Engineers and Contractors - Innovative Technologies to Achieve Highest GeoExchange System Efficiencies for Commercial Projects

Presented by:

Warren (Trey) Austin,
PE, CEM, CGD, LEED-AP

Geo-Energy Services, LLC
Basic Information

• vFlow Technology

![vFlow Logo]

• Terminology – Two Types
  – Pump- Internally mounted variable speed pump controlled and modulated from central control board
  – Valve- Internally mounted control valve controlled and modulated from central control board
Purpose

• Increase system efficiency
• Reduce Installation Labor and Cost
• Improve equipment performance by allowing optimum capacity delivery with real time data analysis of air, refrigerant and water information.
• Reduce Pumping Energy needs
  – Elimination of Additional Head Loss items such as Auto-flow Regulators or Balancing Valves
Old Practice

• Conditions:
  – Heating Mode with 70°F or above EWT
  – Cooling Mode with 50°F or below EWT

• Historical Solutions?
  – More Water Flow
    • High Pumping Energy Needs
  – Can’t Operate or risk….?
    • Lock Outs
  – No Operation Recommended
Advantages

• Pumping
  – Elimination of Additional Head Loss items such as Auto-flow Regulators or Balancing Valves

• Airflow
  – Precision Airflow settings using iGate communicating controls for each stage of operation in return allow for direct modulation of vFlow pump or valve to maintain constant delta T and leaving water temperature
Applications

• Two Primary Categories
  – Closed Loop Systems
    • Traditional 2-pipe System
    • Single Pipe System
  – Open Loop System
    • 2-Pipe System for single pass water flow
vFlow Applications

• Open Loop Systems
  – Using vFlow valve, GSHP units will self modulate valve for water flow based on control board output for stage of compressor and EWT to maintain either constant delta T or fixed LWT.
  – Operation allows for maximum capacity output without operating outside of refrigerant pressure limits that, in past, would trip unit off in high or low pressure situations.
  
  • Heating Mode with 75°F or above EWT
  • Cooling Mode with 50°F or below EWT
vFlow Applications

• Closed Loop Systems
  – Traditional 2-Pipe System
    • Using vFlow valve, GSHP units will self modulate valve for water flow based on control board output for stage of compressor and EWT to maintain either constant delta T or fixed LWT.
    • Operation allows for maximum capacity output without operating outside of refrigerant pressure limits that, in past, would trip unit off in high or low pressure situations.
      – Heating Mode with 75°F or above EWT
      – Cooling Mode with 50°F or below EWT
vFlow Applications - Valve

• 2-Pipe Design:
  – Primary Building Pump on VFD control with delta P (Pressure not T, Temperature)
  – May or may not include separate ground loop pump configured on VFD control with delta T (Yes, this is ok) in a primary/secondary pipe configuration.
vFlow Applications - Pump

• Closed Loop Systems
  – Using vFlow pump, GSHP units will vary the speed of the pump (still a min. limit of about 25%) to control the water flow based on stage of compressor and EWT to maintain either constant delta T or fixed LWT.
  – Operation allows for maximum capacity output without operating outside of refrigerant pressure limits that, in past, would trip unit off in high or low pressure situations.
    • Again, Heating 75°F/Cooling 50°F
vFlow Applications - Pump

• 2-Pipe Design
  – Must use identical sized pumps (High or Low Head) in system or risk dead heading because check valve pressure is too much to overcome.
  – Used in retrofits to extend existing system for expansion to existing building or add on separate building(s) to same ground loop.
  – Pipe Sizing is critical to keep low total head down for long distances
  – For Flo Center lovers with one/two pump per GSHP unit….this is a perfect match!
vFlow Applications - Pump

- **Closed Loop Systems**
  - **Single Pipe Design**
    - Requires one central pump controlled on delta T
    - Individual pump at each unit (High or Low Head selected, should be Low head in most cases).
    - Single Pipe installed throughout building of same size (2”, 3”, 4”, etc.)
    - Typical small and medium scale applications will see about a 4F rise in fluid temperature from 1st unit to last unit on system.
    - May or may not include separate ground loop pump configured on VFD control with delta T in a primary/secondary pipe configuration. Consider for Medium to Large Projects
Case Example 1

- BancFirst, Edmond, OK
- 11,000 ft$^2$
- Built August 2013
- 2 Pipe vFlow – Valve
- Variable Speed Pump on delta P (12 psid)
- 45 tons
- 40-300’ Boreholes
- ERV
Case Example 1

Annual Energy Consumption

Monthly energy consumption in kWh from October to August.
Case Example 1

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Annual Energy Consumption (kWh)</td>
<td>153585</td>
</tr>
<tr>
<td>Annual Total Electric Cost ($)</td>
<td>13,359.60</td>
</tr>
<tr>
<td>Normalized ($/ft²)</td>
<td>1.22</td>
</tr>
<tr>
<td>Annual Water Cost ($)</td>
<td>10,352.03</td>
</tr>
</tbody>
</table>
Case Example 2

• Casady School Fee Theater, Oklahoma City, OK
• 10,000 ft²
• 78 Tons with 7 zones (14 units)
• Lake Heat Exchanger
• CO2 Demand Control Ventilation
• 2-Pipe with vFlow Valve
Case Example 3

- New Construction
- Single Pipe/ 2-Pipe Combination
- vFlow Pump
- 15,000 ft²
Questions?