Unlocking the Potential of Hybrid VRF Systems

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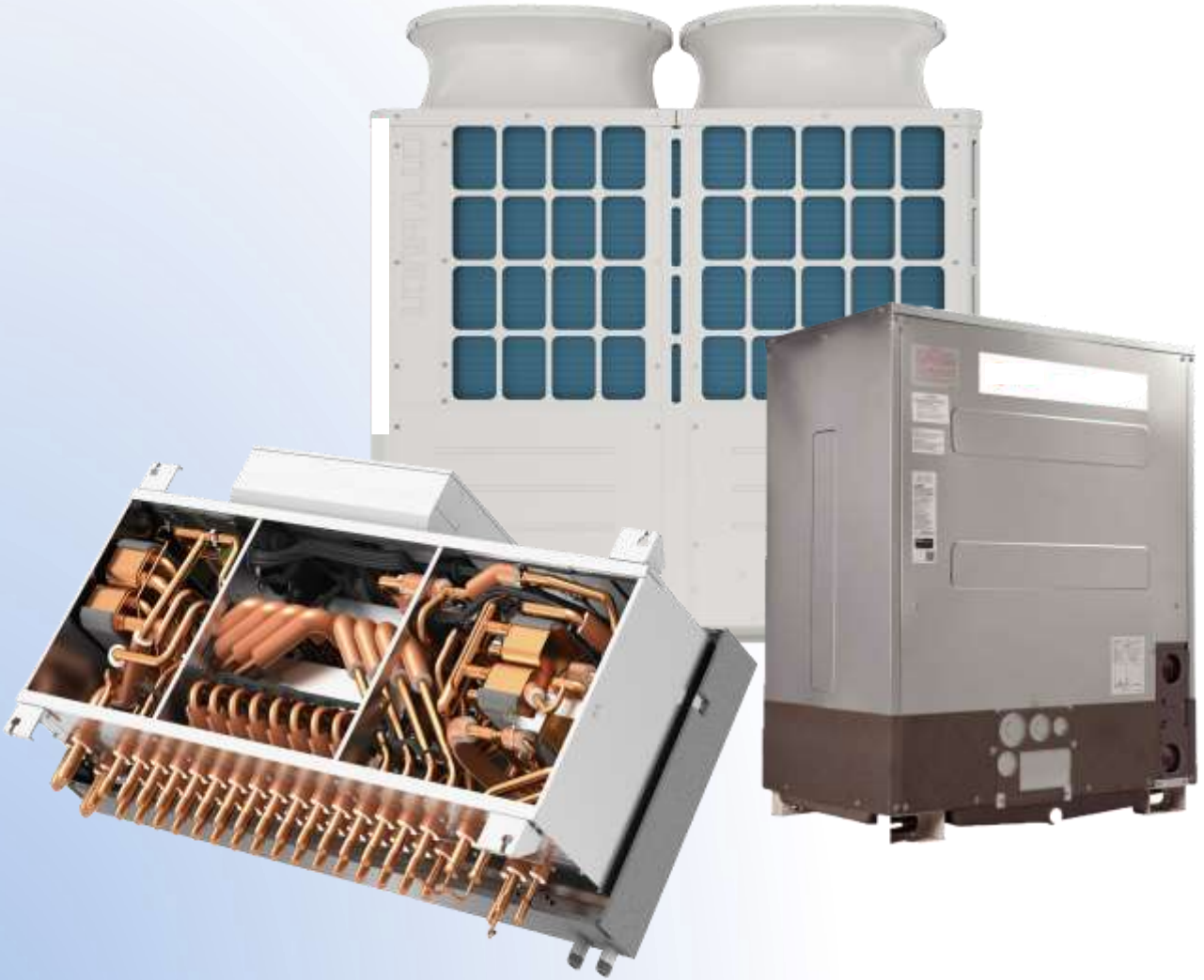


Agenda

Hybrid Variable Refrigerant Flow System (HVRF)

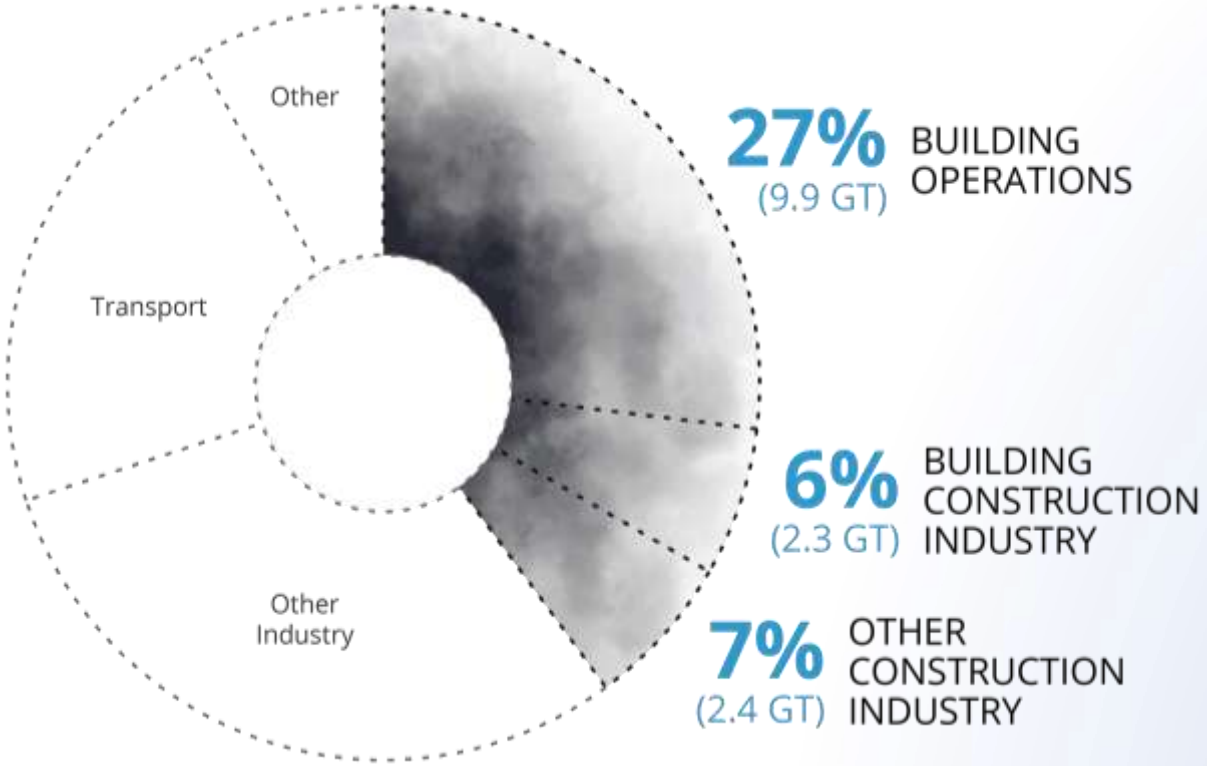
- WHY HVRF
- PRODUCT OVERVIEW
- HVRF FEATURES
- DESIGN CONSIDERATIONS
- ACCESSORIES

Why HVRF?

Changes for the Better Are Coming to Our Industry

- HFC phasedown per American Innovation & Manufacturing (AIM) Act
- US transitioning to lower global warming potential (GWP) products
- Electrification of heat, eliminating on-site fossil fuel burning
- Arid regions eliminating evaporative cooling

Why Focus on the Built Environment?



- The built environment is one of the largest contributors to GHG emissions generating 40% of annual global CO_2 emissions

- Estimated annual impact is 14.6 gigatons (GT)

Sources: https://architecture2030.org/why-the-building-sector/
Table of 100% Clean Energy States by Clean Energy States Alliance

We CAN Reduce Emissions

Electrification could decrease fossil fuel GHG emissions in the U.S. by 41% below 2005 levels by 2050—even without policies to decarbonize the grid

Applying highly-efficient product tiers reduces emissions further

Sources: Table of 100% Clean Energy States by Clean Energy States Alliance
Database of State Incentives for Renewables and Efficiency

Industry Drivers for United States

HOW DOES HVRF FIT IN THE UNITED STATES?

- Updates to ASHRAE® 15 / 34 & UL 60355-2-40 Safety Standard
- International Mechanical Code 2018
- R-410A Refrigerant Phase Out
- Hotel Standards for VRF Systems

ASHRAE® 15 / 34 Considerations

HVRF CAN HELP WITH EASIER ASHRAE COMPLIANCE.

Refrigerant reduction in the overall system

Less refrigerant lines allows for easier design

Water lines eliminate the need for refrigerant leak detection

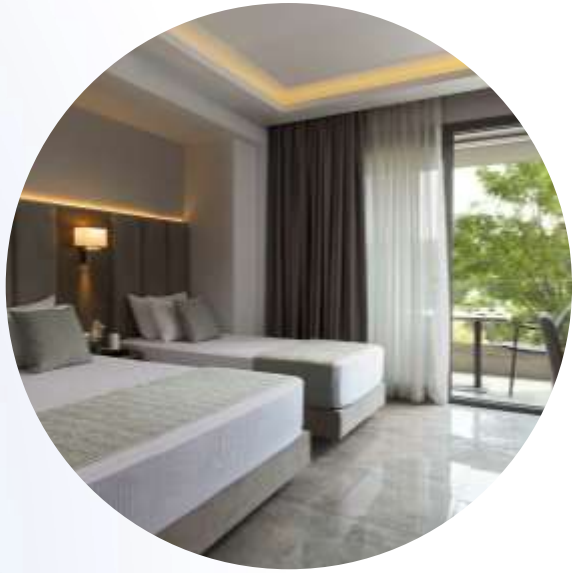
ASHRAE® 15
Outlines when refrigerant leak detection monitors are required

ASHRAE® 34
Classifies refrigerants and determines concentration limits

Sources: ANSI/AHSRAE Standard 15-2022 and Standard 34-2022. ASHRAE Refrigeration Resources.
2018 International Mechanical Code (IMC). 2018 1107.2. Piping Location

Potential Applications

WHAT COMMERCIAL APPLICATIONS DOES HVRF BEST SUIT?

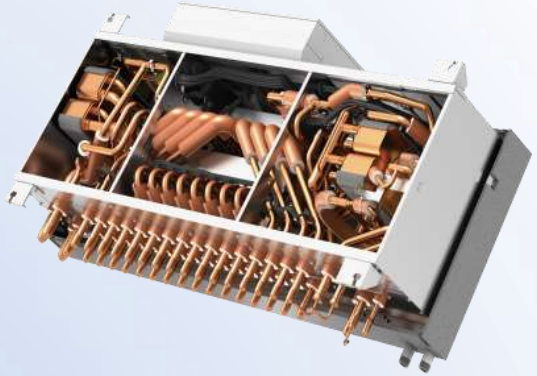


Product Overview

Primary HVRF Components

WHAT KEY PARTS COMPRISE AN HVRF SYSTEM?

