

# City of Lawrence

## Public Works Department

### MEMORANDUM

**DATE:** April 14, 2010  
**TO:** David L. Corliss, City Manager  
**FROM:** Mark Thiel, Assistant Public Works Director  
**CC:** Cynthia Boecker, Diane Stoddard, Chuck Soules, Mark Thiel, Jonathan Douglass, Alan Landis  
**RE:** City of Lawrence Public Library HVAC Improvements  
Project No. PW0930

Please include the following item on the City Commission consent agenda for consideration at the April 20, 2010 meeting:

On February 9, 2010, the City of Lawrence opened proposals for Project No. PW0930, City of Lawrence Public Library HVAC Improvements, RFP No. R1001.

#### **Project Description:**

Design and installation of energy efficient heating and cooling equipment for the Lawrence Public Library.

#### **Project Scope & Details:**

This project will include the engineering and design for the installation of new HVAC systems designed to provide efficient and reliable service while maintaining a controlled environment for the library. The proposals provide three options:

- The replacement of two roof top HVAC units and a digital control system.
- The replacement of the chiller and three basement air handlers. Equipment will be compatible with new roof top units and any other equipment. Energy rating will be in line with the roof top units and all requirements to meet the Federal Stimulus funding. Illustration of energy savings should be included.
- Balance the entire system at the library and make necessary adjustments.

Additional controls will be required to provide zone controls to maintain a more even temperature in the library, and night set-back temperature controls (for unoccupied operation) with a bypass mode when the zones are occupied during "off peak" times. A one year maintenance contract will be included. Also included will be an option for two additional one year agreements for a total of three years. Individual energy monitoring for HVAC equipment installed, both existing and new. We will require a quarterly report of the energy usage for a minimum of three years that will comply with government requirements.

This project includes Federal stimulus money. All current Federal guidelines are required to be followed to assure compliance with the Federal Government requirements.

#### **Proposal Review:**

Proposals were evaluated using the following three criteria: proposed equipment and design, energy efficiency and reporting ability, and cost. RFP's were reviewed, and interviews with contractors were conducted by Mark Thiel [Assistant Public Works Director], Steve Bennett

[Building/Structures Manager], Stan Alldredge [HVAC Tech], Dale Seele [Douglas County Heath Building] and Bruce Flanders [Library Director]. There were numerous follow up conversations with each firm to determine the best overall package that would meet our needs today and moving forward. The system proposed by P1 would be compatible and expandable to meet a future library expansion. Two proposals were received:

Contractor	Equipment Proposed
P1	AAON / Trane
Johnson Controls	York

### **Equipment & Design:**

Both proposals recommended utilizing the same mechanical engineering firm, Hoss and Brown Engineers, Inc., and the same equipment controls and the same program software. The engineer, controls and software meet or exceeded our requirements. The primary difference was the type of mechanical equipment each specified, which is the basis for the most energy savings. Based on the research and review by our team we believe that the P1 – AAON roof top equipment will give us the best energy efficiency, and design life (see attachment AAON). Also specified by P1 was Trane equipment for air handlers and chillers. We have put an emphasis on energy management and conservation. During the RFP review and design by P1 they performed an Energy Star base-line audit of the library which gave them a better idea of what would meet our needs as well as prepare them for future reporting of energy efficiency. P1's approach to the design included an entire review of all existing mechanical equipment, which resulted in a proposal that exceeded our RFP requirement. This approach provided guidance for a complete "whole system" utilizing P1 and their mechanical engineer's expertise. Their proposal also includes a one year service contract that will cover all mechanical equipment, new and existing, at no additional cost. After an extensive review and interview process we were impressed with the P1's approach, reporting ability, and equipment proposal. They have provided the most complete, energy efficient proposal.

### **Future Library Growth / Renovations Evaluation**

The City of Lawrence held two meeting to discuss and review the proposed addition / renovation to the library. The purpose of this review was to confirm that the HVAC upgrades in this project would be compatible with a future renovation. In these meetings were library staff, their architect for the future renovation [Hoss and Brown Mechanical Engineers], P1 staff and several city staff. After both meetings the consensus was that this project would be compatible with future renovations:

- The roof top units incorporate total energy recovery wheels for increased energy efficiency
- Part load efficiency for chiller is IPLV (EER) = 15.3 @ ARI conditions
- Part load efficiency for RTU's is IPLV (EER) = 14.5 @ ARI conditions
- With a decentralized system, all equipment will be compatible with the proposed addition
- Proposed DDC control system is expandable and can incorporate the proposed addition

### **Project Schedule:**

This project, if design and engineering is started April 1, should be completed July 11<sup>th</sup>. The equipment would be removed in stages to help keep the library comfortable. The library will not be closed, and there will be minimal interruption in the daily activities.

