

# AMK HVAC Systems Training

## Module 1: HVAC Fundamentals Topics

- Thermal Comfort
- Basic Air Conditioning Systems
- System Loops
- Zoning
- Psychrometric Chart Overview

Managing Comfort Challenges

<b>Air Speed</b>	<ul style="list-style-type: none"><li>• High velocities from duct exits can cause comfort disturbances</li></ul>
<b>Eliminate Drafts</b>	<ul style="list-style-type: none"><li>• Draft velocities and radiant asymmetry effects cause comfort problems. Vestibules, weather-stripping, and insulation will help.</li></ul>
<b>Vertical Temperatures &amp; Air Stratification</b>	<ul style="list-style-type: none"><li>• Warm air is buoyant and will rise. Temperature differences between the floor and to the occupant head level need to be within 5°F. Supply and return ductwork placement can help control Stratification.</li></ul>
<b>Floor Temperatures</b>	<ul style="list-style-type: none"><li>• Floor temperatures must be controlled between 66°F and 84°F for occupants wearing shoes. The lower limit can be challenging to achieve in colder climates.</li></ul>
<b>Radiant Effects</b>	<ul style="list-style-type: none"><li>• A poorly insulated wall or ceiling can cause radiant panels to be overly hot or cool. This will cause comfort problems with heat radiating to the panel or heat radiating from the occupant. Limit the degree of variation of a ceiling to no more than 9°F.</li></ul>

Source: AMK

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# AMK HVAC Systems Training

## Module 2: Systems Selection Topics

- Collecting project input, including building use, budgets, and schedule, and project delivery type
- Understand Design Criteria That Affect System Selection Priorities
- Evaluating the trade-offs of different system choices
  - Preference of Owner – Own vs. Lease
  - Installed vs. Operational Cost
  - Size and Shape of Building
  - Schedule
  - Comfort and Noise
  - Codes - Energy Codes, Ventilation Codes
  - System Complexity
  - LEED Certification

### ASHRAE 62.1 and 90.1 Requirements

#### For Manufacturing Offices

##### 1. ASHRAE 62.1 – Ventilation

- Outdoor intake location (rooftop unit) located distant from source of contaminant (restroom exhaust fan and vent pipe)
- MERV 6 filters used upstream of wetted cooling coil
- Final design will need to verify outdoor intake airflow per multi-zone re-circulating systems calculations
- Minimum exhaust rates required for contaminant sources (restrooms)



Slide Courtesy: Carrier

##### 2. ASHRAE 90.1 – Energy

- Minimum equipment efficiency must meet Table 6.8.1A (10.1 EER)
- Most energy requirements apply when equipment selections being made, not at system selection

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10

# AMK HVAC Systems Training

## Module 3: Airside Systems Topics

- System Type Overview
- Comfort Control
  - Space Load Temperature Control
  - Humidity, Part Load Control
- VAV Systems
- Changeover/Bypass Zoning Systems

### Constant Air Volume Systems

- Most basic AHU system
- Used for CV reheat and CV Single Zone applications
- Equipment likely to be small rooftops (DX cooling), split systems, large fan coil units (sometimes called Blower coils), and small chilled water air handling units

