



WESTERN PENNSYLVANIA
SCHOOL FOR THE DEAF

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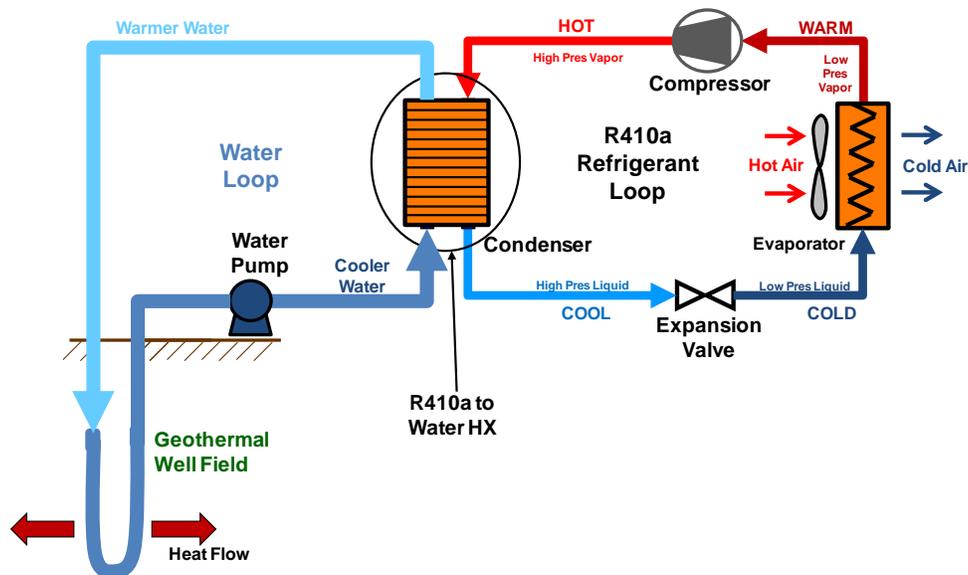
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How Geothermal Systems Work

Figure 1 diagrams the most common geothermal system operating in the cooling mode. This design has two cycles 1) Heat Pump Refrigerant Loop and 2) Water Loop. The heat pump cools the R410a refrigerant which is sent to an air side heat exchanger (evaporator) to cool the air. In this step, the refrigerant heats up and evaporates. The hot refrigerant travels to an R410a refrigerant to water heat exchanger where water is used to transfer the heat energy from the refrigerant into the geothermal well field where it is dissipated into the earth. This design is known as an “Indirect Exchange” geothermal well field design because it uses an R410a refrigerant to water heat exchanger to indirectly transfer heat removed from the air into the ground. To heat the air the cycle runs in reverse.

Figure 1: Indirect Exchange Water Geothermal System – Cooling Mode



Project Description

The WSPD Residence Hall project will house between 40 and 80 students. The 27,000 ft² facility is heating dominate with a peak heating load 384 MBH and a peak cooling load of 44.8 tons. The facility HVAC system was designed as a water-based indirect exchange geothermal system. Seventy, 0.5-1.5 ton water source heat pumps, are distributed throughout the facility and a 20 ton water source heat pump system is used to condition fresh air. A 180 gpm water pump, housed in the mechanical room, moves water mixed with propylene glycol (30%) through a system of water pipes to the heat pumps distributed throughout the facility and into the geothermal well field to accept or reject heat energy into the ground. The propylene glycol serves to prevent the water from freezing. The distributed heat pumps heat and cool the both the building fresh air and return air, to provide year round comfort. Water is used to either accept or reject heat from the heat pumps. The water is then sent to the well field where the heat energy is transferred into the earth.

LEED Certification

A major part of attaining LEED 2009 NC certification involves reducing energy use relative to a baseline system which would comply with all mandated code requirements for equipment efficiency, control of HVAC systems, mechanical systems insulation, etc. Our HVAC design surpasses that benchmark by a conservatively calculated 17% due in large part to the efficiency obtained from utilizing the geothermal well field as a heat source and heat sink depending on the season and the building requirements.

An additional energy benefit results from the reduction of energy consumed by the domestic hot water system compared to current energy code mandates. The selected heaters for this project exceed the required efficiency by 20%. Also, water efficient fixtures reduce water consumption, both hot and cold, by 20% over the code required values.