

CASCADE SYSTEMS II: WATER COOLED VRF SYSTEMS

APPLIED HVAC

HOW IT WORKS



As outlined in the last How it Works for Applied HVAC, **Air-to-Water Heat Pumps** can boost the efficiency of the overall mechanical system while reducing carbon emissions compared to traditional chiller-boiler systems in cascade systems, such as Water-Loop Heat Pump (WLHP) systems.

An improvement on that concept is combining the **Central Plant Air-to-Water Heat Pump** with **Mitsubishi Electric CityMulti Water-Cooled VRF Condensing Units**, which can serve multiple zones at the same time through VRF Technology instead of a WLHP unit that serves only one zone. This allows for the flexibility and energy efficiency of VRF technologies to be incorporated into the design. The VRF system can be connected to the **Central Plant ATW Heat Pump** instead of a boiler that is typically used in retrofits and/or when adding a geothermal field is not feasible.

The design flexibility of VRF is paired with the low carbon benefits of Climaveneta Air-to-Water Heat Pumps to provide the following benefits:

- Low-Carbon Solution in applications where Geothermal is not feasible and cooling tower-boiler system is typically used.
- 4-pipe comfort using 2-pipe hydronic distribution for lower installed cost
- Reduced Refrigerant Charge compared to Air-Cooled CityMulti systems
- **“First”** Heat Recovery is achieved between indoor zones connected to the same Branch-Box Controller (WR2 CityMulti Systems, shown in figure below)
- **“Second”** Heat Recovery is also achieved via the hydronic distribution in the shoulder season, when some condensers are in heating while others are in cooling; NX-N only needs to operate to add or reject heat from the overall system, and only as needed (shown in figure below)
- **Increased Overall System Efficiency:**
 - Optimizes VRF System’s Efficiency: Increase in both Cooling & Heating Efficiency of the CityMulti System when selected with the NX-N Air-to-Water Heat Pump’s Operating Temperatures
 - Optimizes the ATW HP’s selection point since it runs with a warmer temperature in cooling and a cooler temperature in heating to maximize the efficiency.

