CxTAB consultant has completed the water balancing work, the HVAC subcontractor shall 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
- primary chilled water supply and return temperature
- secondary chilled water supply and return temperature
- duct static pressure control
- alarms
- safety control points

Taking the same approach as the design engineering, the college's O&M personnel should use a series of computer-generated touchscreen project checklists that allow his staff 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 should review the contractor-produced piping and sheet metal-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 should include not only specific HVAC system and equipment training but also emergency plan training due to the room high humidity levels as they pertain to the sensible cooling chilled beams. The water balancing of the primary/secondary chilled water and all terminal units, along with the final TAB report, should be included in the PM workorder system for rebalancing in a couple of years. In addition, the hydraulic modeling of the entire system should 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