MITSUBISHI ELECTRIC TRANE HVAC US

MITSUBISHI ELECTRIC

HEATING & AIR CONDITIONING

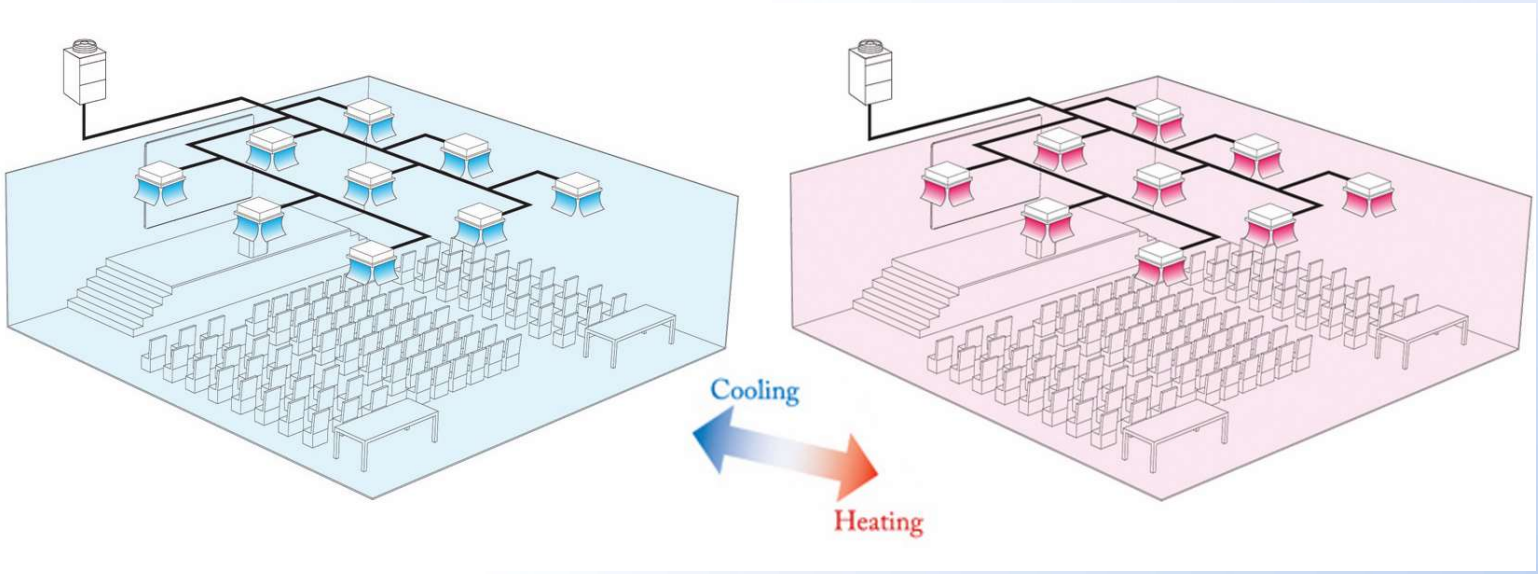
Chris Ouellette
Business Development Manager
Mitsubishi Electric Heating & Air Conditioning

Agenda

- Mitsubishi VRF Systems
- Water Cooled VRF
- The “HEX” Unit
- HVRF – Hybrid VRF
- QAHV – Heat Pump Domestic Hot water
- CAHV – Heat Pump Boiler

VRF - Heat Pump

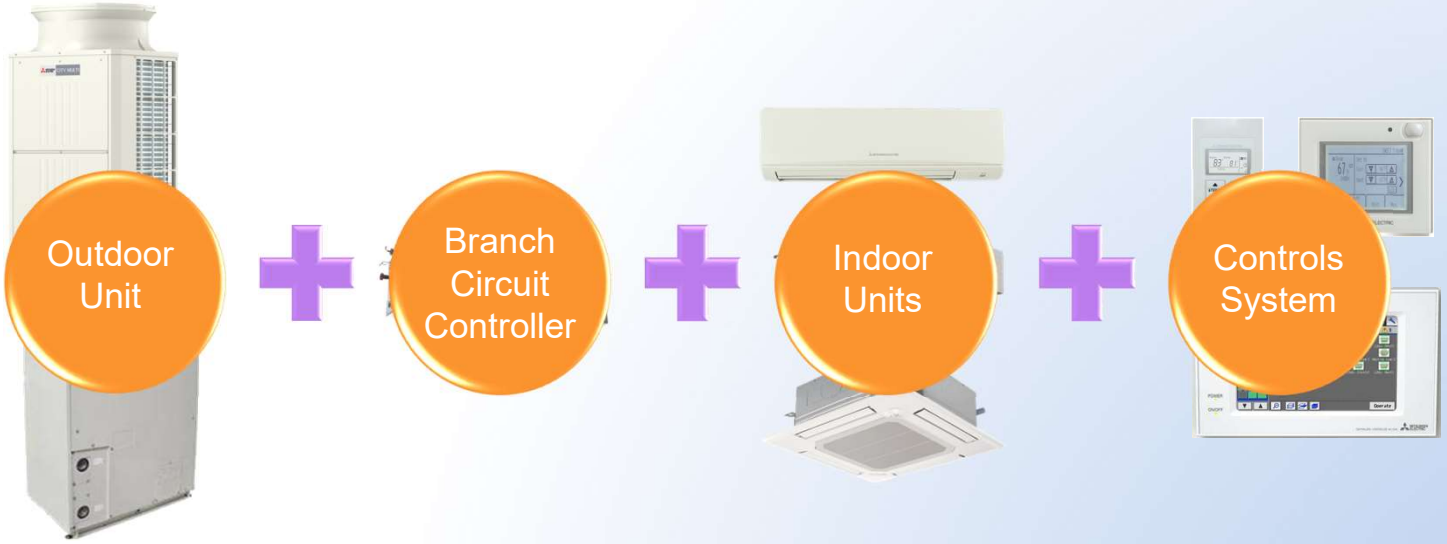
2-Pipe VRF Heat Pump System



MITSUBISHI ELECTRIC TRANE HVAC US

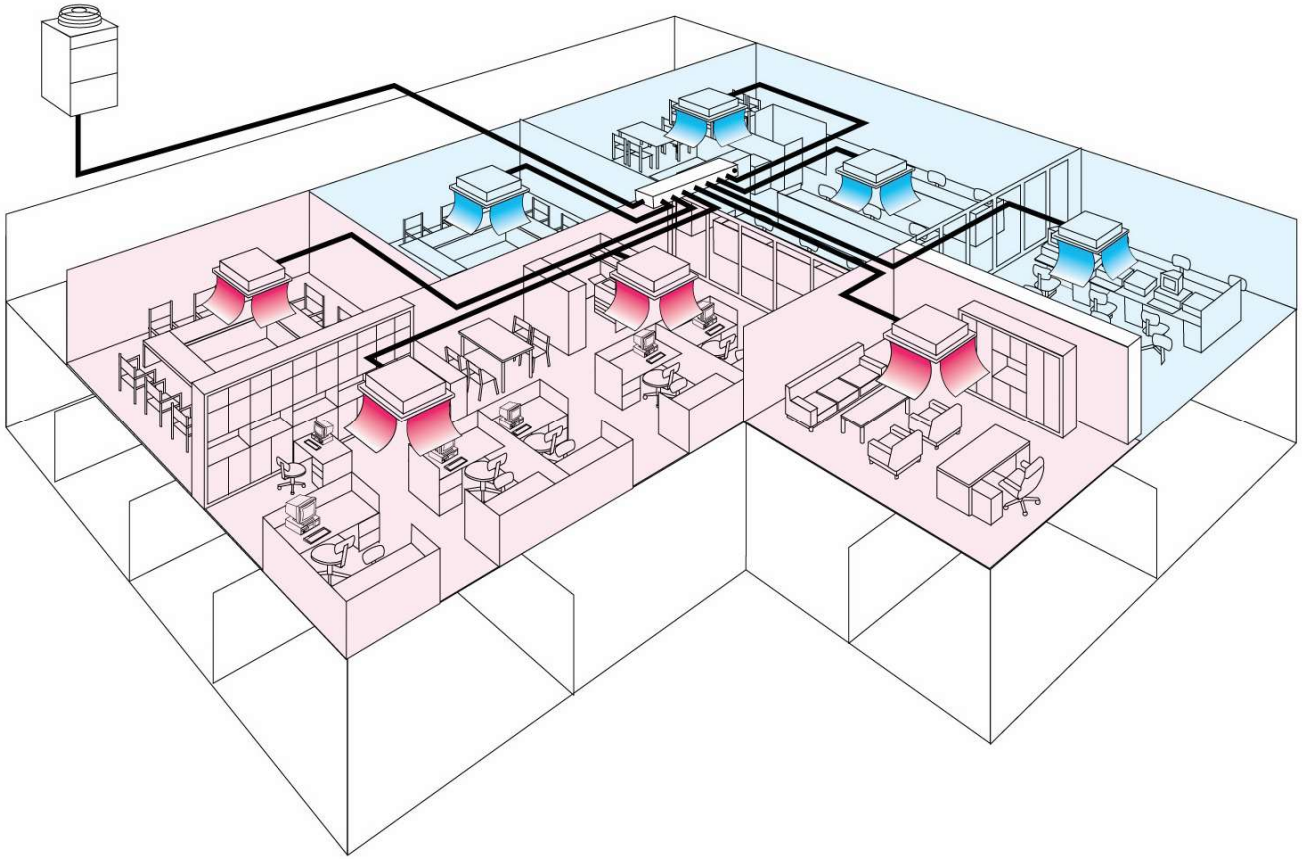
Mitsubishi Heat Pump with Heat Recovery

Simultaneous Cooling & Heating



Mitsubishi 2-Pipe Heat Recovery VRF System

(Simultaneous Heating & Cooling)



