Greater efficiency supports patient care.

Reduce energy-consumption, and improve comfort with active chilled beam system

All ECM content was independently developed and reviewed to be vendor-, product-, and service provider-neutral.

Description

Improve the energy-efficiency, reduce energy use and reduce maintenance costs of the hospital by upgrading or designing around an active chilled beam (ACB) system for cooling and heating. Energy reduction is derived primarily from reduced reheat and fan energy required to operate the system. In addition to the energy and cost saving benefits of a chilled beam system, there are potential space savings. ACB systems can reduce required supply and return chase area by 50%, or more, and reduce the Air Handling Unit footprint by 30 to 40%.

Project Talking Points

ACB systems are essentially heat exchangers. Ventilation air is introduced via an induction nozzle and passed across the beam to be cooled or heated. The ambient air is then mixed with the primary ventilation air and discharged into the space to control the room temperature.

ACB systems have been used for decades in the UK but are still rarely deployed in hospital applications in the United States. In 2011, ANSI/ASHRAE/ASHE Standard 170- Ventilation of Healthcare Facilities opened the door for the use of fan coil units and chilled beams in patient areas through an addendum which has since been incorporated into the body of the document. The standard stipulates ventilation and exhaust rates and strategies for the various areas within healthcare facilities. ACB systems can save up to 40% over conventional variable air volume (VAV) systems, but only when installed correctly and in appropriate applications.

Triple Bottom Line Benefits

Cost benefits: ACB systems require less supply air from the building air handling system and therefore less fan energy is required. Because this also reduces preconditioned air volumes, room reheat energy is significantly reduced. The potential energy reduction of ACB systems can be 30 to 40% depending on climate and application.

Environmental benefits: Reduced energy consumption leads to reduced CO_2 and other greenhouse gas emissions because less energy is required and produced.

Social and satisfaction benefits: ACB systems are energy-efficient, provide good occupant comfort and operate quietly. Additionally, chilled beams have no moving parts, making them very low maintenance when compared to fan coils. ACB systems typically use 100% outdoor air and there is no recirculation of air between rooms, reducing the risk of any cross contamination.

Purchasing Considerations

Primary considerations for purchasing an ACB System include:

- Ventilation requirements (reference ANSI/ASHRAE/ ASHE 170)
- Room purpose and usage
- System installation and maintenance costs
- Cost of the system versus reduced materials costs for ductwork-because chilled beam systems require less primary air, a building's ductwork and equipment space requirements are significantly reduced
- New Construction vs retrofit application - chilled beams offer architectural flexibility with the option to install in ceiling and under-sill/wall units. This modular configuration can be cost-effective for retrofit projects
- Additional staff training or hiring required to operate a chilled beam system appropriately

How-To

1. Assemble a team of relevant stakeholders including the owner, architect, mechanical engineer, energy manager, facilities director, and expert consultants.

2. Identify the aspects that make and ACB the appropriate choice for your application. Once it is decided that a building's HVAC will be designed around an ACB system, the mechanical engineer should work closely with the ACB supplier's application engineers to ensure proper system selection and application. Select an ACB supplier with experience.
3. Ensure that ACBs are used appropriately, and not in critical spaces like operating rooms. Reference ANSI/ASHRAE/ASHE 170 often to ensure appropriate applications. ACB systems are relatively new in hospital applications in the United States but have been successful in-patient room areas and in office spaces.
4. Best design practice is to use ACB systems with a 100% dedicated outdoor air system (DOAS) that eliminates the HVAC system from recirculation of air between rooms. An experienced ACB supplier should be aware of this.
5. Because each chilled beam system design is unique, it is important that design engineers work closely with the manufacturer's engineers to ensure proper system selection for the specific application and project goals. Important considerations when selecting and designing a chilled beam system include:
    - Sensible cooling capacity
    - Acoustics
    - Beam performance and reliability
    - Space temperature and humidity
    - Adequate ventilation
    - Effective room air distribution to maintain occupant health and comfort.
6. Develop a list of energy and cost Key Performance Indicators (KPIs) to measure post-implementation.
7. Ensure that the units are installed in the exact locations shown on the design drawings in order to maintain comfort of the conditioned spaces as intended by the building's engineers and design team. Once the beams are installed, lowered into the ceiling grid

and sitting in their final position, the air and water connections are made according to manufacturer's guidelines.
8. Commission the system. Hire properly trained and authorized personnel to commission the ACB system in accordance with the system's installation manual.
9. Develop an operation and maintenance schedule with adequately trained personnel to ensure the system operates as intended.
10. Measure and Verify (M&V) post-implementation results and compare to KPIs developed during the design phase.

Case Study

A prominent example of a facility using an ACB system is the Moses H. Cone Memorial Hospital in Greenville, North Carolina. The Cone Memorial Hospital uses an overhead active chilled beam system to provide conditioning to patient rooms. This system has reportedly saved 40% over a traditional variable air volume (VAV) system.

Regulations, Codes and Standards, Policies

International:
AHRI
ASHRAE

Standards:
ASHRAE Standard 200 – 2015 Methods of Testing Chilled Beams

ANSI/ ASHRAE/ ASHE 170- Ventilation for Healthcare Facilities

Guidelines (ASHRAE):
ASHRAE Health Care Facilities Resources

US Green Building Council LEED Program

Cross References: LEED

- LEED v4.1

Resources

- *2014 NEBB Annual Conference Presentation titled "Delivering Building Performance and Energy Efficiency*)
- ASHRAE Technical FAQ's
- Can Chilled Beams Work in Patient Rooms
- *Chilled beams in laboratories: Key strategies to ensure effective design, construction and operation*
- *Cool Controls for the Energy Efficient Lab*
- http://architecture2030.org
- *Laboratories for the 21st Century: Best Practices Guide*
- MCD Magazine – Moses H. Cone Memorial Hospital
- *R&D Magazine: A Complete Design Package*

- U.S. Department of Energy Advanced Energy Retrofit Guide U.S. Department of Energy Advanced Energy Retrofit Guide-Healthcare Facilities

ECM Descriptors

Energy

Level: Advanced

Category List:

- Energy
- HVAC

Improvement Type:

- Operations and Maintenance

ECM Attributes:

- Energy

Department:

- Building and Grounds
- Engineering/Facilities Management
- Other