DADANCO

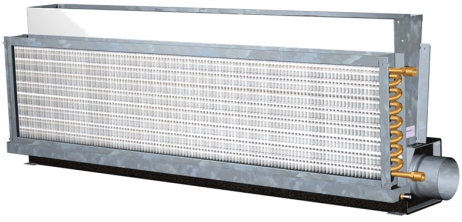
Breathing Life Into Your Building

250 S. Wacker Case Study — Renovation of an Induction System with Active Chilled Beams

Overview

250 S. Wacker in Chicago is a multi-tenant 15 story office tower with retail space on the first floor. The first and top floors had dedicated HVAC systems separate from the system serving the 2nd through 14th floors. These intermediate floors had a floor-mounted induction perimeter system and a constant volume-variable temperature interior system. Each of the floors had approximately 14,300 sq. ft. of rentable floor area (215,000 sq. ft. total).

The building was undergoing a major renovation when we met the developer, RCN Associates in Chicago in the late fall of 2006. At that time they had removed the building's exterior walls and glass and had gutted the building down to the concrete.



The developer had concluded that the existing induction units and enclosures would have to be replaced as they were at the end of their useful life, and they had requested a quotation for replacement units.

Perimeter System Design Issues

The developer was changing the building's exterior envelope to 100% E-glass which significantly reduced the building's heating and cooling loads. The heat losses along the perimeter were reduced to less than 200 Btuh/lineal foot, which made possible the option of distributing the heat from the ceiling overhead.

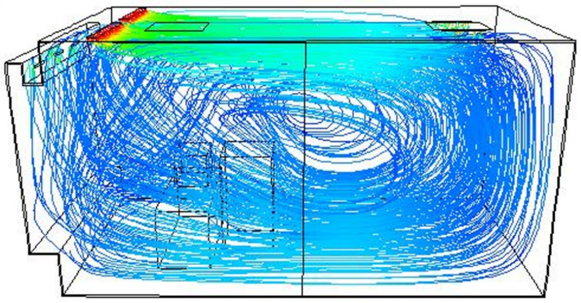
Also, there was sufficient room in the ceilings for ceiling-mounted units.

Active Chilled Beams

ACTIVE CHILLED BEAM SYSTEM SOLUTION

While we provided a quotation for floor-mounted induction units, we suggested that a ceiling-mounted active chilled beam solution would be far better as follows:

- People in the perimeter zones would be comfortable with overhead heating without concerns about downdrafts or cold drafts as the heat losses along the perimeter were low (see FAQ's for more info).
- Floor space would be gained and the building's appearance would be improved (both from the outside and from within) with the removal of the floor-mounted units/enclosures.
- Costs would be avoided as there is no need to purchase new custom enclosures which would have been required if the existing units had been replaced with new floor-mounted units.
- Fan energy and noise levels would be significantly reduced through the performance of DADANCO's patented nozzle technology and the lower static pressures and primary airflows required by the active chilled beams.
- Heat losses would be reduced along the windows by using ACB50 active chilled beams mounted at the ceiling above the window with the air being discharged into the room. With this arrangement, the window would be wiped with relatively cooler (i.e. 70 °F) room air as opposed to warmer (i.e. 110 °F) air if the window was wiped with the heated air, reducing the temperature difference across the glass.



By the spring of 2007 the developer had decided to proceed with our suggested solution and a purchase order was issued for (635) ACB50 active chilled beams. Soon thereafter the original developer sold the building to a new developer, AEW Capital Management in Boston, MA. AEW Capital and their leasing agent, CB Richards Ellis, were not familiar with active chilled beams (the current perimeter system of choice in Chicago is fan-powered VAV).

AEW wanted to learn about the active chilled beam system before they finalized the purchase of the building and a meeting was held to review the system and its benefits. Once AEW had developed a level of comfort through this meeting, they were concerned about developing that same level of comfort with their leasing agents and asked if we could provide an analysis comparing the use of active chilled beams and fan-powered VAV perimeter systems for this project. An energy consumption analysis was prepared and is summarized in the table below. (The active chilled beam system could use the existing vertical duct risers, while the fan-powered VAV system would have required much larger risers. The costs and logistics of this change for the VAV system were ignored for the purposes of this analysis, and only operating costs were compared). The results of the analysis are summarized in the table below.

