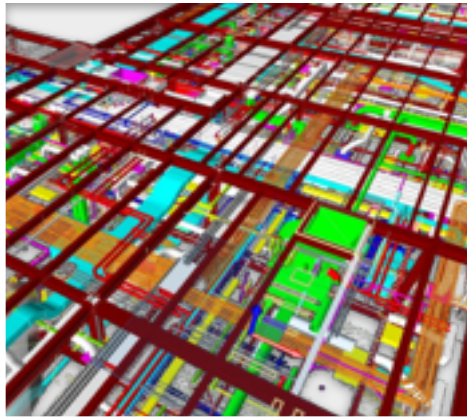
# PMI PREMIER MECHANICAL INC.




## Construction

## Fabrication

## Service


# VRF vs Heat Pump
# Chicago VRF Design & Installation Considerations

# Presentation Overview

- Premier Mechanical Background
- VRF Project Resume
- 2211 N Milwaukee Case Study
- Design Considerations for VRF
- Installation Considerations for VRF

# Company History

- Founded in 1994
- MEP BIM 400 & 500 Levels
- Drawing in 3D Since 1998
- 2 In-House PE's
- Markets
  - High Rise, Tenant Buildout, Health Care, Laboratory, Design Build, Education, Industrial

- VRF Condensers
- Boiler & Chillers Serving Chilled Beams

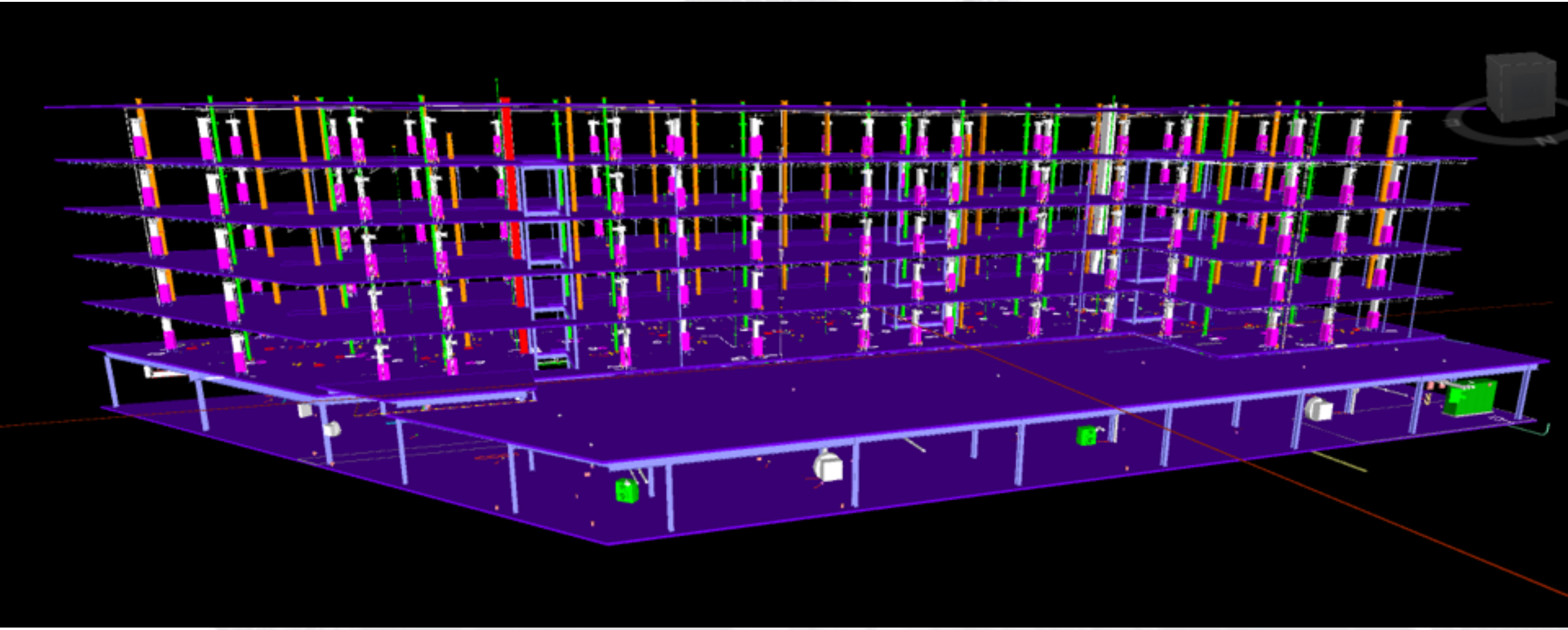
# VRF Resume

- First VRF Job 2008
- Certified Installers Of:
  - 5 VRF Manufacturers
- Over 1000 Tons of VRF
- Over 700 VRF Evaporators