Outdoor Units



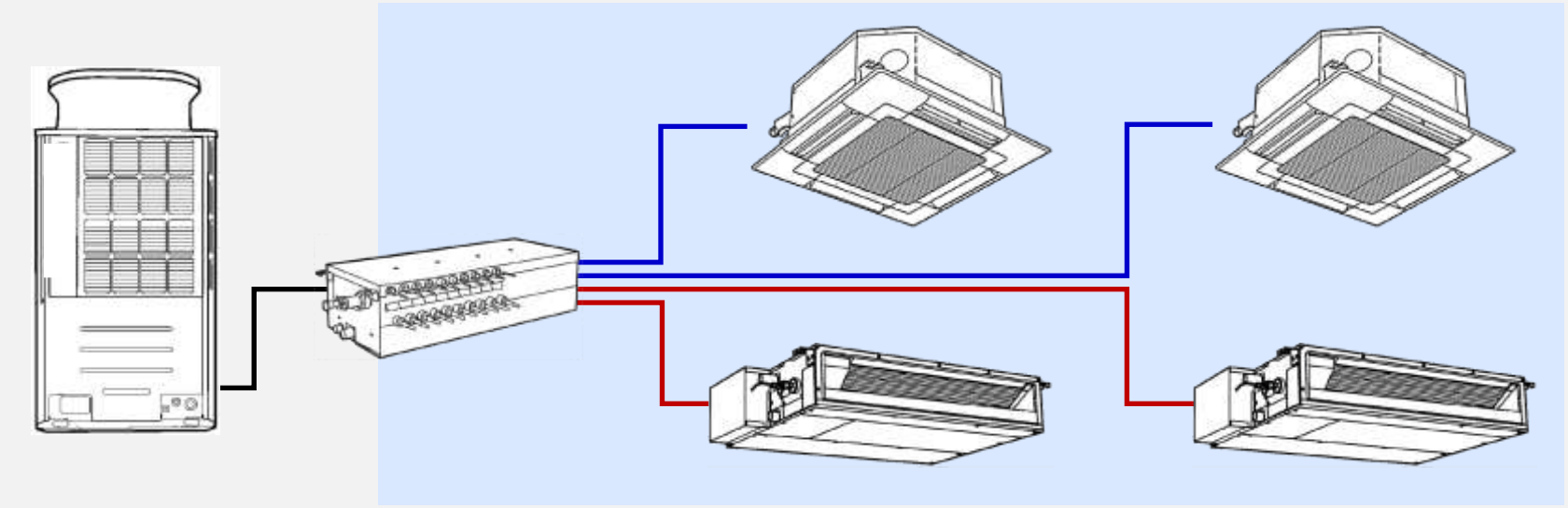
Hybrid Branch Controller

Hydronic Indoor Units

Controls

HYBRID VRF is a Simultaneous System

Developed for use in the UK initially, Hybrid BC Controllers utilize refrigerant-water heat exchangers to supply variable chilled or hot water flow to hybrid indoor units

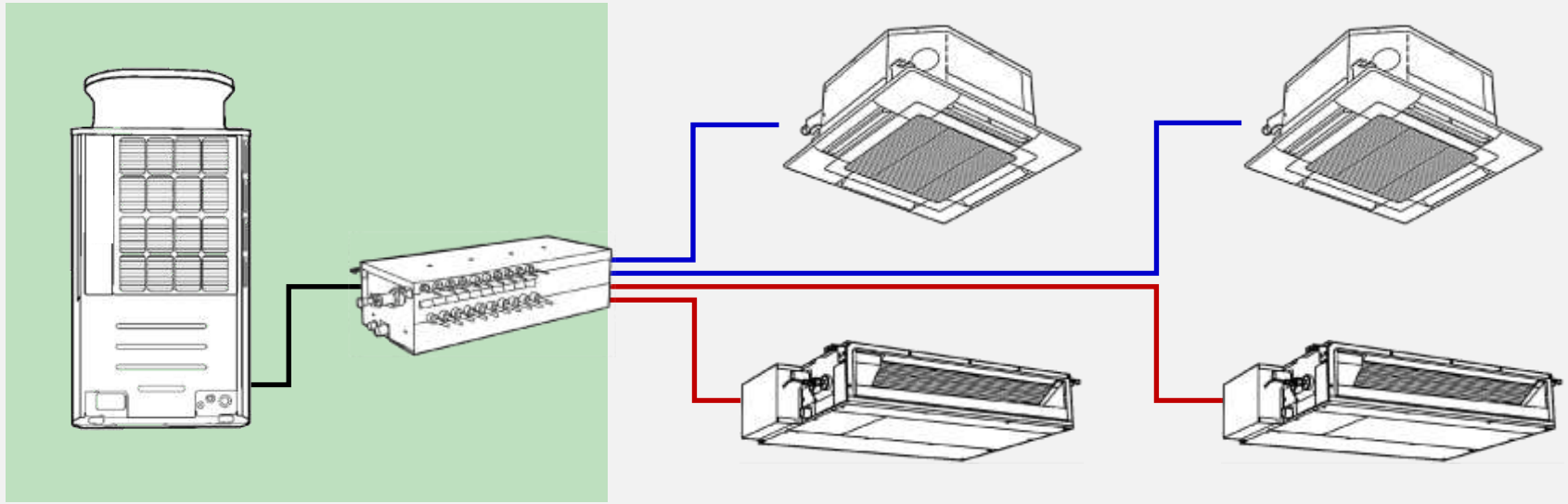


LESS REFRIGERANT

HYBRID VRF BC CONTROLLER
HYDRONIC PIPING
HYBRID VRF INDOOR UNITS

HYBRID VRF is Tomorrow’s Solution, Here Today

- All the benefits of traditional VRF System, plus:
- Up to 30% reduction to system refrigerant amount

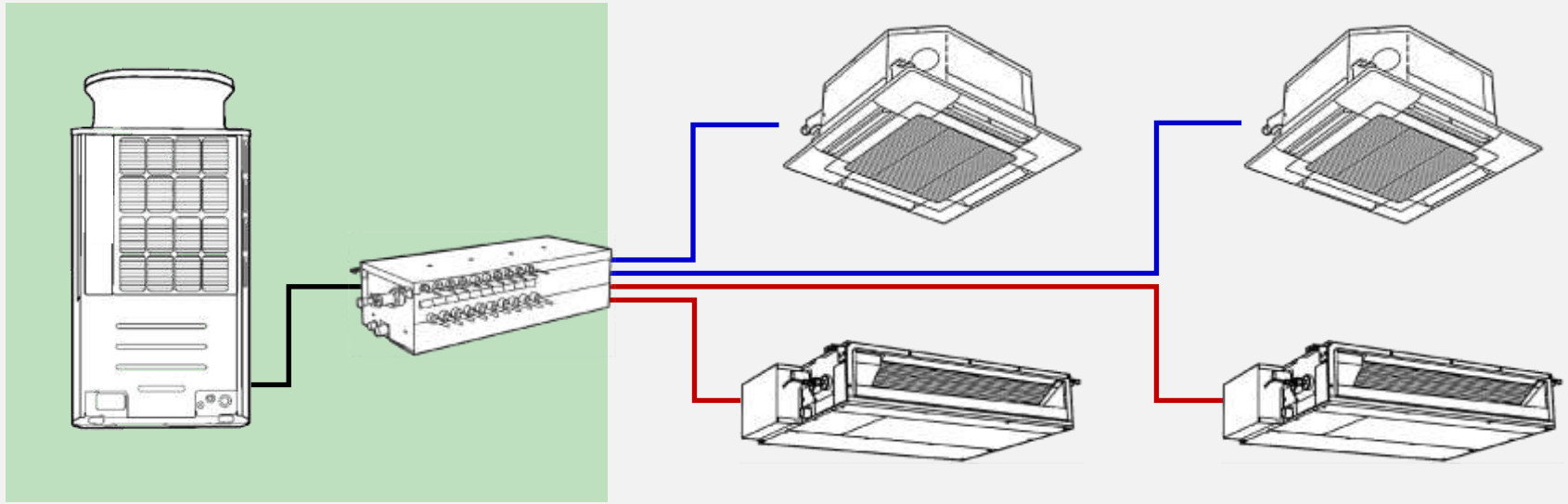


REFRIGERANT COMPONENTS

HYBRID VRF BC CONTROLLER
HYDRONIC PIPING
HYBRID VRF INDOOR UNITS

HYBRID VRF Is Tomorrow’s Solution, Here Today

- All the benefits of traditional VRF System, plus:
- Easily adaptable to future, lower-GWP A2L refrigerants