**Pros**

- Simplicity
- Ease of installation & service
- Low first cost

**Cons**

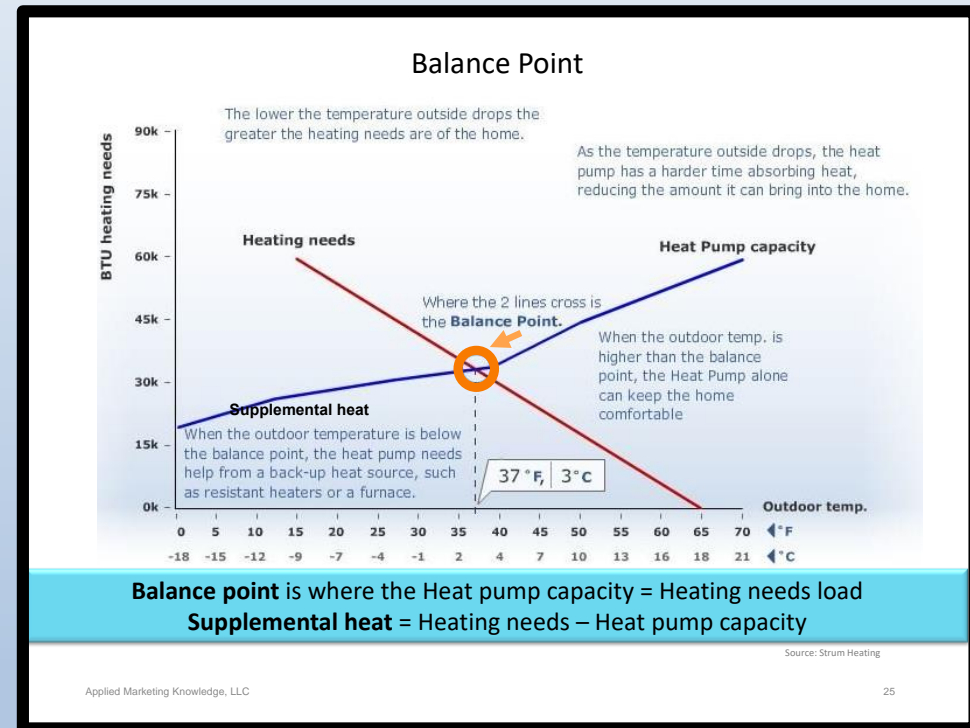
- Higher energy usage
- Single point of control

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# AMK HVAC Systems Training

## Module 4: Heat Pump Systems Topics

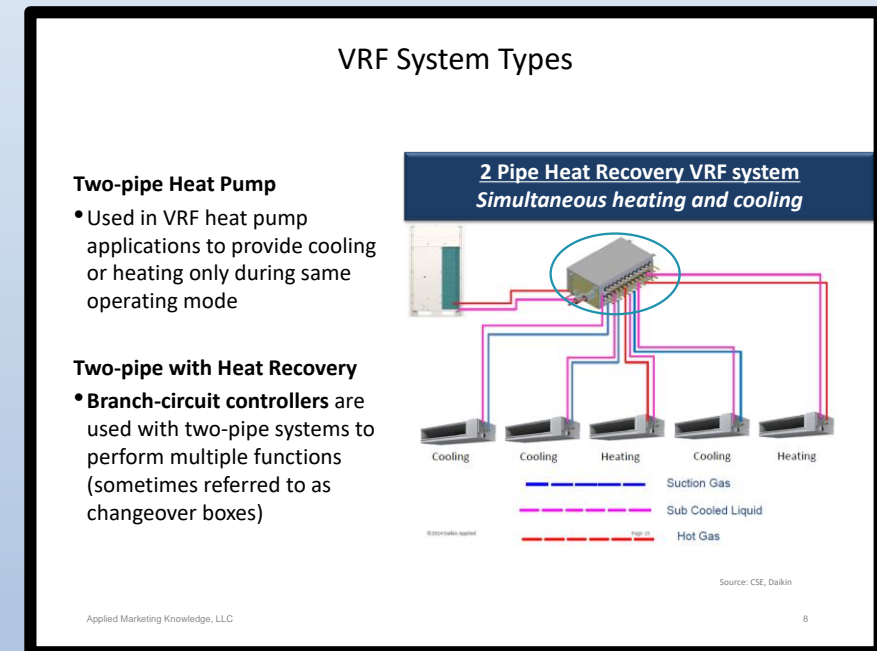
- Heat Pump Basics
  - Overview, What and Where
  - Heat Pump Advantages
  - Life Cycle Economic Examples
- Air Source Heat Pumps
  - Air Source Heat Pump Components & Cycles
  - Air Source Heat Pump Efficiency & Sizing
- Water Source Heat Pumps (WSHP)
  - Closed Loop and Open Loop Systems
  - Heat Transfer Modes & System Layout
  - WSHP Advantages
- Geothermal Heat Pumps
  - Geothermal HP System Designs
  - Geothermal HP Components
  - Water to Water HP Efficiency