# VRF Projects

| Project | Market | VRF Type |
|---|---|---|
| Illinois Valley Community College | Institutional | Geothermal Water Source Heat Pump VRF System |
| Autumn Green Animal Hospital | Commercial | Design Build - Geothermal Water Source Heat Pump VRF |
| VA Hospital North Chicago Bldg 4 | Hospital | Air Cooled VRF |
| O'Plaine Middle School - Gurnee IL | School | Air Cooled VRF |
| RML Hospital | Hospital | Air Cooled VRF |
| Thornton Fractional North High School | School | Air Cooled VRF |
| Thornton Technical Academy | School | Air Cooled VRF |
| Deerfield Public Library | Institutional | Air Cooled VRF |
| 2211 North Milwaukee | Residential | Air Cooled VRF |

# 2211 North Milwaukee Ave Case Study



## Air Cooled VRF Heat Pump Vs. Water Cooled Heat Pump

# 2211 North Milwaukee Ave Case Study

## Air Cooled VRF Heat Pump Vs. Water Cooled Heat Pump

| Building Summary | VRF Design Summary |
|---|---|
| 6 Story Apartment Building | 2 MAU Gas Fired, 10,000CFM Each |
| 1st Floor Parking & Commercial | 16 VRF Condensing Units |
| 2nd - 6th Apartments | 160 Vertical VRF Evaporators |
| 144,000 Sq Ft | 16 Horizontal Ducted VRF Evaporators in Common Areas on 1st Floor |
| 120 Apartments | 17 Zones |

# 2211 North Milwaukee - Upfront Cost Analysis

| Cost Breakdown | Air Cooled VRF | Vertical Stacked HPs |
|---|---|---|
| Equipment | $543,000.00 | $615,000.00 |
| Ventilation | $400,000.00 | $400,000.00 |
| Temperature Controls | $103,000.00 | $65,000.00 |
| Piping Material | $88,000.00 | $175,000.00 |
| Piping Labor | $383,000.00 | $407,000.00 |
| Cost/SqFt | $13.95/SqFt | $14.96/SqFt |
| Total Cost | $2,010,000.00 | $2,155,000.00 |

# 2211 North Milwaukee Ave - Electrical Amp Comparison

| Floor | Air Cooled VRF HP | Water Cooled HP |
|---|---|---|
| 2nd Floor | 52.1 | 303 |
| 3rd Floor | 52.1 | 303 |
| 4th Floor | 52.1 | 303 |
| 5th Floor | 52.1 | 303 |
| 6th Floor | 52.1 | 303 |
| Mechanical Equipment | 826.5 | 200 |
| Total Amps | 1087 | 1715 |