MITSUBISHI ELECTRIC TRANE HVAC US

Water Source Heat Pumps

Water to Refrigerant System

MITSUBISHI ELECTRIC TRANE HVAC US

Water-Source/Water Cooled VRF Systems

- **Uses water instead of air as the heat exchange medium**
- Condensing units are installed inside the building
- Zone cooling and heating is controlled by refrigerant piped between water-source unit and indoor units
- Takes compressor out of the occupied space
- ***Internal Cooling Circuit:***
  ****No need for mechanical room conditioning***

Water Source/Water Cooled VRF

- 208/230 V or 460 V, 3 phase
- Typical sizes available +36 tons
- ~50 indoor units per outdoor unit system
- Can be stacked and racked

Water Source VRF – Closed Loop

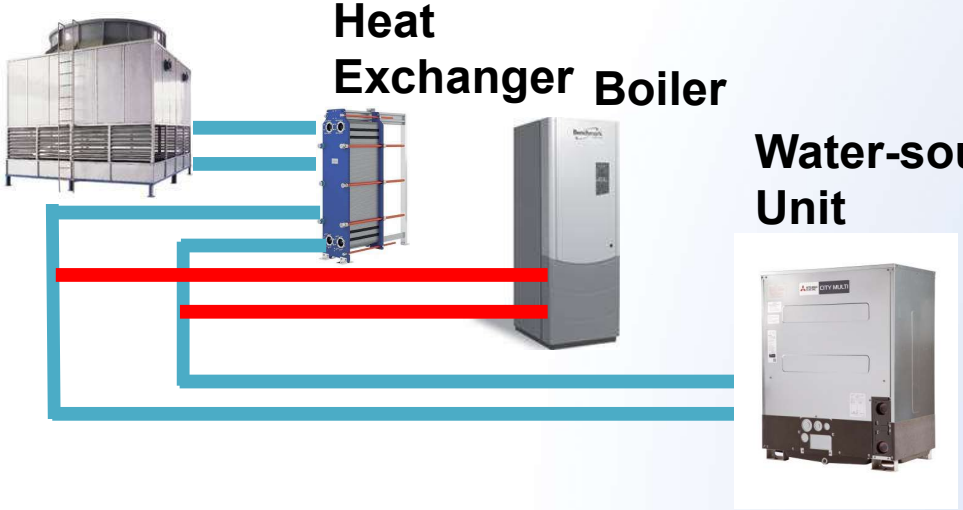
- Closed Loop Geothermal
- Closed Loop HW/CW building loop

Cooling Tower

Heat Exchanger

Boiler

Water-source Unit

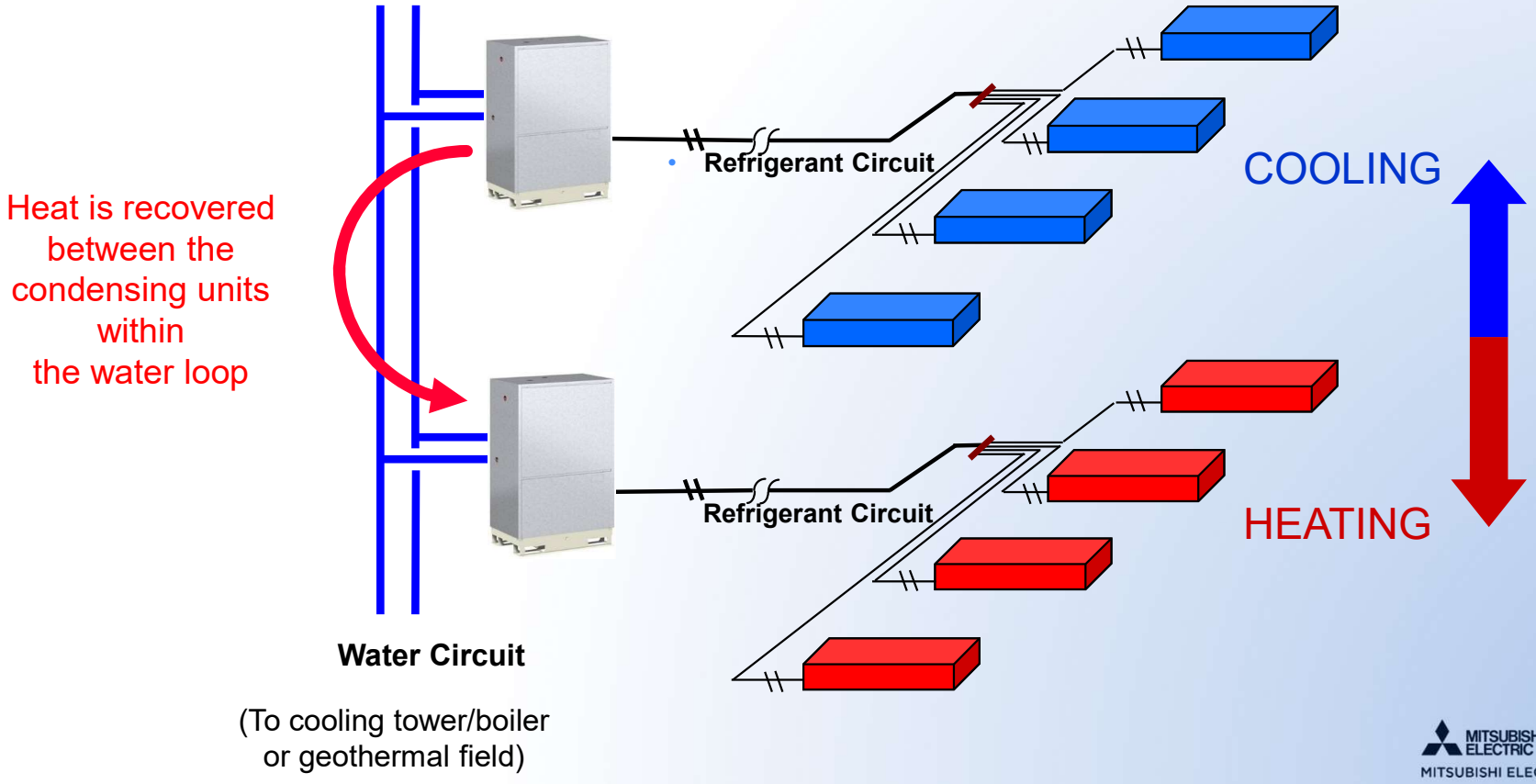


MITSUBISHI ELECTRIC TRANE HVAC US

Water Source VRF - Heat Pump

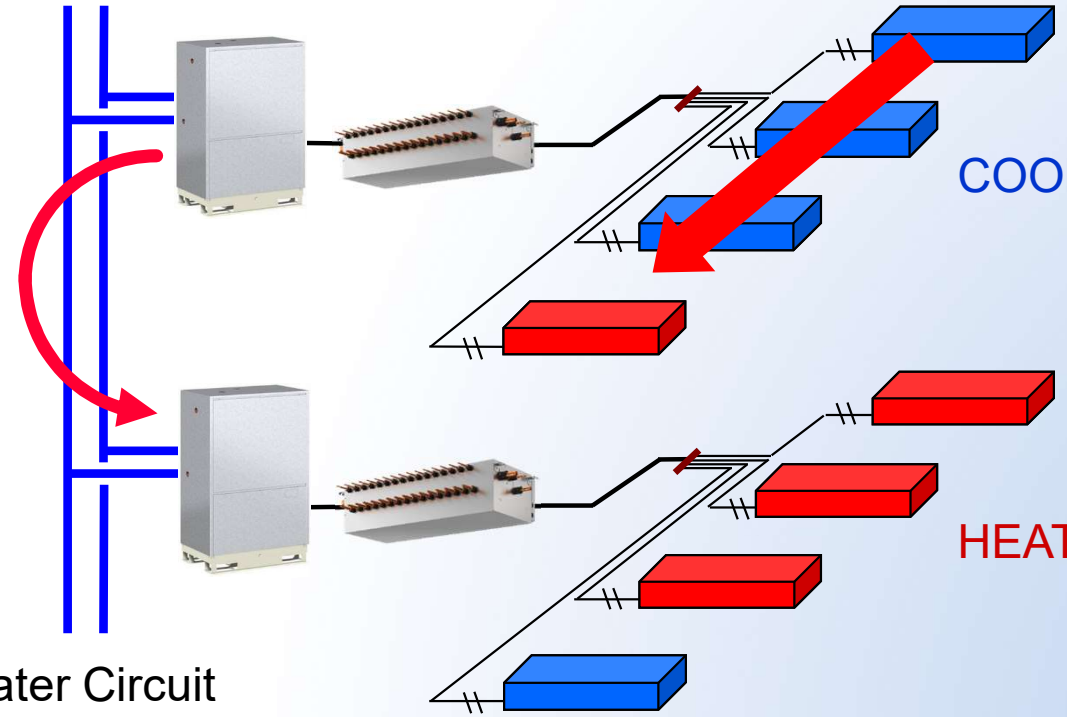
Water-side heat recovery with heat pump system

– Heating or Cooling



Water Source VRF – System Components

Additonal heat recovery opportunity using simultaneous heating & Cooling



Heat is recovered between the condensing units within the water loop

Heat is recovered between the indoor units within the refrigerant loop

Water Circuit

(To cooling tower/boiler or geothermal field)

Refrigerant Circuit

MITSUBISHI ELECTRIC TRANE HVAC US

Hydronic Heat Exchanger

Refrigerant to Water Unit

“HEX”

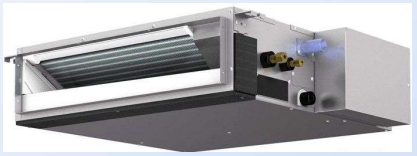
MITSUBISHI ELECTRIC TRANE HVAC US

Hydronic Heat Exchanger - HEX Unit

- **Refrigerant to Water Heat Exchanger**
- Indoor Unit Available for use with CITY MULTI VRF Systems
- Creates opportunity to transfer energy from refrigerant to water
- Can be used to redirect “waste heat” from cooling operation to hydronic systems
- Referred to as HEX or Booster Unit