# AMK HVAC Systems Training

## Module 5: Variable Refrigerant Flow Systems Topics

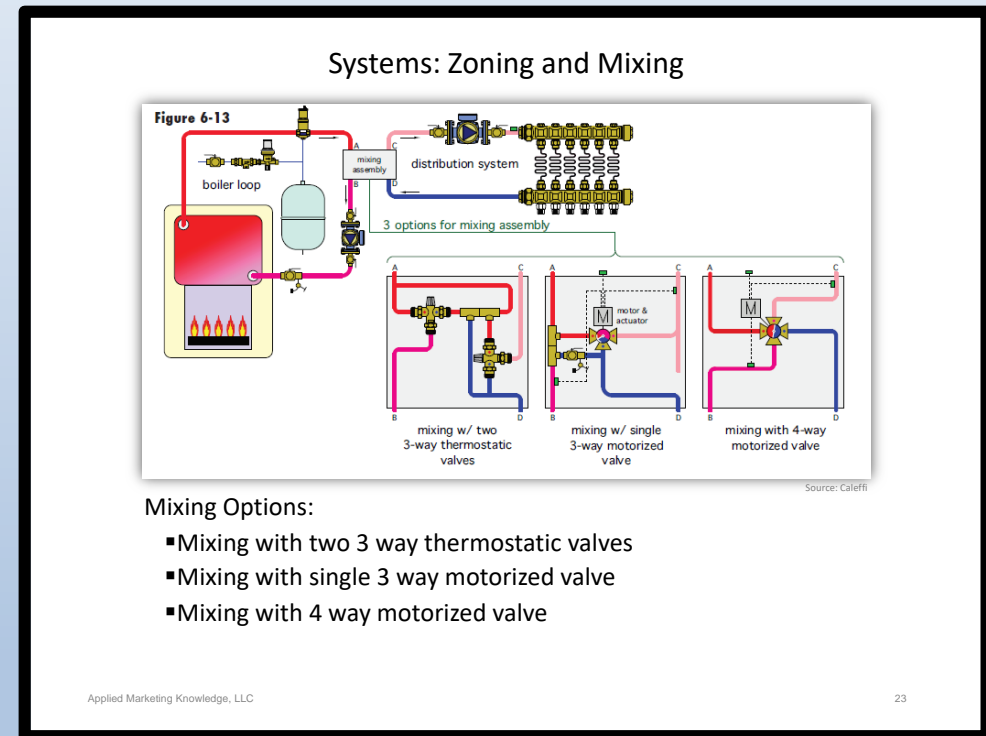
- VRF Technology, How it Works
- VRF Advantages & Opportunities
- VRF Components
- Design & System Layout
- Summary



# AMK HVAC Systems Training

## Module 6: Hot Water & Hydronic Systems Topics

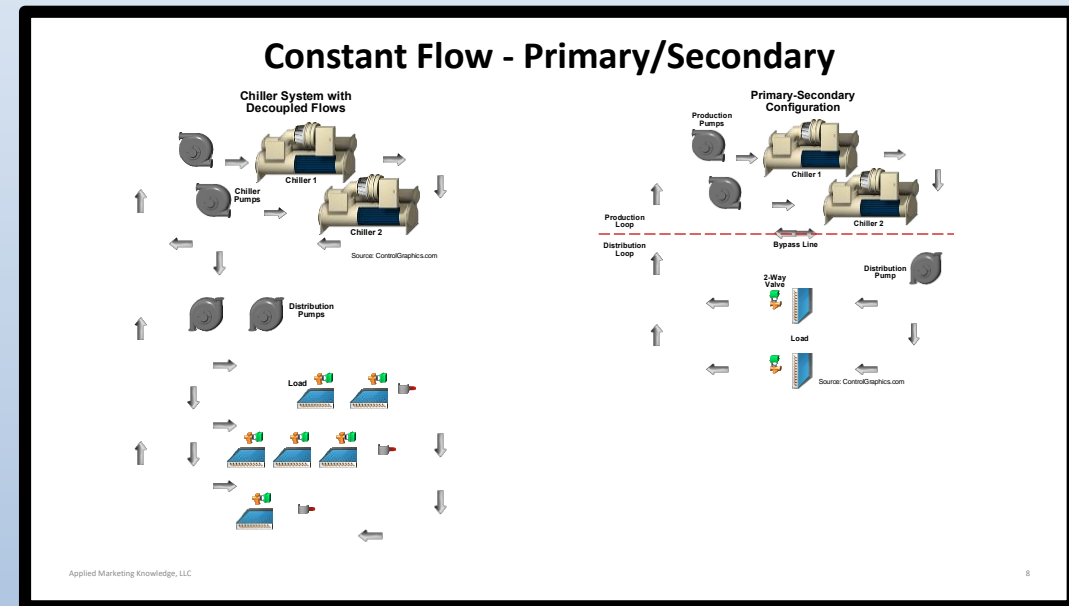
- Heat Transfer
- Hydronic Heat Sources, Heat Emitters
- System Approaches
  - Temperature Designs
  - Zoning and Mixing
  - Controls
  - Distribution Piping Design
  - Circulators, Pumps
  - Air expansion and air elimination
  - Benefits
- Radiant Systems Overview