36.6% Decrease in AMP Requirements

# VRF Design Considerations from a Contractors' Prospective

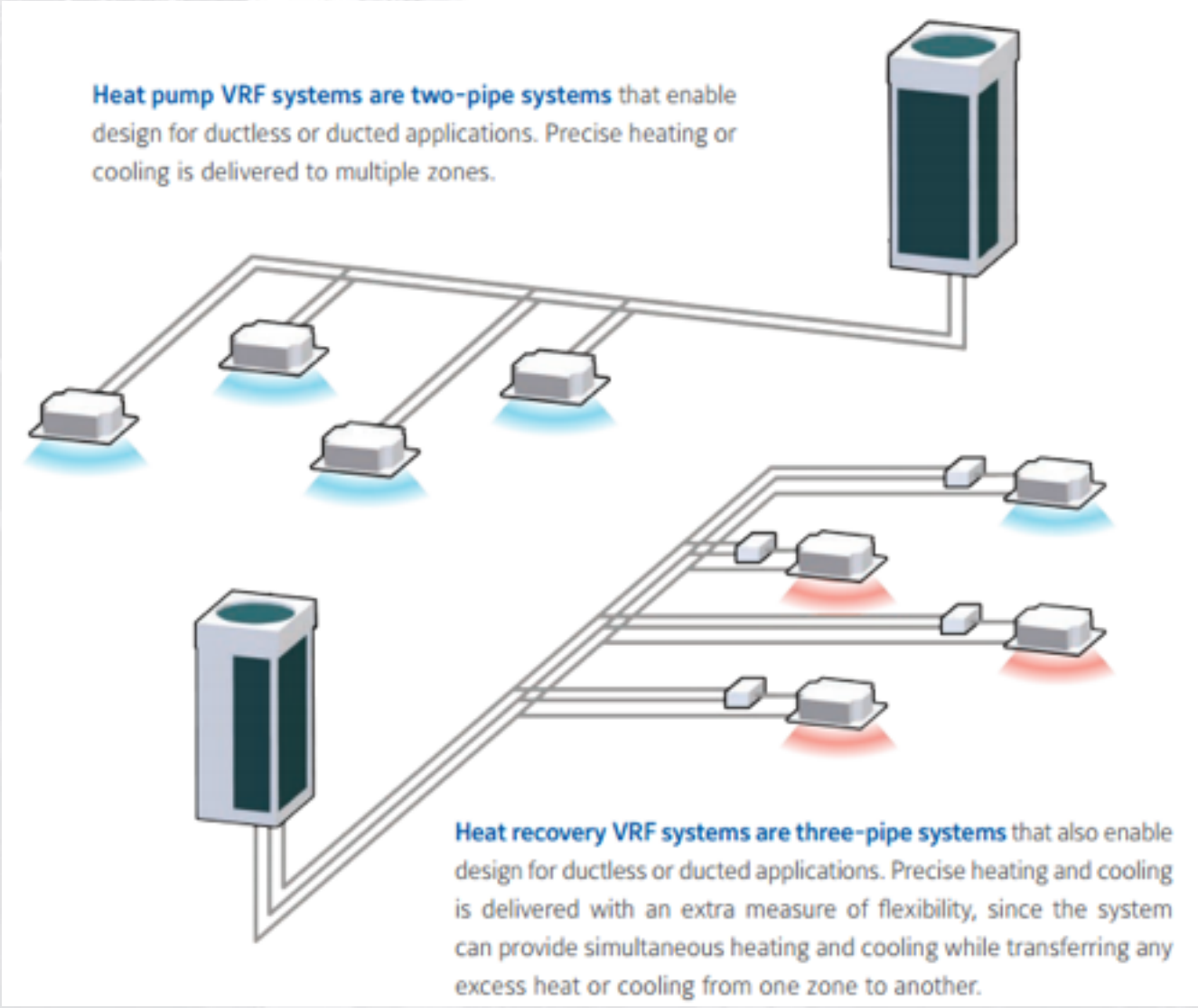
- Heat Pump or Heat Recovery
- Low Ambient
- High Rise
- Temperature Controls
- Intelligent Zoning
- Code Issues

