



### PROJECT INFORMATION

**Building Type:** Education

**Project Type:**

New Construction  
Preservation/Restoration  
Renovation/Remodel

**Special Certification:** LEED Gold

**Climate Zone:** 4A (Mixed-Humid)

**Number of Floors:** 3

**Square Footage:** 265,000

**Mechanical Contractor:** Shapiro & Duncan

**Mechanical Engineer:**

Global Engineering Solutions

**Daikin Manufacturers Representative:**

Havtech, LLC

**Daikin Sales Representative:**

Michael Panopoulos  
Commercial Sales Manager  
Daikin North America LLC

### OBJECTIVE

Support occupant comfort with a heating and cooling system that has the flexibility to adjust to individual preferences and load variations. The system must also facilitate future expansion, integrating new construction with the existing historic structure and minimize damage or reconstruction of existing, historical architecture.

### SOLUTION

Daikin VRV water-cooled systems, with round flow sensing cassette indoor units, provided a comfortable environment conducive for learning. Building efficiency was enhanced using a scheduling feature in Daikin's control system to leverage shifting loads in the building. Use of indoor ductless units minimized penetrations into the existing building's structure.

The Duke Ellington School of the Arts is a high school in the District of Columbia's Public Schools District that combines a full college preparatory curriculum with intensive arts training. The highly acclaimed high school has received many accolades for academic performance and creative arts, the most recent being 'Exemplary Status' from the Arts Schools Network. The school itself could be considered a work of art as the original structure, constructed in 1898, maintains architectural features that pay homage to the colonial history of Washington D.C. The historic façade is merely a front to the new technology that Duke Ellington School has embraced for its student body. The approximately 550 students get the added benefit of learning within a LEED Gold certified building. The newly reconstructed facility encompasses building efficiency and occupant well being

factors, such as indoor air quality, that enhance the student educational experience and productivity.

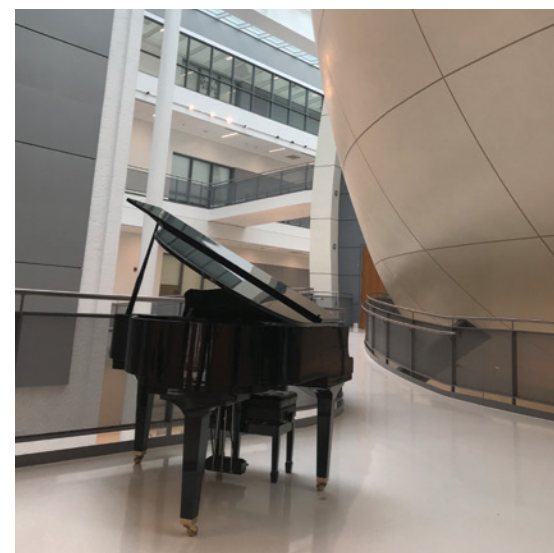
The Duke Ellington School of the Arts attracts talented students from across the country and even the world, and high enrollment demands prompted both a renovation and expansion project. New construction adjacent to the historic structure now gives the school a total of 265,000 square feet for operations; an increase of 165,000 square feet of operating and conditioning space. The increase in square footage demanded attention to operational efficiencies. In addition, sound levels of the mechanical equipment became increasingly important as the performing arts venue would be offered for lease to the local community and businesses.

After evaluating conventional HVAC solutions, Daikin's manufacturers' representative, Havtech, and mechanical contractor, Shapiro & Duncan, in conjunction with Global Engineering Solutions, developed a solution that proposed a Daikin water source VRV heat recovery system. This system would control the consumption of water and electricity by providing zone control and simultaneous heating and cooling, allowing teachers' and students' comfort to be addressed. To minimize water and electricity waste caused by conditioning unoccupied spaces, the functionality of the school day was arranged in a way that made each of the 3 separate functioning areas of the school

independent of one another. Students begin their day with core curriculum classes located in the front of the school; this is considered Zone 1. Zone 2 is in the middle of the school and consists of the cafeteria, study hall, and athletics. As the day progresses, the students make their way towards the back of the school, to Zone 3, where creative classes are held in dance studios, music halls and auditoriums. By purposefully shifting the occupants through the space, the plan also functioned well to shift the building load and concentrate the heating/cooling demand.

The project achieved LEED Gold certification with the majority of the points coming from the mechanical systems. The VRV system utilizes high-efficiency cooling towers with ultra-low sound packages to exchange heat between

