

Vertical Stacked Fan Coil Applications – the pitfalls of oversizing

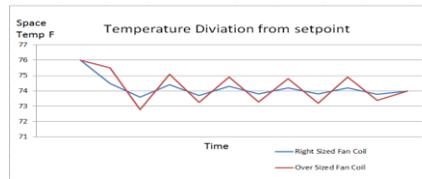
Forward

Stacked fan coils have been widely applied to hotels and condominiums since the 1970's. Decentralized HVAC systems have always been the preferred choice where occupancy is inconsistent or unpredictable to minimize operating cost. Since their introduction, these considerations have become more of a deciding factor where energy costs continue to rise and environmental concerns have increased 10 fold. Right sizing the equipment is critical to meeting comfort expectations and minimizing energy consumption.

Tips to Designing an Efficient and Quiet Stacked Fancoil System

Over sizing any HVAC equipment can lead to many operational problems but oversizing a terminal unit specifically can lead to uncomfortable noise, temperature and humidity conditions, and rob your system of efficiency. In a typical hotel, rooms are often unoccupied during peak loads. Occupancy could be 100% but the guests are not typically in their suites between 10am and 4pm which coincides with the highest HVAC loads. So let's explore the risks with oversizing these units from a comfort and energy standpoint. Temperature, airflow, humidity and sound all affect your guest's experience.

Temperature: oversizing a fan coil can create temperature swings in a suite and lower the delta 't' in your chilled water system. The chart below illustrates the temperature swing of a 600MBH fan coil serving a space load of 450MBH



Humidity: We need to remove a specific number of grains of moisture to maintain humidity and we can't do this if the fan is off. We must maintain our 10F chilled water delta 't' across our coil and slow the fan down to wring the moisture out of the air. Oversizing the fan and cooling coil causes the unit to cycle and eventually we'll lose control of our humidity level. A good relative humidity target is 55% which is easily achievable with a system sized to meet the load with 45EWT, 10F delta 't', 55F supply air temp and fan speed control. The humidity load is primarily from outdoor air so if the ventilation is preconditioned with a DOAS unit, this becomes a non-issue.

Airflow: excess air flow creates two problems; the first being drafts. Our body skin surface temperature is around 92F. We feel cold drafts or heat waves when the difference between air and skin exceeds 30F and the velocity exceeds 50FPM. The air temperature off a cooling coil is typically 55F – 57F so if we're overflowing the system, we're likely to create drafts with a higher than 50FPM air velocity.

Noise: The second problem with excess airflow. The more air we delivery, the higher the sound power level of the fan which means higher radiated and discharge noise. The easiest way to minimize noise is to not oversize your fan.

Energy Consumption: Every piece of equipment has a "best operating point" (BOP) from an efficiency standpoint and we have

the ability to hit those points with today's variable speed equipment. However, over-sized equipment typically prevents this from happening. For example, if our control valve is oversized, we'll lose control of the space temperature by not having sufficient valve authority. If the fan is over-sized, it could operate in an in-efficient or unstable point on the curve and/or short cycle.

Over Sized Equipment Cost

More: over-sized fan coils have larger coils, larger fans, larger risers and take up more space all of which add unnecessary cost to a project. The over-sized fan coil capacity means larger pumps, chillers and boilers as well. Lighting and plug loads have come down with higher efficiency appliances and LED lighting and building envelopes have improved so we must take these reductions into account. Right sizing your HVAC equipment is your best defense against excessive energy consumption and occupant discomfort.

Summary: right sizing your terminal units will lead to right sizing the HVAC system which will provide the most efficient, quiet and comfortable design. Oversizing terminal units can lead to excessive noise, thermal discomfort, and higher operating and maintenance cost.