

HIGH-PERFORMANCE HOSPITAL PATIENT ROOM FILTRATION RETROFIT USING CONSTRUCTION MANAGEMENT PROJECT DELIVERY

This month's B2B will focus on retrofitting a hospital's patient floor with the addition of fan-powered HEPA filter units, one per patient room, on a 30-patient room floor. The building program is to initiate this first phase to improve the room air purification environment with the addition of 99.97% efficiency to trap particles that are 0.3 microns or larger. To do this, the existing room supply air ceiling diffusers will be removed and the associated ductwork will be capped and sealed. In their place, a 2-by-4-foot fan-powered HEPA filter, located over the patient's bed, will provide laminar flow supply air to the room.

The choice of the 1/3-hp fan-powered unit was made to avoid the additional air static pressure (SP) on the existing central air system. This added resistance, created by a HEPA filter, will range from an initially clean filter 1-inch water gauge (wg) SP to a manufacturer's recommended filter replacement 2.5- to 3-inch wg. SP dust-loading resistance.

The project delivery method shall be construction management (CM) beginning in the conceptual phase of the building program. The building owner has contracted the services of an owner representative along with a third-party commissioning (Cx) and testing, adjusting, and balancing (TAB) consulting firm (CxTAB) to work with the team. In addition, the hospital shall also hire an infection control (IC) consultant to advise the design team as well as the CM in regard to design and construction phase air quality control requirements. The HVAC consulting engineer, along with electrical, plumbing, architectural, and structural engineering sub-consultants, will lead the design team.

The CM shall have a project manager and in-house estimating, including mechanical and electrical estimators, a mechanical-electrical coordinator, and the company's own in-house registered professional engineer, to assist in value engineering in the conceptual phase of the job.

The design team and hospital staff recognize that the HEPA filters are not a solution for volatile organic compounds (VOCs), as these airborne chemicals are mostly derived from off-gassing of building materials or products as well as cleaning products used in the facility. HEPA filters are unable to remove VOCs, as they simply are far smaller in size than what can be trapped within the filter material. The same is understood with removal of viruses, bacteria, and mold.

The design engineer for this project will require the CM's TAB subcontractor to complete existing condition system air supply and return cfm and static pressure readings so as to perform the same TAB after the HEPA units are installed to assure the facility O&M staff that the overall air system and space pressures have not been adversely affected from this air quality retrofit.

The design team, along with the owner and the CM's input, shall produce conceptual drawings, design development (DD) drawings, and specifications and contract documents (CD) in sync with the CM. Together, they'll provide budget estimates in the conceptual

phase and a guaranteed maximum project cost between the DD and CD phases. The hospital's O&M facility manager and her technicians shall review the documents throughout the design phase and receive introduction training of the new equipment at that time. The O&M personnel shall observe equipment startup, air balancing, the CM subcontractors' punchlist, the commissioning system demonstration, and commissioning of infection control policy and procedure.

The design engineer, as well as the CM team, is directed to *2019 ASHRAE Handbook — HVAC Applications* Chapter 9 (Healthcare Facilities), Chapters 37-44 (Building Operation and Management), and Chapter 61 (HVAC Security). They should also read *ASHRAE 2016*, Chapter 29 (Air Cleaners for Particulate and Contaminants) and ANSI/ASHRAE/ASHE Standard 170 for a complete understanding of ventilation and air filtration for health care facilities.

As an integral part of this ventilation focus, the hospital, designers, and CM team will include HVAC filtration guidelines referencing Chapter 29 noted above. These final filters shall be MERV 20, >99.999% efficient. The infection control consultant will review the HVAC basis of design in accordance with this infection control commissioning initiative and will commission the final installation.

The automatic temperature control system shall include several ventilation monitoring features, including air particle counts in the patient rooms as well as the patient corridor. In addition, the fan-powered filter units shall use variable-speed drives to maintain the required supply air cfm while the filters' static pressure will increase over time due to dust loading. Individual room space pressure sensors will ensure these patient rooms are under a preferred positive room pressure.

The CM shall include the following during the shop drawing submittal phase:

- Equipment submittals - Fan filter performance curves - Sheet metal field fabrication drawings - A startup sheet - Troubleshooting sheets
- O&M manuals, parts, and lubricants - ATC and energy management submittal, including one complete ATC submittal integrating the fan-powered filter manufacturer's unit-furnished ATC into an integrated overall ATC submittal.

The third-party commissioning and TAB consulting (CxTAB) services shall be as follows:

- TAB system flow diagram of the entire supply air, return air, and exhaust air system associated with the patient room system with cfm and static pressure indicated at each fan and at each component of the fan units.
- Commissioning functional performance test of existing central air and exhaust air systems, fan-powered filter units, and the automatic controls associated with this entire retrofit system.

Refer to The Facility File 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 below that he will need to upload on to his tablet computer prior to heading out to the construction site to complete the 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. The completed checklists, along with associated digital photographs taken at the time of the field visit, will 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 Hospital's Facility Manager HVAC Subcontractor
- ATC Subcontractor Electrical Subcontractor Plumbing Subcontractor Fire Protection Subcontractor ATC Subcontractor Architect State Energy Department ASHRAE
- Piping Subcontractor Sheet Metal Subcontractor Third-Party CxTAB Consultant Third-Party Infection Control Consultant
- Equipment Manufacturers Building Inspector
- Others: *(insert list)* _____

- Plumbing Fire Protection HVAC System Infection Control
- ATC ACC Units Pumps Fans Air Handlers Terminal Filter Units Piping System Sheet Metal System TAB
- Commissioning Others: _____

HVAC STARTUP CHECKLIST

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

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 Filter Units Piping System Sheet Metal System TAB
- Commissioning Others: _____

COMMISSIONING FPT (Functional Performance Test)

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

HVAC CONTRACT DRAWING INSTALLATION CHECKLIST

- Division 1 Project Closeout Telecommunication Equipment
- Owner Furnished Equipment Structural Electrical