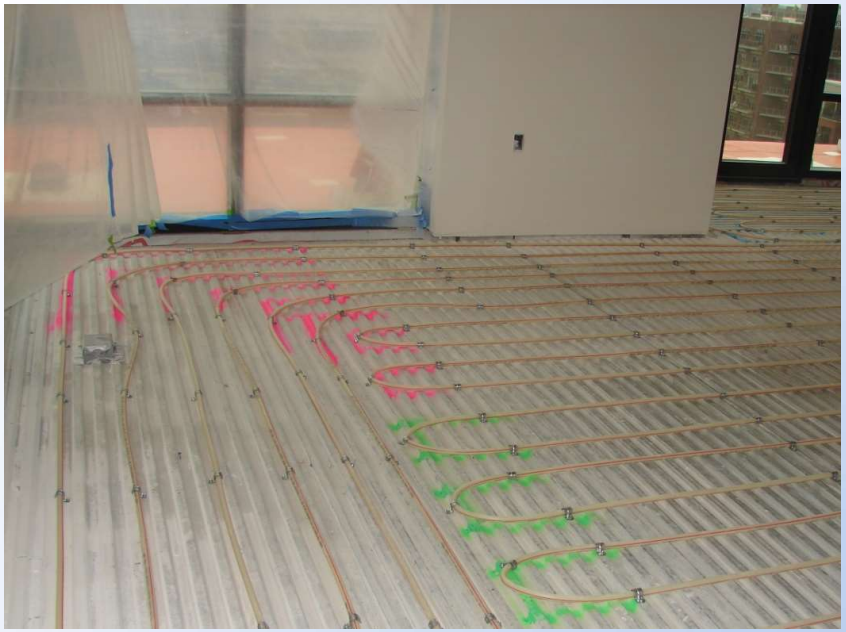
HEX – An Indoor Unit

- Contain a Linear Expansion Valve (LEV) that automatically modulates
- Allow the precise amount of refrigerant through the heat exchanger
- **HEX Unit**
  - 36 MBH and 72 MBH
  - Hot water: 86° F – 113° F
  - “Cool” water: 41° F – 86° F

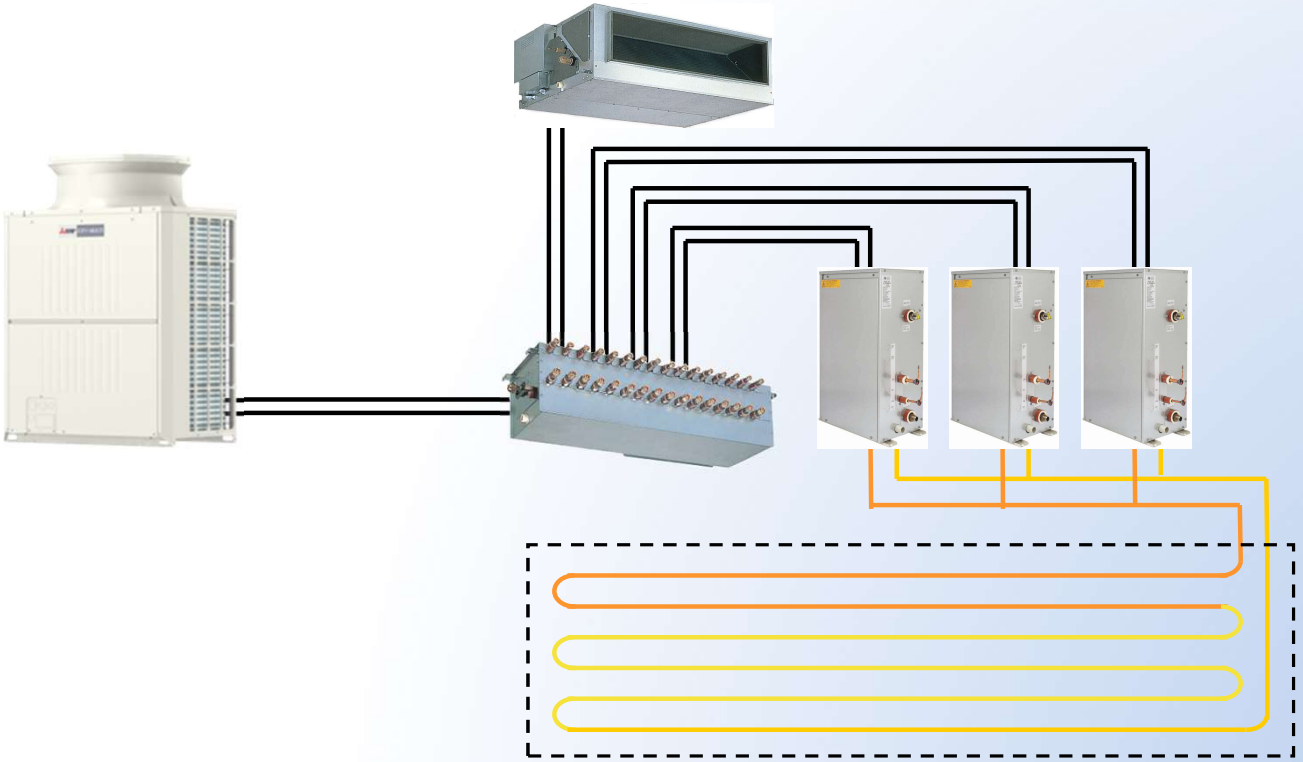


HEX Application Ideas

- HVAC Applications
  - Radiant Heating
- Plumbing Applications
  - Domestic Hot Water pre-heat
- Special Applications
  - Pool Heating or Cooling
  - Snowmelt



