

California Dream House a Palace of Comfort

Mechanical Air Service President Russ Donnici worked with the home architect and owner's representative for a year to develop the plans for the Atherton project.



Russ Donnici, CEM, president of Mechanical Air Service, Inc., San Jose, CA, needed a good seven pages of copy to describe the work he and his team performed as they tackled a tremendous residential comfort project in Atherton, CA. His team consisted of himself, Matt Donnici, vice president of construction, and Scott Larson, vice president of service.

This 13,000 sq. ft. project incorporates many top-notch indoor air quality products, unique installation procedures, extensive system commissioning, and some very stringent owner requirements. *Contracting Business* is therefore pleased to announce that the judges have selected this project as a Quality Home Comfort Award winner in the category of "Retrofit/Renovations of More Than 3,000 sq. ft."

The residence contains four bedrooms, six bathrooms, kitchen, office, family room, maids' quarters, swimming pool, and two cabanas.

STRINGENT REQUIREMENTS

The owner — who chose to remain anonymous — had decided to remodel the home and its mechanical systems after buying it, due to his concerns over the home's indoor air quality.

No internal fiberglass or materials containing formaldehyde could be used in the project.

Among the mechanical system requirements:

- All ducting had to be stored with the ends sealed to prevent contamination of the materials prior to installation
- All installed materials had to be bagged and sealed at the end of each day to prevent contamination
- As many energy saving components that could be installed without structural modifications would be considered
- The highest quality air filtration system was essential.

AIR QUALITY EXPERIENCE HELPED

Mechanical Air Service — a second-generation mechanical contracting company founded in 1977 — was referred to the project by one of its vendors. The vendor was aware of Mechanical's access to excellent IAQ services, through its association with Mechanical's sister company, Indoor Air Diagnostics, which specializes in finding remedies for indoor air quality problems.

"Once the owner's consulting group realized that IAD was our sister company, they decided to retain Mechanical Air Service to do the mechanical engineering, IAQ specifications, and produce a set of engineered drawings," says Donnici.

IAQ TO THE MAX

Mechanical Air Service's filtration system design included high-efficiency pleated filters, 85% rated bag filters, and 99% rated HEPA final filters, all of the highest filtering strength.

"These are not what our industry calls 'home'

This 13,000 sq. ft. residence presented Mechanical Air Service, Inc. with a virtual home comfort legacy project.



PHOTOS BY TIM RYAN, CLEVELAND, OH.

HEPA filters," says Matt Donnici. "These were commercial grade, clean room-quality HEPA filters. The system had to have the ability to filter out VOCs from the air stream."

The home also had to remain under a positive air pressure at all times, and be extremely quiet, designed to meet an NC 20-25 sound rating.

The home comfort system features six dedicated Greenheck BSQ main supply air fans rated at 3.0-in. static pressure, to handle the pressure drop created by the pre-filters, bag filters, VOC filters, cooling coil, HEPA final filter, 18 reheat coils and the duct system.

A dedicated Bryant FX4ANF air handling system was used for the server room in the home that housed all the AV electronics, plus two high-efficiency Westinghouse 90+ AFUE furnaces in the cabanas.

All filter banks were fitted with Dwyer magnahelic gauges permanently installed, so that the pressure drop across the filters can be monitored at all times.

Mechanical Air Service specified and installed four Purafil PK-18 VOC modules on each air handling system, containing 50%

carbon and 50% potassium permanganate (an inorganic compound used as a deodorizer and disinfectant).

"The Purafil VOC filters have proven to be very effective at reducing VOC levels in the home prior to, and after turn over of the home," says Donnici.

"The HVAC environmental system provides the ultimate in indoor air quality for the owners"

For added protection, each of the six main air handling systems in the home use Ultravation's high-intensity UV light systems to kill mold spores, bacteria, and viruses.

QUIET, EFFICIENT COMFORT

For whisper-quiet sound, the supply air discharge air velocities could not exceed 300-350 fpm, and the return air velocities could not exceed 360-420 fpm.

The condensing units are Westinghouse FS4BF models, utilizing R-410A refrigerant, which provide up to 16 SEER efficiency in a two-speed operation.

"This allowed us to stage the cooling based on the actual need in the home," Donnici explains.



Mechanical Air Service's Atherton, CA project required maximum air filtration, to match its high-quality furnishings.

by Terry McIver, Senior Editor



Russ's son Matt Donnici, right, vice president of Mechanical Air Service, Inc., served as the controls engineer. Scott Larson served as project manager.



Westinghouse 16 SEER condensing units positioned on the rooftop. Two-speed operation stages the cooling based on need.

