

Replacing perimeter induction units with Active Chilled Beams: renovation of an occupied building in Chicago, IL

Overview

The building at 29 North Wacker Drive in Chicago was built in the 1960s. This 10-story low rise building was originally designed with perimeter induction units installed on the walls, under the windows, on floors 3 through 10. This older system was inefficient and required a high volume of high pressure air as well as being noisy and expensive to operate. In 2010 an increase in utility costs and an emphasis on green technology made a detailed mechanical assessment necessary which resulted in ten energy conservation measures being identified and improvements to the HVAC system recommended. The design team decided that one improvement would be to replace the perimeter induction units on floors three through ten with Active Chilled Beams (ACBs) that would be installed above the drop ceiling.



Design Considerations

- The building would be occupied during the renovation so the existing HVAC system must remain operational until a new air handling unit could be installed at the end of the upgrade.
- Reduce energy consumption of the building.
- Increase usable square footage of office areas.
- Improve the building environment: increase indoor air quality, lower noise levels, improve heating & cooling effectiveness and provide better overall comfort.

Design Solution

A design which included Active Chilled Beams by Dadanco to replace the perimeter induction units was chosen.

- The ACBs were installed with pressure reduction devices so that the existing Air Handling Unit (AHU) could be used until the refurbishment was complete and a new AHU installed. At that time those reduction devices were easily removed.



Dadanco's ACB30 Active Chilled Beam sits above the drop ceiling tile and is concealed by a grille

Photo courtesy of Windy City Representatives



Design Solution (continued)

- Two way valves installed on the ACB ϕ s converted the existing constant flow system to a variable flow system offering energy savings through reduced pump requirements.
- The use of lower water temperatures by the ACB ϕ s meant that the original steam boilers could be replaced with high-efficiency boilers that required half the space.
- Installing the ACB ϕ s above the drop ceiling meant additional floor space was available due to the removal of the perimeter induction units under the windows.

Results

- Building energy use was reduced by 417,000 kwh annually which is more than 25%
- Noise was reduced by 6 dB(A)
- Cooling was now available during the shoulder months which increased comfort
- \$150,000 in utility rebates and incentives was realized
- Ability to reuse the existing dual piping layout for the ACB ϕ s reduced the cost of the project
- LEED gold achieved in 2014 (for existing buildings: operations & maintenance)

Summary

After a detailed mechanical assessment was performed on the building at 29 North Wacker Drive in Chicago it was determined that Active Chilled Beams should be utilized to provide heating, cooling, and ventilation to the perimeter zones of the third through tenth floors of the building. In addition to being the most effective system available, savings were offered during the construction phase (through the reuse of the primary piping) and long term (through the reduction in energy use) by using Dadanco's active chilled beams.

The renovation of the building resulted in an Energy Star Score increase from 66 to 88 as well as a cost reduction from \$2.33 per ft² to \$1.03 per ft². It is worth noting that the building energy use was reduced by more than 25% even though the occupancy increased from 40% before to 95% after the refurbishment.