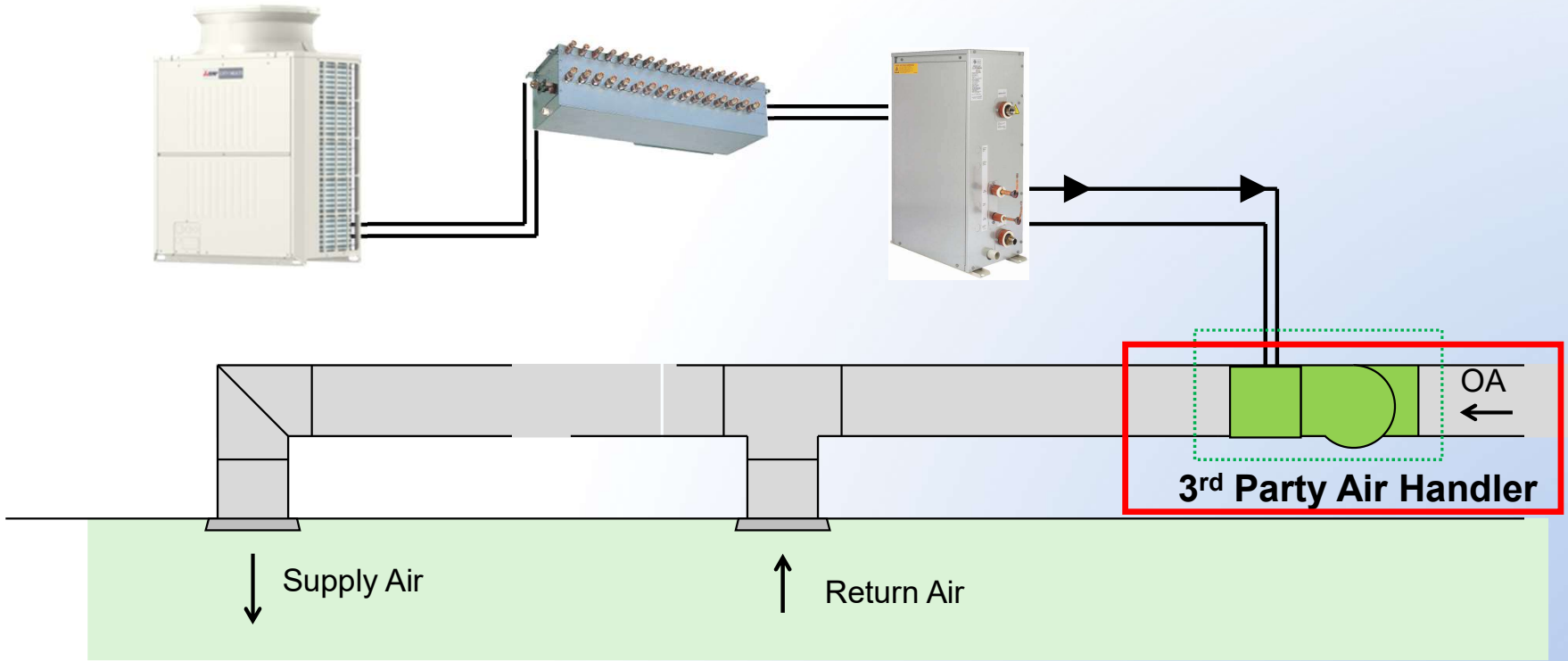
HEX – Radiant Loop



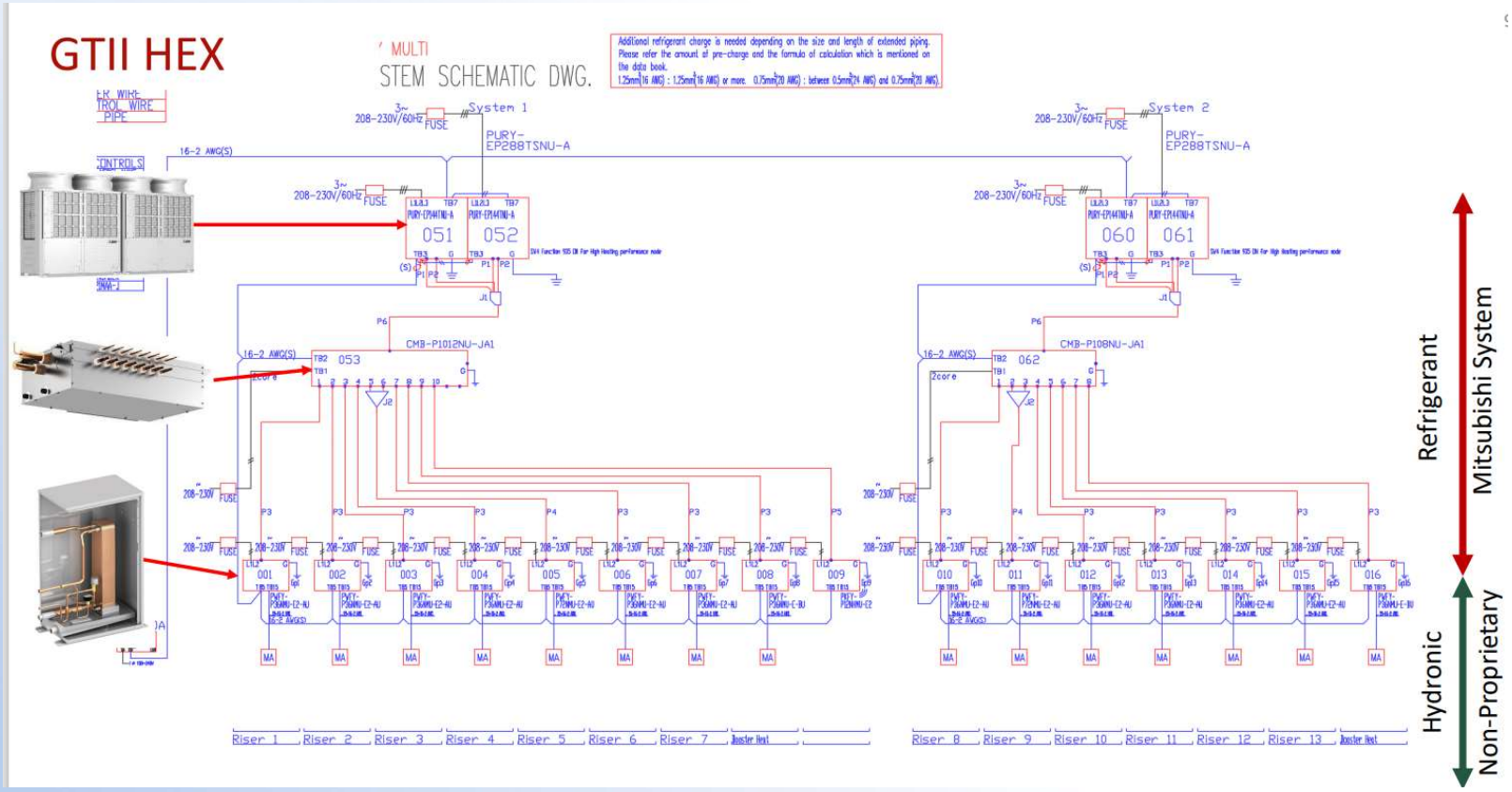
Lexington Fire Station – Lexington, MA

MITSUBISHI ELECTRIC TRANE HVAC US

3rd Party Applications



Gardner Terrace



MITSUBISHI ELECTRIC TRANE HVAC US

Gardner Terrace – Attleboro, MA

Hybrid Variable Refrigerant Flow System

Refrigerant to Water VRF System

HVRF

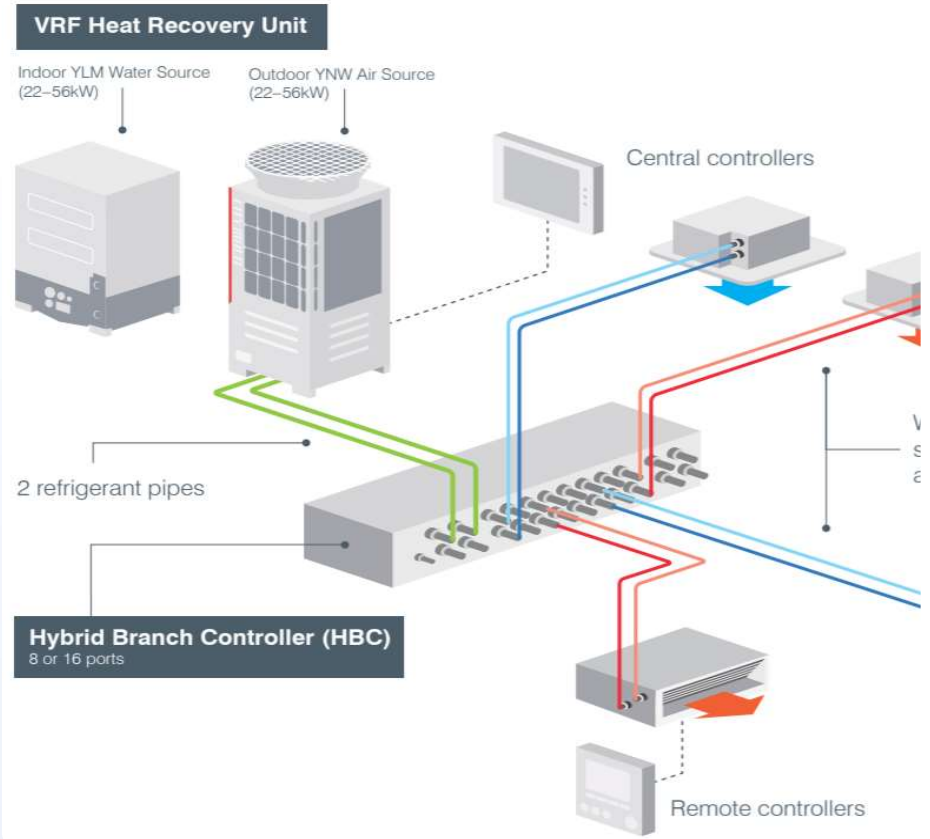
2012

MITSUBISHI ELECTRIC TRANE HVAC US

Hybrid VRF

Refrigerant to Water System

- Combines benefits of VRF and a Hydronic System
- Heat Recovery System
- Water is delivered to indoor units and removes refrigerant from occupied spaces



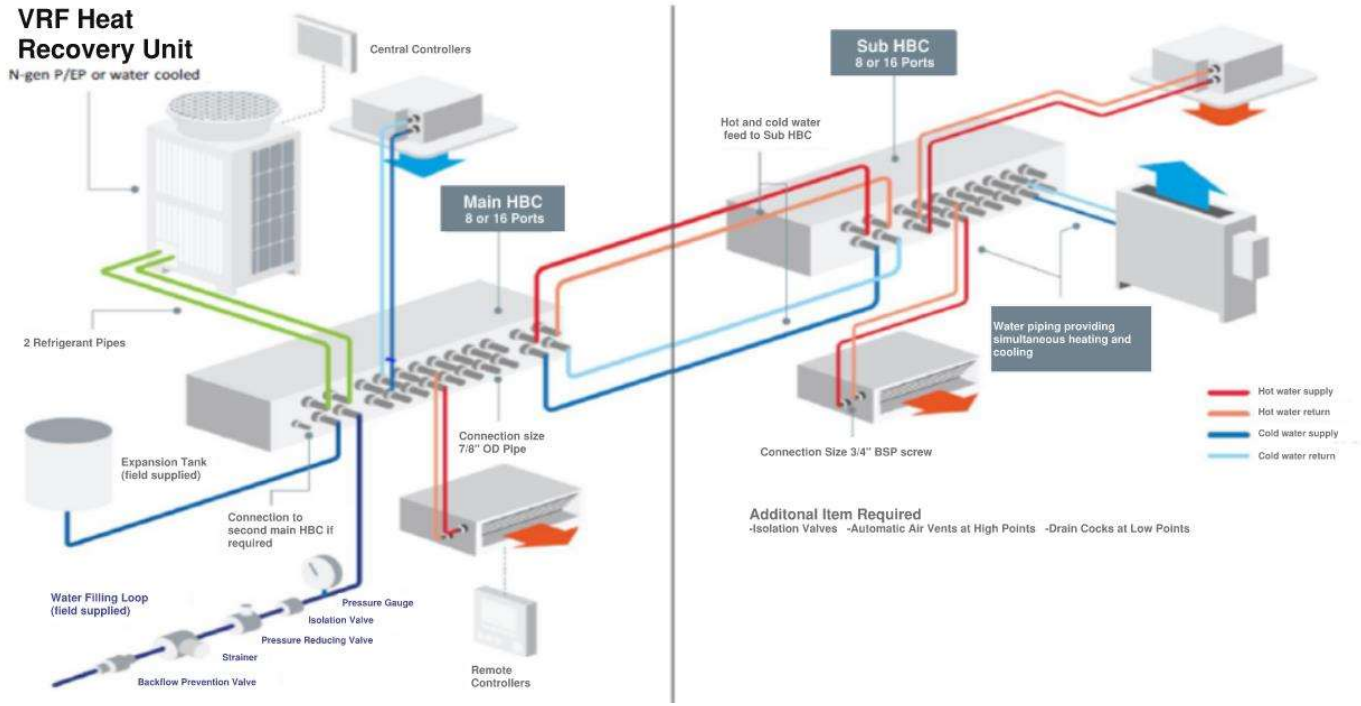
MITSUBISHI ELECTRIC TRANE HVAC US

Benefits of a Hybrid VRF system

- Hybrid VRF removes refrigerant from occupied spaces
- Significantly simplifies compliance with ASHRAE 15/34
- Design and Installation like VRF
- Mitsubishi's 2-Pipe simultaneous heating and cooling system

