ENGINEERED SMOKE CONTROL IN A COLLEGE DORMITORY BUILDING

RETROFIT CONSTRUCTION USING CONSTRUCTION MANAGEMENT PROJECT DELIVERY

This month's B2B will focus on a college building program to add dormitory building smoke exhaust systems to serve existing corridors in three four-story buildings. The design intent of the engineered zoned smoke control of the existing supply air system serving the four corridors is to shut the affected supply air damper that serves when activated by the associated ceiling smoke detector. When a corridor goes into smoke alarm, the new roof-mounted smoke exhaust fan will start and the affected floor's smoke exhaust air damper shall open providing 20 air changes of exhaust air from the corridor. The alarm signal will also be sent to the campus fire alarm system control center.

The project delivery method shall be construction management (CM) in accordance with Construction Management Association of America (CMAA). The design team shall work with the CM's project manager, as well as the college's construction group's project manager and the campus facility manager, fire alarm consultant, electrical engineering consultant, structural consultant, and in-house college architect.

The design team leader shall be the HVAC consulting engineer, while the college will hire a 3rd-party commissioning and testing, adjusting, and balancing (TAB) air balancing (CxTAB) consulting firm. The campus's facility manager and her O&M staff, including the BAS operator, will participate in the CM process beginning at the conceptual design phase.

The design engineer, as well as the entire team, is directed to *2015 ASHRAE Handbook — HVAC Applications*, chapter 7 (Educational Facilities), chapters 36 through 43 (Building Operation and Management), chapter 53 (Fire and Smoke Control), and chapter 59 (HVAC Security). They should also read ASHRAE's *Handbook of Smoke Control Engineering* for a complete understanding of ventilation and space pressure guidance in smoke control practice.

The design team will complete a study of the proposed building pertaining to locations of air intakes, air exhausts, prevailing winds, cooling tower air drift and plumbing vents, as well as the proposed smoke exhaust discharge to outdoors to avoid being drawn back into the building's air intakes. Design considerations will also include adjacent building air intakes and exhausts.

The corridor (floors two, three, and four) central air system will include one supply air system with 100% outdoor air to provide corridor positive pressure and makeup air to the floor under normal operating conditions. The existing central air unit has a preheat coil capable of heating 100% outside air to 55°F in an engineered smoke control mode emergency condition. There is no existing return air or exhaust air in the corridor. The new smoke exhaust duct system shall have a single exhaust grille and normally closed automatic damper on each floor (floors two, three, and four). The exhaust duct shall terminate on the roof with an angular upblast exhaust fan, arrangement 10 discharging 10-ft above the roof with the duct secured with guide wires. Prevailing winds, adjacent buildings, and discharge velocities will be taken into account based on chapter 24 of the 2017 *ASHRAE Handbook-Fundamentals, Airflow Around Buildings* to avoid short-circuiting of exhaust air into air intakes.

Each corridor floor will have an existing supply air duct main with a new normally open automatic damper. In a smoke alarm condition, e.g. on the third floor, the supply air damper on this floor shall close. In this smoke alarm condition, the fourth-floor and second-floor new supply air dampers shall remain 100% open, creating a positive air pressure below and above the smoke affected floor.

The design team and CM firm shall begin to come together at the Conceptual Phase of the design working closely with the campus staff. The 3rd-party CxTAB consultant shall use the design team's Basis of Design to begin the initial training of the O&M personnel, and will invite the local fire department personnel in for an introduction/training of fire/smoke control of these new smoke exhaust systems.

At the end of this first Phase of design, the CM will provide the initial project estimate. During the Construction Phase, the O&M staff shall follow along with the subcontractors when the smoke control system is started up and air balanced for normal operation and smoke control operation, and they will observe the CM's mechanical-electrical coordinator and automatic control subcontractor demonstrating the 3rd-party CxTAB consultant's functional performance test.

The design and CM team shall complete a static air pressure test for each floor under a smoke control simulation working closely with the 3rd-party CxTAB consultant.

The CM team's HVAC subcontractor shall include the following during the shop drawing submittal phase:

- Equipment submittals - Fan curves - Sheet metal field fabrication drawings - Startup sheet - Troubleshooting sheets - O&M manuals, parts, and lubricants - ATC and smoke management submittal including updated automatic controls of the existing corridor makeup air system ATC submittal integrating manufacturer's AHUs furnished ATC into an integrated overall ATC submittal.

The owner's 3rd-party CxTAB consultant services in the Construction Phase include the following:

- TAB system flow diagram of entire supply air and exhaust air systems with cfms and static pressure indicated at each piece of equipment and at each component e.g., pressure drop across filter units. In addition, airflow and corridor space pressure conditions will be documented under smoke mode floor by floor.
- Observe the commissioning functional performance test by the CM's team for the central air and exhaust air systems under normal operation and engineered smoke control operation.

Refer to The Facility File for additional information pertaining to completing the B2B test. **ES**