Ground Source Mini Splits & VRF: Ductless Solutions

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Variable Refrigerant Flow (VRF)
Heat Pump
Heat Pump with Heat Recovery
Simultaneous Cooling & Heating
Traditional Boiler & Cooling Tower Water Source VRF System
Geothermal Plant Side Configuration With or Without Hybrid
WS VRF Temperature Range

- Typical condenser water temperature target to eliminate heat entering water temperature de-rate is around 70 deg F.
- Typical condenser water temperature target to minimize cooling WS module power & capacity penalties in balance with tower sizing and power consumption is 85 deg F in summer.

Standard Entering Water Temperature is 50°F - 113°F without glycol
# Inlet Water Temperature

<table>
<thead>
<tr>
<th>Water Temp.</th>
<th>23°F</th>
<th>50°F</th>
<th>85°F</th>
<th>95°F</th>
<th>113°F</th>
<th>23°F</th>
<th>50°F</th>
<th>70°F</th>
<th>113°F</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Standard Correction Factor</strong></td>
<td>-</td>
<td>1.00</td>
<td>1.00</td>
<td>.94</td>
<td>.86</td>
<td>-</td>
<td>.84</td>
<td>1.00</td>
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<tr>
<td><strong>Low Temp. Correction Factor</strong></td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
<td>.94</td>
<td>.86</td>
<td>.65</td>
<td>.93</td>
<td>1.00</td>
<td>1.00</td>
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</tbody>
</table>

Standard entering water temperature range is 50°F – 113°F

*Using Low Temperature Correction Factor Requires Glycol*
L-Generation Water-Source

Features and Improvements:

• Best-in class efficiency ratings across all categories
• Reduced refrigerant charge by up to 40%
• Single modules up to 20 tons (Previously only 10 Ton)
• Enhanced cross-flow water-side heat exchanger design for improved efficiency
• Modular units can be twinned to expand capacity ranging from 6-28 Tons (Heat Recovery) and 6-30 Tons (Heat Pump)
• Compact footprint
• Quiet operation: 46-58 dB(A)
• Heating and cooling operation with condenser water temperatures as low as 23F
• Water side connections changed to bottom supply and top return – better air purging and promoting debris removal.
• 0-10V output signal added for individual module flow modulation.
The Next Generation of VRF Equipment

L-Generation Water-Source

Features and Improvements

<table>
<thead>
<tr>
<th>% Improvement in Above Efficiency Ratings</th>
</tr>
</thead>
<tbody>
<tr>
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<tr>
<td>P120</td>
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<tr>
<td>P144</td>
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<td>P168</td>
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<tr>
<td>P192</td>
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<tr>
<td>P216</td>
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<tr>
<td>P240</td>
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<tr>
<td>Avg.</td>
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</tbody>
</table>
When/Why Use Water Source vs Air Source VRF?

- **Benefits of Water Source**
  - Higher equipment efficiencies
  - Heat recovery between systems
  - Geothermal applications available
  - Ability to efficiently provide heating in cold climates
  - VRF equipment is out of the elements
  - Equipment can fit in a freight elevator

- **Benefits of Air-source**
  - Lower installed cost
  - Less indoor space used
  - Less complex controls
When/Why Use Water Source vs Air Source VRF?

- **High Rise Applications over 130 Ft / 160 Ft mark (OU below/above):**
  - Limited ground/roof space to accommodate all air source modules.
  - Affects on operating range, oil return issues, compressor longevity with Air Source when using extended vertical height (Med Pressure Kits).

- **Cold Climate Applications:**
  - Cost of gas vs electric heat?
  - Elimination of ambient de-rates (with boiler / tower designs).
    - 24-7/Assisted Living / Elderly Care in extreme cold climates
  - Requirements for redundant backup heat.
    - Difficult to do at zone level with air source – easy for boiler / tower WS.
  - No aux. heat control hysteresis with CN24 offsets.