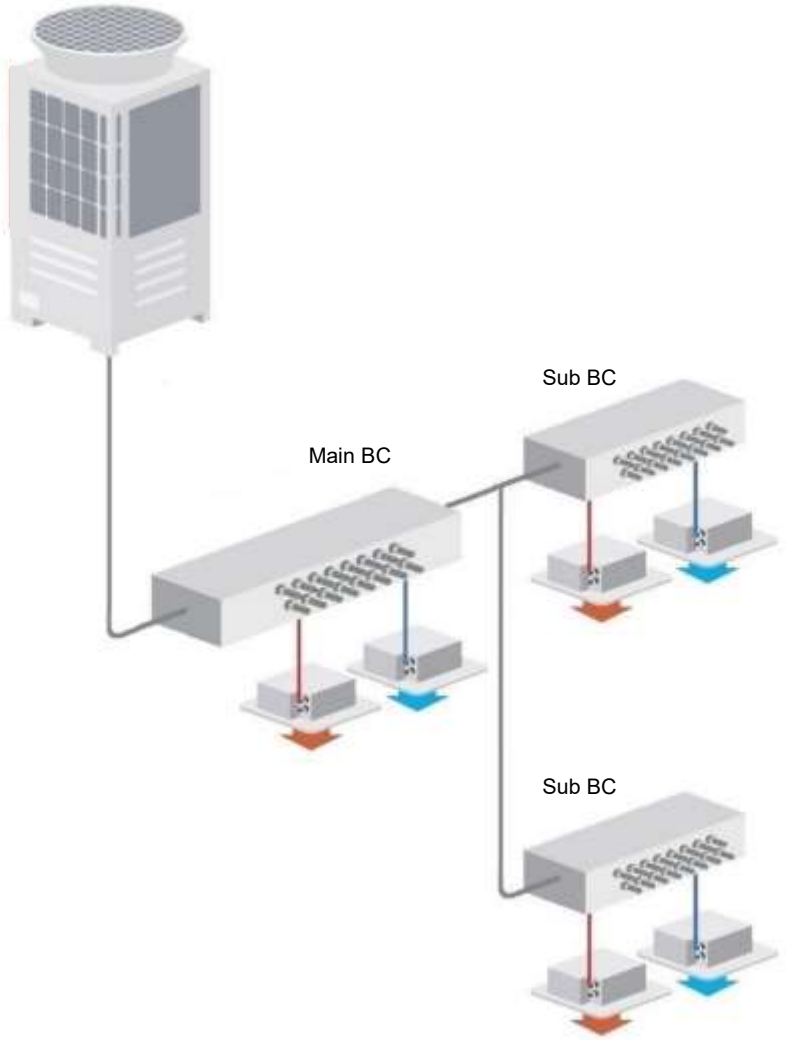
FUTURE A2L REFRIGERANTS

HYBRID VRF BC CONTROLLER
HYDRONIC PIPING
HYBRID VRF INDOOR UNITS

HVRF Features

HYBRID VRF is a Simultaneous Heat/Cool System

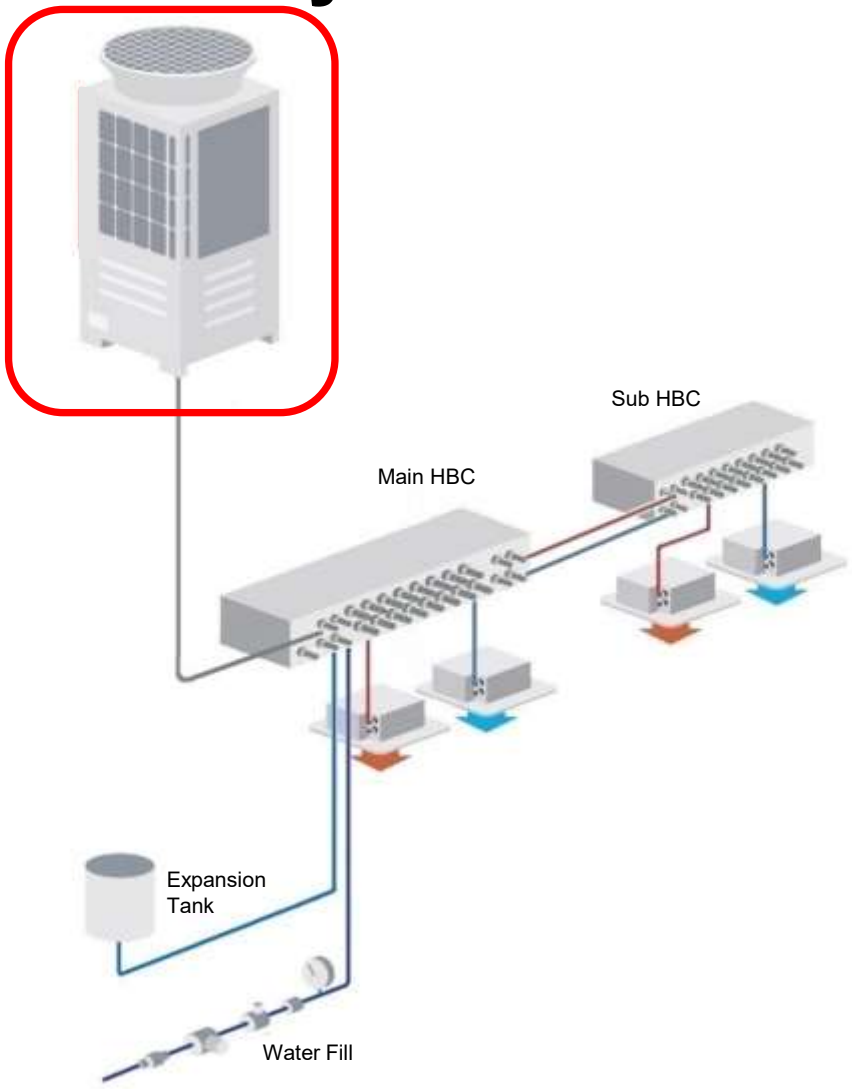
- Traditional VRF system diagram:



HYBRID VRF is a Simultaneous Heat/Cool System

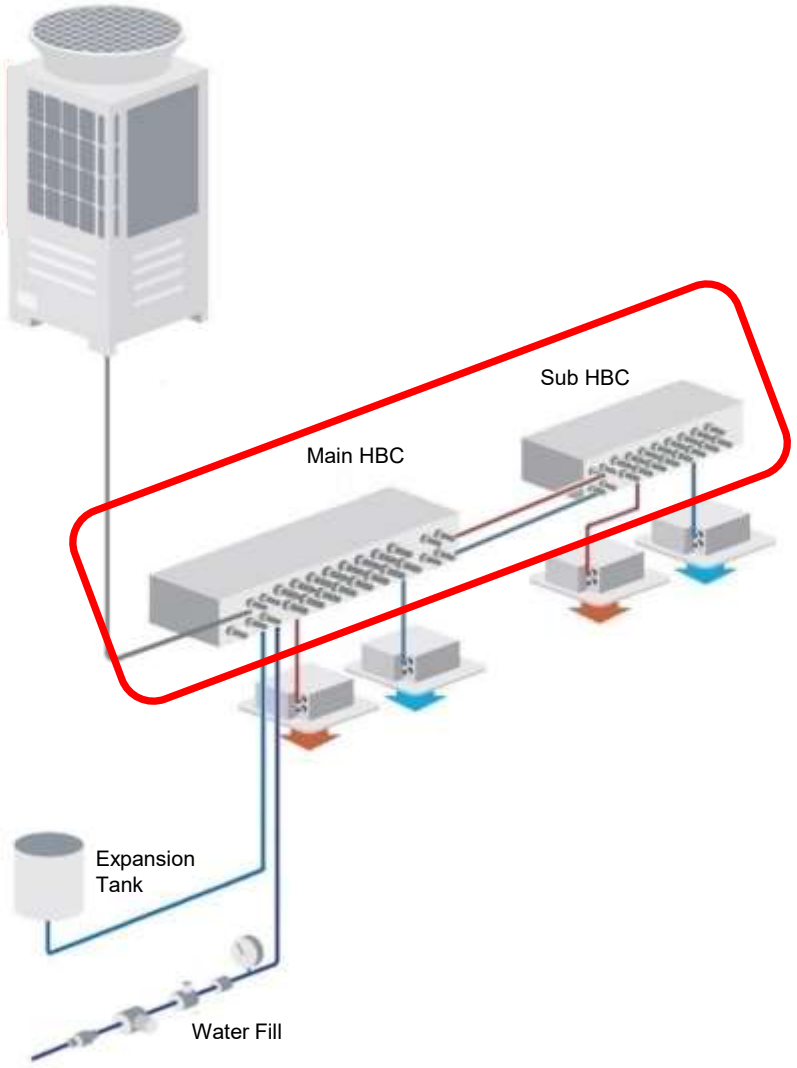
Hybrid VRF system diagram:

- Uses Typical VRF outdoor units
- Piping allowances between outdoor unit, HBC, & traditional VRF
- Compatible with water-source outdoor units
    - 23-113°F EWT (with glycol) allows geothermal efficiency & incentives



Hybrid Branch Circuit Controller

- Exchanges heat between refrigerant & water; modulates water flow to indoor units & refrigerant-free Sub HBC Controllers
- Main HBC includes pumps, refrigerant-to-water heat exchangers, zone valve blocks, and all built-in controls
  - Supports systems up to size 120 MBH (larger systems use two HBCs)
  - 8 and 16 branch models available
- Use Sub HBC for additional branches
  - 8 and 16 branch models available

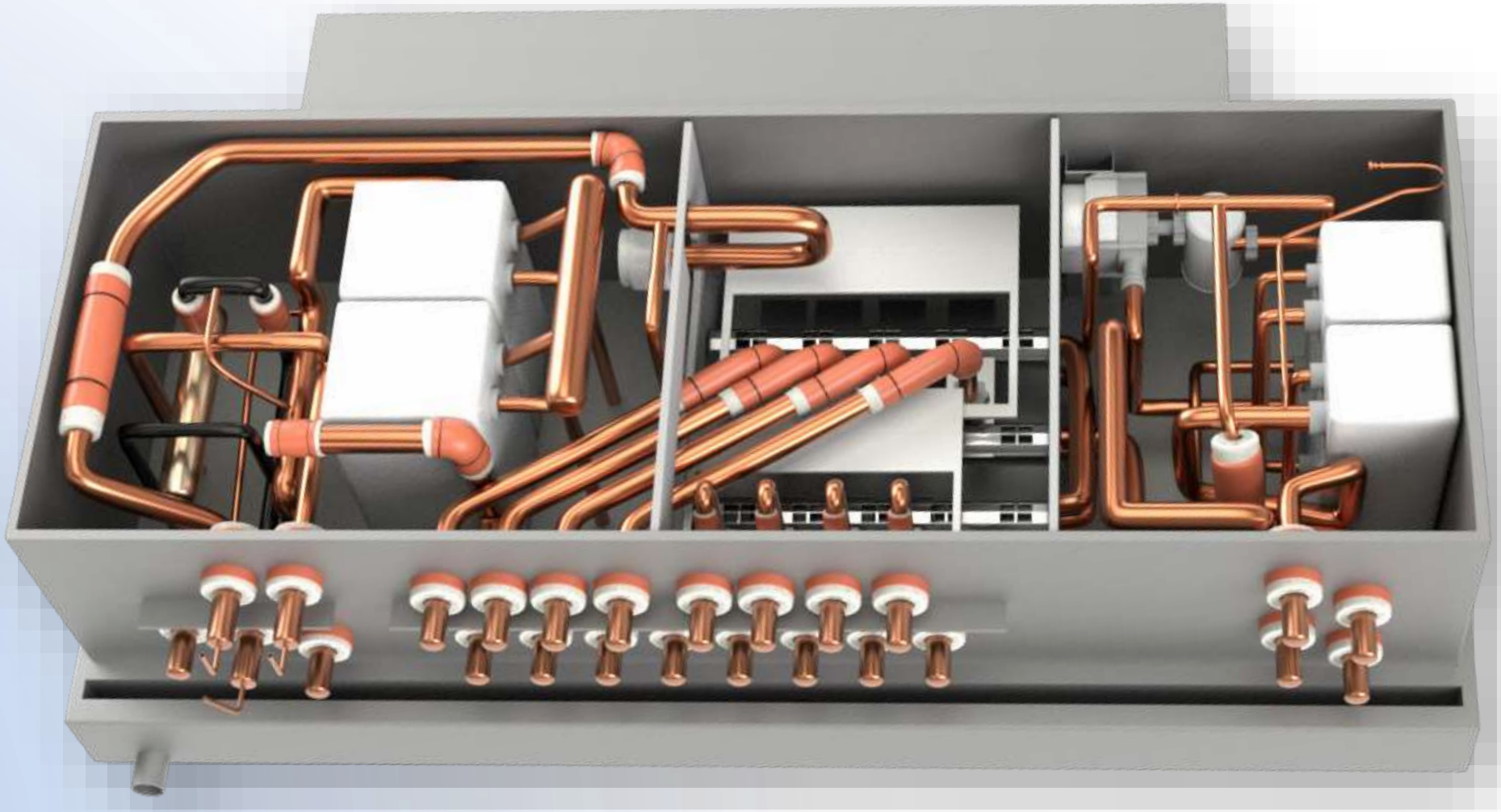


Primary HVRF Components

HYDRONIC INDOOR UNITS

- Same indoor unit chassis as traditional VRF
- No linear expansion valves
- Integral chilled / hot water temperature reset
- Unidirectional flow piping
- Up to three IDUs per port (reverse return piping)
  - Up to 30mbh
- 36mbh and 48mbh require two ports

HYBRID VRF Operation is Remarkably Simple



HYBRID VRF Operation is Remarkably Simple

SIMULTANEOUS OPERATION

Within a Main HBC, Refrigerant-to-water heat exchangers form two circuits operating in heat & cool modes for simultaneous operation

HYBRID VRF Operation is Remarkably Simple

SIMULTANEOUS OPERATION

Each circuit has:

an inverter pump

HYBRID VRF Operation is Remarkably Simple

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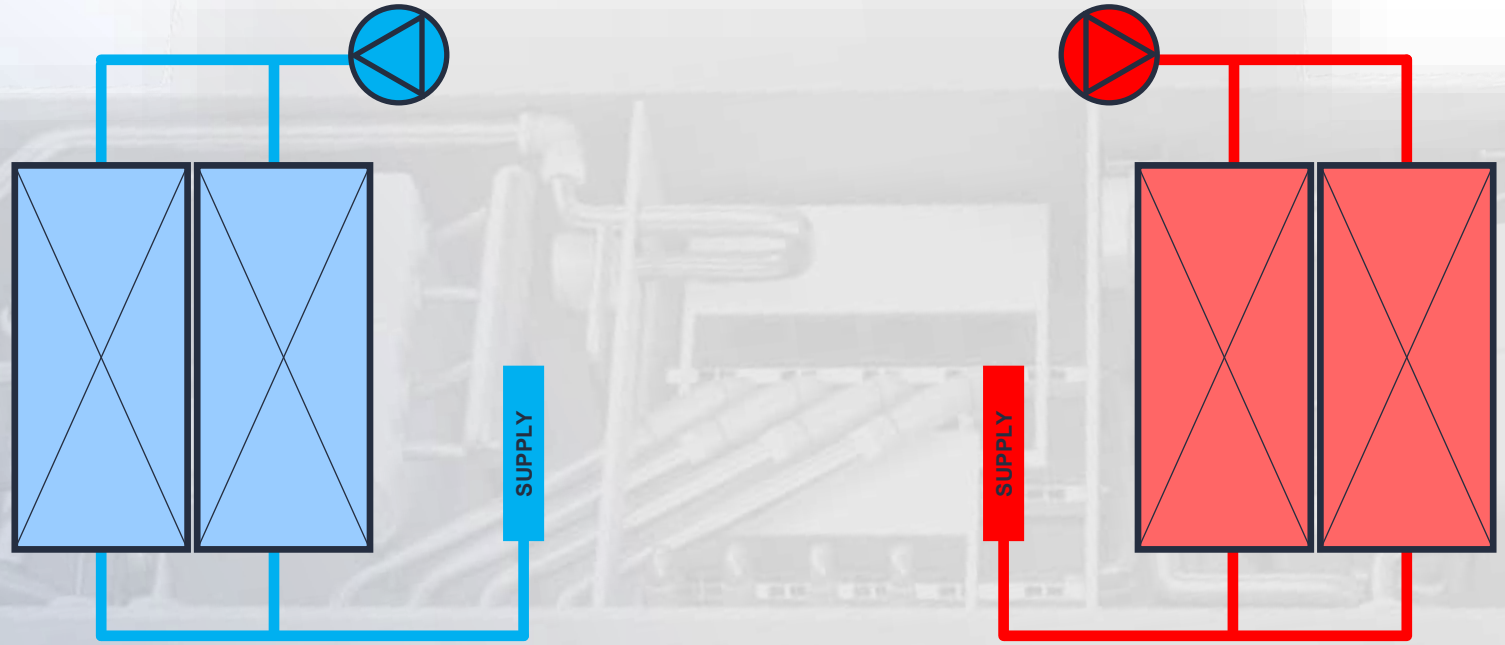
a supply header