FIVE STAGES OF BOILER CAPACITY

The home had an existing Raypak H-330 boiler with a capacity of 274,000 Btu output. Donnici added two, 2-stage Raypak H3-242 models, each with a capacity of 204,000 Btu output, to design

an “on-demand” style of heat.

“For energy conservation measures, we have five stages of boiler capacity, so the system can bring on only as much heating capacity as needed,” he explains.

“The two-speed, high-efficiency air conditioning units and the five steps of boiler control have contributed to significant energy savings.”

Donnici programmed an outdoor temperature reset schedule into the system, to modulate the hot water loop temperature based on outside air temperature.

A Bell & Gossett P4 80 gpm main pump uses a low-speed motor for low noise, and is mounted on a concrete seismic isolation pad. Donnici had to make some modifications there as well, to be able to hold two 100 gallon water heaters above it. Each hot water reheat coil is equipped with fully-modulating, two- or three-way zone valves by Johnson Controls, to provide only as much heat is necessary.

“This aids in preventing wide temperature swings from the thermostat set point,” says Donnici.

The large master bedroom suite and private office uses a Uponor radiant floor heating system.

“We utilized an Uponor 101 panel to control the system and modulate the water temperature based on an outdoor reset schedule to save energy,” says Donnici. “The radiant system acts as first stage heat for the three zones comprised of master bedroom, master bath, and private office.”

SPECIAL CONTROL NEEDS

The home’s mechanical system had special control needs, for which Donnici selected a Johnson Controls Metasys system with Internet capabilities. The control system has four custom-fab-

ricated control panels, and each equipment relay has a pilot light and built-in, hands-off-auto switch, which aids in servicing and troubleshooting the system.

PRESSURIZATION TEST BRINGS IMPROVEMENTS

The homeowner insisted that the home be pressurized at all times, to keep unwanted contaminants from entering the home. Crawl and attic spaces also had to be kept at a negative air pressure.

“Since the structure of the home was not going to change, and the original windows and doors were to remain, we needed to know actual leakage rates before any interior demolition or changes were made,” says Matt Donnici.

To pressurize the home, Donnici used an extended capacity, two-fan blower door test station, which identified the total leakage of the structure and many of its leak points.

“The home had a leakage rate of more than 7500 cfm,” reports Donnici. “Our testing helped us develop some specific sealing guidelines required by all trades during the remodel. During construction, we tested the window and door assemblies with our duct blaster, to determine their leakage rates and the required weather stripping and/or sealing needed.”

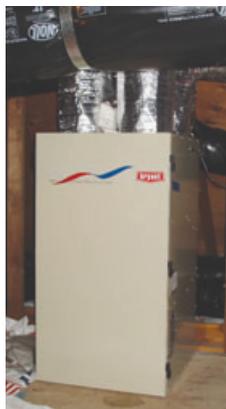
Each of the six main home mechanical systems included a large outside air intake, pre-filter, modulating damper, and hot water reheat coil to preheat the air as needed in winter. This is why the additional boiler capacity was needed

COMMISSIONING INCLUDES LASER PARTICLE COUNTER

Mechanical Air Service followed an extensive commissioning process, including a duct blaster test of all duct systems, balancing of the air and water systems, and a total home pressure test using a blower door assembly.

“We used a laser particle counter to verify the effectiveness of the HEPA filters, and an RAE system PPB hand-held photo ionization detector — capable of measuring VOCs down to 1 part per billion — to test the effectiveness of the Purafil VOC filters,” concludes Larson.

The Atherton project is a stunning example of a contractor’s dedication to excellence under challenging circumstances. It serves as a model of technical accomplishment, and of the successful integration of forced air systems with radiant heating and indoor air quality products. 



Bryant HRVBBLVU heat recovery ventilator.

EQUIPMENT LIST

- ▶ 6 Bryant CE3AA horizontal coils (R-410A refrigerant)
- ▶ 3 Bryant HRVBBLVU heat recovery ventilators
- ▶ 1 Bryant FX4ANF air handler
- ▶ Johnson Controls Metasys system
- ▶ 4 Johnson Controls DX-9100 controllers;
- ▶ 18 Johnson Controls 2- or 3-way modulating reheat valves
- ▶ 6 Greenheck BSQ fans
- ▶ 6 Westinghouse FS4BF rooftop condensing units
- ▶ Dwyer magnehelic gauges
- ▶ Purafil PK-18 VOC modules on each air handling system
- ▶ 6 Ultravation UV lights
- ▶ Mason Industries isolators
- ▶ Bell & Gossett P4 pump w/low speed motor
- ▶ 2 Raypak H3-242 two-stage boilers
- ▶ 1 Uponor 101 radiant floor heating system