# AMK HVAC Systems Training

## Module 7: Chilled & Condensing Water Systems Topics

- Chiller Equipment
  - Air Cooled
  - Water Cooled
  - Absorption Chiller
- Chiller Components
  - Evaporator, Condenser, Compressor, EXV
- Chiller Application Design Fundamentals
- Chiller Piping and Loop Design
  - Constant & Variable Flow,
  - Primary/Secondary Design
- Chiller System Variations
- Chiller Plant Optimization and Control

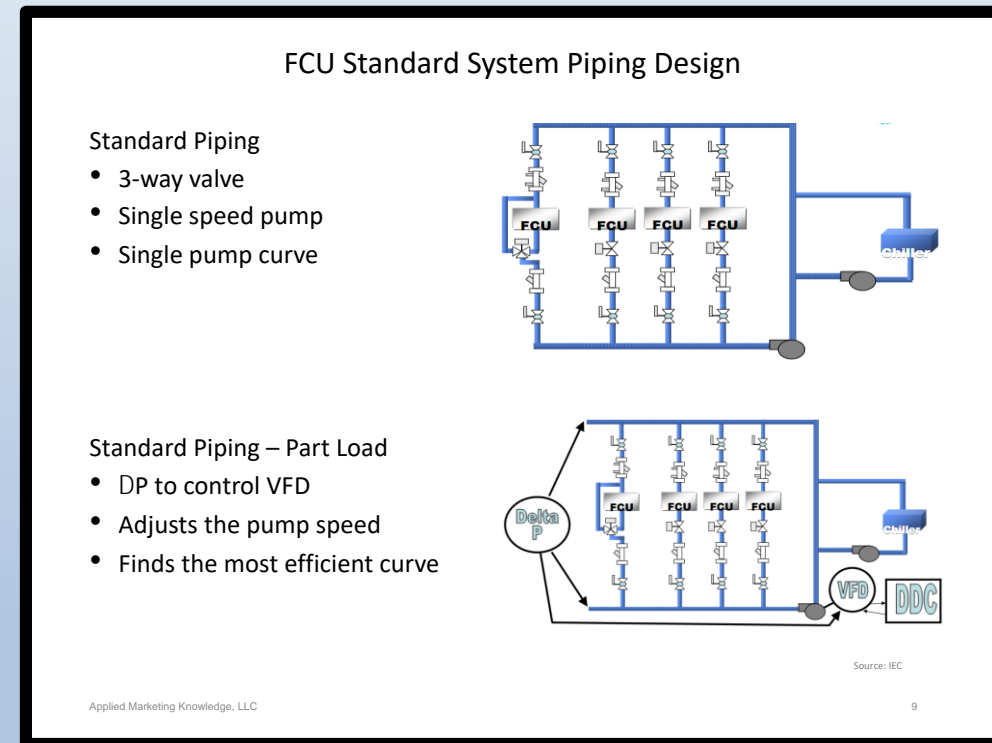


# AMK HVAC Systems Training

## Module 8: Chilled Water Terminal Units

### Topics

- Fan Coils
  - Features and Design Options
  - Standard Piping Design
  - On Demand Piping Design
  - Integrated Piping System
- Chilled Beams
  - Types of Chilled Beams
  - Operational Overview
  - Piping and System Layout





# AMK HVAC Systems Training

## Module 9: Automatic Temperature Controls Systems Topics

- Control Action Fundamentals
- DDC Components & System Architectures
- Unit Controller Examples, Specific Applications
- Building Automation Technology
- Control Points Classification & Engineering Design