VRF Wall Mounted Evaporator

# VRF Heat Pump VS Heat Recovery

## VRF Heat Pump
- Lower First Cost
- Single Mode Operation

## VRF Heat Recovery
- Higher First Cost
- Simultaneous Heat & Cool



# Low Ambient

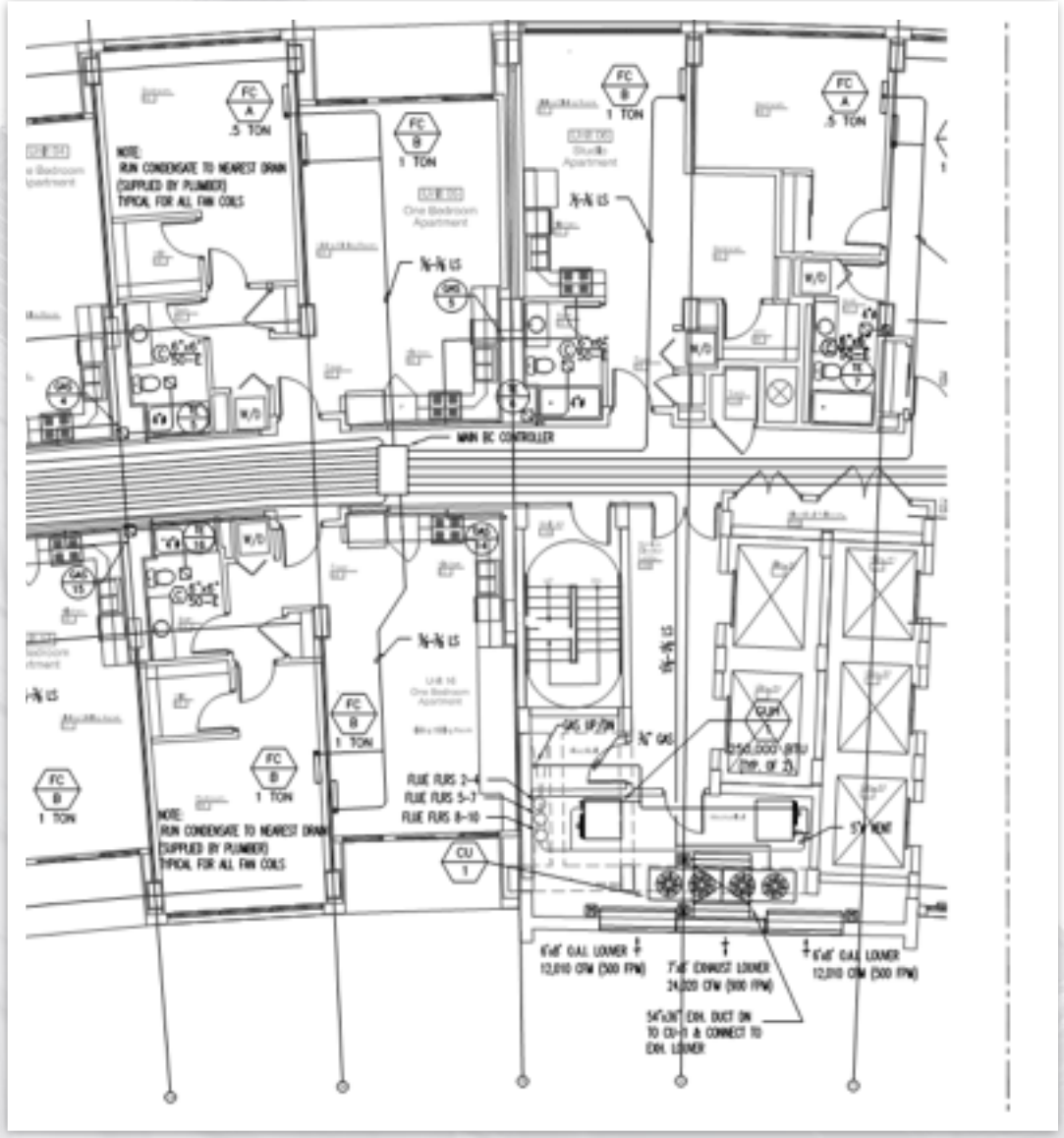
- Heating Capacity on VRF
  - MAU (Discharge Air Reset)
  - Supplemental Heat
  - Water Cooled/Geothermal VRF
  - Sizing of VRF Condensing Unit
  - Condensing Unit Location

