Hydronic System Design

Geothermal Nuances

presented by

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The Great Hydronic Heist

Train Robbery by Fujiwara
Do you design or install hydronic systems using water-to-water heat pumps?
If yes, do you follow the manufacturer’s instructions?
Figure 3: Typical Single Compressor Unit Piping Connection
Figure 2: THW Typical Load Piping

NOTES:
1. Place air vent at the highest point in the system.
2. Thermistors should be installed in an immersion well. Locate thermistor in the bottom half of the tank.
3. P/T (pressure/temperature) ports are internal for THW units on load and source connections.
4. Other components (additional ball valves, unions, etc.) may be required for ease of service. This drawing shows only minimum requirements. Your specific installation will dictate final component selections.
5. Buffer tank must be approved as a heating vessel.
6. Local code supersedes any piping arrangements or components shown on this drawing.
NDW Typical Application Piping

NOTE: * A 30 PSI pressure relief valve (Part No: SRV30) should be used in hydronic applications.

WaterFurnace
NDW Series

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The distribution system will dictate the required temperature to meet the load.
Figure 3: Typical Single Compressor Unit Piping Connection

- Hydronic Fan Coil
- Make-up Water Line
- Backflow Preventer
- Pressure Reducing Valve
- Air Vent
- Expansion Tank
- Check Valve
- Pressurized Storage Tank
- Water to Water Heat Pump

Temperature Points:
- 110 °F
- 120 °F (3 times)
- 130 °F

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Key Question

Why are we sending the hottest (or Coldest) water in the system back to the buffer tank where it is mixed and diluted to a lower temperature before we send it to the load?
But, first....

Let’s discuss the importance of the distribution system to overall system performance
Understanding the Load

• Every application is unique and must be fully understood
• Residential heating loads will fall between 11 – 23 BTUH/Sq Foot
• A room-by-room load calculation is required to design the distribution system
• To cover those really nasty days, I would use a 1.25 safety factor times the design load
• Unlike boilers, you cannot turn up the temperature to hide your sins!!!
Let’s pick a Radiant System

<table>
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<tr>
<th>Output at 120 F &amp; Rv = 0.5</th>
<th>16.5</th>
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| 31 |

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Let’s pick a Fan Coil

<table>
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<th>MPH</th>
<th>BTUH @ 120 °F EWT</th>
<th>FCXi</th>
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Why is this Important?

Doing a little interpolating the resulting COP improvement associated with a 10 degree reduction in Load Side EWT is over 16%
Special Thanks to Jens Ponikau
...and How about Controls?

Important Strategies:

• Outdoor Reset
• Demand Enabled
  • WILO Stratos Pump
  • Heat Pumps
• Hydronic
  Supplemental Heat
  Delayed by 3 to 6
  Hours
• Manual Changeover to
  Cooling
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…or for a more modest system….

- **NEMA 1 Enclosure with full length hinged cover**
- **DPDT Plug-in Relays** with indicator LED & locking test button.
- **Fully adjustable time delay relays** preset at factory for optimal performance and reliability.
- **Demand Enabled Control Logic** to enable heat pump only when there is a call for either heating, cooling or water heating. Essentially eliminating unnecessary run time to maintain a tank temperature.
- **Clearly labelled, easily accessed, and generous space for point-to-point field wiring**, supported with system wiring diagrams.

**DIN mounted compact array of relays** that are easily tested, serviced and have LED indicators.

**Point-to-Point field wiring connections** which are easily accessed, labelled and have plenty of space for excess field wire.
Designed to supply 100% of Domestic Hot Water—Year Round!

37,500 BTUH of Supplemental Heat available for extreme cold weather

Can handle as many fan coil and radiant zones as you need!
Bottom Line

It is often said that geothermal costs too much....

Frankly, I think we are failing to maximize the value. Through simple design techniques and a fundamental competence in the design community we can sell the technology at a competitive price and actually deliver outstanding value!
Ibs of CO$_2$ per Million BTUs

- Oil
- Propane
- Electric Heat
- Natural Gas
- Geothermal (from Grid-ave)

per EPA Mandatory Reporting of Greenhouse Gas Guidelines & Efficiency of 82% and COP = 3.7
The Power of Choice !!
Thank you !!!
Questions ?????