HYBRID VRF Operation is Remarkably Simple

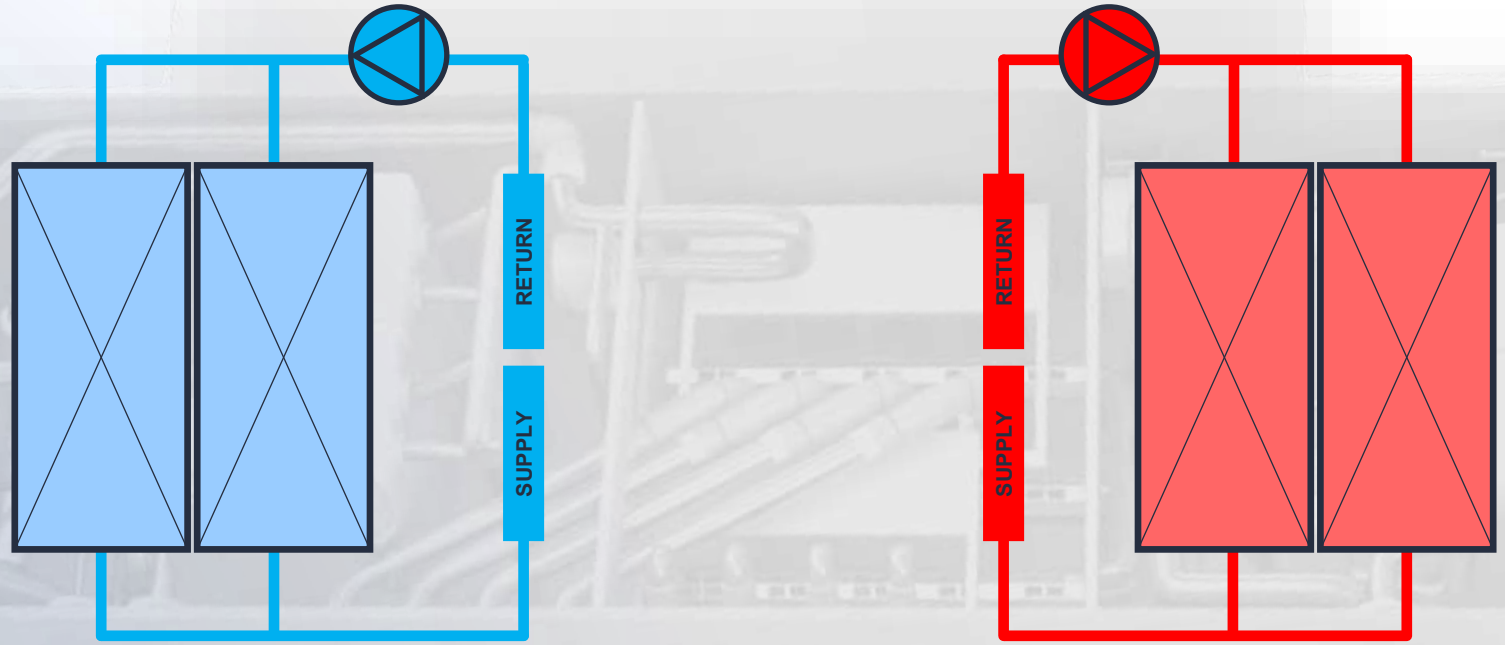
SIMULTANEOUS OPERATION

Each circuit has:

an inverter pump

a supply header

and a return header



HYBRID VRF Operation is Remarkably Simple

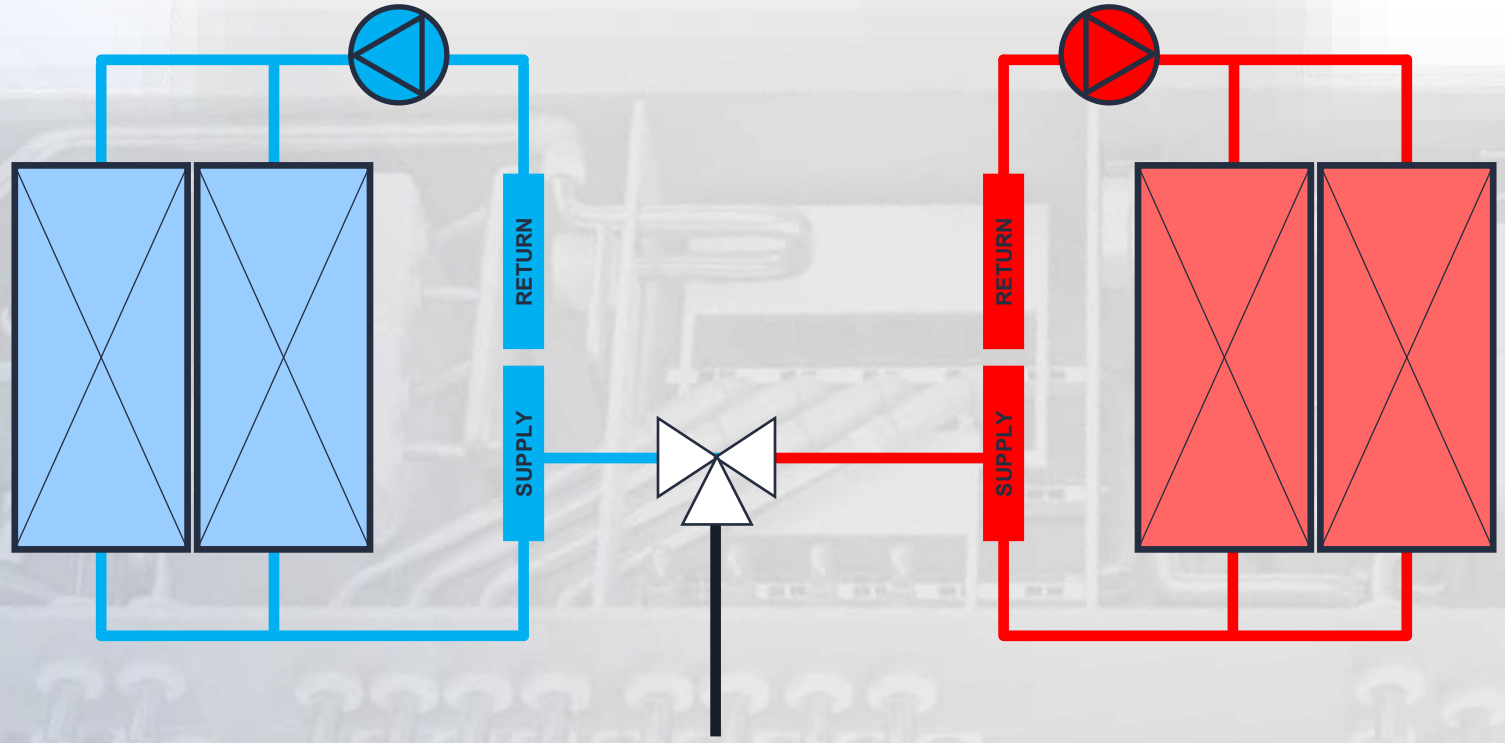
SIMULTANEOUS OPERATION

Main HBC Controllers with 8 or 16 ports are offered

Connect Sub HBC to add 8 or 16 additional ports to these same two circuits

Each port has:

a 3-way supply valve



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SIMULTANEOUS OPERATION

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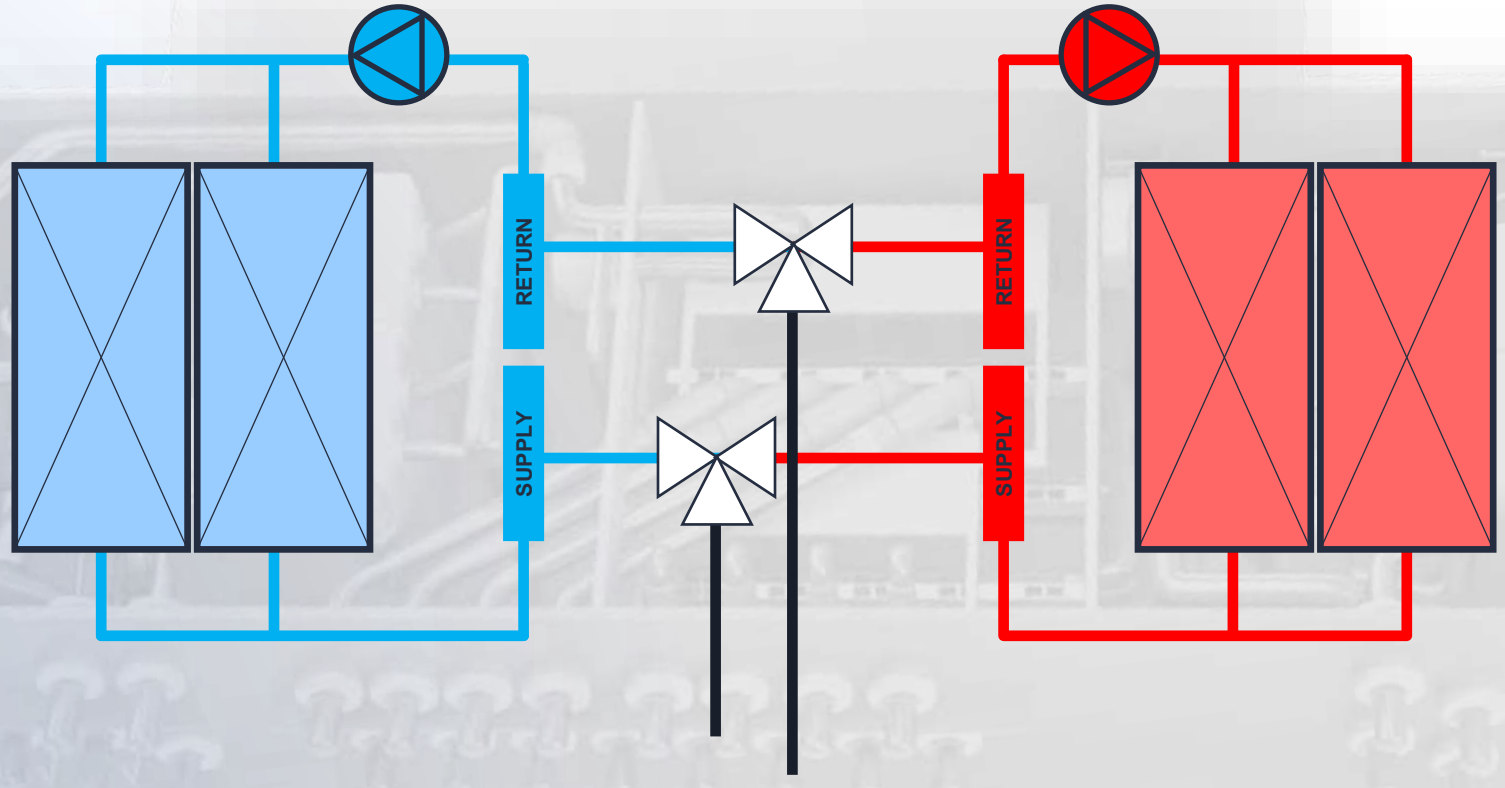
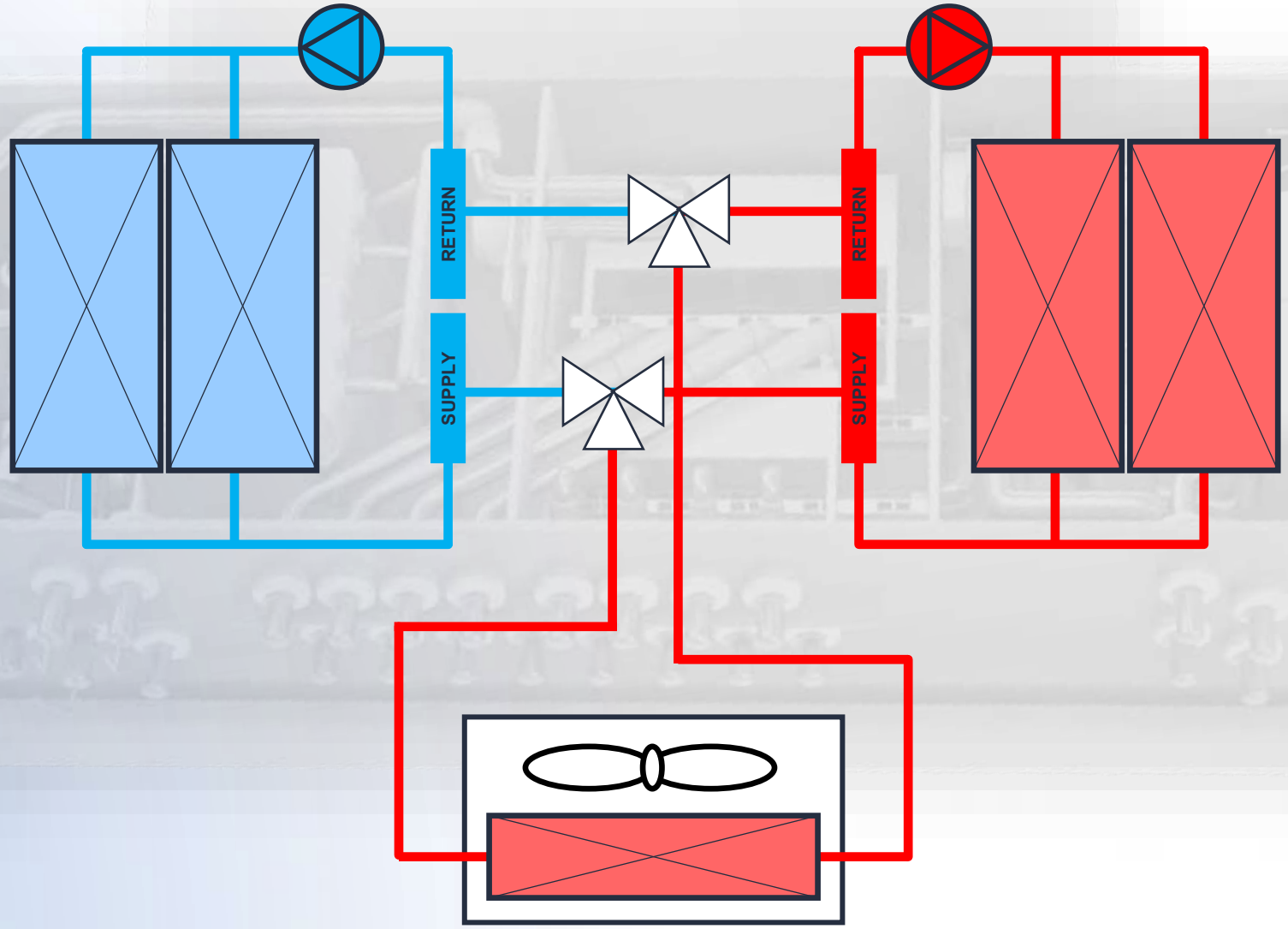


HYBRID VRF Operation is Remarkably Simple

SIMULTANEOUS OPERATION

Valves allow each port to provide modulating hot water flow from the circuit in heating…

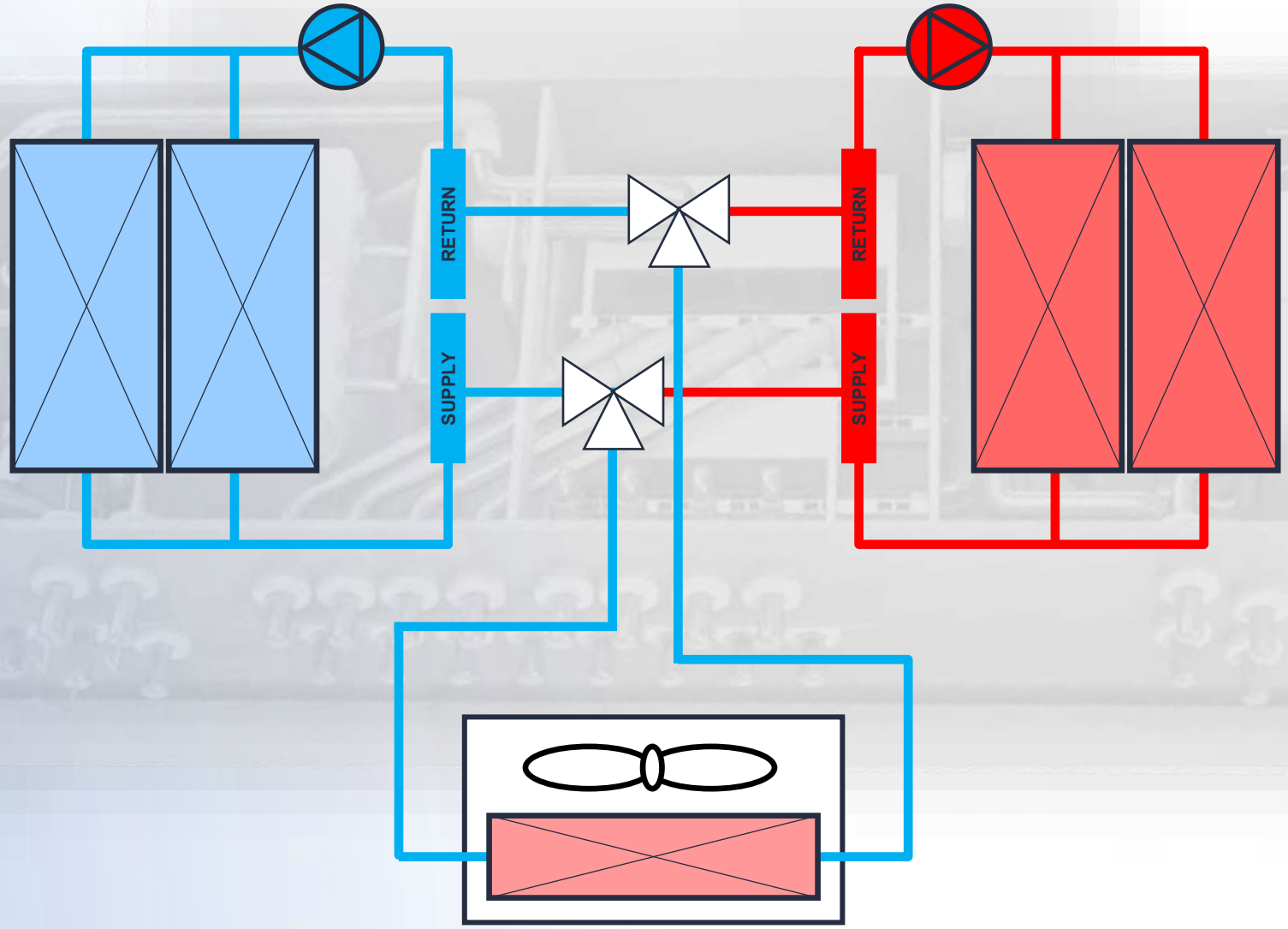


HYBRID VRF Operation is Remarkably Simple

SIMULTANEOUS OPERATION

Valves allow each port to provide modulating hot water flow from the circuit in heating…