VRF Air Cooled Ducted Condensing Unit

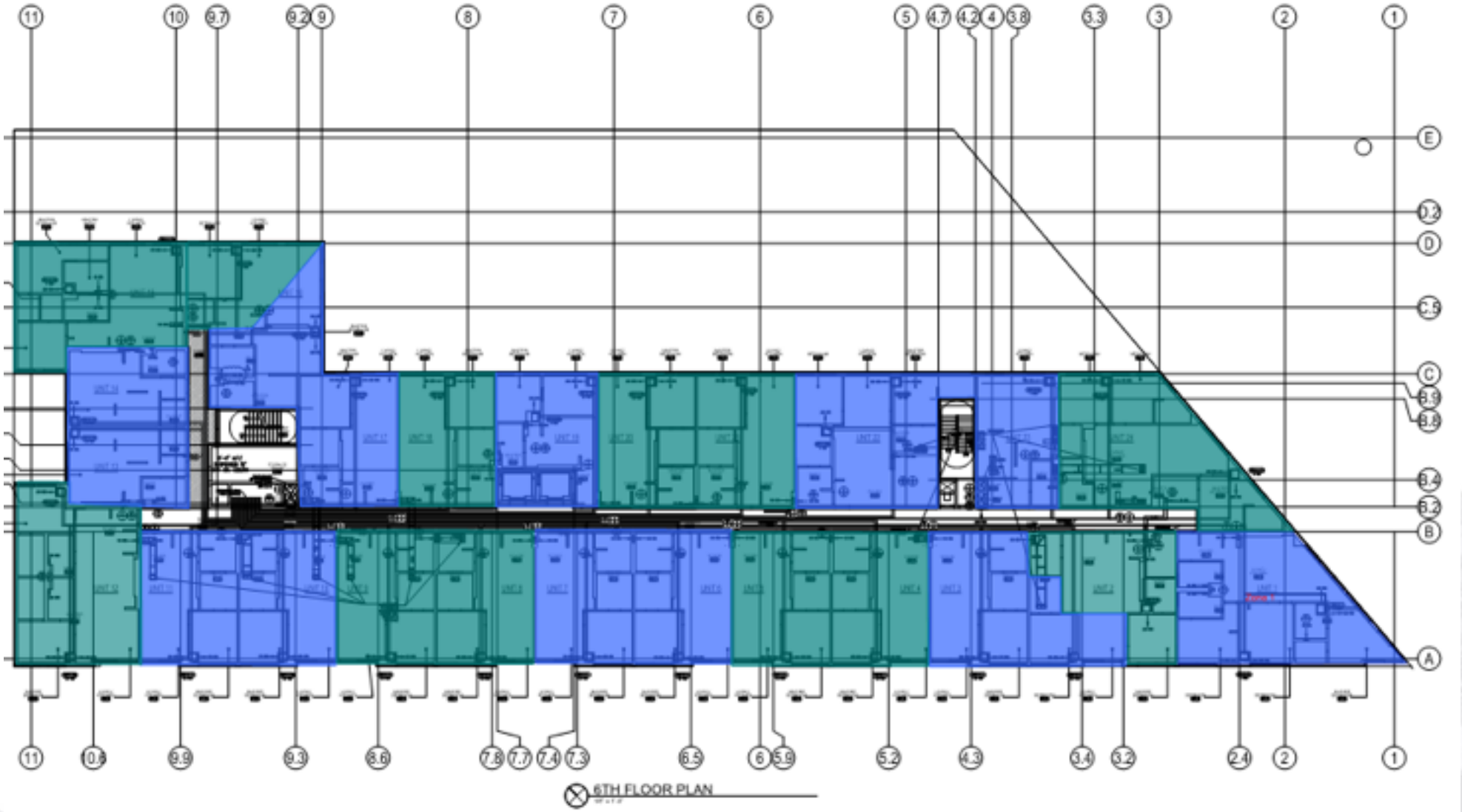
- Maintenance Access
- Use of Existing Gas Unit Heaters

# High Rise Considerations

- Building Height
- Manufacturer Line Length
- Refrigerant Codes
- Air Cooled
  - 10 Story Range
- Mech. Equipment Space



