

COOLING TOWER FOR A PHARMACEUTICAL PROCESS COOLING WATER SYSTEM - NEW CONSTRUCTION USING CONSTRUCTION MANAGEMENT PROJECT DELIVERY

This month's B2B focuses on a new cooling tower to serve a pharmaceutical facility's new process water system. This tower will be a closed-loop, evaporative condenser to operate 24/7/365. The tower will have a floor-mounted end suction condenser water pump, and a second pump will serve as a standby. Each pump shall have a VFD to respond to the variation in flow to the 20-process equipment heat exchangers each with two-way modulating automatic temperature control (ATC) valves. The tower shall also have two variable-speed, forced-draft fans to provide additional fan capacity in the event that one fan fails.

The design team includes the HVAC, structural, plumbing, and electrical consultants, and the HVAC consulting engineer will serve as the prime engineer for this HVAC infrastructure addition. The pharma capital project manager will retain a third-party commissioning and testing, adjusting, and balancing (CxTAB) consultant.

The pharma facility operation and maintenance (O&M) manager should review the design HVAC engineer's proposed scope of work based on the *2016 ASHRAE Handbook – HVAC Systems and Equipment*, Chapter 1, HVAC System Analysis and Selection, to determine the optimum cooling tower application for this pharma equipment line.

The O&M staff also will be provided access to *2016 ASHRAE Handbook*, Chapter 14, Condenser Water Systems, and Chapter 41, Evaporative Air-Cooling Equipment. The O&M facility manager and design team should also review *2019 ASHRAE Handbook – HVAC Applications*, Chapters 37-44, Building Operation and Management.

At the same time, the O&M facility manager will require the design team and HVAC subcontractor to follow the Cooling Technology Institute (CTI) cooling tower manual and CTI certification criteria as part of the project delivery process.

The project delivery method will be construction management (CM) with a guaranteed maximum price (GMP), so the CM and his in-house estimator will be involved in the design phase and 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; testing, adjusting, and balancing (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 receive equipment training from the cooling tower manufacturer's startup technician and pharma owner-furnished process equipment training using the O&M manuals and contract drawings (that will eventually become the as-built drawings).

In the conceptual phase of the project, the facility manager and her O&M staff will want to contribute information to the design team's writing of the contract specification and, more specifically, the 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.

In the construction phase, the O&M staff will want to revisit the aforementioned design phase issues. 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 coordinator and the subcontractor's startup personnel and receive equipment training from the cooling tower manufacturer's startup technician and system training using the O&M manuals and contract drawings. The cooling tower technician shall verify tower performance in strict accordance with the Cooling Tower Institute (CTI). **ES**

Once the startup has been completed and the ATC subcontractor and third-party 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 the subcontractors demonstrating the system to the CxTAB consultant. The ATC subcontractor and the cooling tower technician will also begin collecting system performance by trending pertinent HVAC system and equipment data including the following:

- outdoor air dry bulb & wet bulb temperature
- condenser water supply and return temperature
- guidelines points in CTI thermal performance test
- alarms
- cooling tower control points

Taking the same closeout punch list approach as the design team, the pharma's O&M personnel will 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 will start at the beginning of construction and not at project closeout so that the facility files can be inputted into the existing computerized maintenance management software (CMMS) system. Touchscreen O&M checklists will include:

- equipment shop drawings
- O&M manuals, parts list & lubricants
- troubleshooting tips
- seasonal changeover procedures
- startup & shutdown instructions

The O&M staff will review the CM produced piping and field fabrication/field coordination drawings prior to fabrication. Touch screen service checklists will include:

- location of shutoff valves, ATC valves, & balancing valves
- strainers
- equipment & control devices
- access for servicing equipment
- standby switchover procedures

The training process will include specific HVAC system and equipment training as well as emergency plan training due to the HVAC event. The water balancing of the process condenser water and cooling tower, along with the final TAB report, will be included in the preventive maintenance work order system to routinely assure continuous system performance. In addition, there will be a hydraulic modeling of the entire system that will be updated after the final TAB report. This requires the TAB 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 will include:

- equipment
- system
- emergency plan
- automatic controls
- energy management



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