or modulating chilled water flow from the circuit in cooling

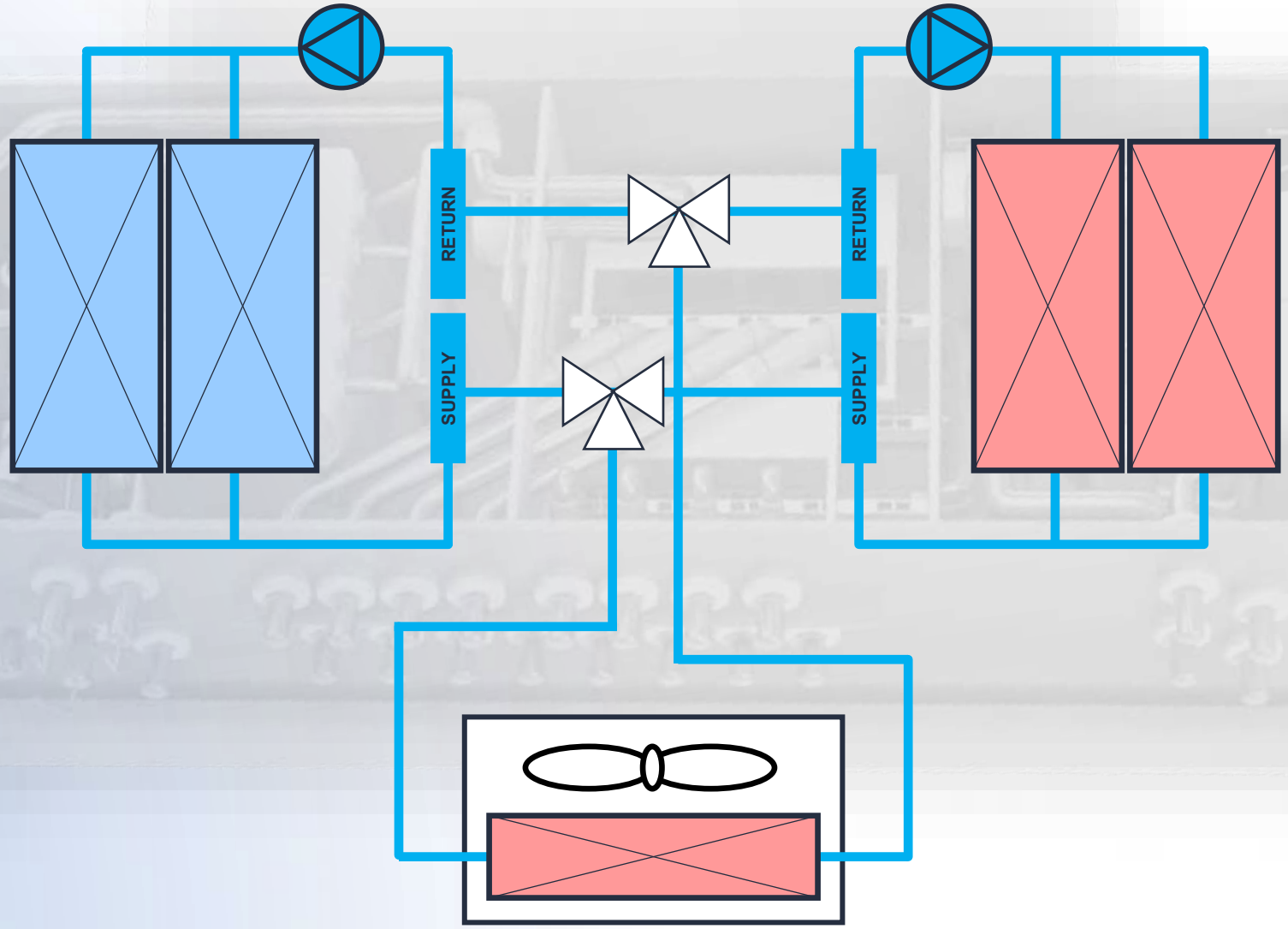


HYBRID VRF Operation is Remarkably Simple

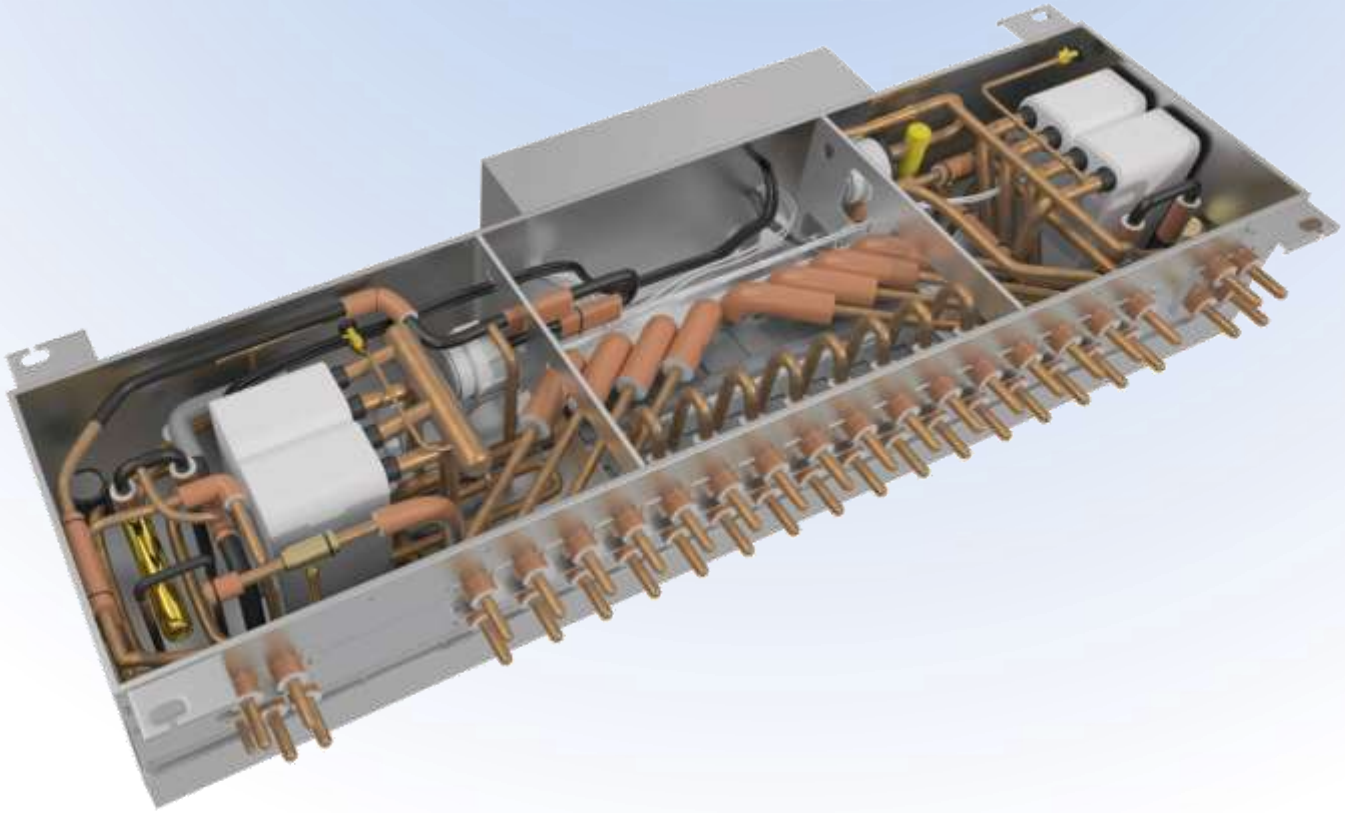
HEAT OR COOL OPERATION

Both circuits operate in same mode when simultaneous operation is not required

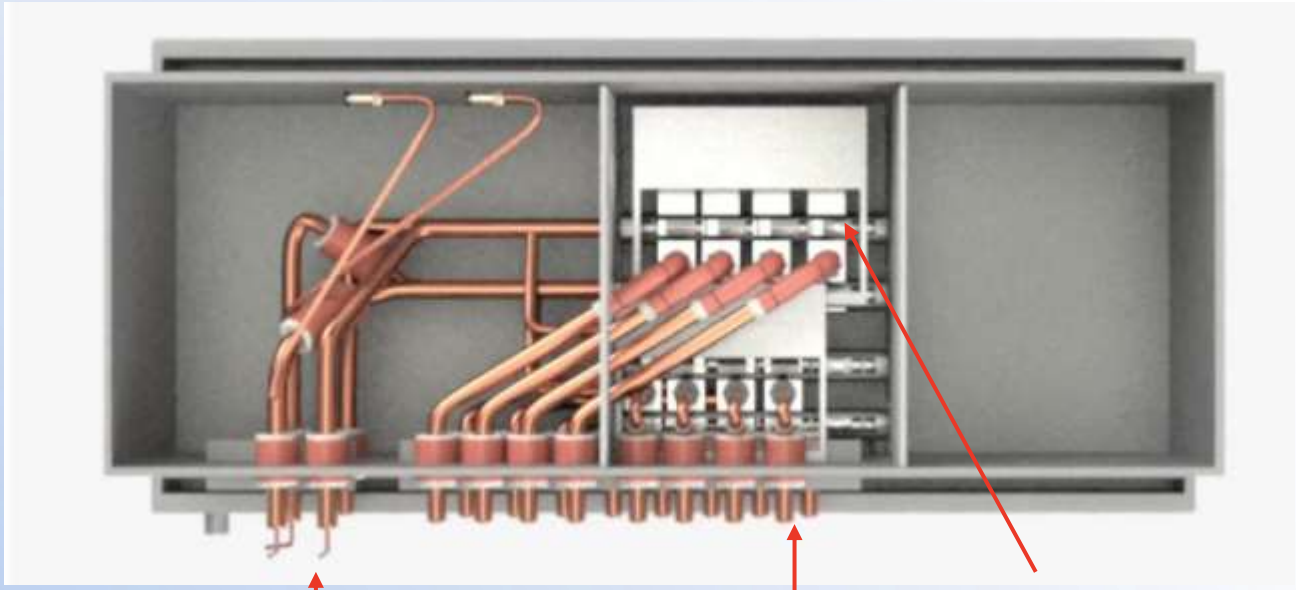
HVRF water temperature generally ranges from 41°F to 140°F and HVRF leverages reset to maximize efficiency



HYBRID VRF Operation is Remarkably Simple



Sub Hybrid Branch Controller



Mode Selection and
Modulating Zone Valve Block

Sub-HBC Water Connections

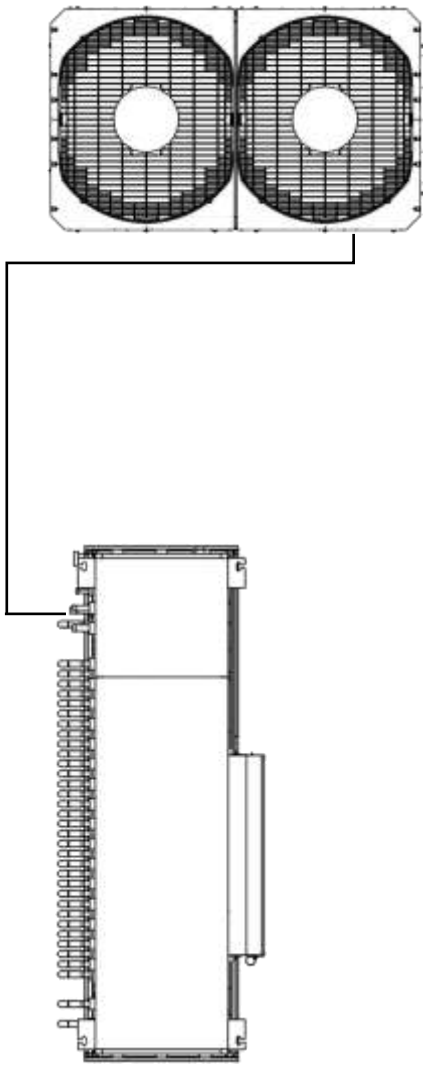
Independent Zones
to Indoor Units

- No Pumps
- No Heat Exchangers
- Adds Additional Zones
- Water only

Design Considerations

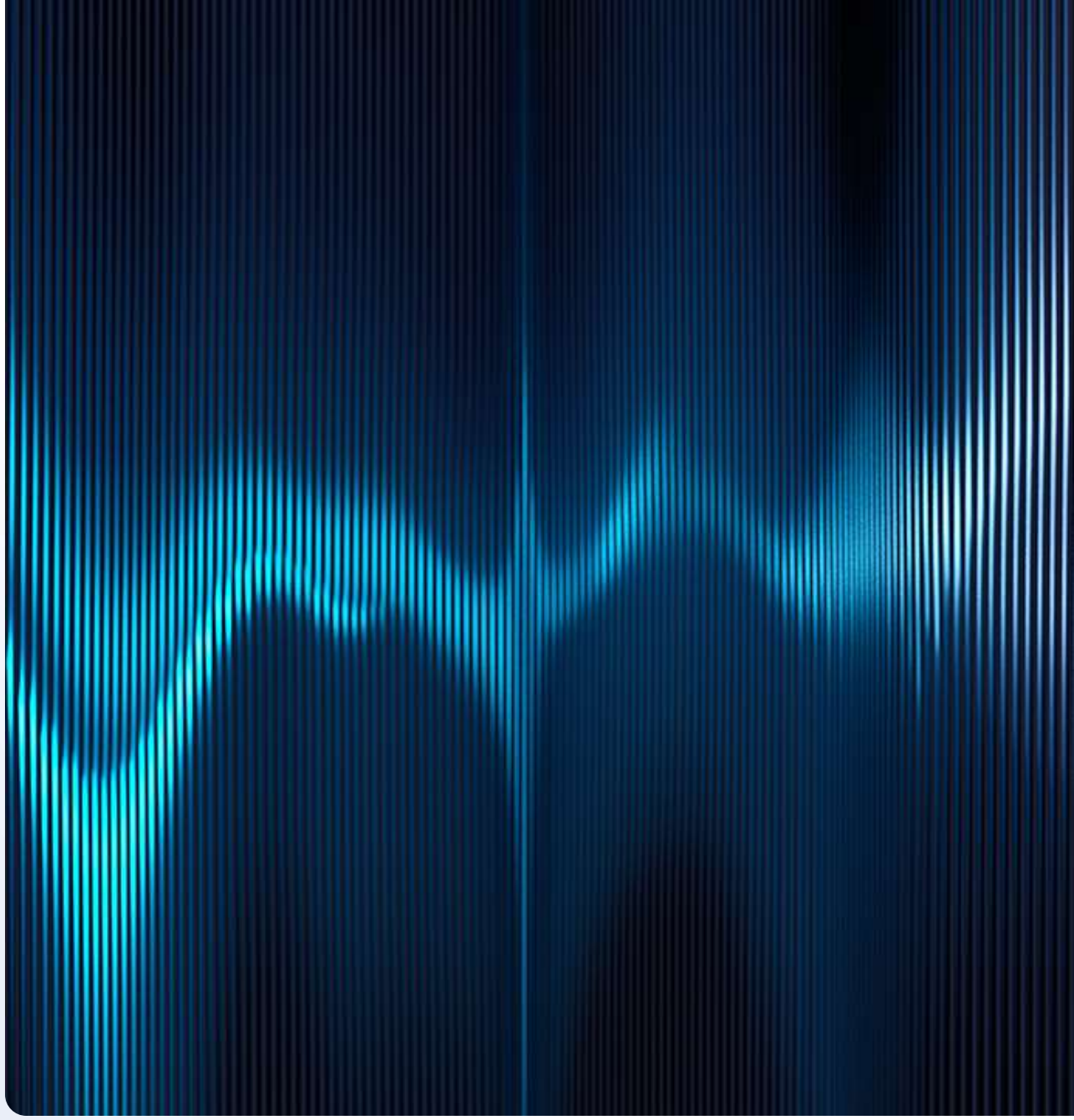
Hybrid Branch Controller

- 1-2 spare branches always recommended
  - Allows future additional zoning
  - Simplifies service in case of branch valve failure
- Main HBC accommodates systems up to size 120
  - 12 and 14-ton systems require two Main HBCs
- Only one Sub HBC connects to Main HBC for additional branches
- Each Main HBC requires its own expansion tank

