Kauffman Center For The Performing Arts

A Symphony of Architecture and Air

The Kauffman Center for the Performing Arts, the vision of philanthropist Julia Irene Kauffman, took 16 years to unfold. From the moment the venue opened in September 2011, the visually spectacular facility has become iconic to Kansas City residents.

In the words of architect Moshe Safdie, "It takes a million details to get a building right." For the Kauffman Center, this attention to detail extends to the ultra quiet ventilation system that ensures patrons enjoy distraction free performances. It also extends to the dramatic lobby of the facility, which is an artwork of energy efficiency and ambitious design.

Marrying the artistic vision with the mechanical requirements of such a space was challenging, but the design team collaborated closely with Price to integrate linear floor grilles, in-wall displacement diffusers and round floor displacement diffusers. Price was the only manufacturer with the capability to provide the customized solutions required to meet the demanding performance requirements of the facility.

Project Summary

PRICE PRODUCTS

RFDD Round Floor Displacement Diffusers
DFG Custom Linear Floor Grilles
Custom Flow Diffusers

PROJECT HIGHLIGHTS

Location: Kansas City, Missouri
Project Type: Commercial, New Construction
Project Cost: $413 Million
Year Completed: September 2011
Square Footage: 285,000 ft^2

DESIGN TEAM

Design Architect: Moshe Safdie Architects
Associate Architect: BNIM Architects
Mechanical Engineer: Arup USA Inc
Local MEP Engineers: W.L. Cassell & Associates Inc
Price Representative: Jorban Riscoe & Associates

The Challenge

Balancing HVAC Form and Function

From afar, the Kauffman Center for the Performing Arts is visually stunning. Step into the lobby and you are swept away by a four story atrium with curved glass walls and dramatic suspension cables evocative of a stringed instrument. Efficiently conditioning this wide open space with its 40,000ft^2 of glass and high solar load would call for the use of both customized underfloor air distribution diffusers and displacement ventilation.

The bold design of the lobby continues into the Muriel Kauffman Theatre and Helzberg Hall. The Kauffman Center has already become a magnet for the performing arts in Kansas city, and the design team wanted to ensure that patrons can experience performances in comfort and free of from unwanted noise.

Placing underfloor diffusers beneath auditorium seats offered distinct energy efficiency advantages, the quietest possible air distribution, and enhanced thermal comfort due to the low risk of draft sensation. Firsthand witness testing of the various thermal conditioning options was an important part of the final design decision.

The Solution

Custom Linear Floor Grilles From Price Solve Unique Design Challenge

The four story glass exterior wall of the atrium sweeps around the face of the building in a grand curve. Curved underfloor displacement diffusers are elegantly integrated into the aesthetic design of the lobby. The diffusers, which are situated where the suspension cables meet the floor, are custom crafted to exacting architectural requirements and blend seamlessly with the space.

Price's impressive custom capabilities were utilized to design and produce the 100+ feet of specialty curved linear floor grilles that wrap the exterior wall, theaters and staircase. Price adhered to stringent lead times and collaborated closely with the engineer, architect and contractors to help achieve a stunning and functional result.

The project engineer estimated that conditioning this lobby/atrium area using overhead air distribution would triple or quadruple the air volumes required to maintain the same level of thermal comfort provided by the displacement air distribution. The use of displacement ventilation significantly increased energy savings within the building when compared to other approaches.

DFGL - Displacement Floor Grille

Features

- 1 or 2 way discharge patterns.
- Variety of core styles and fasteners.
- Integrated equalization baffle.
- Ships with protective film on face.
- Pencil proof models available.
- Extruded aluminum frame with reinforcing support bars.

Kauffman Center for the Performing Arts

Firsthand Witness Testing Supported the Selection of Displacement Ventilation

In the performing halls, over 2,200 Price Round Floor Displacement Diffusers (RFDD) are inconspicuously installed beneath the auditorium seats. When the design team began developing the vision for the facility there were three overriding objectives – reduce energy consumption, maximize patron comfort, and eliminate audible distraction from the heating and cooling system.

