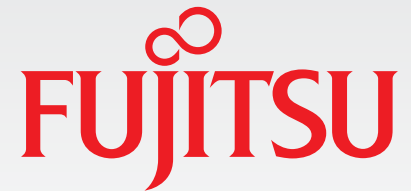




## CASE STUDY



### PROJECT:

Large residential retrofit

### LOCATION:

Phoenix, AZ

### THE TEAM:

#### HVAC CONTRACTOR:

Sharp Air Conditioning & Heating, LLC.

### CHALLENGE:

Incessant heat and huge solar gain and the need for energy efficiency

### SOLUTION:

J-II VRF system

### RESULT:

Zoned rooms, homeowners not blasted with air blowing directly on them while other spaces too warm

## DESERT HEAT AND A DUCTED ALTERNATIVE

According to Greek legend, the phoenix was an unimaginably beautiful bird that, after a long life, died in a fire of its own making, only to rise again from the ashes. It's an enduring symbol of death, rebirth and the aspirations of humankind.

Phillip Darryl Duppa, an early English settler, envisioned the rise of a great metropolis from the small settlement on the land of long-gone Native American inhabitants.

"A new city will spring, phoenix-like, upon the ruins of a former civilization," Druppa said. And he was right.

Now, 150 years later, the Phoenix Valley is home to 4.9 million people and the scorching heat is as much a factor now as ever. In July, average high temperatures crest 106°F, falling briefly into the double-digits overnight.

"If you talk to an old-timer, they'll tell you that Phoenix has gotten hotter," said Aaron Sharp, founder of Sharp Air Conditioning & Heating, LLC. "Most attribute it to the quantity of pavement in the valley."

### EFFICIENCY, DESPITE BRUTAL HEAT

Sharp AC & Heating focuses on high-end residential work, and most of that takes the form of service and retrofit. Given the mild winters in the Sonoran Desert, heating here is a smaller consideration than the need for reliable AC, though still necessary.

In Phoenix, the key challenge is dealing with incessant heat and huge solar gain and – with rising electrical rates – the need for energy efficiency is very important, too. High-efficiency products are fast gaining popularity with installers, and Sharp is no exception. →



The 4,000 square-foot home needed a five-ton VRF system to replace the air conditioner and gas-fired furnace.



## CASE STUDY

"We've recently made a push into green energy and high efficiency retrofits," said Sharp. "For most of our clients, comfort and efficiency trump upfront cost."

It's meant that Sharp technicians are doing a few less in-kind replacements of AC units each year. Sometimes they use a solar-ready approach, where new AC condensers are installed along with the components necessary to connect to a dedicated photovoltaic panel. Other times, they're finding ways to get creative with condensers and zoning, adding efficiency while improving comfort and controllability.

### ADDING ZONES

An AC replacement in a single-story, 4,000-square-foot home prompted Sharp to inquire about the light-VRF J-II system made by Fujitsu.

Technicians were removing a 15-year-old, 12 SEER air

conditioner and gas-fired furnace. With special consideration made for the homeowners' requests, he decided to replace the existing equipment with a five-ton J-II condenser. He also planned to add three new zones.

"Once you max out the mechanical efficiency of available options, you need to find other ways to reduce power consumption," said Sharp. "By adding zones to the house, we're not only improving the controllability of the space, but increasing efficiency. It's something few people realize before we speak with them about it."

The family's two children had moved out, leaving large parts of the house unused. Because the entire ground floor was on a single zone, some rooms were more comfortable than others, by a great amount. The full, finished



The master bedroom is now on an independent zone.

basement was a second zone and suffered similar problems, though not as bad.

The owners were adamant that the new system not "blow" cool air forcefully across the room, making them feel quite cold near a supply grille, and too warm anywhere else.

Sharp's plan was use the 19-SEER J-II for its ability to support up to nine zones. This way, the unused floor-space could be set separately from the rest of the home, and the master bedroom and common areas could be controlled individually. In addition, smaller zones meant lower static pressure in the ductwork.

To make sure his plan checked out, Sharp had his layout checked for performance and compatibility standards in Fujitsu's Design Simulator. This way it he could quickly determine if the plan needed any changes before installation began.

After his design got the green light, Sharp technicians put the plan to work.



Changes to the home's existing ductwork accommodated a five-ton VRF system, while also adding three new zones.

## FLEXIBILITY, AT LAST

"The upstairs trunk line was removed, and three smaller branches were added, each with their own fan coil," said Sharp. "This took a little more work than simply connecting the condenser to wall-hung evaporators, but it was well worth the effort."

The living room return was re-used. New return boxes were cut in for the master bedroom and the kids' rooms, and individual T-stats were added.

A new fan coil was installed for the basement zone, but supply and return ducts were left unchanged. A 12,000 BTU ceiling cassette was installed in the theatre room, which always got

coils and the ceiling cassette, we have a combined 78,000 BTU maximum load connected to a 60,000 BTU condenser - or 130 percent of capacity."

VRF condensers can be undersized because it's rare that all evaporators would be require to run at the same time. And in such an instance, the EEVs (electronic expansion valves)



To give precise and responsive control over the basement theater room, Sharp installed a ceiling cassette unit with its own thermostat.

## A SOLUTION AND AN OPTION

"There are a lot of high-SEER, conventional AC units on the market," said Sharp. "Many offer variable speed and inverter compressors; the difference is that we're zoning with refrigerant circuits here, instead of zone dampers. Closing-down entire circuits when not in use provides a comfort and efficiency advantage."

The homeowners recently told Sharp that they're the most comfortable they've ever been in the home. Maybe that says something about being an empty-nester, but it probably has to do more with the retrofit.

Those complaints of being blasted with cold air? Now a thing of the past.

For Sharp AC & Heating, the new system is a growing option for light commercial applications, or when retrofitting a residential heating and cooling system.



The large trunk line and coil in the attic was removed and replaced by three smaller branches and fan coils supported by the VRF condenser outside.

too hot when occupied. With its own thermostat, the room now responds rapidly.

"The J-II provides the flexibility of a full VRF system, but doesn't require three-phase power," said Sharp. "With the four fan

like a multi-zone mini-split. But longer line-sets and the ability to accommodate many more zones make it a far more capable solution. With sizes between three and five tons, the systems fit the bulk of Sharp's jobsites.

on each of the evaporators will throttle to maintain operation of all indoor units.

Aside from the use of refrigerant headers instead of branch boxes, the J-II VRF system installs much