VRF ASHRAE 15 In Restricted Volume Spaces

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Such as hotel rooms, dormitories, supportive housing, and similer spaces.

Case Study on a Supportive Housing Project

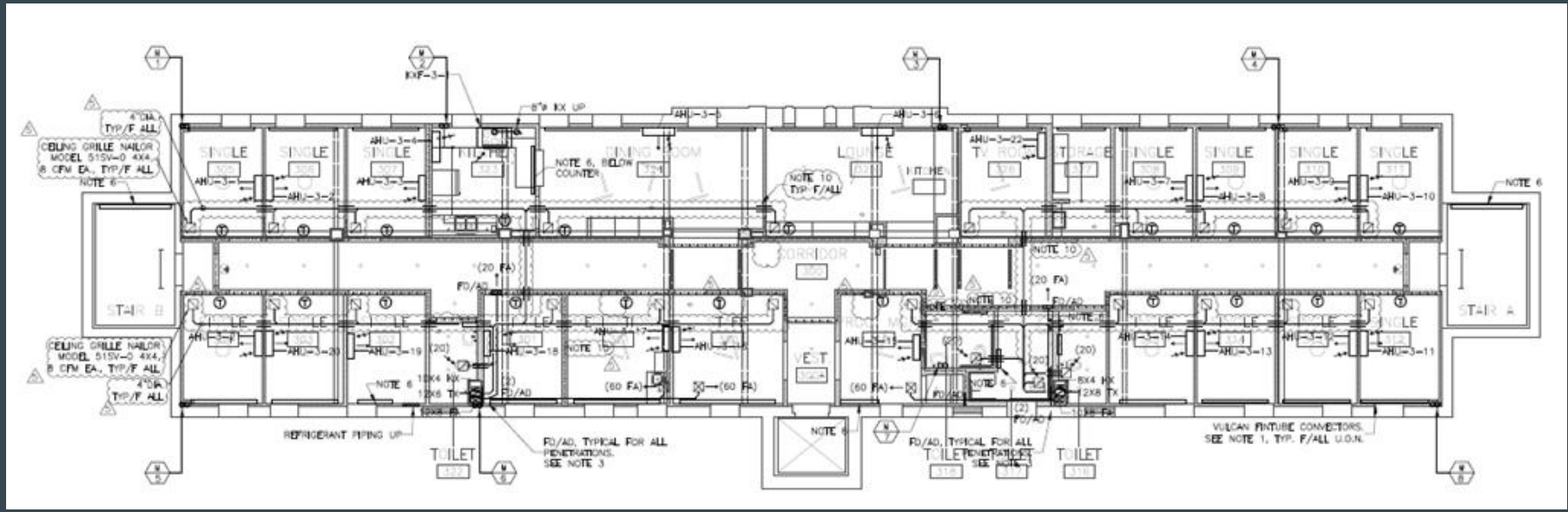
This case study is of the 3rd floor of 101 Tompkins Avenue Staten Island, a supportive housing facility. The sleeping rooms are small, approximately 90-100 square feet with an 8’-6” ceiling height.

A Mitsubishi PUHY-P192TSKMU-A Condensing Unit was used, serving 22 Mitsubishi Wall Mounted PKFY-P units.

System is charged with approximately 74.6 lbs of R410A.

The smallest room has an area of 93 ft^2 and a volume of 800 ft^3 and the Minimum Applied Volume (MAV) requirement for this facility is 7500 ft^3.

Mechanical Floor Plan of 101 Tompkins 3rd Floor



Problem Statement

Meet the NYS standard of no more than 10 lbs/mCF of R410A. The national standard ASHRAE 15 requires no more than 26 lbs/mCF. The ASHRAE requirement is significantly more lenient than NYS standard.

The smallest room was measured at 800 ft^3

Meet all standards including ASHRAE 15, 34, and 62.2.

The MAV was found to be approximately 7,500 ft^3

Possible Solutions

Ducted distribution to connect all spaces acting as a permanent opening to increase the Total Volume (MAV) per ASHRAE 15 & NYS. This particular building includes a ducted Energy Recovery Ventilator (ERV), effectively providing permanent openings and increasing the MAV to complaint levels.

ERV unit using outdoor air to displace and dilute possible leaks. At this time no standard, code nor Authority Having Jurisdiction (AHJ) recognizes this method as a means to dilute refrigerant concentrations.

Refrigerant Leak Detection System (RLDS) with Solenoid Valves on branch refrigerant lines serving the leaking circuit. At this time no standard, code nor Authority Having Jurisdiction (AHJ) recognizes this method as a means to dilute refrigerant concentrations.