- **Projects driven towards Geothermal:**
  - Ultimate efficiency / Highest Cost!
  - Hybrid Geo (Cooling Dominant Profiles) with tower to trim peaks can offer significant well field cost reduction!
How Does Water Source VRF Compare?

**VRF Sample Building Operating Cost**
34,000 SF Office Building - Cincinnati Ohio

<table>
<thead>
<tr>
<th>Month</th>
<th>Full Geo VRF Yearly Cost</th>
<th>Water Source VRF Yearly Cost</th>
<th>Air Cooled VRF Yearly Cost</th>
<th>Rate &amp; Fuel Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>$37,590.00</td>
<td></td>
<td>$43,370.00</td>
<td>$0.10/kwh, $1.1/therm</td>
</tr>
<tr>
<td>2</td>
<td>$37,590.00</td>
<td></td>
<td>$43,370.00</td>
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<td>11</td>
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<tr>
<td>12</td>
<td>$37,590.00</td>
<td></td>
<td>$43,370.00</td>
<td></td>
</tr>
</tbody>
</table>

- **26% Savings** switching to full Geo VRF
- **13% Savings** switching to full Geo VRF
Water Source VRF /Geothermal
Advantages

- Wide Temp Range – Up to 113 deg F inlet water temp – well field sizing!
- Reduced Compressor quantity / maintenance
- Ability to size more for block load vs sum of peaks
  - Less nominal total installed tonnage.
- More flexibility on connected capacity vs air cooled VRF.
- Usually no need for auxiliary heat or large heating de-rates as with air cooled.
Ground Source Ductless Solutions: Using Splits & VRF

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VRF Commercial Applications

- Combine dissimilar load profiles.
- High Zone density.
- Locate compressor section.
- Simplify System.
• VRF
• Packaged Heat Pumps
• Snow-Melt
• Pool Dehumidifier
• Pool Water Heating/Cooling
• Garage Heat
Refrigerant Standards

ASHRAE Standards
• ASHRAE 15: Safety Standard for Refrigeration Systems
• ASHRAE 34: Designation and Safety Classification of Refrigerants

NYS Mechanical Code
• Chapter 11 - Refrigeration
VRF Residential Applications

• Existing Heat emitters not designed for Low Temperature Applications.
• No existing ductwork.
• High Zone Requirements.
VRF Geothermal Connections

Flow Switch

Strainer

Circulator

2-Way Valve

To/From Loop Field

Indoor Units

VRF Condenser

Indoor Units

VRF Condenser

To/From Loop Field
Why isn’t VRF in your toolbox, to solve today’s problems?

Thank you
• 40% of Skidmore College is heated and cooled geo-thermally—to date
First VRV HVAC system - Wiecking Hall

- Ultra high efficiency heating and cooling heat pump (air source) not after 2014
  (Water source) geo conversion

- Individual room control
- 6” above the finished ceiling
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ah.humsi@samsunghvac.com
www.samsunghvac.com
Climate Solutions

New York Geothermal Energy Organization
Samsung Commitment to Efficiency

Our focus on driving efficiency

Efficiency cannot be measured only by AHRI ratings. Other factors contribute to it:

- Heat Recovery
- Centralized Controls to Optimize the System
- Individual Controls

Improved Efficiency
Samsung Indoor Units

Indoor Unit Flexibility

360 Cassette
9K-48K

4-Way Cassette Wind-Free ™
9K-48K

Mini 4-Way Cassette Wind-Free ™
5K-50K

1-Way Cassette Wind-Free ™
7.5K-12K

Wi-Fi Adapter
(MIM-HO3UN)

Slim Duct
7.5K-48K

H.S.P. Duct (High Static Pressure)
54K

Duct S
7.5K-48K

Big Ceiling
36K-48K

Multi-Position Air Handler
12K-60K

Whisper- Wall Mount
5K-28K

MAX- Wall Mount
32K

Ceiling/Wall Convertible
18-24K

Floor Standing (Concealed type)
6-24K

FLOOR STANDING (exposed type)
6K-24K

*The Wind-Free™ unit delivers an air current that is under 0.15 m/s while in Wind-Free™ mode. Air velocity that is below 0.15 m/s is considered "still air" as defined by ASHRAE 55-2013 (American Society of Heating, Refrigerating, and Air-Conditioning Engineers).