# Temperature Controls & Intelligent Zoning

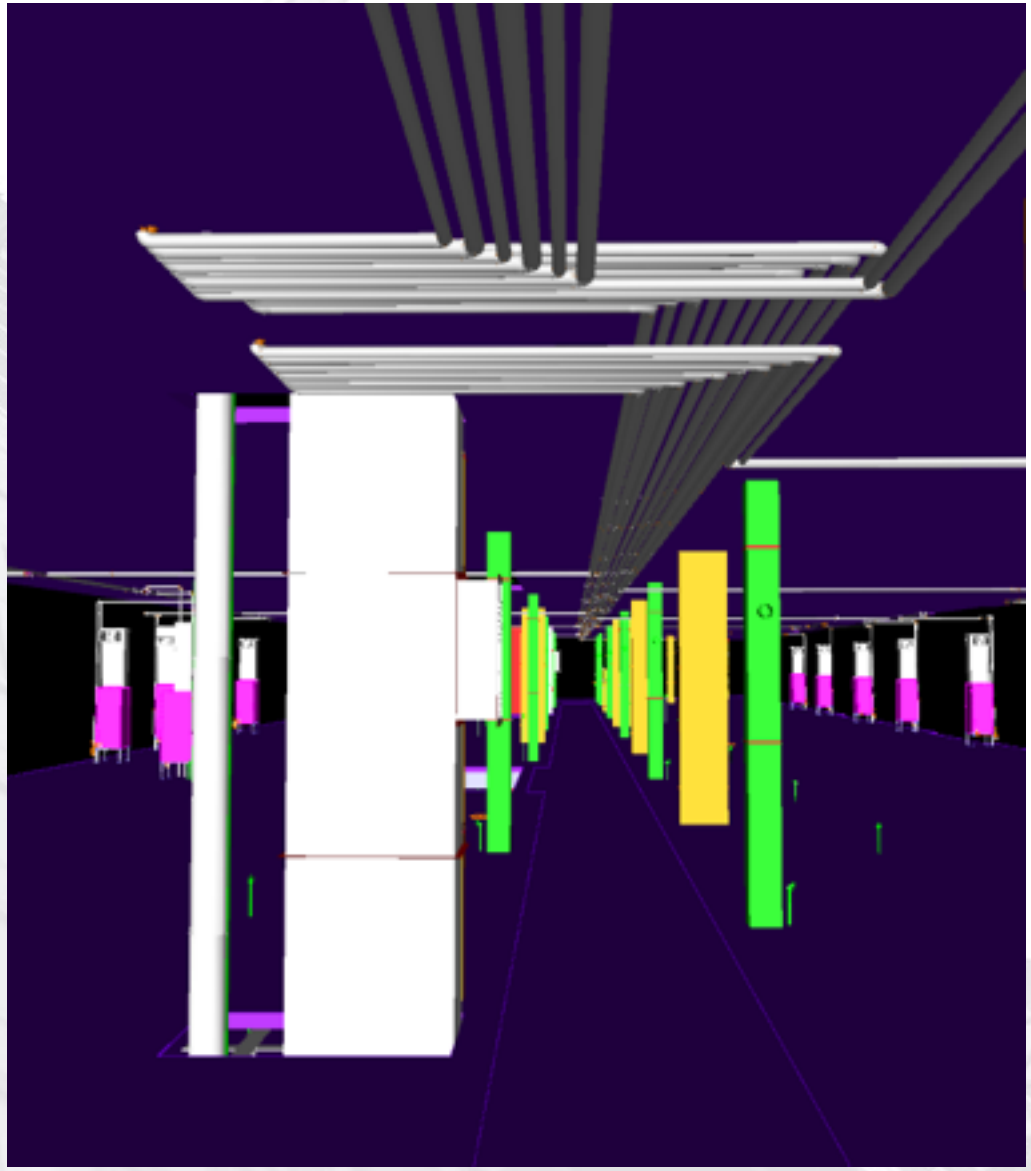


# VRF Code Issues

- City of Chicago Code - No Flared or Mechanical Connections
- City of Chicago Code - Firemen's Dump Valve Circuits Exceeding 100#
- City of Chicago Code - Relief Valves Required Greater than 30#
- ASHRAE 15 - Maximum Refrigerant 26lbs/1000ft3 (R410a)

# VRF Installation Considerations

- Certified Installers
- Hard Pipe vs Line Set
- Manufacturer Practices
- Flaring
- VRF Component Protection



2211 N Milwaukee - BIM Model

# Manufacturer Certified Installers

- VRF is Not a Residential Split System
- Certification
  - Installation
  - Commissioning
  - Service
- Manufacturers Participation
  - Before Install, During Install, Startup

Examples of Poor Installations

# Hard Pipe vs Line Set

Line Set Considerations:

- Kinking of Smaller Diameter
- Less Joints
- More Hangers

Hard Pipe Considerations:

- Increased Insulation Cost
- Cleaner Install

Insulation Considerations:

- EPDM Insulation Required
  - VRF Operating Temps
- Vapor Barriers
  - Pipe Hangers

# Varying Manufacturer Requirements

Commissioning
- Pressure Testing
  - Pressure & Duration
- Evacuation
  - Double or Triple Pull-Down
  - Micron Level & Duration

