Improving Detroit's School HVAC Systems

Project:
Dove Academy/Lyon Mechanical

Location
Detroit, MI

Comparison Date
June 2024 - August 2024

The Team:

Owner
Dove Academy of Detroit

Project Developer:
Lyon Mechanical

HVAC Engineer:
Lyon Mechanical

HVAC Contractor:
Lyon Mechanical

HVAC Distributor:
Johnstone Supply - Taylor Branch

A crane was used to move condensing units to the roof of Dove Academy.

In early 2024, Dove Academy hired Lyon Mechanical Inc. to install 20 tons of single-phase VRF equipment at its facility.

In its heyday, Detroit, MI, was the undisputed hub of the automotive world, with giants like Ford, General Motors, and Chrysler driving its economic engine.

On a line graph, Detroit's rise to and fall from prominence parallels the use of the V-8 engine in consumer sedans. As the country began to favor smaller displacement powerplants and lighter vehicles, manufacturing moved out of Motor City, taking much of its workforce with it. Real estate value imploded.

Big wheels turn slowly, but they do turn. Today, Detroit is re-emerging as a hot real estate market thanks to revitalization efforts, affordable housing, and growing business investments. The city's downtown area is experiencing a resurgence, with tech companies and startups establishing a presence.

As families move back in, the city's aging infrastructure has come under scrutiny. This may be most evident among its educational facilities.

Dove Academy of Detroit is a pre-K through eighth-grade public charter school that occupies a 96-year-old building in the Conant Gardens neighborhood. Until earlier this year, the facility didn't have air conditioning. Dove Academy's physical structure has always been well maintained, but Detroit's legendary heat and humidity made it unbearable inside the school from time to time.

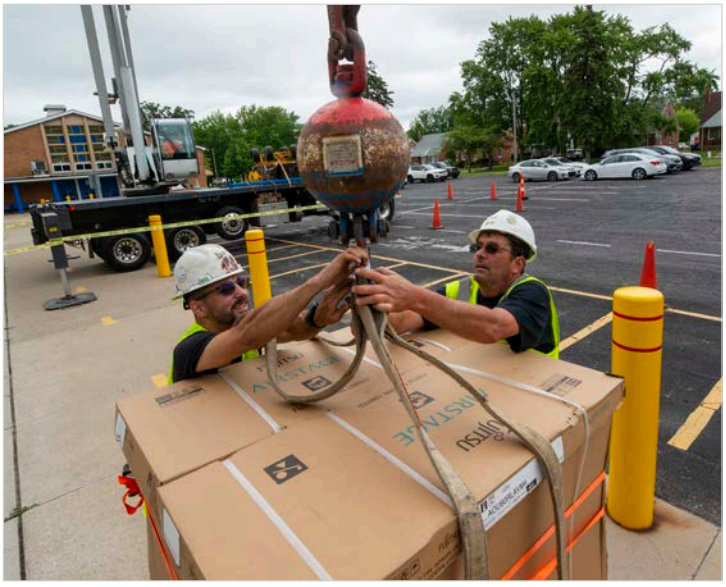
Extreme Conditions

"Over the past few years, the school has been required to cancel classes for the younger students when the classrooms exceed 82°F," said Carlo Serafini, of Lyon Mechanical, Inc. "It's not as big a concern with the middle schoolers. Nonetheless, kids were sent home quite a few times over the past few spring semesters, generally when outdoor temperatures reached 90°F."

One of the school's four, five-ton AIRSTAGE J-IV condensing units mounted on a snow stand.

Serafini (CEO) co-owns Lyon Mechanical with Kelly Oprisiu (CFO), whose grandfather started the company in 1974. The firm focuses on commercial, industrial and government work within a 300-mile radius of Detroit. Much of that work includes educational facilities, with the HVAC retrofit at Dove Academy being one of its most recent projects.

Lyon Mechanical has maintained the school's 62-year-old, 2 million BTUh steam boiler for years. When boiler maintenance costs recently became unreasonable and class cancellations grew more frequent due to summer temperatures, Serafini began attending school board meetings to present an HVAC solution.