**Proper sizing and installation of equipment is critical to achieve optimal performance. Split system air conditioners should be paired with appropriate coil components to meet ENERGY STAR criteria. Ask your contractor for details or visit www.energystar.gov.
**Product Line Up**

**DVM S Water (1Ø -3Ø)**

**DVM S Water**
Available in 6, 8, 10, 16, and 20-ton capacities.
- Connect up to 3 units for system capacities up to 50 tons
- Single-phase non-modular, Heat Pump only
- Available in 3.2, 4, and 4.5-ton capacities

Uses standard DVM S indoor units

Three-phase Heat Pump or Heat Recovery, configured in field.
Commercial Air Conditioning Solutions
DVM S Water Commercial (1Ø -3Ø)

Renewable Energy Source
Eco-friendly DVM S WATER uses geothermal energy as a renewable heat source instead of a cooling tower and boiler, effectively supporting businesses, environmental and cost reduction initiatives.

Operation Monitoring
A smart Auto Commissioning Management (ACM) function continually monitors operation. If a malfunction occurs, the last 30 minutes of operational data will be stored for review by a technician.

Cost-effective Water Flow Control
Regulates the amount of water used to cool and heat the outdoor unit. It determines the optimum flow of water based on the internal temperature of the space, economizing both the circulation pump's energy usage and costs.

6, 8, 10, 16, and 20-ton and can connect up to 3 units for system capacities up to 50 tons.
Economical Design And Setup
At 20 tons, the large-unit capacity of DVM S WATER facilitates economical installation with a smaller footprint and lighter weight which is an ideal solution for larger buildings.

Note: 16 Ton unit and measurements are show in the image above.

Broad Installation Options
DVM S WATER provides extended piping length of up to 558 ft and installation height of up to 164 ft. The piping allows individual indoor units to perform capacity connection control and automatic refrigerant equalization for more balanced performance between units.

Louver-Less Installation
Because the system cools with water, it eliminates the need to install unsightly louvers to allow air to circulate and to remove excess heat. Its streamlined operation supports easy installation inside a building without impacting the integrity of its architectural design.
Variable Speed Compressors
Match the Load of the Space - Minimal Temperature Variation

Digital Inverter 8 Pole
The system maintains the desired set temperature without frequently shutting off and on, which provides substantial reduction of energy consumption.

Low outdoor noise levels are also a benefit of the Digital Inverter system.
Wind-Free™* Technology - A Samsung Exclusive

Unique Features

Fast track your comfort.
The unit's 2-Step Cooling mode cools the air incredibly fast in Fast Cool mode, then automatically changes to Wind-Free Cooling mode and maintains the temperature. You'll be cool and comfortable in no time flat.

Holey moley.
This is unbelievable: Thanks to 21,000 micro holes, we stop drafts from happening. Located in the unit's front panel, these tiny feats of engineering maintain the desired room temperature by gently and calmly dispersing cool air through a room. So you'll feel really comfortable, but surprisingly, you won't feel annoying, cold drafts.

Beautiful from the inside out.
At the heart of the Wind-Free air conditioner is the Samsung Digital Inverter compressor. Technology that makes the unit extraordinarily quiet, durable and efficient. It's quite the attractive feature.

* Wind-Free™ mode will only operate during cooling operation. The Wind-Free™ unit delivers an air current that is under 0.15 m/s while in Wind-Free™ mode. Air velocity that is below 0.15 m/s is considered “still air” as defined by ASHRAE 55-2013 (American Society of Heating, Refrigerating, and Air- Conditioning Engineers).
Wind-Free Video

Stay blue without any draft to be felt

Get Cool Fast, Stay Cool

SAMSUNG
Thank you

Questions?