Project: San Francisco International Airport

Sustainable Building Products

Case Study Library

Price is the leader in sustainable air distribution technologies, including active and passive beams, underfloor air distribution, and displacement ventilation.

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Case Study Library

Price is the leader in sustainable building air distribution products such as active and passive beams, displacement ventilation, and underfloor air distribution.

These European-inspired technologies represent the future of commercial HVAC in North America, and Price has completed hundreds of successful installations.

Many of these installations are included within these pages, intended to serve as inspiration for future building designs.

Partner with Price on your next sustainable building project, and together we'll build a better environment.

Displacement Ventilation

Underfloor Air Distribution

Active and Passive Beams

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Displacement Ventilation

Project: **Edgewater Casino**

Location: **Vancouver, BC**

Project Cost: **$8 million**

Sq. Ft: **70,000**

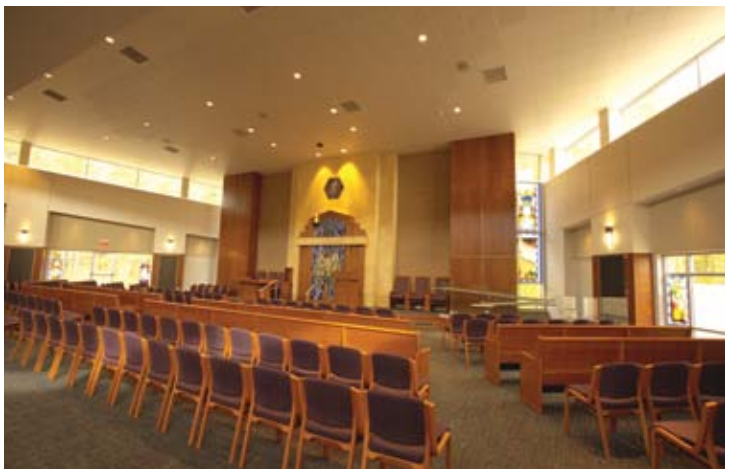
Price Products: **Custom DF1R, ARFHD**

Price Representative: **E.H. Price, Vancouver**

Design Team: **VEL Engineering, Patrick Cotter Architects, & Broadway Refridgeration & Air Conditioning**

The Challenge: Edgewater Management Inc. wanted to create a contemporary gaming facility that would integrate into the urban, downtown location while maintaining an interior experience that is consistent with a glass building. A Paramount concern of the owner was to provide an environment with the highest level of thermal comfort and indoor air quality for its patrons and employees to enjoy. It was also critical to deliver exceptional energy efficiency, all the while maintaining inviting atmosphere. Large solar heat gains and vaulted ceilings made achieving these conditions a design challenge.

The Solution: Due to the building's large vaulted ceilings and the requirement for exceptional indoor air quality, thermal comfort and energy efficiency, it was evident that this project would not be able to use a traditional mixing air distribution system. The decision was made to design a hybrid displacement system. This included a floor displacement system in the lower space where the slot machines would be installed and a low-level sidewall displacement system on the upper level where the gaming tables were to be located.



Displacement Ventilation

Project: **Beth Am Shalom**

Location: **Lakewood, NJ**

Project Cost: **$4.7 million**

Sq. Ft: **17,000**

Price Products: **DF1W**

Price Representative: **Mechanical Technologies**

Design Team: **KSI Consulting Engineers & Spiezle Architectural Group, Inc.**

The Challenge: This sanctuary presented two major challeneges from an air distribution perspective. First, the high ceilings threatened to waste energy, and the design team wanted a solution that would cool only the occupied zone and not the 20 ft of additional space. In addition, the sanctuary featured numerous floor-to-ceiling windows around the perimeter, limiting the ability to run ductwork to the ceiling and ruling out the option of providing mixing ventilation from the ceiling.

