



Small Duct High Velocity Heating, Cooling and IAQ Systems

Hi-Velocity Systems Case Study

The Summit House Project - Plastic Systems Inc.

The Summit Public House on Capital Hill in Seattle faced an interesting HVAC challenge: It is a smoker's bar and even the smokers complained that it was too smoky, hot, stuffy, and dusty.

The existing HVAC system consisted of few electric wall heaters and a couple of noisy exhaust fans. All of the refrigeration equipment running behind the bar, and the cooking equipment in the kitchen with little or no air movement, added a large heat gain to the smoky environment. The owner had secured several expensive conventional quotes, but none of them could guarantee improved performance requirements of the ventilation, filtration and smoke removal. The other contractors were also informed that the ceiling of the bar is the first floor of the three stories of condos above, so no rooftop installations of ventilation equipment was possible. Vibration isolation for the ceiling-hung duct and fan coil were another performance requirement.

The bar totals about 1,600 sq ft, split between seating and bar area, and a pool table/gaming area. With a ceiling height of 9 feet, the total area volume is 14,400 cubic feet. A 1.5 to 2 ton unit would have more than met the heat/cool loads, but did not provide enough volume and air movement for smoke removal. We selected the 4-ton HV-100 BU Fan Coil from Energy Saving Products Ltd.

With an open concrete ceiling, exposed duct with drilled outlets was not only the best choice, but also the only choice. The 1,100 cfm of the HV-100 was set up to bring in 100% outside air in the spring, summer and fall, and can be dampered to return 50% in the winter. A passive air intake duct with back draft damper was installed in the wall at the end of the bar where the refer equipment heat gain occurs. When the exhaust fan exceeds the make-up air and the doors and windows are closed, the damper opens to balance the supply to the exhaust.



Exposed Duct with Drilled Outlets



Exposed Duct with Drilled Outlets in Games Room



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For the smoke removal to be effective it would need to address both air collection and exchange. The air being delivered through drilled outlets at the ceiling level created a low pressure zone to draw the smoke upward, and mix it up high where it is collected and exhausted through a ducted fan in the seating area, and a wall fan in the game room. The 2" Ø drilled outlets in the game room average 59.75 cfm, and the bar room averages 47.3. The difference is primarily in the way the duct was run and the number of holes in each length of duct. Measuring all the drilled outlets on high speed totals 1,060 cfm, and 370 cfm on low. With both exhaust fans running on high and the fan coil on 100% outside air, the air is changed in the bar every 6.7 minutes: 14,000 cu. Ft. /2,150 cfm exhaust = 6.7 minutes, or 9 air changes per hour.



HV-100 BU with Sun Pure SP200C

The HV-100 fan coil was hung with vibration isolators on all thread and unistrut suspended from the ceiling. No vibration transmits into the ceiling or the duct, and the system is very quiet. With the system off, the background noise reads 67.9 db, mostly from the refer equipment. With the system on high speed, the average reading is 71.68 db, low speed at 69.26, and this is without the sound attenuating flex.

The Sun Pure SP200C photo catalytic was selected for the MERV 11 filtration of ash, city soot and other air-borne particles. The two 20 watt germicidal lights help eliminate air born pathogens that increase with occupancy, and activate the 72 sq ft of catalyst which oxidizes miscellaneous air born chemicals, carbon monoxide and odors. Combine this filter system with the Hi-Velocity System's ability to move and mix the air, and the system is ideal for this type of application.

In the end, we came in under the conventional quotes and had a very pleased bar owner and landlord. The owner said that within a week business was up 20% just on word of mouth about the improvement. The smoke from an ashtray rises straight up and disappears with the mixed air on its way to be exhausted. One non-smoking customer noted that after sitting at the table for an hour with approximately 20 people smoking, he could not even smell smoke in his fleece jacket when he left. Smoke and ash no longer coat all the surfaces. After 1 1/2 years they still have not added a heat pump to heat and cool because the air movement, mixing and fresh air make-up have kept it comfortable except on the coldest week of last winter.

The Summit House is open evenings and weekends. It makes an excellent drilled outlet showcase job, has great drink selections, and is pleasant enough for non-smokers. For questions or more details call Mike or Bill at Plastic Systems Inc. at 206-860-7970 or e-mail plasticsys@earthlink.net.

Submitted by Mike Schaeffer - Plastic Systems Inc.