

Case Study



Park Elementary



Improving Energy Efficiency and Occupant Comfort

with AAONAIRE® Energy Recovery Wheels and Digital Scroll™ Compressors

Park Elementary School is located in Columbia, PA. It is a kindergarten through sixth grade public elementary school in the Columbia Borough School District with around 50 teachers and 500 students.

In 2006, Park Elementary School's aging HVAC system needed replacing. Each of the school's classrooms were served by hot water heating only vertical unit ventilators and cooling only CAV, constant air volume, packaged DX rooftop units. The gymnasium, cafeteria, and administrative offices

were served by CAV packaged DX rooftop units each with a hot water heating coil.

Gary Trostle, the specifying engineer for the Columbia Borough School District, stated "For the Park Elementary School project, I wanted the replacement units to be energy efficient, provide a more comfortable environment for the students and teachers, and improve the school's indoor air quality, including meeting the current ventilation code requirements."

One potential replacement solution proposed was standard VAV, variable air volume, packaged DX units with hot water reheat VAV terminal units for the classrooms and administrative offices and standard CAV packaged DX rooftop units with hot water heating coils for the gymnasium and cafeteria. It would be a low initial cost solution that would be



easy to install and be able to meet the ventilation code requirements. However, this solution would not improve occupant comfort because the units would still have on/off compressor staging, and thus would not be able to tightly control the air temperature supplied to the VAV terminal units resulting in classroom temperature swings and uncomfortable students and teachers. The units would also only be moderately more energy efficient.

Another potential replacement solution proposed was hydronic cooling and heating VAV and CAV rooftop air handlers. With the installation of a high efficiency chiller plant the system would be more energy efficient than the previous system. This solution would improve occupant comfort and indoor air quality because the air handlers would be able to match the buildings temperature and humidity loads with their modulating water valves and be able to meet the ventilation code requirements. However, the high cost of the air handlers, chiller plant, their installation, and the system maintenance made this solution nearly infeasible.

The AAON® Solution

Noting the issues with these proposed solutions, Troy Schreffler, an AAON sales representative with HC Nye Co., presented Trostle with the replacement solution of AAON RM Series packaged DX units with AAONAIRE® total energy recovery wheels and Digital Scroll™ compressors. "Including factory installed energy recovery wheels and Digital Scroll™ compressors on the units," Schreffler commented, "substantially improved the units' energy efficiency and ability to provide occupant comfort." For heating the CAV units and VAV terminal units included hot water heating coils.



Because RM Series units can be specified with up to 100% outside air, meeting the ventilation requirements would not be a problem. The units would also include additional indoor air quality improvement features including double wall construction and 4" filters. Finally, the AAON solution would require no more installation or maintenance costs than the proposed standard packaged DX rooftop unit solution. Therefore, because the AAON RM Series units effectively met all of Trostle's replacement goals, Park Elementary School decided to go with the AAON RM Series solution.

Serviceability

Standard features of the RM Series units also made them favorable to the school. One of these features is the unit exterior paint which exceeds a 2500 hour salt spray test, per ASTM B 117-95 requirements, extending the life of the unit. Another is the patented slide out backward inclined supply fan assembly (Patent No. 5,738,167) which provides increased static pressure capabilities and is easily serviceable. Finally, full-length stainless steel piano hinges and zinc cast handles on the access doors and isolated compressor/controls cabinet doors and unit specific color-coded wiring diagrams in both point-to-point and ladder form also make the unit easily serviceable. Because the units are easily serviceable, time and money are saved while performing maintenance over the lifetime of the unit.



Indoor Air Quality

The school's replacement RM Series packaged DX rooftop units included optional AAON indoor air quality features. Double wall construction was specified on the units to provide a cleanable interior surface, reduce the resonated noise created by the unit, and prevent any insulation from being directly in the air stream. Insulation exposed to the air stream provides a porous surface that easily harbors dirt and microbial growth. Four inch MERV 7 pleated filters that help to improve the indoor air quality of the school by filtering out contaminants down to about 3 microns were also specified on the units. MERV, or Minimum Efficiency Reporting Value, is a number from 1 to 16 that is related to an air filter's efficiency. The higher the MERV rating, the more efficient the air filter is at removing particles. Other filter options are available for the RM Series as well, including 4" MERV 11, 13, or 14 pleated filters with 2" MERV 7 pre filters. The specified options helped to improve the indoor air quality of the school.

Additional CAV Unit Features

The gymnasium and cafeteria units included two additional options not included on the VAV classroom and administrative office

units. One option specified was hot water heating coils to match up with the school's boiler system and provide the heating for the gymnasium and cafeteria. This allows the units to provide energy efficient load matching heating along with the Digital Scroll™ compressor load matching cooling. The other option specified on the units was return air CO₂ override sensors that open the outside air dampers more than the standard amount to provide more fresh air and better indoor air quality when indoor CO₂ levels exceed a field adjustable setpoint.

Digital Scroll™ Compressor

An option included on each of the units was a Digital Scroll™ compressor, which varies the volume of refrigerant that flows through the cooling system. The Digital Scroll™ compressor allows the VAV units to tightly control the supply air temperature by modulating its cooling capacity from 10 to 100%, eliminating the supply air temperature swings common with standard DX VAV units. It also improves the units' energy efficiency while matching the required load with its power reduction during partial capacity. The compressor runs for a longer period of time, thus dehumidifying the air more and cycling the compressor on and off less, reducing wear on the

compressor. Trostle specified the compressors, "because the VAV units needed something that would give us good temperature control as the volume of air supplied is decreased." In addition, the Digital Scroll™ compressor allows the CAV units to be able to consistently match the space load, improving those units' energy efficiency as well.



AAONAIRE® Total Energy Recovery Wheel

An optional, AAON patented, factory installed AAONAIRE total energy recovery wheel was included on each of the schools rooftop units (Patent No. 5,826,641). Adding a total energy recovery wheel helps reduce the units' energy consumption by pre-heating, pre-cooling, humidifying, and dehumidifying the ventilation outside air (depending on the conditions). The wheel is mounted in the outside air intake and exhaust airstreams. While the wheel spins the exhaust air stream transfers some of its heating (or cooling) capacity to the wheel, which is then transferred from the wheel to the entering outside air stream. Depending on the air conditions, an AAONAIRE energy recovery wheel pre-conditioning of the outside air can increase the tonnage of a unit by as much as 30% while at the same time doubling the unit's EER.

A Comfortable Learning Environment

Park Elementary School was extremely satisfied with the RM Series packaged DX units with AAONAIRE® total energy recovery wheels and Digital Scroll™ compressors. As Mike Miller, Columbia School District's operations and maintenance manager said, "The AAON units provide the students and teachers with a comfortable learning environment and save the school district money because they are energy efficient and easy to service and maintain."



Contact your local AAON sales representative for more information about AAONAIRE® Energy Recovery Wheels, Digital Scroll™ Compressors and other innovative solutions from AAON.



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