Rooftop HVAC System Replacement for Campus Administration Building Project Using Integrated Project Delivery

This month's Facility File is based on an existing 60,000-square-foot college campus administration building HVAC system retrofit. The project building program plans to replace three existing rooftop direct expansion cooling and gas heating units and the associated VAV terminals and perimeter fan-powered terminals with electric heating coils. This equipment has reached the end of its useful service life, and an energy replacement program has been implemented to upgrade existing HVAC systems on campus.

At the recommendation of the college's consulting engineer, the project delivery method shall be integrated project delivery (IPD) as referenced in the *2019 ASHRAE Handbook — HVAC Applications*, Chapter 59 (Integrated Building Design). The HVAC design will also include consideration for Chapter 8 (Educational Facilities) in this handbook. The IPD team shall include the college's facility manager, a third-party owner representative to facilitate the project, and enlist the IPD team's participation.

Other team members are a third-party commissioning and testing, adjusting, and balancing (TAB) consultant firm; design team; general contractor; HVAC subcontractor; and the VRF and DOAS manufacturer representative. The building's facility manager and her O&M staff will participate in the IPD process beginning at the conceptual phase along with the preselected VRF and DOAS equipment manufacturer representative. The facility manager will assist the IPD team in understanding the intricacies of owning, operating, and managing a campus setting.

The O&M staff shall review the *2016 ASHRAE Handbook*, Chapter 18 (Variable Refrigerant Flow HVAC Systems) and then the *2019 ASHRAE Handbook — HVAC Applications,* Chapters 37-44 (Building Operation and Management) and Chapter 61 (HVAC Security). In addition, the staff will review ASHRAE Standard 15-2016 and Standard 34-2016-Safety Standard for Refrigeration Systems and Designation and Classification of Refrigerants.

With all of these design guidelines from ASHRAE, the IPD team discussed specific building standards that needed to be applied to this project as well as project scheduling/timeline. For the facility operation, with in-house staff and not an outsourced group, the staff will want to assure that there is adequate contract specification requirements included pertaining to O&M, training, the preventive maintenance work order system, and energy operating budget.

In the Phase 3 Concept Development of the IPD project, the facility manager and a few of her O&M technicians will want to contribute information to the design team member's writing of the contract specification and, more specifically, the following activities: service contracts, parts inventory, and as-built drawings requirements.

For this July Facility File, the IPD team working together with the owner-designer-builder, based on a building program construction budget, the IPD estimator — along with the prime subcontractors — will be involved in the design phase and be able to contribute to the contract documents. In the construction phase, the O&M technicians will want to revisit the issues noted earlier that were included in the design phase.

After the installation startup and air balancing, next is the scheduled commissioning phases. The O&M staff will want to be proactive in following along with the IPD team's mechanical-electrical in-house coordinator and the subcontractor's startup personnel and receive equipment and system training from the VRF and DOAS startup and commissioning technician using the O&M manuals and contract drawings (that will eventually become the as-built drawings). **ES**

The HVAC subcontractor and VRF/DOAS technician shall go through an automatic control system initial dry-run demonstration prior to demonstrating the system to the campus representatives, HVAC design engineer, and the O&M staff. The ATC subcontractor will also begin collecting system performance by trending pertinent HVAC system and equipment data including the following:

☑ Outdoor air dry bulb and wet bulb temperature ☑ Space dry bulb and wet bulb temperature ☑ Space pressure ☑ Outdoor air quantity ☑ Alarms ☑ Off-site internet computer control interface.

Taking the same approach as the design engineering, the facility manager's 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 should start at the beginning of construction and not at project closeout so that the facility files can be inputted into a CMMS system. Touchscreen O&M checklists should include:

☑ Equipment shop drawings ☑ Maintenance work orders ☑ O&M manuals, parts list, and lubricants ☑ Troubleshooting tips ☑ Remote monitoring instructions

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

☑ Location of automatic dampers and volume dampers ☑ Filters ☑ Equipment and control devices ☑ Access for servicing equipment ☑ Refrigerant monitoring devices.

The training process should include specific HVAC VRF systems and DOAS system ventilation and emergency plan training due to unexpected alarm e.g., outdoor air quality alarm and refrigerant alarm. An air-balancing report will be completed and the as-built conditions will be updated after the final TAB report. This will require the TAB subcontractor to provide the air-balancing reports along with the associated system flow diagrams noting quantities and pressures for future rebalancing if necessary as part of the project closeout documents. Touchscreen training checklists should include:

☑ Equipment ☑ System startup and shutdown ☑ Emergency plan ☑ Automatic controls ☑ Energy management

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