(left to right) Lyon Mechanical's Bob Fitzgerald and Ray Short rig condensing units to be craned to the roof of the school.

"I convinced the school board to permit me to conduct a pilot project in three classrooms in early 2023, utilizing a two-ton Fujitsu AIRSTAGE H-Series mini-split system in each room," he explained. "Over the following year, they performed so well that all the teachers wanted to use those rooms. Members of the board visited the classrooms and immediately approved the heat pump retrofit for the elementary wing of the school."

Serafini owned his own HVAC company before joining Lyon in 2020. He knew that mini-splits would work well, but a VRF system would offer advantages at scale if used for the entire two-story, 4,000-square-foot wing.

"Initially, I was under the impression we'd have to install one mini-split per classroom because only single-phase power was available at the site," said Serafini. "That would've resulted in a condensing unit outside each room. I didn't learn about an alternative until I began speaking with Kurt Milner, sales manager at Johnstone Supply's Taylor branch. He told me about Fujitsu's AIRSTAGE J-IV single-phase VRF system."

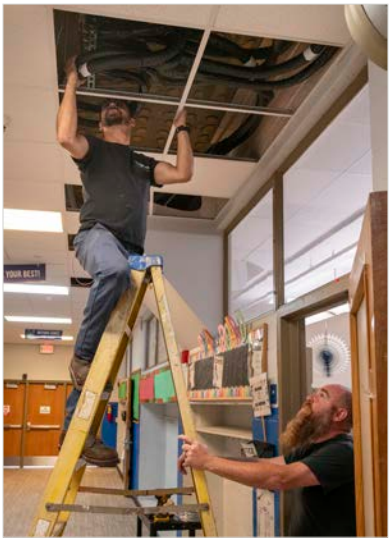
Early on, the only question was whether the new VRF system could handle Detroit's severe winters. Historically, the city has experienced record lows of -14°F twice, once in 2014 and again in 2019. Aside from a -13°F cold snap in 2015, annual record low temperatures have hovered around 0°F.

"I explained to the board that the heat pump system I was proposing could effectively provide space heating with outdoor conditions as low as -15°F without relying on its backup electric resistance element," said Serafini. "That knowledge put them at ease, as it did me."

Building a Blueprint

With assistance from Milner and Fujitsu Sales Engineer Lizzie Bourgeois, Serafini assembled the VRF system design in Fujitsu's AIRSTAGE Design Simulator software. Their suggestion was to use the single-phase J-IV system as the basis of design. Before the design was finalized in the spring of 2024, Bourgeois and Milner walked the site with Lyon Mechanical.

"One of the challenges in older buildings adding cooling is the power availability, both in terms of voltage/phase and available service," explained Bourgeois. "The biggest consideration at this site was the lack of three-phase power. Using higher capacity AIRSTAGE V-Series units would've required a very costly electrical upgrade. The J-Series design we settled on provided many of the advantages common to three-phase systems, like ample line set lengths and the option to use refrigerant headers to simplify piping. We're providing 20 tons of capacity here, all on single-phase power."



Lyon Mechanical installers Bob Fitzgerald and Collin Schaale run linesets.

When the time came to order equipment Johnstone Supply had everything in stock.

Before the project even began, Serafini and Oprisiu recognized its potential to serve as a blueprint for other schools in the area, many of which are old, moderately sized, lack air conditioning, and are overdue for heating system replacements.