MITSUBISHI ELECTRIC TRANE HVAC US

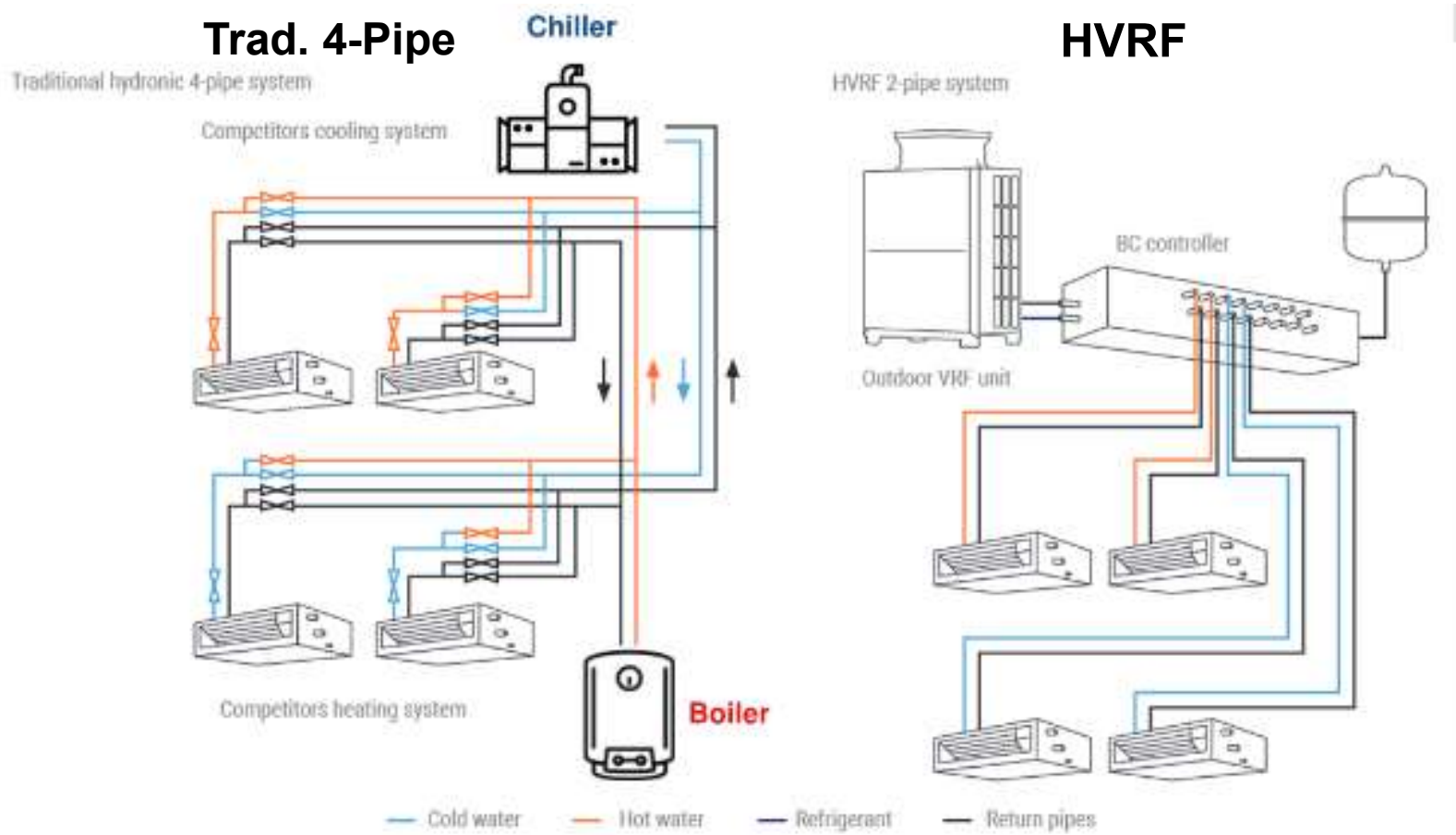
HVRF Flexible Layout



Additional Hydronic Components Required

MITSUBISHI ELECTRIC TRANE HVAC US

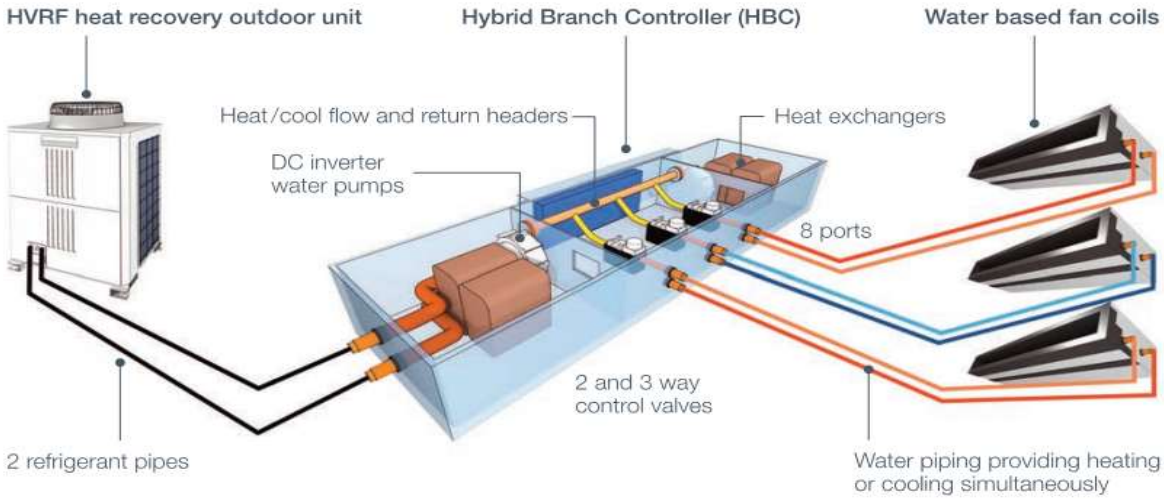
HVRF vs. traditional Chiller/Boiler System?



MITSUBISHI ELECTRIC TRANE HVAC US

Hybrid VRF System

- Best of VRF Technology and Hydronic Technology Combined
- Same VRF Design Principles we use today
- New Water Piping Options for Lower Installed Cost
- Built In Efficiency
- Packaged system –No 3rd party controls required



MITSUBISHI ELECTRIC TRANE HVAC US

BC Controller to Indoor Units

Berklee School of Music, Boston, MA

Domestic Hot Water Heat Pump

Refrigerant to Water System

QAHV

2007

MITSUBISHI ELECTRIC TRANE HVAC US

QAHV – Heat Pump Hot Water Heater

- Utilizes Natural refrigerant (CO_2)
- High efficiency (COP up to 3.73)
- Supplies High Temp Hot water (up to 176°F)
- Operable at low outdoor temp (-35°F)
- Maintains 100% heating capacity to 26°F
- Complete Package for a Plug and Play approach

- *Large* Scale DHW System – 20-25 apartments
- ***Paradigm Shift for DHW Hot Water Systems*** ***(Small Source, Large Storage)***

Nominal Capacity 40KW

(136,485 BTU/hr.)

MITSUBISHI ELECTRIC TRANE HVAC US

QAHV- Heat Pump Hot Water - Years in the Making

- Mitsubishi Electric started producing Heat Pump Water Heaters in **1980**
- **1st CO_2** Heat Pump Water Heater produced in **2007**
- **4 generations** of models/**16 years** of data to produce 1st US model

1st Gen: 2007
2nd Gen: 2009

3rd Gen: 2011

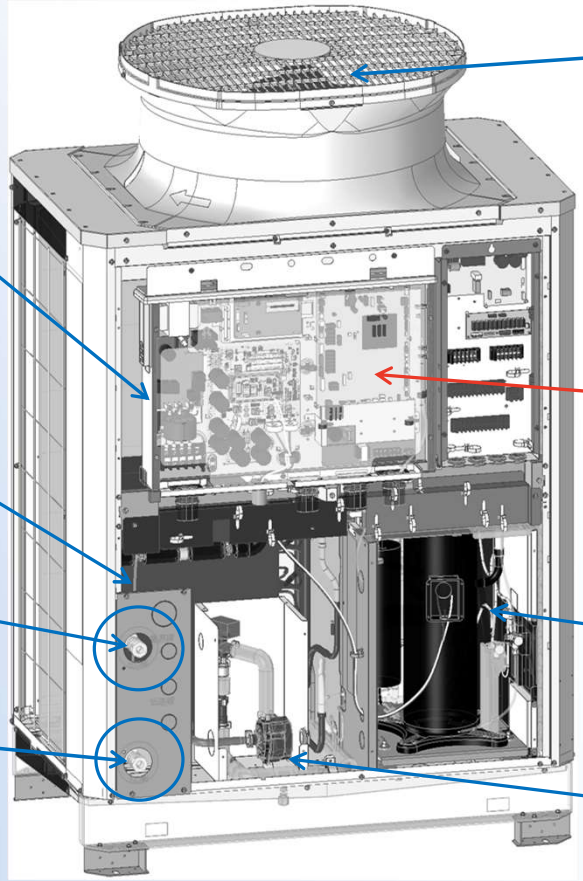
4th Gen: 2015

US 1st Gen: 2021

5th Generation Product

MITSUBISHI ELECTRIC TRANE HVAC US

QAHV- Condenser & Evaporator in one



Fan motor

Control box (main)