The W.L. Cassell engineering team visited the Price Technical Center in Atlanta,

Price DFGL displacement floor grilles provide a uniform low velocity flow into a space, with minimal turbulence or induction of room air. Best suited for linear perimeter applications, the DFGL may be installed with a continuous or segmented look. The cool supply air flows across the floor and gradually fills the occupied space. The superior air quality and low noise levels associated with the DFGL make it suitable for any application that demands a comfortable, quiet space.

GA to view a mock-up of the space and conduct firsthand witness testing.

Originally designed with underfloor swirl diffusers, the design team was concerned that the higher velocity air would cause an uncomfortable draft around patrons' ankles.

The applications team from Price recommended displacement diffusers as an alternative, and during their visit to Price Research Center North, the engineers were able to take off their shoes, roll up their pant legs and experience firsthand the low velocity air from displacement diffusers. The mock-up gave the design team the opportunity to manipulate air velocities and experience the relative effects. The team was impressed by the performance of the diffusers, cementing their decision to utilize displacement ventilation on the project.

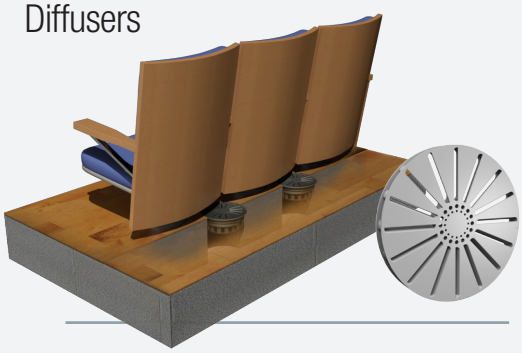
> Conditioning this lobby and atrium area using traditional overhead air distribution would have tripled or quadrupled the air volumes required.

In addition to comfort, the noise reduction associated with displacement was essential to help meet the acoustical design objectives of the space.

Theaters are incredibly sound-sensitive, and noise from the air distribution system needs to be imperceptible. Because displacement diffusers distribute air into the room at a low velocity, the pressure drop across the face of the unit is minimal. This allows for discreet operation that is typically much quieter than an overhead mixing system.

The integration of the aesthetic and functional in the facility culminated in a symphony of "architecture and air" at the Kauffman Center for the Performing Arts – but as Bill Whitman of local mechanical engineering firm W.L. Cassell & Associates stated, "the true magic is hidden."

Round Floor Displacement Diffusers



Air disperses from 2,200+ Price RFDD's placed under theater seats at an airflow virtually indistinguishable to the seated patrons.

To accommodate the exceptional thickness of the slab and ensure that the catch pan would be accessible for maintenance, Price custom modified each diffuser basket with an extended catch pan and filter.

Advantages of UFAD:

Indoor Environmental Quality

Provides a whisper quiet, draft free space while increasing ventilation effectiveness by removing airborne contaminants.

Efficiency

The reduced air volumes required result in potential energy and cost savings.

Design Team Profile

Safdie Architects

Safdie Architects is an international architectural and urban planning practice founded and led by Moshe Safdie. Projects by Safdie Architects are distinguished by their geographic and cultural diversity and represent many building types and scales.

BNIM

The 2011 National Architecture Firm Award Winner, in BNIM's 40-year history, the firm has Won over 300 awards on the local, regional and national level ranging from excellence in design to cutting-edge research in materials and sustainability to master planning.

ARUP

Arup is an independent firm of designers, planners, engineers, consultants and technical specialists offering a broad range of professional services. Arup puts sustainability at the heart of its work, and believes that innovation is key in combating global environmental issues.

W.L. Cassell & Associates Inc

Since 1933, W.L. Cassell & Associates Inc. has been a Consulting Engineering leader, providing comprehensive design and construction administration of Mechanical, Electrical and Communications systems, in the greater Kansas City region.

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