Proposal

Office VRF System with Acoustical and Electrical Breadths

Alec T. Canter

Proposed Alternative

The alternative being proposed herein, a variable refrigerant flow system serves only as an alternate to the current system and in no way is to represent a better or more correct design for the medical office building. The system will be studied as a viable option throughout the semester and evaluated as being a plausible or not option for design.

Mechanical Depth

The variable refrigerant flow system (sometimes referred to as variable refrigerant volume, VRV) is a system that was found to be a worthwhile study when evaluating several options for the Oklahoma University Children's MOB. VRF technology is not a cutting edge system; it has been popular in China, Japan, and parts of Europe for several decades, but until recently it was not popular among the HVAC industry within the United States.

The important factors that caused this system to take precedence for the Medical Office Building are as follows:

- system high efficiency,
- increased controllability,
- possibility of simultaneous heating and cooling,
- a comparably small footprint, and
- possible decreases energy consumption and emissions

It is important to note however that the cause for the small footprint is partially due to less ductwork or none at all. Essentially, VRF systems do not need ducting and the only purpose for ducted air would be to supply adequate outdoor air ventilation. Since the building in question is an office building with medical intentions, reducing ductwork must be done carefully and appropriately so as not to induce an unhealthy environment. Additionally ASHRAE has set standards for amounts of refrigerant used in enclosed quarters and within significant rooms, such as patient rooms.

Typically, most hospitals and healthcare designated buildings have spaces, which require one hundred percent outdoor air. This is to mitigate stagnate air, improve patient comfort levels, and most importantly mitigate the spread of airborne illness. Therefore, in designing the VRF system it is of utmost concern to keep rooms, which are deemed sensitive to stale air connected to a supply of air that meets its minimum outdoor air requirement. The VRF system design will be similar to the diagram below with multiple outdoor condensing units each serving a multitude of spaces.

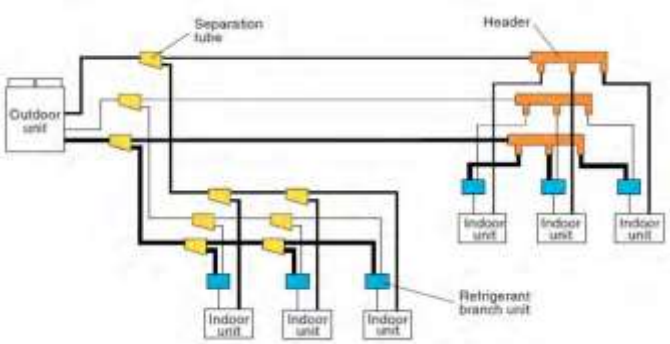

Figure 6: Typical Layout of a VRF System (taken from ASHRAE)

Acoustics Breadth

The changes proposed above to incorporate VRF boxes into each space should reduce the sound created by air handling units in the mechanical spaces and each of the individual occupied spaces. This is mainly due the absence of the originally required VAV boxes, which were designed to serve individual spaces and zones. It is reported that indoor units for VRF systems operate at sound levels as low as 27 dB and 29 dB when they are connected to supply air duct work.

Spaces will be studied to find if the airborne noise generated by the VRF system are comparable to the existing system. If they prove to be significantly higher than the existing sound power levels redesign of the air supply and indoor equipment will need to take place. The sound power level of two systems will be compared through the noise criteria rating and that which is standard for the type of room. Redesign would consist of implement sound reducing equipment such as duct silencers, Z-walls for mechanical rooms, or ever relocation of VRF indoor evaporator units. In this analysis acoustical properties of building materials and mechanical equipment will be evaluated using applicable American National Standards Institute standards, basic architectural acoustics calculations, ASHRAE acoustics guidelines, and Excel.

Electrical Breadth

With the implementation of different mechanical equipment and the exchange of others, it will be important to investigate whether the existing electrical distribution equipment is adequate for the new VRF equipment. Electrical equipment such as conductors, circuit boards, and conduit are going to need to be sized according to their characteristic load amps, horsepower, and voltage. Motor starters will be sized for any mechanical equipment such as pumps and fans applicable to the VRF system design. The National Electric Code will be utilized for all of the sizing and calculations.