



Geo-Solar Hybrid Heating/Cooling System Control Diagram

No Scale

- * Shoulder (Spring - Fall) Mode
 - o Occupied - Windows and Doors Closed
 - o During the shoulder season, the mass thermal storage tanks are manually valved so that one tank is dedicated to storing heat from the solar thermal collection subsystem and the other is used for cooling storage from the geothermal subsystem. Refer to the Solar Thermal Collector and Geothermal System for details.
 - o Solar thermal collector subsystem cycles to maintain one (1) mass thermal storage tank within its required temperature range for heating load. The other mass thermal storage tank is allowed to "cool down" to be used on milder days during the shoulder season for the radiant heating, and subsequently the cooling of the radiant floor.
 - o As determined by the building operator, geothermal system may be allowed to cycle in cooling mode to maintain cooling mass thermal storage cooling setpoint.
 - o Either manually or automatically (still to be determined), radiant floor heating and cooling system will draw supply water from either heating mass storage tank or cooling mass storage tank, depending on the tank temperatures and the related outdoor air temperature and solar conditions.
- * Occupied - Windows and Doors Open
 - o Same as Occupied - Windows and Doors Open cooling mode.
- * Unoccupied
 - o Same as Unoccupied cooling mode.
- * Emergency
 - o Same as Emergency heating mode.

Mass Thermal Storage Tanks

Sequence of Operations

Heating (Winter) Modes

- * Occupied - Closed
 - o During heating modes, the mass thermal storage is manually valved so that the solar thermal collectors are the main source of heat with the heated water from the panels first going through the domestic water pre-heat exchanger before entering the mass storage tanks.
 - o Heated water moves through both mass storage tanks, drawing heating supply water from top of warmest tank and returning cooler water to bottom of tank, allowing for stratification of water temperature in tanks.
 - o Solar thermal collector subsystem cycles to maintain the mass thermal storage tank within its required temperature range (90 deg F to 200 deg F). Refer to Solar Thermal Collector and Radiant Floor Heating and Cooling Integration and Controls Design for subsystems operations.
 - o Normal heating operation is for load to be met with only solar thermal collectors active.
 - o If solar collector subsystem is active and the mass thermal storage tank temperature is below its minimum heating Btu setpoint (90 deg F, adj.), geothermal subsystem may supplement the hot water input to the mass thermal storage tanks. Refer to Geothermal System for subsystem operation.
 - o When mass thermal storage tank temperature sensor reaches minimum heating Btu temperature (90 deg F, adj.), first deactivate geothermal subsystem, and then allow solar collector subsystem to continue under normal heating operation.
- * Occupied - Open
 - o Same as Occupied - Closed hours heating mode.
- * Unoccupied
 - o Same as Occupied - Closed hours heating mode.

Cooling (Summer) Modes

- * Occupied - Windows and Doors Closed
 - o During cooling modes, the mass thermal storage is manually isolated from the solar thermal collectors and domestic hot water subsystems. The geothermal system provides cooling water to both mass storage tanks.
 - o Cooling water moves through both mass storage tanks, drawing cooling supply water from the bottom of the cooler tank and returning warmer water to the top of the tank, allowing for stratification of water temperature in tanks.
 - o The geothermal subsystem operates to maintain the mass thermal storage tank at its minimum cooling Btu temperature setpoint. Refer to Geothermal System and Radiant Floor Heating and Cooling for subsystems operations.
- * Occupied - Windows and Doors Open
 - o During Occupied - Windows and Doors Open hours, geothermal subsystem is allowed to operate to maintain mass storage tank Btu temperature for cooling.
 - o Radiant floor heating and cooling system is deactivated and locked out from operation while in Open mode.

- * Unoccupied
 - o During Unoccupied hours when off-peak electrical rates apply, geothermal subsystem is activated, if necessary, to bring mass storage tank to cooling Btu temperature setpoint.
 - o Once mass storage temperature has reached the minimum cooling Btu temperature setpoint, the geothermal subsystem is not allowed to run again until off-peak hours.
- * Emergency
 - o Same as during Emergency heating mode.

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