The Solution: Displacement ventilation was a natural selection for the sanctuary; the reduced energy consumption and mechanical flexibility it offers addressed the design challenges of the space while allowing to the architect to retain full design flexibility. Since displacement only conditions the occupied zone, energy was not wasted cooling the 20 ft of empty space towards the ceiling with return air captured at the ceiling level. This allowed the engineers to downsize the mechanical equipment that services the space, contributing to energy savings of 21% for the whole building.

Displacement Ventilation

Project: **Piqqusilirivvik ICLF**

Location: **Clyde River, NU**

Sq. Ft: **23,680**

Price Products: **DLE, DF1, DR180**

Price Representative: **E.H. Price, Edmonton**

Design Team: **FSC Architects and Engineers**

The Challenge: Piqqusilirivvik: Inuit Cultural Learning Facility is an educational facility that promotes cultural preservation, enhancement and excellence for the Inuit people. This facility presented a number of unique challenges for air distribution. FSC sought to ensure high indoor environmental quality to maximize the learning potential of the students. In addition, their previous experience working in Northern Canada had indicated that Inuit elders could be particularly susceptible to mechanical noise and drafts, therefore avoiding these conditions was imperative. The learning facility was designed using traditional wood construction, and FSC was reluctant to compromise this aesthetic with mechanical equipment, including overhead ducting. Finally, given the remote, off-the-grid location of Clyde River, utility costs are very high; as a result, achieving utility savings through the HVAC system was of critical importance.

The Solution: In order to achieve the indoor environmental quality, thermal comfort and energy savings required in the space while also integrating the HVAC system into the architectural design, FSC chose to employ Price displacement ventilation. FSC was familiar with the benefits offered by displacement systems, but was particularly drawn to Price's unique ability to integrate diffusers into the design of the space. Price offered all this at a competitive cost and with the shortest lead time – a critical component given the tight deadlines and the dependence of the project on intermittent Northern shipping schedules.

Displacement Ventilation

Project: **San Francisco International Airport: Terminal 2**

Location: **San Francisco, CA**

Sq. Ft: **640,000**

Price Products: **Custom Displacement**

Price Representative: **Norman S. Wright**

Design Team: **Gensler, Micahel Willis Architects, Hamilton Aitken Architects & SJ Engineers**

Seeking LEED Gold Designation

The Challenge: In 2008, the San Francisco International Airport (SFO) embarked on a renovation project to restore the historic Terminal 2 (T2) into a state-of-the-art domestic terminal. Minimizing the building's environmental footprint and achieving LEED certification were crucial goals of the terminal's design. In addition, the design vision of the project architect required that the diffusers integrate seamlessly into the space. This required custom diffusers; however, it was imperative that the special design not negatively impact performance. This meant that testing the diffusers to verify performance would be required.

The Solution: In buildings with high ceilings, such as SFO T2, displacement ventilation has the advantage of conditioning only the occupied zone and not the large volume of space above it. This reduces the supply air volume required, allowing the mechanical equipment servicing the space to be downsized, thereby reducing utility cost. In addition, given the higher supply air temperature of displacement (around 65 °F), the building can increase economizer hours to take advantage of "free cooling" and further improve efficiency. These energy savings were critical to the terminal achieving its sustainable design goals and LEED targets. In order to meet the precise design requirements of this project, a supplier that could design and manufacture diffusers to the custom specifications of the architect, as well as test these designs to verify performance was needed. Price designed a diffuser to Gensler's specifications, and employed their state-of-the-art laboratory, Price Research Center North, to confirm that the designs would work as expected, and to provide smoke videos demonstrating air patterns to the design team.

Displacement Ventilation

Project: **Legacy Junior High School**

Location: **Layton, UT**

Sq. Ft: **163,000**

Price Products: **Custom DF1W**

Price Representative: **Midgley Huber**

Design Team: **Van Boerum & Frank Associates & VCBO Architecture**

The Challenge: The Davis School District in Utah has long established itself as being dedicated to sustainability with a goal of creating learning environments that maximize student learning potential. Design requirements for the Legacy project called for a central heating system. The school district and architect saw this as an opportunity to utilize displacement ventilation - a strategy that would keep them in line with their energy efficiency goals. Ensuring that the integration of the displacement diffusers into the space was aesthetically pleasing was also a key design challenge.