Perimeter System	Existing Induction	Fan-Powered VAV	Active Chilled beam
Design Cooling Load	262 tons (382 sq. ft./ton)	156 tons (641 sq. ft./ton)	156 tons (641 sq. ft./ton)
Primary Airflow from Central AHUs	47,135 CFM (0.47 CFM/sq. ft.)	86,270 CFM (0.86 CFM/sq. ft.)	31,760 CFM (0.32 CFM/sq. ft.)
Supply Airflow (Circulation Rate)	Unknown	86,270 CFM (0.86 CFM/sq. ft.)	116,600 CFM (1.17 CFM/sq. ft.)
Fan Energy at 100% of Design	64 kW	182 kW	22 kW
Fan Energy at 70% of Design	64 kW	106 kW	22 kW
Pump Energy	28 kW	8 kW	12 kW
Total Combined Fan and Pump Energy	92 kW at Design & 70% of Design	190 kW at Design & 114 kW at 70%	34 kW at Design & 70% of Design

The active chilled beam system consumes only 30% of the fan and pump power for the fan-powered VAV system if one assumes that the average cooling loads will be 70% of the full design cooling load.

From the photo at the left above, note the capped take-offs on the risers that had served the floor-mounted induction units. New takeoffs were made off the vertical risers at the ceiling to serve the active chilled beams and the secondary water piping was also relocated from the floor to the ceiling. From the photo at the right above note that a primary air manual balancing damper was installed upstream of each active chilled beam for commissioning purposes. The photo below shows a finished office area.

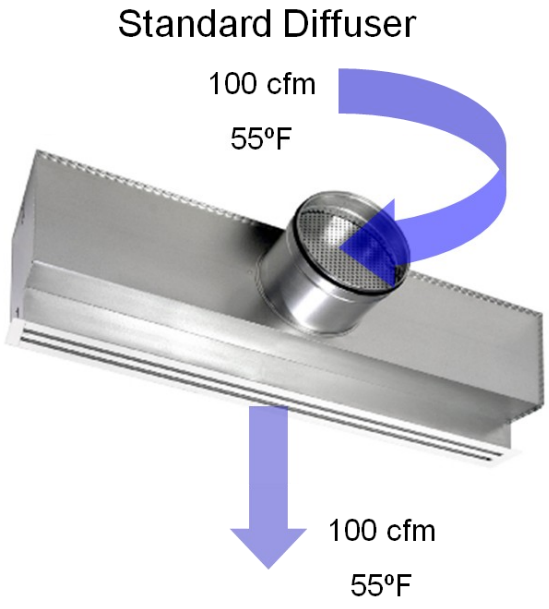
LEED CERTIFICATION

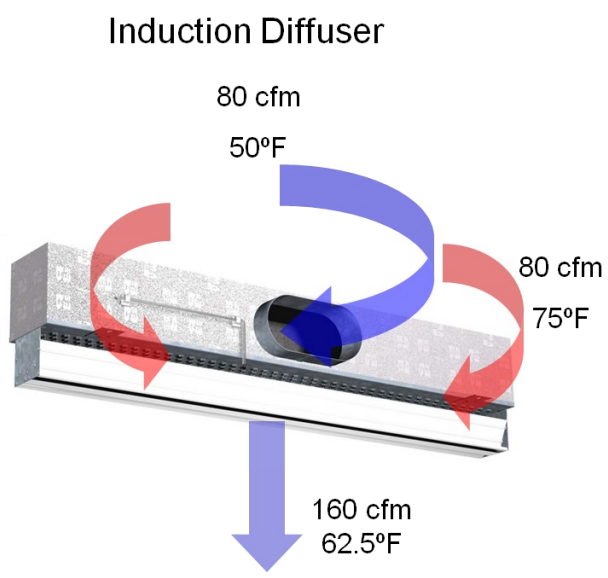
To this point there had been no consideration about making 250 S. Wacker a "green" building, but as the project progressed AEW began thinking along these lines. In their proposals to prospective tenants, AEW's leasing agents began promoting the building as a green building. AEW is now pursuing LEED certification for this building

The active chilled beam system is now installed and operating. A number of developers, architects and engineers have visited the site with us and on one recent visit the outdoor conditions were –12 °F. We were pleased to observe that it was still very comfortable sitting right next to the window with not a hint of a downdraft.

INTERIOR SYSTEM

One final note - the interior system in the building will ultimately be converted to a single duct VAV system. This is within the scope of tenant improvements and this work is being deferred until the building is leased. One additional suggestion we have made is to consider the use of lower primary air temperatures (i.e. 50 °F as compared to the more conventional 55 °F) to further reduce the fan power in the building. The primary air would be delivered to the zones through Inffuser induction diffusers. The Inffusers induce room air into the primary air before the mixed supply air is discharged into the room. In this manner the primary air is tempered upward to about 60-65 °F and the supply air quantity and air movement within the zones is effectively doubled. A decision on this suggestion will not be made until the building is leased.





260 North Elm Street Westfield, MA 01085
Ph: (413) 564 – 5657
Fax: (413) 568 – 2969

www.dadanco.com
info@dadanco.com