

ENGINEERED SMOKE CONTROL IN A HOSPITAL

NEW CONSTRUCTION USING CONSTRUCTION MANAGEMENT PROJECT DELIVERY

This month's B2B will focus on a new 12-story patient tower located at a health care campus. This month's test will address the design intent of an engineered zoned smoke control of return air, supply air, and exhaust air system serving the patient floor common corridors. The associated elevator tower will have its own standalone engineered smoke control 100% outside air unit to positive-pressurized elevator shaft system.

The project delivery method shall be construction management in accordance with the Construction Management Association of America (CMAA). The design team, along with the construction manager (CM) project manager, shall include the health care system owner; owner representative; building facility manager; and 3rd-party commissioning and testing, adjusting, and balancing (TAB) air and water balancing (CxTAB) consultant; architect; consulting engineers (HVAC, structural, plumbing, and electrical); and information technology engineers, along with the infection control (IC) 3rd-party consultant. The building's facility manager and her O&M staff including the BAS operator will also participate in the CM process, beginning at the conceptual design phase.

The designer engineer as well as the entire team is directed to *2015 ASHRAE Handbook — HVAC Applications*, chapter 8 (Healthcare Facilities), chapter 15 (Fire and Smoke Control), chapters 36 through 43 (Building Operation and Management), chapter 53 (Fire and Smoke Control), and chapter 59 (HVAC Security). They should also read ANSI/ASHRAE/ASHE Standard 170-2013 for a complete understanding of ventilation and air filtration for health care facilities.

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 patient corridor (floors three through 12) central air system will include one supply air system with airside economizer control that will also include a preheat coil capable of heating 100% outside air in an engineered smoke control mode emergency condition. Return air system shall be capable of 100% exhaust in the same engineered smoke control mode. The associated exhaust to outdoors duct will terminate on the roof extending/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 (Airflow Around Buildings) of the *2017 ASHRAE Handbook — Fundamentals* to avoid short-circuiting of exhaust air into air intakes.

Each corridor floor will have a supply air duct main and associated automatic damper along with a matching return air-exhaust air duct main and its automatic damper. In a smoke alarm condition, e.g. on the fourth floor, the supply air damper on this floor shall close. In

this smoke alarm condition, the fourth-floor return air-exhaust air damper shall remain 100% open, creating a negative air pressure on this floor. The central AHU's airside economizer cycle shall switch to 100% exhaust, and the supply airside will go to 100% outdoor air with the return air damper closed. The third-floor and fifth-floor return air-exhaust air dampers will close with their associated corridor supply air duct mains and automatic dampers remaining open, creating a positive pressure above and below the affected fourth-floor smoke condition.

The design team and CM firm shall begin to come together at the Conceptual Phase of the design, working closely with the hospital 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 this high-rise patient tower.

At the end of this first phase of design, the CM will provide the initial project estimate. At the end of the Design Development Phase, the CM will provide a GMP (guaranteed maximum price) for the job. During the Construction Phase, the O&M staff shall follow along with the subcontractors when the smoke control system is started up, air balanced for normal operation and smoke control operation, and 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 drawing - Startup sheet - Troubleshooting sheets - O&M manuals, parts, and lubricants - ATC and energy management submittal including one complete 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, return air, and exhaust air systems with cfm and static pressure indicated at each piece of equipment and at each component (e.g. pressure drop across filter units).
- 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 Files for additional information pertaining to completing the B2B test. **ES**



The design engineer shall check off the boxes from the list of company's standardized field observation checklists that he will need to upload on to his tablet computer prior to heading out to the construction site to complete his final HVAC inspection and punchlist. These checklists will be touchscreen type. When the engineer returns to the office or he sends the completed checklists via the

internet to the office, the completed checklists shall be automatically downloaded to the company's computer server and placed in the job folder's "Project Closeout" section of the folder. The completed checklists, along with associated digital photographs taken at the time of the field visit, will automatically be electronically sent to the following individuals and departments.

TEAM CORRESPONDENCE DIRECTORY CHECKLIST

(Check the appropriate boxes)

- Owner Owner Representative IPD Lead Engineer
- Construction Manager General Contractor Design-Build Contractor Building Owner's Facility Manager HVAC Subcontractor Owner's ATC Operator Electrical Subcontractor
- Plumbing Subcontractor Fire Protection Subcontractor
- ATC Subcontractor Architect State Energy Department
- ASHRAE Piping Subcontractor Sheet Metal Subcontractor
- 3rd-Party CxTAB Consultant 3rd-Party Infection Control Consultant Equipment Manufacturers Building Inspector
- Others: (insert list) _____

HVAC CONTRACT SPECIFICATION CHECKLIST

- Division 1 Project Closeout Telecommunication Equipment
- Owner Furnished Equipment Structural Electrical
- Plumbing Fire Protection HVAC Infection Control
- ATC ACC Units Pumps Fans Air Handlers Terminal Units Piping System Sheet Metal System TAB
- Commissioning Others: _____

HVAC CONTRACT DRAWING INSTALLATION CHECKLIST

- Telecommunication Equipment Owner Furnished Equipment
- Structural Electrical Plumbing Fire Protection HVAC
- Infection Control ATC ACC Units Pumps Fans Air Handlers Terminal Units Piping System Sheet Metal System
- TAB Commissioning Others: _____

HVAC STARTUP CHECKLIST

- Telecommunication Equipment Owner Furnished Equipment
- Structural Electrical Plumbing Fire Protection HVAC
- Infection Control ATC ACC Units Pumps Fans Air Handlers Terminal Units Piping System Sheet Metal System
- TAB Commissioning Others: _____

COMMISSIONING FPT (Functional Performance Test)

- Telecommunication Equipment Owner Furnished Equipment
- Structural Electrical Plumbing Fire Protection
- HVAC System Infection Control ATC ACC Units
- Pump Heating System Chilled Water System Condenser Water System Fans Air Handlers Terminal Units
- Piping System Sheet Metal System Equipment Room
- Others: _____