The Solution: Displacement diffusers from Price were incorporated throughout the entire school, including classrooms and common areas. Improved ventilation effectiveness was a key driver for the selection of displacement, which can significantly improve the indoor air quality in a space. Improved indoor air quality can lead to increased student concentration and performance, as well as a reduction in airborne illnesses. Comfort was also a key motivator behind the selection of displacement ventilation. Displacement utilizes slightly warmer, lower velocity air than traditional mixing systems, which minimizes cool drafts in the space. Displacement systems are also extremely quiet, a critical design criteria in any school. The architect, engineer and Price worked closely to ensure that the integration of the diffusers was aesthetically pleasing. In keeping with the architect's design specifications, diffusers were placed in opposing corners of the classrooms.

Displacement Ventilation

Project: **Manitoba Hydro Place**

Location: **Winnipeg, MB**

Sq. Ft: **695,250**

Price Products: **Custom DF1R**

Price Representative: **E.H. Price, Winnipeg**

Design Team: **Kuwabara Payne McKenna Blumber Architects (Design Architects), Smith Carter (Executive Architect), & Transsolar (Energy/Climate Engineer)**

Seeking LEED Platinum Designation

The Challenge: Superior energy efficiency was a mandate of the design throughout Manitoba Hydro Place, the new headquarters of Manitoba's primary energy utility, and delivering ventilation air in an energy efficient way was essential. The design of Manitoba Hydro Place called for high ceilings in the gallery. If overhead mixing ventilation was used to condition the space, a significant amount of energy would be wasted cooling the unoccupied zone in the upper levels of the gallery. However, if a ventilation system were installed at eye-level, as is common in displacement systems, it would be essential that the diffusers be integrated into the architectural design vision for the gallery.

The Solution: Displacement ventilation results in room air stratification, which causes warm, contaminated air to collect at high levels outside the occupied zone. This has the dual benefit of improving air quality and saving energy in spaces with high ceilings, like the Manitoba Hydro Place gallery. The displacement system does not condition the air above the occupied zone, resulting in reduced supply air volume and fan power energy savings. The design architects at KPMB emphasized the fact that since displacement diffusers are at eye-level, they must fit into the architectural design of the gallery. To meet this criteria, Price supplied customized black DF1R diffusers that were recessed into the wall and featured false corners so the diffuser had no breaks from one end of the room to the other.

Displacement Ventilation

Project: **Cercle Moliere**

Location: **Winnipeg, MB**

Project Cost: **$8 million**

Sq. Ft: **18,700**

Price Products: **DF1**

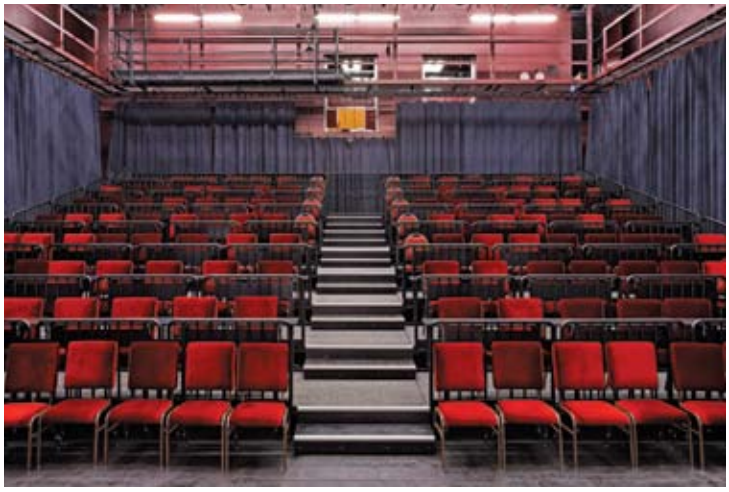
Price Representative: **E.H. Price, Winnipeg**

Design Team: **Epp Siepman Engineering & Cibinel Architects**

LEED Silver Designation

The Challenge: Highly variable cooling loads, a moveable catwalk along the ceiling, and a non permeable curtain along the theater's perimeter combined to make mixing ventilation an unattractive option in this historic theater. In addition, a system that could minimize noise and avoid disrupting theater effects, such as dry ice or smoke, was desired. Energy efficiency gains were also valued, as the building is seeking LEED silver designation and the high ceilings and lighting loads of the theater threatened to waste energy if they were conditioned with mixing ventilation.