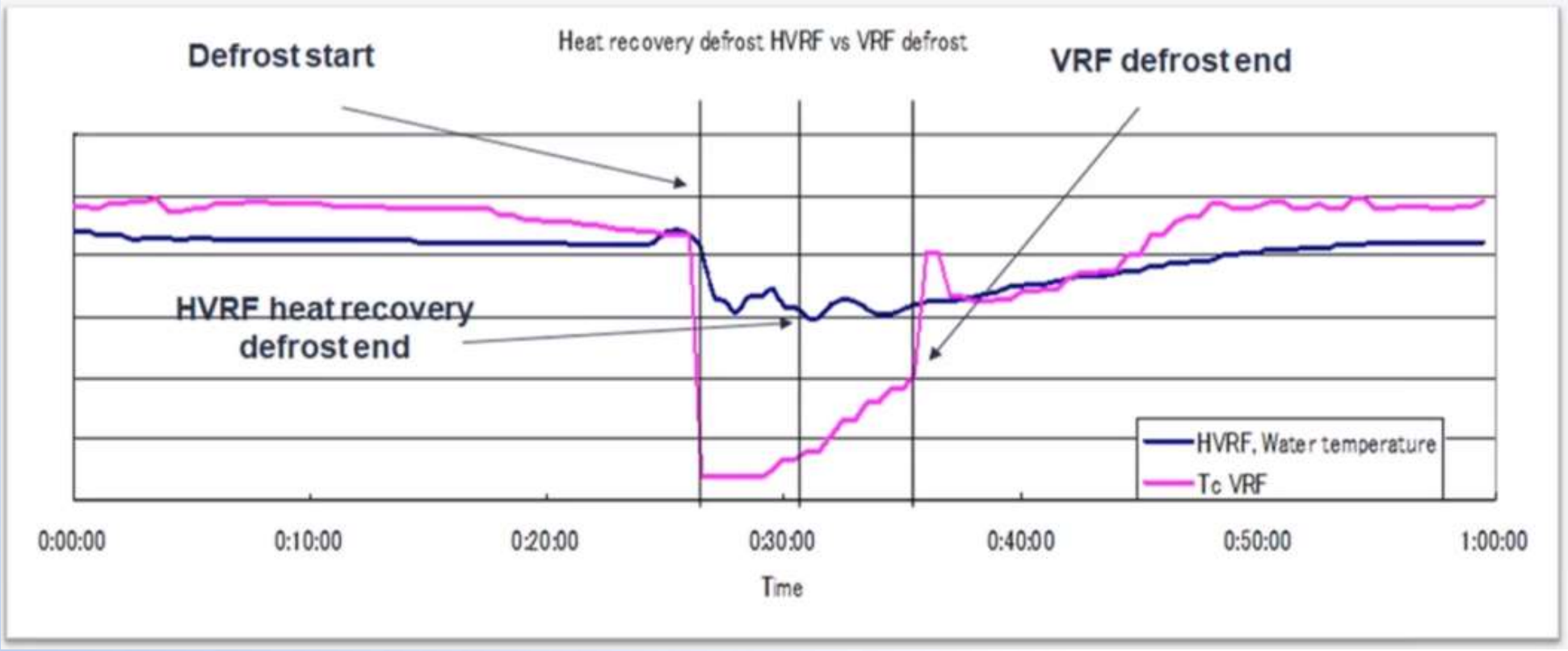


Noise Considerations

- Noise is similar to standard BC or slightly less.
- Noise at Indoor Unit lower due to water use, especially in defrost.
- For reduced noise, position HBC at least 15ft away from closest Indoor Unit.



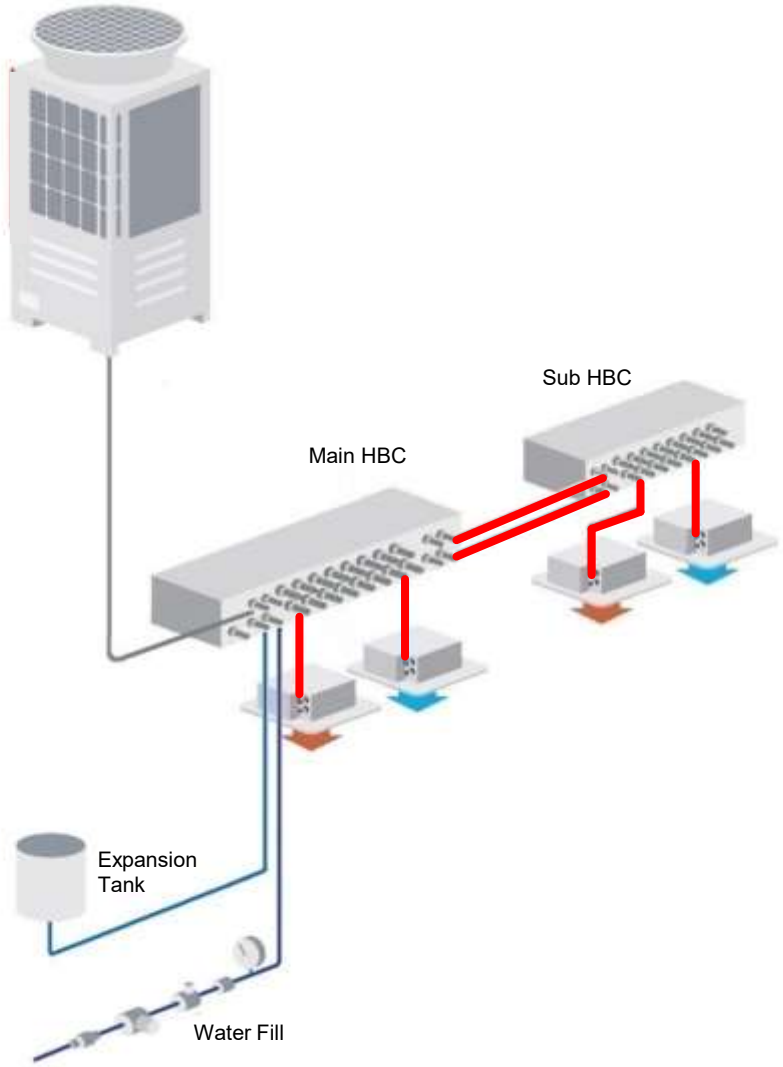
Heat Recovery Defrost



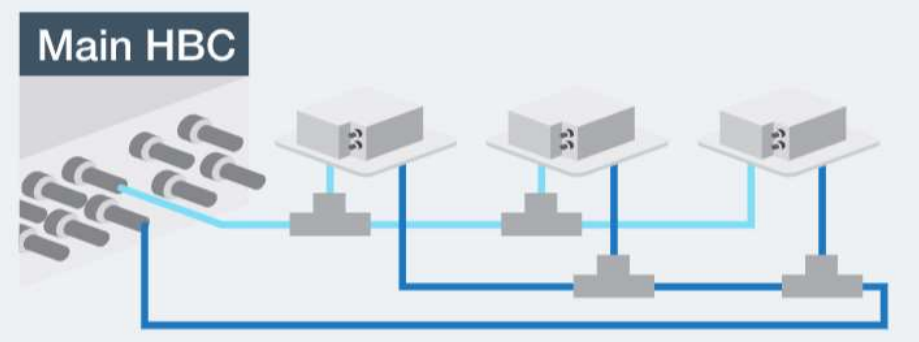
HVRF defrost against the built-up water temperature in heating, reducing defrost time by approximately 50% based on total water volume in the system (compared to traditional VRF)

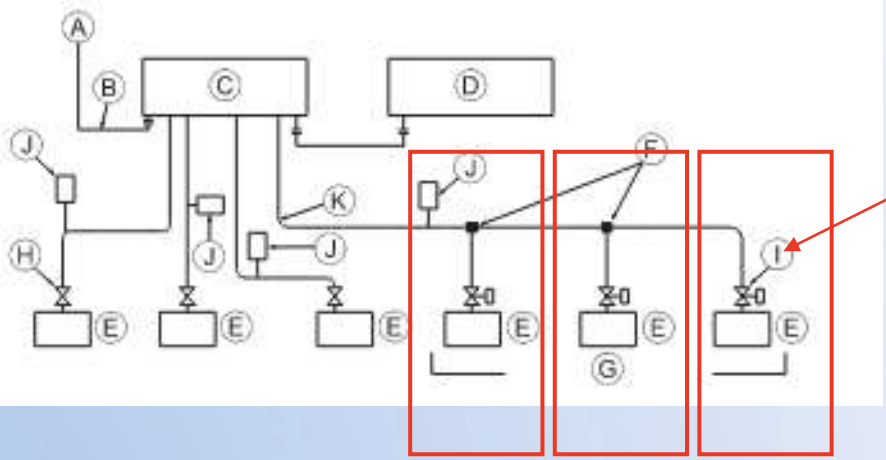
Piping Allowances

- Limitations are very similar to traditional VRF systems
- If long runs are required, strategic placement of first device can be key



Balancing of Ports





When twinning up to 3 Indoor Units:

Reverse Return “Self-Balancing”