**Energy Efficiency & Reporting:**

The library's HVAC system consists of five roof top units with one chiller, three air handlers, and various controls. Three of the HVAC units have recently been replaced. The two units that have not been upgraded were installed in 1971. These two units have a Seasonal Energy Efficiency Ratio (SEER) of 8. The replacement units have an EER rating of 12.8. The AAON and Trane equipment have incorporated energy savings designs into their units. The total package with equipment and controls specified by P1 will give us the best overall package. The AAON equipment is a complete unit. Additional equipment would need to be added to the York system, proposed by Johnson Controls, to achieve an equivalent EER rating.

All reporting requirements will be performed by the contractor. P1 has prior energy compliance grant reporting and have included a staff member dedicated to assure correct and prompt reporting compliance. They are a local company and have a long history with the City of Lawrence providing quality and professional services.

**Project Funding:**

The budget for this project is \$550,000, funded 100% through the EECBG program grant. The two proposals submitted are as follows:

<b>VENDOR</b>	<b>Total</b>
Engineers Estimate	\$550,000.00
Johnson Controls	\$397,704.00
P1 Group	\$423,620.00

**Recommendation:**

Based on a through review by Mark Thiel, Bruce Flanders, Steve Bennett and Stan Alldredge we are recommending that the selection of P1 be made to perform this project. Both Johnson Control, Inc. and P1 had impressive submittals but we feel that overall P1's submittal is the better choice for this project. P1 has a long established excellent working relationship with the City of Lawrence, and completed a much more detailed evaluation of the facility prior to providing a design proposal. Presently we have a service contract with P1 for the following buildings: City Hall [including Information Systems Environmental Systems], Lawrence Arts Center, Riverfront Plaza Offices, and Police Department ITC on Bob Billings Parkway. P1 also performs maintenance and equipment repairs at Lawrence Public Library, Fire/Medical #1 and Senior Services building.

P1 is a local contractor that has always provided excellent services for the City. The HVAC renovation of City Hall was done in four stages over five years. All work was done while City Hall was operating. This will be similar to the library project in many ways. Their service response is outstanding. The president of the company attended the RFP interview. He emphasized their local involvement throughout Lawrence and assured us of their commitment of the quality of work and people on this project. Both vendors are using the same engineering firm and the same environmental controls.

The use of AAON and Trane equipment will accomplish maximum energy savings; the addition of (4) Variable Air Volume (VAV) boxes with reheat capabilities was recommended by P1 and is not part of the required proposal. We are recommending that the VAV boxes be added as part of this project at a cost of \$12,800. They will give greater temperature control to individual areas in the library producing even greater energy efficiency and comfort. They also allow the individual units to operate at a lower capacity which generates greater energy savings. The

assurance of compliance with the federal grant reporting, the long time excellent service they have provided the City of Lawrence all make P1 the best choice for this project.

**Action Request.** Approve and authorize the City Manager to sign a contract with P1 Group, Inc., Project No. PW0930, in the amount of \$423,620 for library HVAC improvements, plus an additional \$12,800 for VAV boxes, for a total amount of \$436,420 provided the contractor can meet the terms established in the contract documents.