Control Wiring
- Shielded vs Non-Shielded Cable

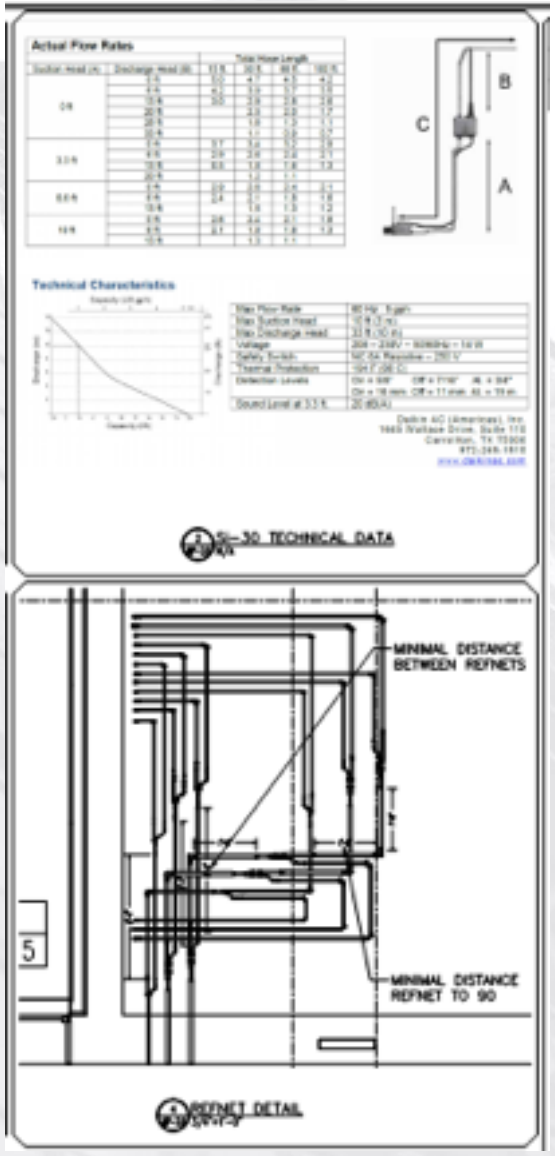
Service/Isolation Valve

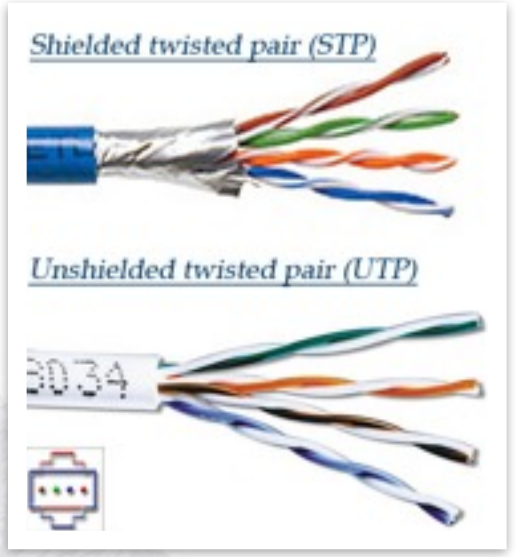
Refrigerant Tees
- Manufacturer or Field Provided
- Inlet/Outlet Distance Restrictions