Or Manual Balancing Valve

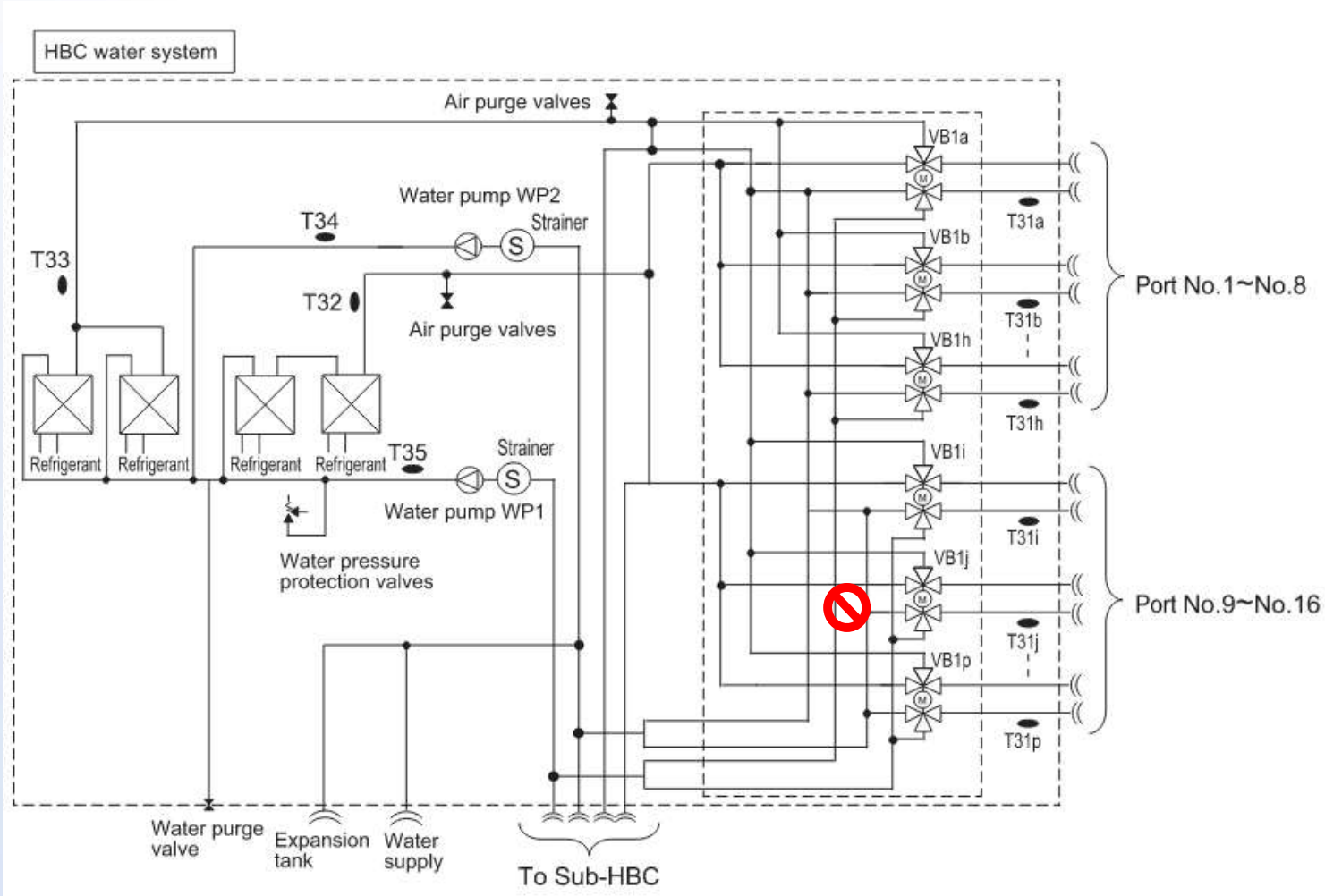
Balancing of Ports

Combining ports for fan coils over 30 MBH can only be done on ports served by same pump for balancing.

Example:

Twin Ports 1&2 = OK

Twin Ports 4&5 = Incorrect **X**



Accessories

Water Fill, Expansion, & Quality

PERMANENT FILL LINE

- Testable
- Higher first cost
- Will pass all local codes

Water Fill, Expansion, & Quality

SYSTEM FEEDER

- Testing not needed
- Middle-to-low first cost
- Noise potential (positive displacement pump)
- Alarming on Leak
- Less Fill Line Pumping

Hydronic Accessories

DRAIN, AUTO AIR VENTS, & AIR SEPARATOR

Install at Lowest Points

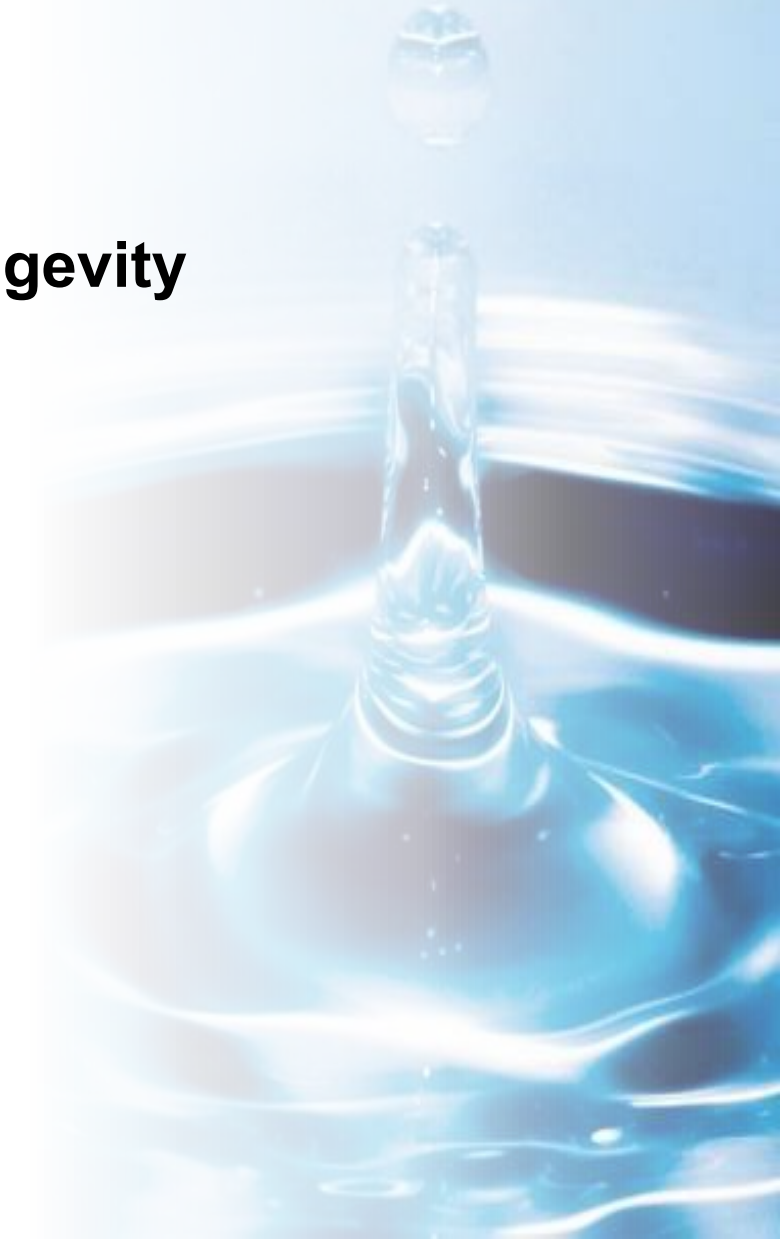
Install at Highest Points

Install at HBC

Water Fill, Expansion, & Quality

Water quality is vital! **High Water Quality = System Longevity**

- Specify water pipes be cleaned & flushed before commissioning
- Specify all air be purged from system
- Regular water quality testing is recommended
- Inhibitor recommended for longevity



HVRF Piping Options

Water Piping

PIPING MATERIAL AND CONNECTIONS

PEX water piping is NOT approved

	MLP PERT—AL—PERT	COPPER	PEX Not Approved
Oxygen Barrier	Yes—aluminum	Yes—copper	Yes–Film with Poor Longevity
Connection Quantity	Low	High	Low
Expansion / Loops	0.125” /10°F/100’ Sometimes	0.11” /10°F/100’ Sometimes	1.1” /10°F/100’ Yes
Hanging Requirement	Extra Hangers	Standard	Extra Sleeves & Hangers
Cost Factor	1.2	3	1

Water Piping

PIPING MATERIAL AND CONNECTIONS

- **Line sizes are identical for MLP and copper**

- **Pre-insulated MLP minimizes install costs**
  - ¾” rolls/25mm (82’ length)
  - 1-¼” sticks (16’ length)

- **Insulation required due to potential 140°F water temp in heating**
  - Refer to local codes

Summary

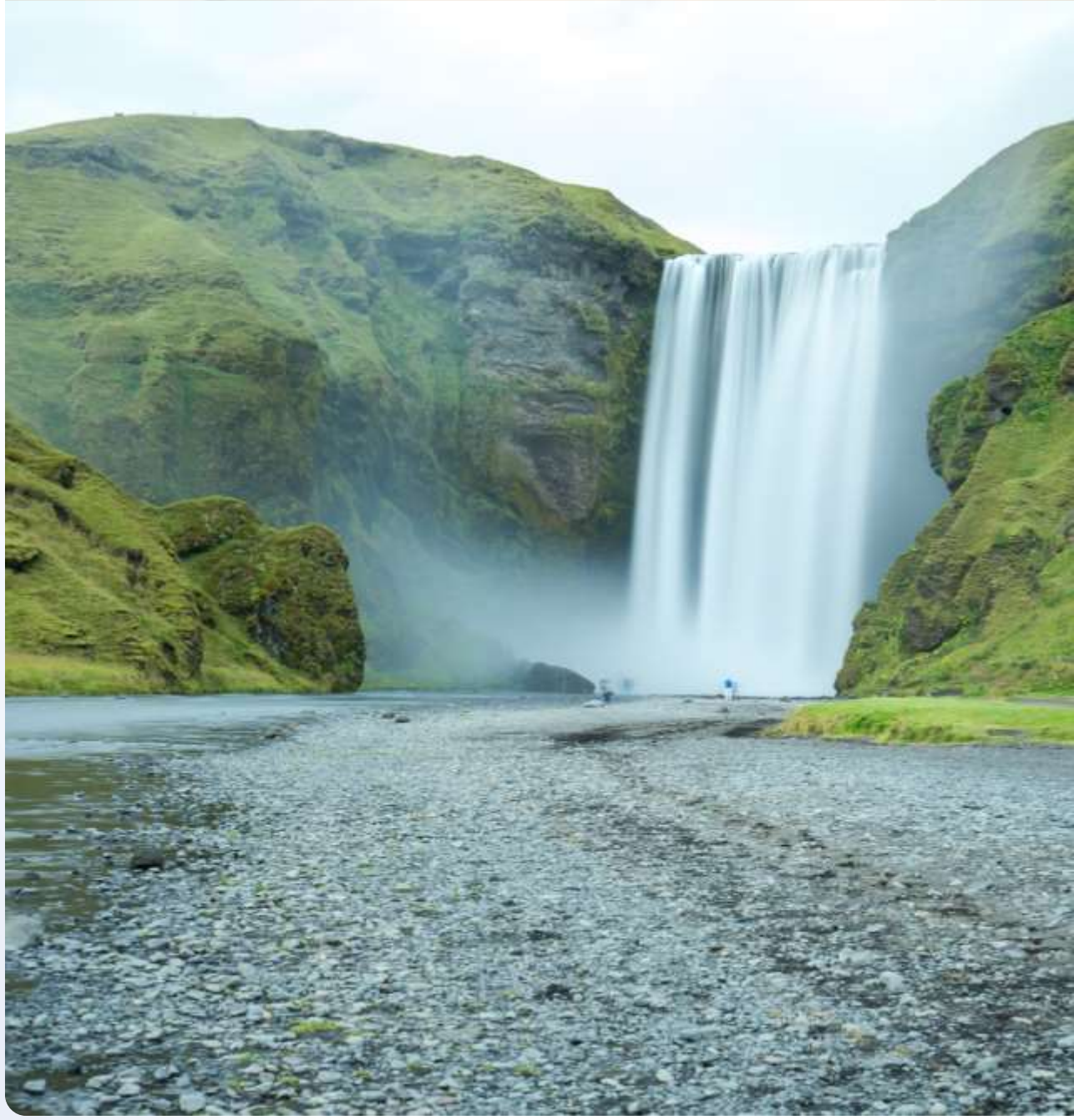
HVRF uses less overall refrigerant

More easily complies with ASHRAE 15

Best of VRF and hydronic systems

Same plug and play controls as VRF

MLP fittings make installation fast and easy



Thank You