Attachment: AAON Equipment Comparison Document

## **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.*



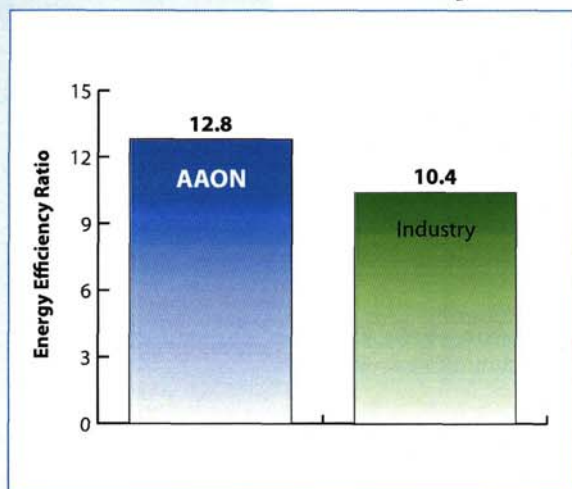
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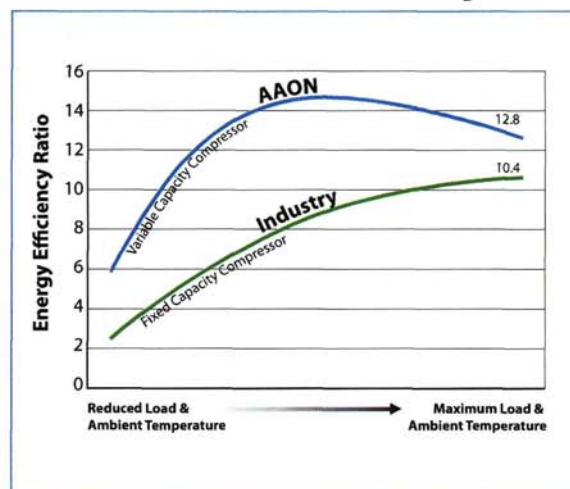
# AAON DESIGN PROVEN TO SAVE ENERGY!

## Full Load Efficiency



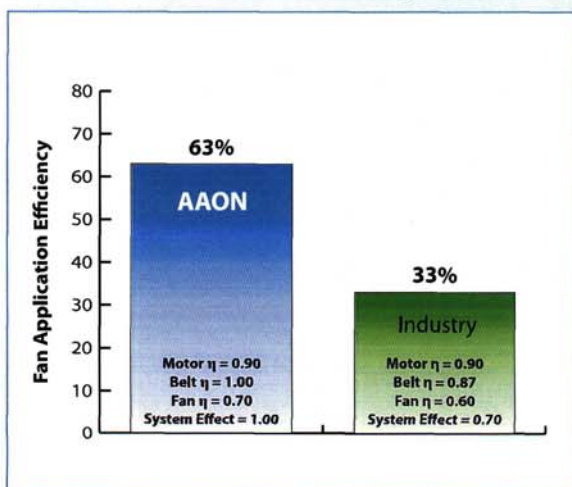
\* Industry unitary large equipment efficiency as of 03/30/09 per active listing in AHRI data base (sorted by OEM Trade Name)

## Part Load Efficiency



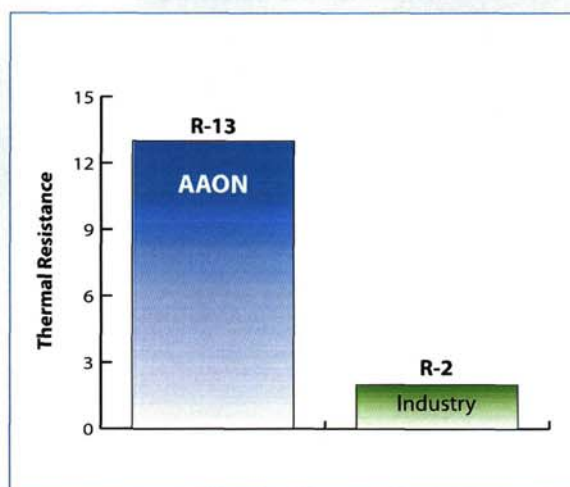
\* Variable capacity compressor without hot gas bypass compared to fixed capacity compressor with hot gas bypass

## Fan Efficiency



\* Industry belt-driven, housed, forward curved fan total efficiency compared to AAON direct drive, unboxed backward curved fan total efficiency.

## Cabinet Insulation



\* Two inch, double wall, rigid polyurethane foam insulation compared to one inch of fiber glass batt. Includes AAON thermal break. Does not reflect air leakage. Inclusion of air leakage would further improve AAON over industry standard due to the use of rigid panel design and superior gasketing.

**“It’s not bragging if you can back it up.”**

- Dizzy Dean (Baseball Hall of Fame)



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# Case Study



## Park Elementary



### Improving Energy Efficiency and Occupant Comfort

*with AAONAIRES® 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 AAONAIR® 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 CO<sub>2</sub> 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 CO<sub>2</sub> 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.