The Solution: Given the unique characteristics of the theater, Price performed a computational fluid dynamics analysis to ensure that displacement would meet the comfort criteria of the theater. This analysis concluded that displacement would result in a comfortable theater, even when the space was fully occupied in a variety of layouts. The low face velocity of displacement ventilation ensures drafts are avoided and theatrical effects are not disrupted, while low noise levels ensure that the audience experience is not negatively impacted by the HVAC system and the system's energy savings contribute to the building's LEED designation.



Displacement Ventilation

Project: **Clyde Schools**

Location: **Clyde, OH**

Sq. Ft: **1,100-1,500**

Price Products: **DR90**

Price Representative: **Air Control Products**

Design Team: **Fanning Howey**

The Challenge: The project design firm was given the challenge of designing cooking and serving environments that provide high indoor air quality and a high level of comfort for occupants. Typical mixed air distribution systems can short circuit the supply air flow directly through kitchen exhaust hoods comforting the personnel in the space or without giving the supply air an opportunity to reach the occupied zone. The project called for an alternative solution to traditional mixing systems, with any improvements to energy efficiency viewed as an additional bonus.

The Solution: Displacement provided the ability to locate the diffusers near the floor, ensuring that clean fresh air would be delivered to staff before being exhausted through the kitchen fume hoods. This strategy meant that the risks of system "short circuiting" common to mixing systems could be avoided. Another advantage of displacement ventilation in commercial kitchens is that the air flow pattern makes it extremely effective at drawing away kitchen odors and preventing the recirculation of contaminants through the space.

Underfloor Air Distribution

Project: **Okotoks Health and Wellness Center**

Location: **Okotoks, AB**

Sq. Ft: **1,000,000**

Price Products: **Underfloor Controls, Terminals and Round Floor Diffusers**

Price Representative: **E.H. Price, Calgary**

Design Team: **SSE Architects & Keen Engineering**

The Challenge: Due in large part to the rapid growth of the population within the City of Calgary and surrounding areas, the Calgary Health Region (CHR) recognized an urgent need for a new multi-service health and wellness center for the residents of the town of Okotoks, Alberta. From the very early stages of planning, the vision for the new facility was to offer residents of Okotoks localized treatment of non-life-threatening medical conditions within a building designed to respect the long term sustainability goals of the town itself.

The Solution: Keen Engineering elected to implement an underfloor air distribution system for the North Community Services Wing of the health center. To assist in accomplishing this design goal, Keen enlisted the services of the local Price office in Calgary and described to Price a rather unique application for underfloor air distribution. Rather than simply design a traditional passive style underfloor air system, Keen wanted the ability to add variable volume heating, and deliver it from the floor as well. This method of heating the perimeter of the building using underfloor air delivery was selected to avoid a conventional perimeter heating system of either radiant panels or finned radiation. Delivering the air properly at low levels, directly into the occupied zone contributes to better indoor environmental air quality for the occupants. Underfloor air distribution systems also provide opportunities for reducing energy consumption when compared to a traditional overhead air delivery system.

Underfloor Air Distribution

Project: **Radio Shack Headquarters**

Location: **Fort Worth, TX**

Price Products: **Underfloor Diffusers, Grilles, Terminals and Controls**

Price Representative: **M.J. Air Products**

Design Team: **James Johnson and Associates**

The Challenge: When the Radio Shack Corporation began planning the construction of their worldwide headquarters in Fort Worth, Texas, they knew that they would be building a cutting-edge facility that would incorporate the latest technology in fabricated environments. Radio Shack desired to create the ultimate environment from the standpoint of thermal comfort. They planned all along to install a state-of-the-art system that would provide occupants with individual control at their work stations, conserve energy, be low maintenance, and qualify for LEED certification.