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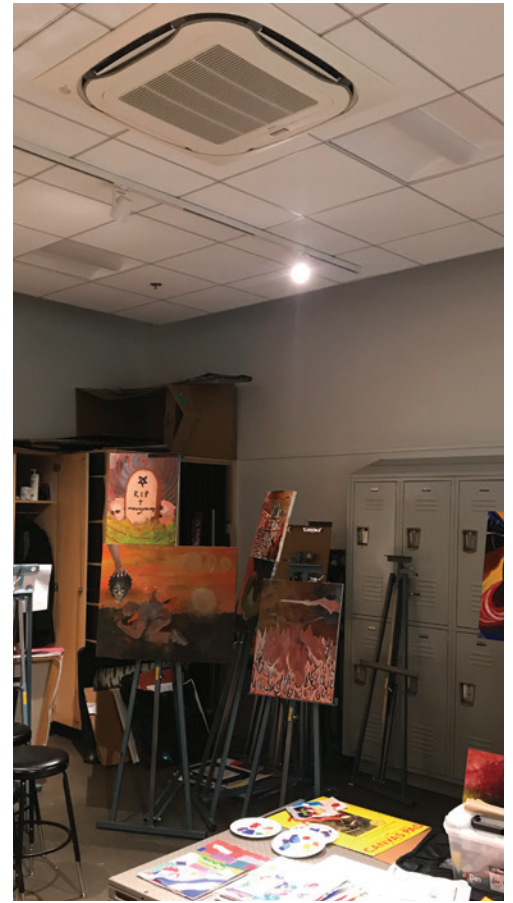
the building and the outdoors. Heat recovery is realized both on the refrigerant side of the system, between rooms, as well as within the water side of the system, between condensing units; thereby providing a high level of energy efficiency throughout the building.

Twenty-eight VRV water-cooled systems are delivering a total of 466 tons of capacity. The water-cooled condensing units utilize a refrigerant loop that transfers energy from the indoor fan coils to the condensers in cooling mode. Then, a water loop absorbs the rejected energy and releases it via a cooling tower. Inverter compressors deliver precise amounts of refrigerant to each indoor fan coil, reducing energy consumption by variably providing only the energy required to heat or cool the space. Havtech's Tim Dorman highlighted the additional benefits that these low maintenance systems would have on time and energy savings for the school's facilities staff. *"The consulting engineer and the mechanical contractor worked diligently to optimize this building's total life-cycle costs, by both leveraging Daikin's water-cooled VRV capability and functionality, as well as by reducing the*

*maintenance and increasing efficiency that the school will see for many years to come."*  
–Tim Dorman

Daikin round flow cassettes are installed in 264 zones and are positioned and programmed to operate during custom schedules within the 3 main zones previously described. The 360° round flow sensing cassette became the favored choice for the school particularly due to the low sound levels (27 dBA on low fan mode). The built-in intelligent eye sensor is able to sense occupants in the space and direct airflow around the occupants while maintaining the same temperature between the floor and ceiling. This greatly reduces the all too common problem of hot or cold spots within the zone, and the time consuming "comfort calls" to the maintenance staff. Further reducing maintenance time is the cassette's self-cleaning feature; the cassette has a default setting that triggers a robotic arm to brush dust off of the filter every night between midnight and 3 A.M. and deposit debris from the filter into an interior holding canister. The staff values the indicator light which notates the canister's

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maximum capacity. Without additional time or action, they know when to act, making maintenance simpler, more efficient, and less time-consuming. To clean the canister, a vacuum hose is simply inserted in an easy-to-reach location on the exterior of the cassette and within seconds, the canister can be emptied.

Due to varying occupancy, times of use, and optimal use of spaces, combined with a limited and controlled operating budget, the heating and cooling system selected for this project needed a master controls system that would provide extensive control options as well as the ability to integrate into an existing building management system. Integration

was achieved through the *intelligent Touch Manager™* (iTM) *BACnet®* function. Daikin's *iTM* central controller provides a perfect solution from the aspect of technical application as well as serving the diverse managerial needs and expectations of the district. A Daikin *Navigation™* controller was installed in each zone to allow for occupant input into the comfort of their space. The *Navigation™* controller will enable occupants to adjust the temperature and fan speed on-demand, within predefined limits, as set by leadership, to control operational costs and to manage the shifts experienced in cooling load.

The expertise of Havtech and Shapiro & Duncan was utilized through Daikin's product

offering giving this unique school a superior comfort system that will benefit the institution for years to come. The school has won several awards since re-opening in 2017, including the Engineering News-Record award for "Best K-12 Education Project" for the Mid Atlantic region and the 2018 "First Award", an international architecture design award for non-residential buildings. Daikin delivered a comfort solution that went above and beyond what a traditional non-inverter system could offer. From aesthetics to zone control and sound levels to efficiency, the Duke Ellington School of Arts now has a budget-friendly heating and cooling system that fits the facility's prominence.



#### DAIKIN EQUIPMENT

- 28 (466 Tons) VRV-WIII
  - 12 Tons Heat Pump
  - 454 Tons Heat Recovery
- 264 FXFQ – round flow Sensing Cassettes
- 16 FXMQ – DC Ducted Concealed
- 182 BSV – Branch Selector Box
- 280 BRC – *Navigation™* Controller
- 1 DCM *intelligent Touch Manager™*
- 4 *iTM* Plus Adaptors

## THANK YOU



#### ADDITIONAL INFORMATION

Before purchasing this appliance, read important information about its estimated annual energy consumption, yearly operating cost, or energy efficiency rating that is available from your retailer. Actual savings and costs will vary. Cost and savings statements are applicable solely to the installation indicated. For additional information please contact the installing contractor, distributor or factory representatives.

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