Line Lengths

2 & 3 Pipe Layout

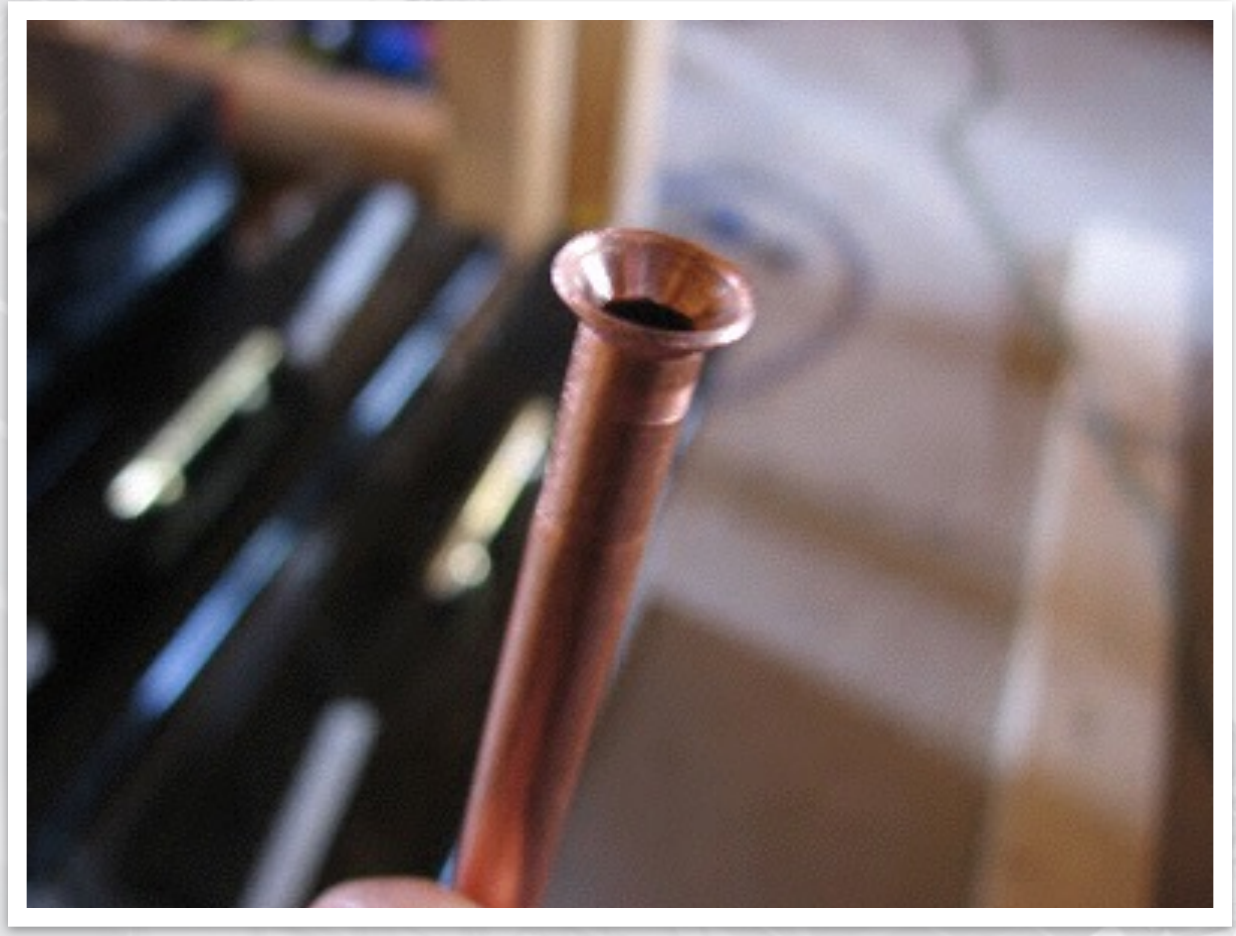
Others?



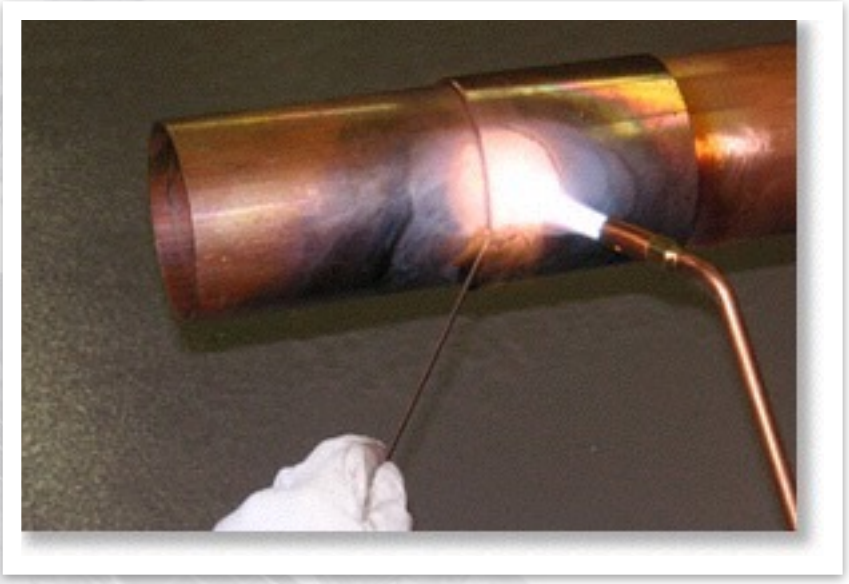
# Flaring

- R410a vs R22 Flare
- Chicago Code



# VRF Component Protection

- Nitrogen Purge
- Heat Protection



# Summary

Evaluate Building Heights
- 10 to 12 Stories
- Mechanical Space Locations

Design Considerations
- Condenser Location
- Intelligent Zoning

Installation Considerations
- Certified Installers
- Manufacturer Variations

PMI PREMIER MECHANICAL INC.

# Questions?

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