Rapid Progression

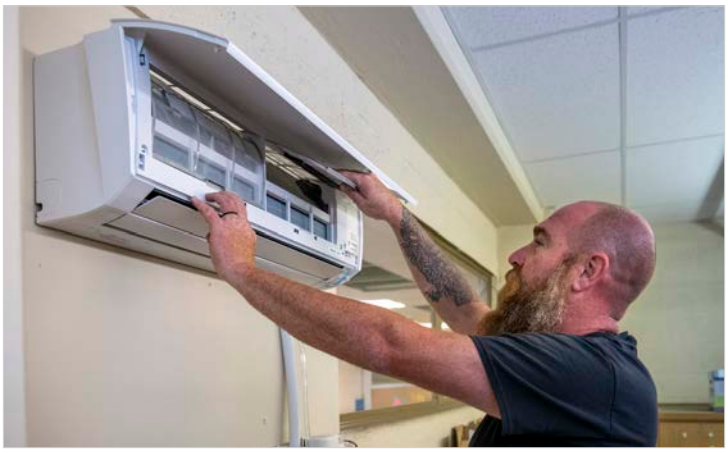
Even before summer break began, the project proceeded one classroom at a time. Two, five-ton condensers were installed at ground level for the first-floor classrooms, and two identical condensers were craned to the roof to serve the upstairs. Each condenser provides capacity for six wall-mounted indoor units. At 12,000 BTUh apiece, each head serves one classroom.

Splitting the systems between the ground and the roof was done only to simplify piping installation and concealment. The VRF system would've been more than capable of supplying refrigerant to the whole wing from a single location, considering the available 164 feet of connected line set length and 49 feet of vertical separation permitted between indoor and outdoor units.

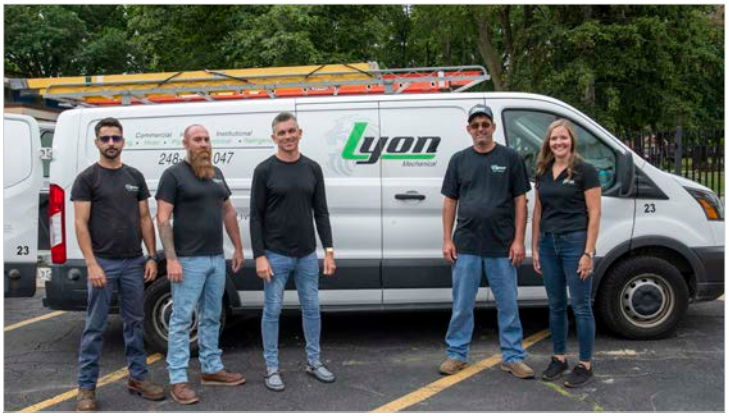
"We encountered very few issues, considering the age of the school and the fact that the J-IV was new to me and our technicians," said Serafini. "There was a chase in the drop ceiling, which we used to install our refrigerant manifolds. This allowed us to keep all piping above the ceiling. The only real challenge was coring through a foot of brick and block."

Comfort and energy savings were the main goals for the project, but centralized control was certainly a consideration.

"Lyon Mechanical installed a central remote controller, providing full system control from a single location," explained Bourgeois. "This allows a building manager to turn all the systems on or off simultaneously."



Lyon Mechanical installer Collin Schaale installs filters in a wall-mount unit.



(left to right) Bob Fitzgerald, Collin Schaale, Carlo Serafini, Ray Short, Kelly Oprisiu.

One School At a Time

The project began in June 2024 and culminated in August. This was faster than expected.

"The school board and all faculty have been blown away with the comfort levels. Their only question was why this hadn't been done earlier," said Serafini. "We had a fantastic support team between Kurt and Lizzie. She walked the jobsite with me and was always quick to answer any questions our crew had. She was a rockstar."

Plans have already been made to replicate the VRF installation on Dove Academy's middle-school wing next summer. As far as using Dove Academy as a blueprint and example for other schools in the area, the amount of interest generated has already surprised Oprisiu and Serafini.

A similar school nearby, the Most Holy Trinity Catholic Academy, has already signed a contract with Lyon Mechanical to implement a nearly identical system in their 14,000-square-foot facility beginning in the fall. Bids are currently out with three other schools.

"We're in a good position," said Serafini. "Detroit is booming, and heat pump technology has come of age. We're in a good market for it, with cold winters and very hot summers. This system provides an outstanding opportunity to conserve energy year-round, not to mention comfort and control improvements in the old buildings still in use here."

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