Gas Cooler/HEX

Main Control Board

Outlet

Compressor

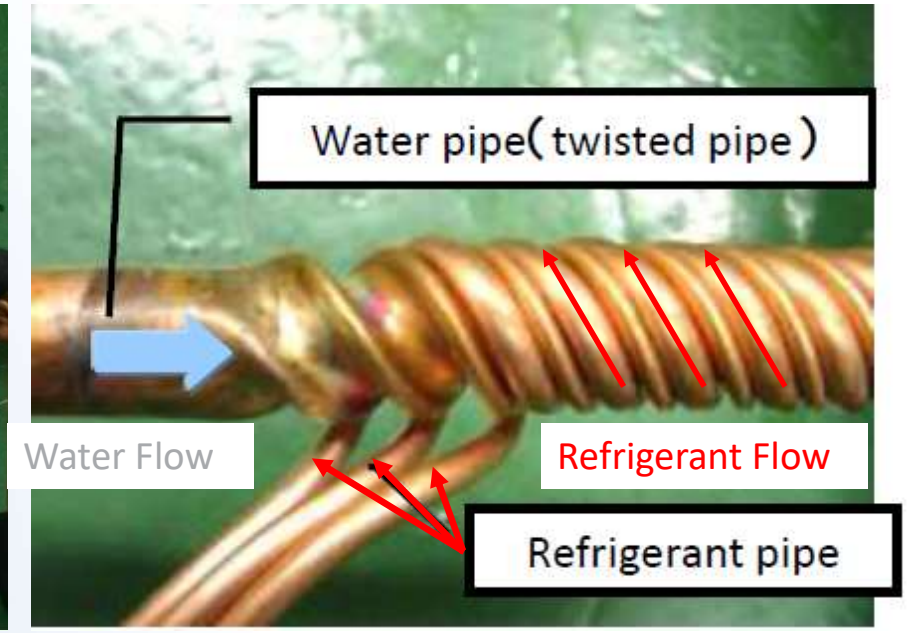
Inlet

Inverter Driven Water pump

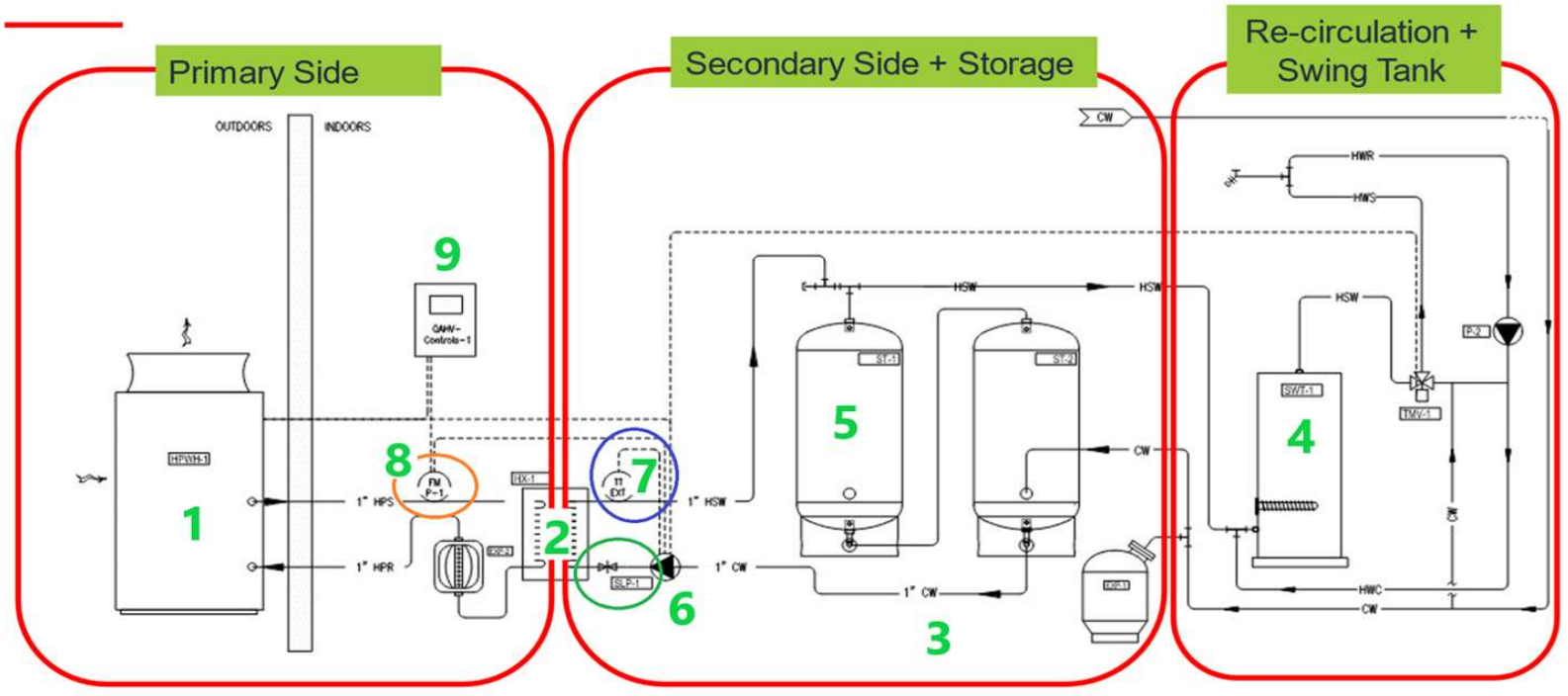
MITSUBISHI ELECTRIC TRANE HVAC US

QAHV Heat Exchanger

- Twisted Spiral Gas Cooler (HEX)
- Patented Technology
- Double Wall Construction

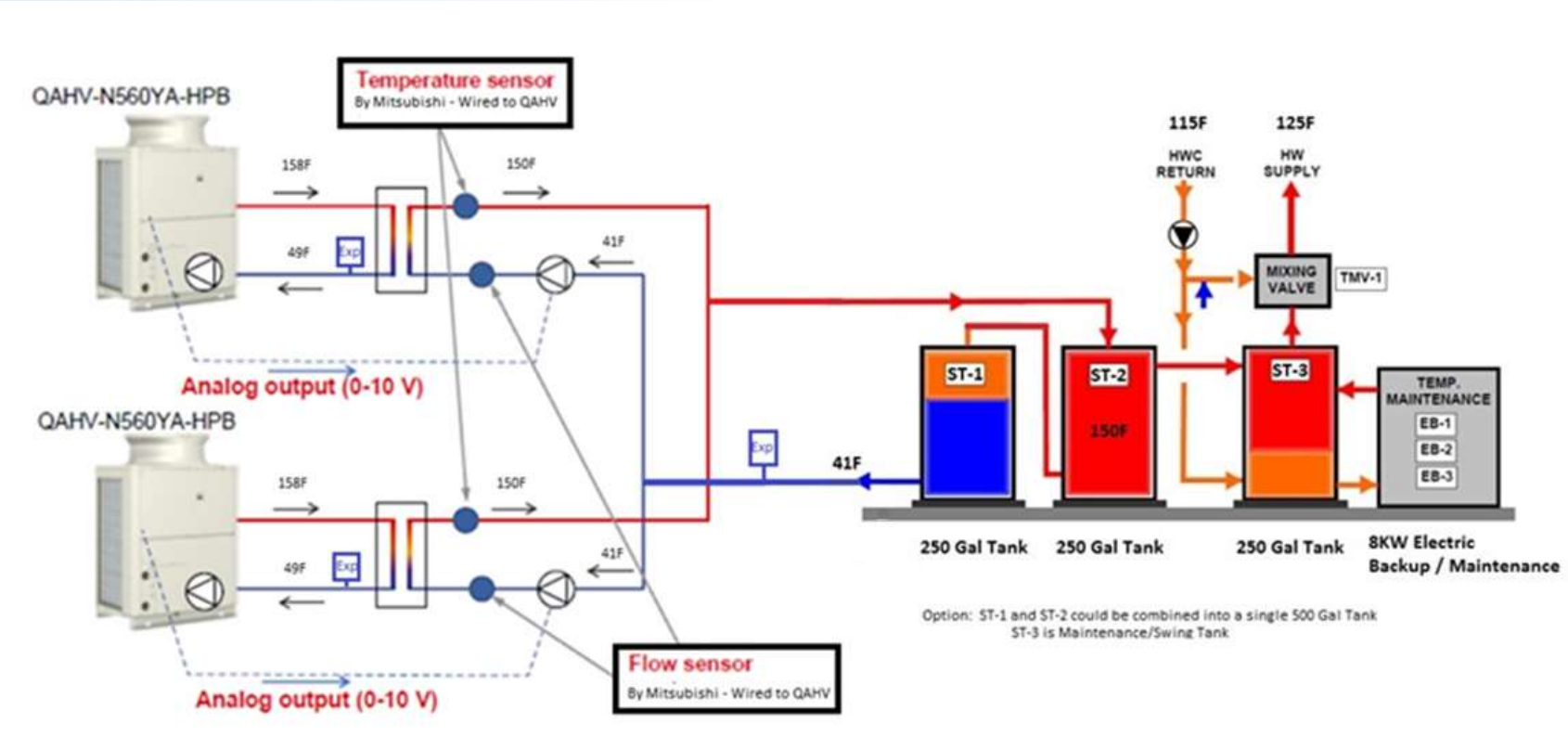


Anatomy of the QAHV



MITSUBISHI ELECTRIC TRANE HVAC US

QHAV- System Schematic



MITSUBISHI ELECTRIC TRANE HVAC US

System **Design**

- Design parameters include:
  - Building Occupancy, Gallons per Day per Person, Supply Temp, Storage Temp, etc.
- Mitsubishi will provide support documentation on design.
- **Can compare storage vs. capacity options**

Heating Capacity: 372,900 BTU/h
Tank Volume: 500 Gallons

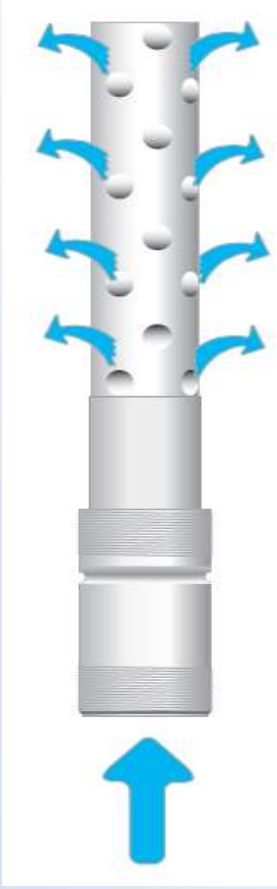
Vs.

