Application Note 2033:
CFM/CFMR Supply Air Delivery Best Practices

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Introduction

This application note is to serve as a guide to applying the DOAS systems correctly to a VRF design.

What the DOAS system provides

VRF systems utilize a linear expansion valve (LEV) at each indoor fan coil to precisely meter the amount of R410a refrigerant delivered to each terminal unit in each zone. On a multi-zone VRF system, the compressor(s) located in the centralized outdoor unit system speeds up or down to accommodate varying loads in the occupied spaces.

One consequence of this underlying VRF operational strategy is that the discharge air from fan coils is variable; supply air temperature varies inversely with loading for cooling and supply air temperature varies in a directly proportional way with loading for heating. In cooling, supply air temperatures may range from around 50F to 65F; in heating, supply air temperatures may range from around 90F to over 115F*. Since the system continually adjusts to meet the required cooling/heating load for each space and since part-load compressor efficiency is superior to full load efficiency, VRF systems operate with a reduced energy input as compared to their single speed scroll compressor based counterparts.

Mitsubishi's CFM/CFMR systems are the culmination of VRF technology mixed with dedicated outdoor air systems (DOAS) in an effort to provide mechanical ventilation in a more efficient way. Unlike other VRF fan coils whose primary purpose is occupant comfort in providing cooling/heating to satisfy zone loads, the primary function of CFM/CFMR units is occupant safety since they are being used to meet the ventilation requirements of prevailing mechanical code, which is based primarily on International Mechanical Code (IMC) or ASHRAE 62.1 (varies by state).

Potential Design Issue

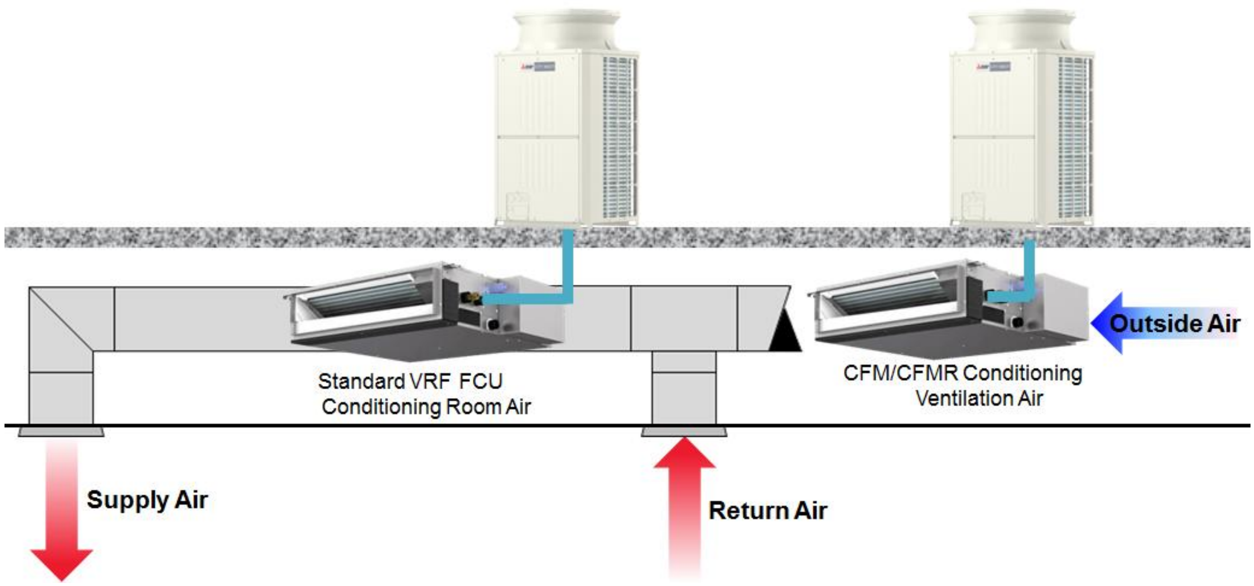
While standard VRF fan coils control to room temperature, Mitsubishi's CFM/CFMR product line has supply air temperature control capabilities, however, it is important to note that the stability of supply air may vary more significantly than it would from a hydronic system as the DX based VRF condensing unit is continually working to meet load while maximizing efficiency. The compressor is relatively slow to react so as to conserve energy, and while a quicker reaction would yield more stable supply air temperatures, the energy penalty to do so outweighs the occupant comfort benefit of more consistent supply air.

As a result, it is recommended that design professionals duct the CFM/CFMR conditioned ventilation air to the back of the other VRF fan coils on the project rather than introducing this air directly to the occupied space. If the air must be ducted directly to the occupied space due to architectural or other constraints, it would be best to introduce the air in a location where it isn't going to impact occupant comfort, such as hallways, corridors, or near the return of the other VRF fan coils.

Design Example

Figure 1 below shows one possible method to maximize the benefit of CFM/CFMR systems when designing them for use with VRF cooling/heating systems. This is not the only acceptable method of design, but rather a recommended method of mechanical design should architectural constraints allow for direct coupling of ventilation air with the cooling and heating system.

Figure 1:



**Supply air temperatures may vary outside of the stated range; temperature ranges were given for example purposes only and are intended to represent normal operation of a properly designed VRF system.*