The Solution: The design team evaluated several UFAD equipment suppliers, and was most comfortable with Price's quality and service capability. Price worked with the design team to address specific issues and design a system that would work for this specific application. In the end, Price supplied hundreds of underfloor terminals, over 4,000 linear grille assemblies, and over 6,000 swirl diffusers.

Active and Passive Beams

Project: **Memorial Hospital Pharmacy**

Location: **Jasper, IN**

Price Products: **ACBL 2 Way Active Beams**

Price Representative: **RL Craig and Colby Equipment**

Design Team: **BSA Lifestructures**

The Challenge: In 2009, Memorial Hospital was faced with the challenge of renovating an existing, 5,600 sq. ft. pharmacy. The Memorial Hospital Pharmacy design team faced two key challenges: reducing energy consumption (and subsequently operating costs) and selecting a system with reduced ductwork requirements that could work within the extremely limited plenum space available—the pharmacy itself sits under several patient floors with restricted floor-to-floor heights. The facilities team at Memorial Hospital wanted to improve on the all-air system that was already in place, therefore they were open to new ideas. They did, however, also have concerns about the moderate levels of humidity that are experienced during the Indiana summer due to heavy rainfall.

The Solution: Active beams from Price were the ideal solution for this project. Water is several times more efficient than air at transporting thermal energy, and by selecting a hydronic solution such as beams, the engineer was able to increase the energy efficiency of the system by reducing the size of the air handler and ductwork required to service the space. The use of smaller piping in active beam systems also addressed the challenge of extremely low floor-to-floor heights and restricted plenum space by eliminating the need for large ductwork. Humidity was not an issue in the space, as this was easily controlled through the primary air handler, ensuring that only air with the desired moisture level would be delivered to the space. Moisture sensors were also incorporated into the Price active beams. The active beam system has been running for over a year and is described as “shockingly comfortable” by the team, who is considering utilizing active beams in other areas of the hospital that are planned for renovation.

Active and Passive Beams

Project: **Bournedale Elementary School**

Location: **Bourne, MA**

Price Products: **ACBL 1 Way Active Beams, DF1 Displacement Diffusers**

Price Representative: **Buckley Associates**

Design Team: **Garcia Galuska DeSousa Consulting Engineers**

The Challenge: The Bournedale Elementary design team knew they wanted to create a learning environment that was comfortable, energy efficient, and provided occupants with a high level of indoor air quality. The final design also had to address the high humidity conditions typical in ocean boundary communities and to the owners desire to provide air-conditioning. Maintaining simplicity in maintenance and control, as well as the extremely conservative noise levels recommended by ANSI presented additional design challenges.

The Solution: The design team selected to employ both Price active beams and displacement ventilation to meet their energy efficiency, comfort, and indoor air quality goals. During an analysis of the design alternatives, Price conducted a classroom mock-up so the design team could witness displacement ventilation in action under the conditions that would normally be experienced at Bournedale Elementary. The design team was also able to familiarize themselves with the features and performance of the active chilled beams that they selected for the final system design. The level of comfort achieved during the mock-up and demonstrations played an important role in the final selection.

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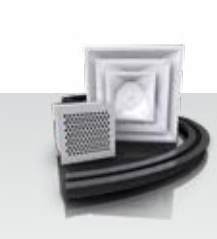
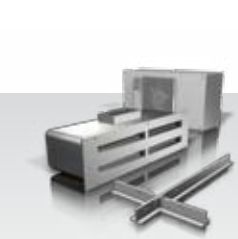


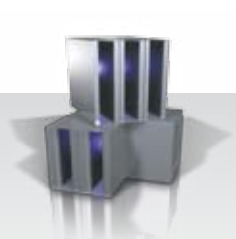
Grilles & Diffusers



Critical Environments

Terminals & Controls

Sustainable Building



Noise Control

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