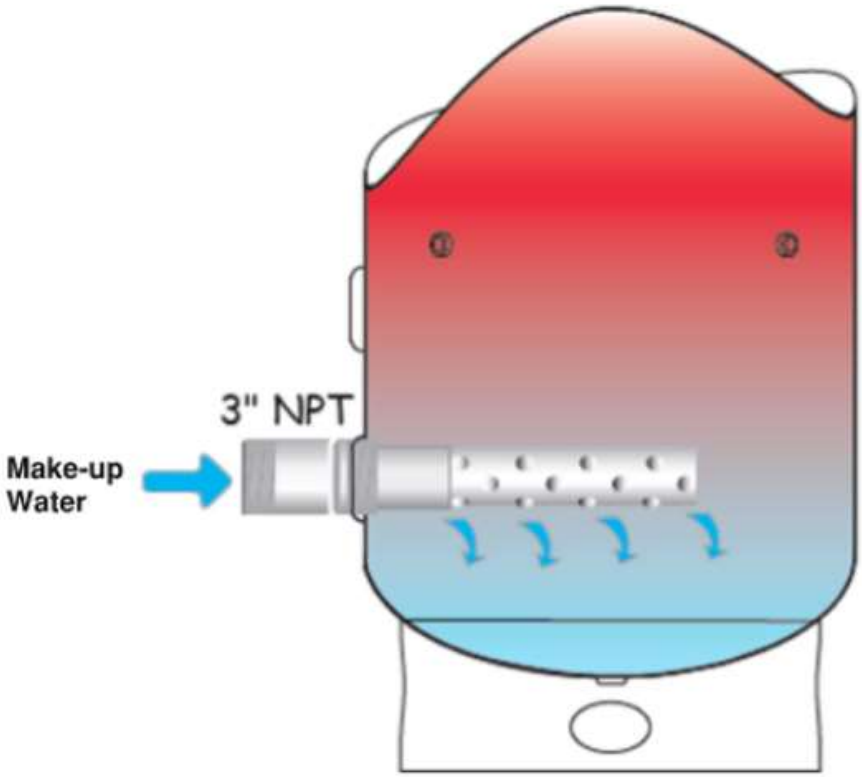
Heating Capacity: 236,200 BTU/h
Tank Volume: 1,242 Gallons

MITSUBISHI ELECTRIC TRANE HVAC US

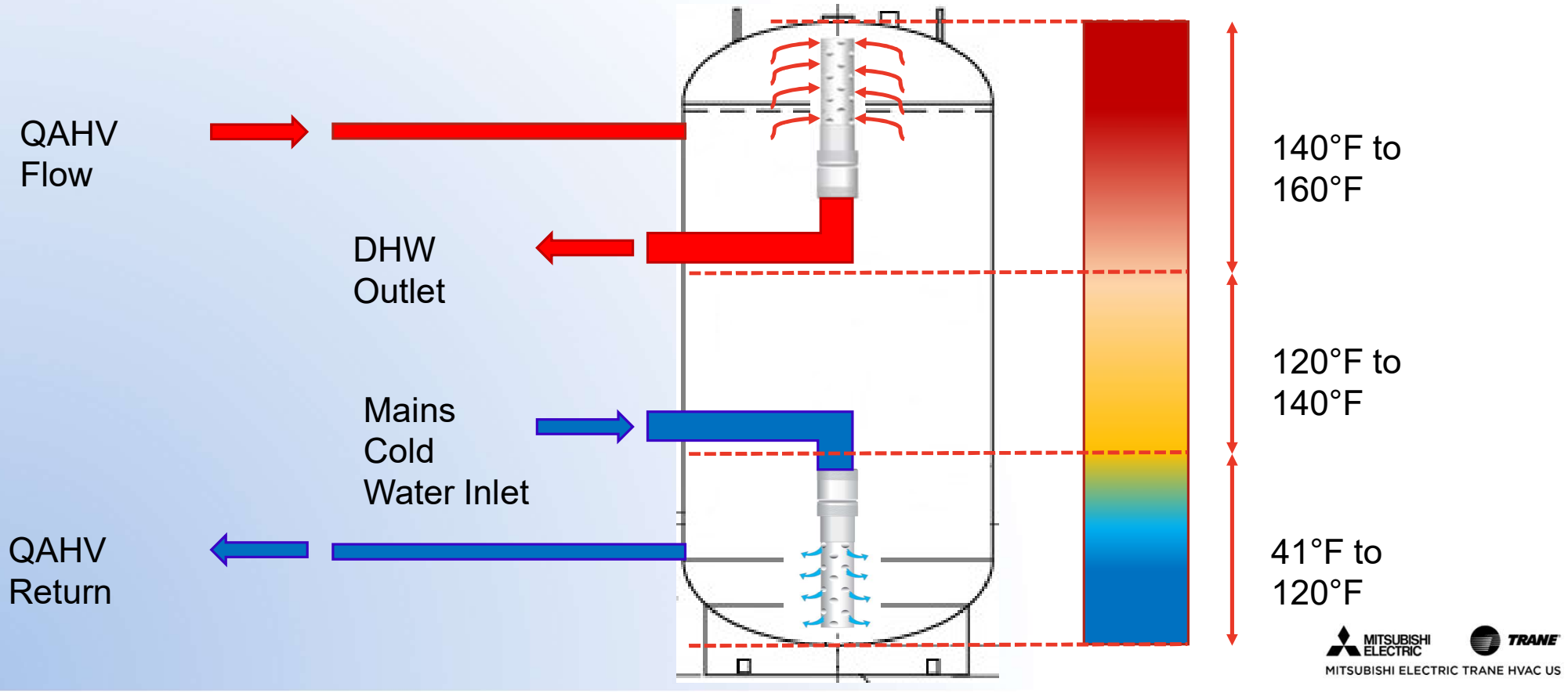
Storage Tanks - Sparging System

- Low Velocity Water delivery
- Reduces Turbulence
- Maximizes Stratification
- Improves system efficiency



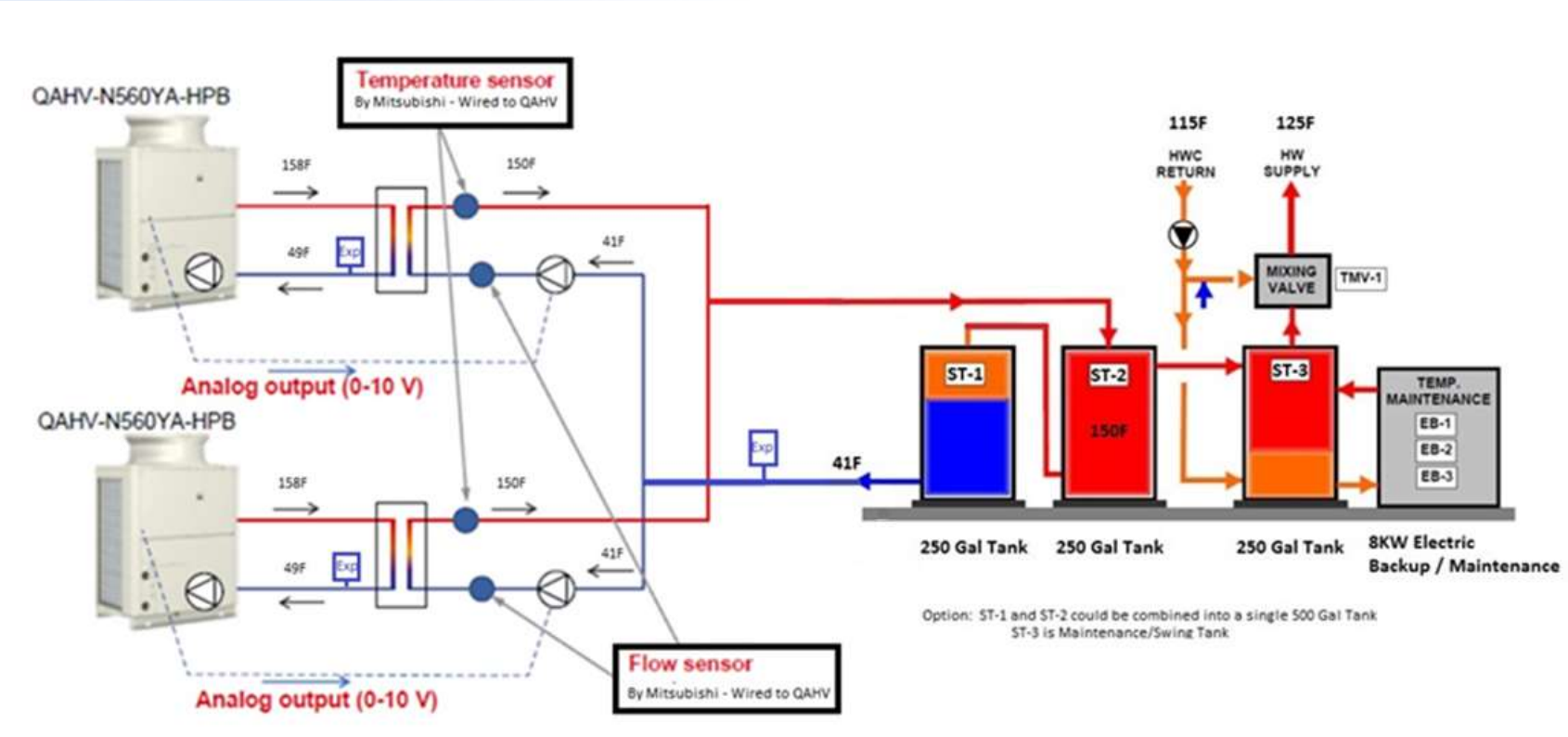


Tank Stratification



MITSUBISHI ELECTRIC TRANE HVAC US

QHAV- System Schematic



MITSUBISHI ELECTRIC TRANE HVAC US

QAHV - Hotel Marcel , New Haven CT

- Large hot water demand
- 3-QAHV Units
- 165 guest rooms
- On-site laundry
- Full kitchen, catering and banquet services

MITSUBISHI ELECTRIC TRANE HVAC US

Hot Water Heat Pump Boiler

Refrigerant to Water System

CAHV

MITSUBISHI ELECTRIC TRANE HVAC US

What is CAHV?