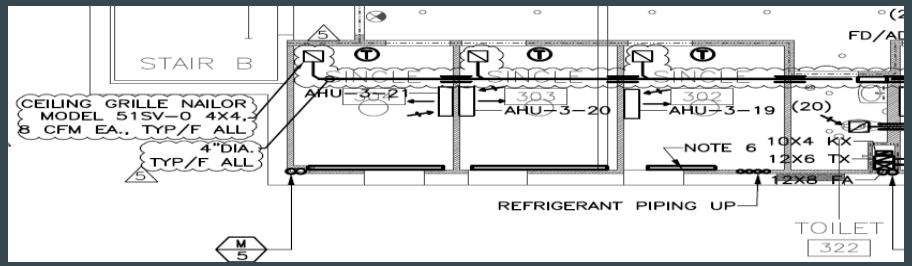
Ducted Network

The ducted network constitutes permanent openings by increasing the total volume (MAV) through connected rooms.

Connected Volume 23,063 ft^3 .

Satisfies ASHRAE 15, where the charge of refrigerant will expand through permanent openings (ducts).

Satisfies Fire codes through use of Fire dampers or extended sleeved ducts.

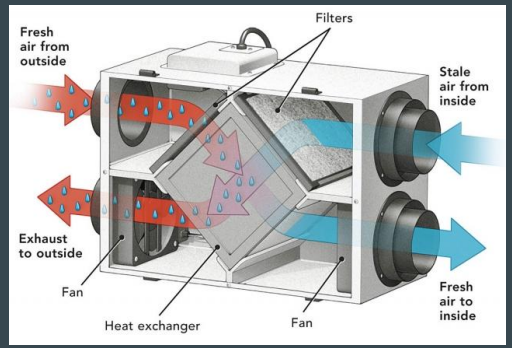


Energy Recovery Ventilator with Cascade Ventilation

ERV cools and dehumidifies incoming air in cooling season and preheats and humidifies incoming air in the heating season.

Allows the project to meet ASHRAE 62.2 standard for ventilation.

Serves as an additional safety measure if refrigerant were to leak by dilution. Does not count for ASHRAE 15



Total of 300 CFM required for Tompkins 3rd floor (ASHRAE).

Continuous 20 CFM each bathroom (4)

Continuous 25 CFM in the kitchen (1)

Each living space Exhaust 9.2 CFM (21). Air is supplied in common areas and exhausted out of sleeping rooms (the supplied outdoor air moves from room to room and is ‘Cascade Ventilation’).

Refrigerant Leak Detection System

Bacharach Multizone gas leak monitor:

- Depending on the type of detector, there are different ways to detect the refrigerant with varying types of precision.
- Some methods include diffusion based photoacoustic infrared technology and non-dispersive infrared technology.
- Detection of refrigerant can be set as low as 1 ppm to 1000 ppm .
- Multiple detectors can be connected to a single monitoring unit.
- Monitors 16 zones expandable up to 48 zones.
- Pricing starts at $8,095 for a 16 zone unit with a remote monitor.
- Monitor can be integrated into any BMS/BAS.

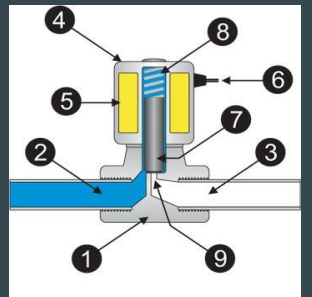
Solenoid Valves with Refrigerant Detection System

Solenoid valves are able to shut off the flow of a fluid, in this case the refrigerant.

Working in conjunction with a Refrigerant Detection system, it is possible to shut off refrigerant flow to areas where a leak has been detected.

This would only be needed in rooms/spaces that do not meet MAV (minimum applied volume). Only Refrigerant circuits to this type of space would be fitted with this system.

Total refrigerant volume that could then leak into the restricted space is limited to the volume that is inside of the indoor unit and the refrigerant lines.



HVAC High Performance

Given today's Energy Codes, Passive House standards and the interest in Energy Conservation most buildings are becoming high performance both in the envelope performance and in the mechanical systems design. Such buildings already have ERV's to mitigate the extremely low levels of infiltration. The ERVis used maintain acceptable indoor air quality (IAQ).

ERV systems usually have heat exchange efficiencies between 70-80% in heating, somewhat lower in cooling. (1)

VRF Cassette units eliminate duct leakage, which are about 10-20% of total airflow in ducted system. (2)

VRF have high part-load efficiency (IEER) 18.9 / 19.1 allowing for high seasonal energy efficiency since HVAC systems typically operate within 40% to 80% maximum capacity. All electric systems use an advantageous electrical rate. (3)

Conclusion

Creating permanent openings between rooms is currently the only single solution that will satisfy ASHRAE 15.

In a High Performance building an ERV will already be present, so those ducts will serve as permanent openings to satisfy ASHRAE 15. This is the only known method to satisfy ASHRAE 15 in low volume spaces at this time.

A Refrigerant leak detection system along with mechanical ventilation is viable to satisfy ASHRAE 15 requirements only in mechanical rooms.

Citations

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