

# CORPORATE CAMPUS OFFICE BUILDING RETROFIT TO RADIANT HVAC DESIGN-BID-BUILD PROJECT

This month's B2B will focus on the renovation of an office building located on a major corporation's U.S. headquarters campus. The existing HVAC system to be replaced is an antiquated hot water heating system serving baseboard radiation, unit heaters, and a rooftop HVAC unit. The cooling is an existing air-cooled chiller serving the single rooftop HVAC unit.

This single-story building is scheduled to be renovated into an open office concept, and the HVAC system will have a direct outside air system (DOAS) with gas-fired heat and direct expansion cooling supply air to active chilled beams. Supply air to active chilled beams shall receive supplemental cooling via a 60-ton air-cooled chiller providing 55°F chilled water supply connections at each active chilled beam. Hot water radiant heat panels, located around the perimeter of the building, will be served by a 600 MBH condensing boiler providing 125° hot water supply to these panels.

The project delivery method shall be design-bid-build (DBB). The building owner outsources the O&M but will keep the on-site O&M technicians involved in the project delivery process. The design team shall include the HVAC, structural, architectural, plumbing, and electrical consultants with the HVAC consulting engineer serving as the prime for this infrastructure retrofit. The owner shall retain a third-party (CxTAB) commissioning and testing, adjusting, and balancing consultant.

The design team shall produce conceptual drawings, design development (DD) drawings and specifications, and contract documents (CD) in sync with an estimating consultant providing budget estimates in the conceptual phase and DD phases. The O&M personnel shall review the documents throughout the design phase and receive introduction training of the new equipment. The O&M technicians shall observe equipment startup, TAB, general contractor's subcontractor's punchlist, and the commissioning system demonstration.

The HVAC design engineer is directed to the *2019 ASHRAE Handbook – HVAC Application* Chapter 3 (Commercial and Public Buildings), *2016 ASHRAE Handbook – HVAC Systems and Equipment* Chapter 5 (In-Room Terminal Systems) for active chilled beam discussion, and Chapter 6 (Radiant Heating and Cooling) for radiant heat design considerations. The design engineer will reference Chapter 32 for boilers and Chapter 43 on liquid chiller systems for design considerations.

Each perimeter room will need to have radiant heat panels at an average of 30 Btuh per square foot based on individual room heat loss calculations for the radiant heat loss calculations. The DOAS unit shall provide the ventilation load and the dehumidification load with the active chilled beams providing space cooling at an average of 800 Btuh per square foot. Space temperature shall be maintained at 68° heating and 75° cooling on a design-heating day.

There will be a new chilled water loop and associated inline circulator to pump the chilled water through the distribution piping to

the open space area active chilled beams. The conditioned outdoor air in sync with the chilled beams shall be sized to handle the space heat gain. A new hot water loop and associated inline circulator will pump this water through the pipe distribution to the individual open space area radiant heat panels. The heat loss calculation takes into account heat loss within the roof heat loss, perimeter heat loss, and heat to raise the supply air from 60° to room temperature. Heat output capacity will be based on the manufacturer's heat output per square foot of radiant panel surface. The system will be based on 10° delta hot water supply with radiant heat hot water return resulting in 125° HWS and 115° hot water return.

These two new piping systems will be installed with isolation valves at the boiler and air-cooled chiller each with supply and return connections along with bellows air separators, thermometers and a differential pressure gage, and pet cocks cross-connecting the supply and return mains at the equipment. Downstream of the chilled water supply and hot water supply mains shall be the circulator (no standby circulator) with a pressure differential gage connection and pet cock at circulator inlet and similar connection at circulator discharge to balance the pump flow along with a ball valve to adjust flow at the pump and to aid in balancing of both the chilled water and hot water systems. All this piping and associated pump shall be furnished and installed, per the contract drawings and specification, at the underside of the roof structure in the open space that has ceiling panels strategically located to encompass the radiant panels hung from above.

## General Contractor and associated subcontractors shall include the following shop drawing submittal data:

- Pipe, valves, fittings, and hanger submittals - Field coordinated drawings - Radiant panels - DOAS unit - Air-cooled chiller - Condensing boiler - Pumps with pump curves - Startup sheet - Troubleshooting sheets - O&M manuals, parts, and lubricants
- ATC and energy management interface submittal including one complete ATC submittal integrating the new radiant HVAC system ATC with the existing campus ATC as-built submittal.

## The third-party commissioning and TAB (CxTAB) firm shall complete the following:

- TAB system flow diagram of chilled water system and hot water system with gpm and pump heads indicated at the new circulators as well as at the radiant panels.
- Commissioning functional performance test of the new combined radiant HVAC system in sync with the new DOAS systems.

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 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. 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)*

- Project Consultants  Owner Representative  IPD Manager
- Construction Manager  General Contractor  Design-Build Contractor  Facility Manager  HVAC Subcontractor  ATC Subcontractor  State Energy Department  ASHRAE  Piping Subcontractor  Sheet Metal Subcontractor  Third-Party Commissioning and TAB Consultant  Third-Party Commissioning Consultant  Third-Party TAB Consultant  Equipment Manufacturers  Building Inspector
- Others: *(insert list)* \_\_\_\_\_

**HVAC CONTRACT SPECIFICATION CHECKLIST**

- Division 1 Project Closeout  Office Equipment  Owner-Furnished Equipment  Structural  Electrical  Plumbing  Fire Protection  HVAC  Infection Control  ATC  Boilers  Pumps  Chillers  Fans  Outdoor Air Handler  Active Chilled Beam  Radiant Heat Components  Piping System  Sheet Metal System  TAB  Commissioning  Others: \_\_\_\_\_

**HVAC CONTRACT DRAWING INSTALLATION CHECKLIST**

- Division 1 Project Closeout  Office Equipment  Owner-Furnished Equipment  Structural  Electrical  Plumbing  Fire

- Protection  HVAC  Infection Control  ATC  Boilers  Pumps  Chillers  Fans  Outdoor Air Handler  Active Chilled Beam  Radiant Heat Components  Piping System  Sheet Metal System  TAB  Commissioning  Others: \_\_\_\_\_

**HVAC STARTUP CHECKLIST**

- Division 1 Project Closeout  Office Equipment  Owner-Furnished Equipment  Structural  Electrical  Plumbing  Fire Protection  HVAC  Infection Control  ATC  Boilers  Pumps  Chillers  Fans  Outdoor Air Handler  Active Chilled Beam  Radiant Heat Components  Piping System  Sheet Metal System  TAB  Commissioning  Others: \_\_\_\_\_

**COMMISSIONING FPT (Functional Performance Test)**

- Basis of Design Document  Owner-Furnished Equipment  Structural  Electrical  Plumbing  Fire Protection  HVAC System  Infection Control System  ATC System  H&V Air System  Heating System  Air Conditioning System  Boilers  Pumps  Chiller  Fans  Air Handlers  Terminal Units  Piping System  Sheet Metal System  Equipment Room  Others: \_\_\_\_\_