- Modular Air-Source Hot Water Heat Pump
- Uses low GWP refrigerant (R454C | GWP 148)
- Outlet water temp up to 165F (74C)

Applications:

- Space Heating (HW Coils, In-Floor Heat, Baseboard)
- Domestic Hot Water (Used stand alone or for maintenance)
- Pool Heating
- Industrial heating processes

MITSUBISHI ELECTRIC TRANE HVAC US

CAHV – Under the hood

Product Features:

- 136,480 BTU/Hr. (40KW) with modulation - steps of 1706 BTU/Hr (0.5kW)
- Cascade multiple units - up to 16 (2,183,680 BTU/Hr)
- COP up to 3.49
- Up to 165F Water
- -13F Rating / -35F operation
- Optimization / Staging built in
- BMS Integration
- R454C refrigerant (GWP146)

MITSUBISHI ELECTRIC TRANE HVAC US

What is CAHV?

<Hot Water Usage>

Multi family

Hospital

Factory

Dormitory

Hotel

Health center
Sports gym

Hotels & health center

For heating and thermal applications such as showers and swimming pools in hotels and health centers.

Community heating

For heating applications such as radiators and underfloor heating in housing complexes.

Factory

For applications with high heat-retention loads, such as parts washing and painting lines. The CAHV can also meet high horsepower demands by combining several units.

MITSUBISHI ELECTRIC TRANE HVAC US

What is CAHV? – Comparison with QAHV

	 QAHV	 CAHV
• Heat Source	• Air	• Air
• Refrigerant	• R744 (CO2)	• R454C
• Outlet Water Temp.	• 120~176F (49~80C)	• 75~165F (24~74C)
• Heating Capacity	• 136,480Btu/h (40kW)	• 136,480Btu/h (40kW)
• Heating Method	• Transient heating that directly raises the temperature of city water. **Best suited for High Delta-T**	• Circulation heating that circulates water from hot water storage tanks or load-side equipment. **Best suited for Low Delta-T**

MITSUBISHI ELECTRIC TRANE HVAC US

CAHV – Features

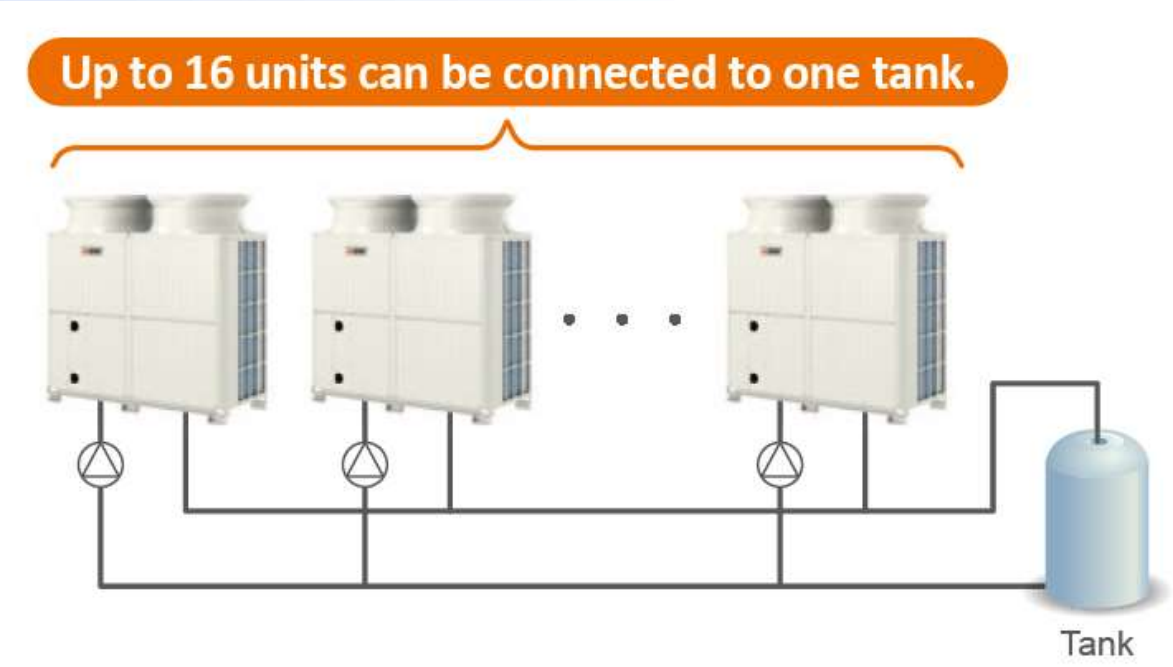
- Low GWP Refrigerant
- R454C
- Eco-friendly and lower flammability

	R407C	R410A	R32	**R454C**
Ozone depletion potential (ODP)	0	0	0	**0**
Global warming potential (GWP)	1,770*	2,088*	675*	**148***
Flammability	No flame propagation	No flame propagation	Slight flammability	**Slight flammability**

MITSUBISHI ELECTRIC TRANE HVAC US

CAHV – Design Flexibility

- Multi-Unit Installation
  - Possible according to the tank storage capacity

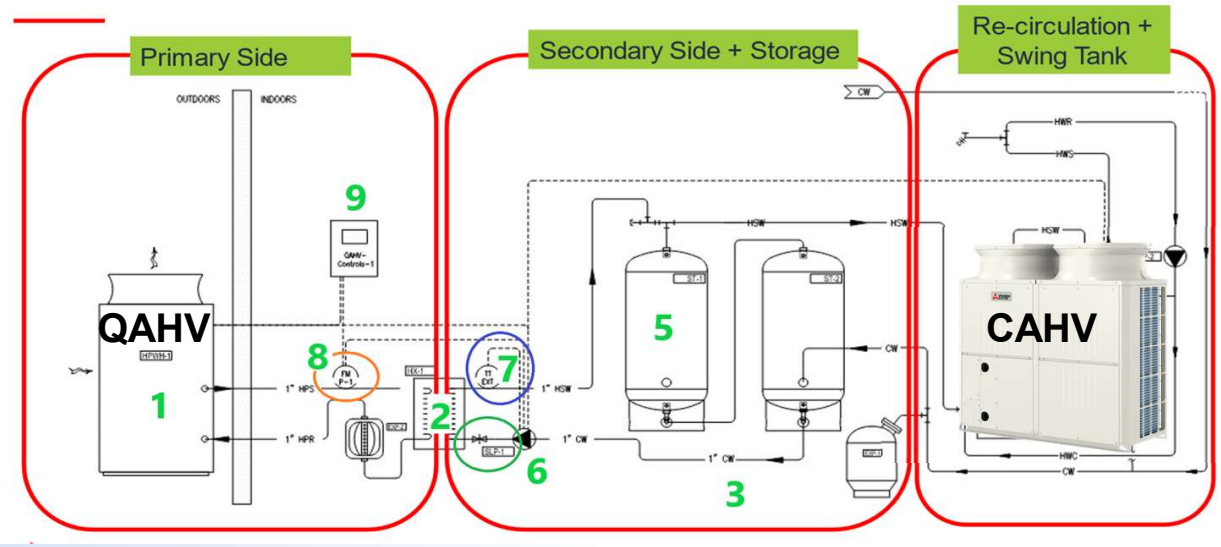


CAHV

CAHV – More than a boiler

CAHV Replaces electric swing tank

- Higher efficiency
- Packaged system



MITSUBISHI ELECTRIC TRANE HVAC US

What's Next????

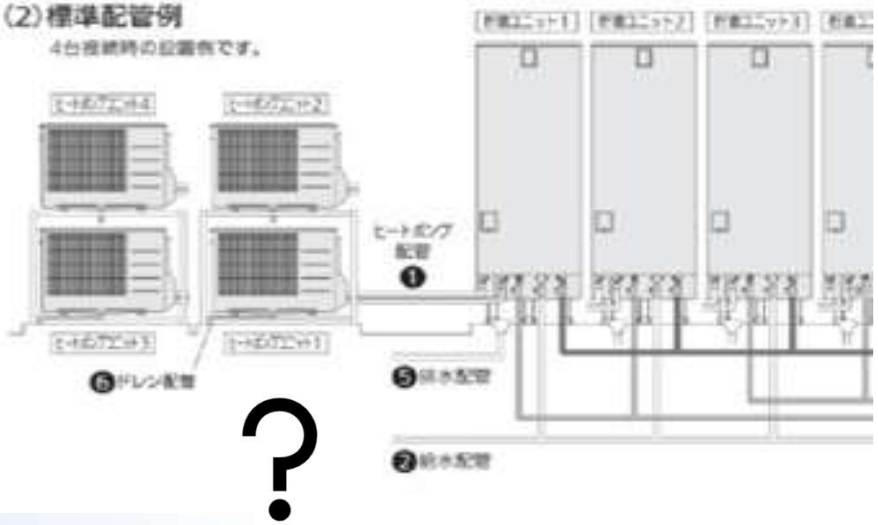
Air-to-Water – QUHZ (Mini Hot Water Heater) ?

Product: QUHZ-Multifamily

- Up to 4x QUHZ and 4x tanks
  - 550L (145gal) tank
  - **Total water storage of 2200L (580**

Target Market/Application:

- Light commercial applications: schools, nu
- Multifamily buildings: retrofit and new cons



MITSUBISHI ELECTRIC TRANE HVAC US

Chris Ouellette
Business Development Manager
Mitsubishi Electric Cooling & Heating
couellette@hvac.mea.com
978-241-0487

MITSUBISHI ELECTRIC TRANE HVAC US