



## Geo-Solar Hybrid Heating/Cooling System Control Diagram

No Scale

### Solar Domestic Hot Water Sequence of Operations

#### Heating (Winter) Modes

- \* Occupied - Windows and Doors Closed
  - o Domestic water mixing valve MV-1 blends domestic hot water from the pre-heat exchanger storage tank with cold city water to maintain the domestic water supply temperature T-6 setpoint (110 deg F, adj).
  - o If domestic water supply temperature T-6 drops below its minimum setpoint (105 deg F, adj.), then the auxiliary domestic water heater cycles on to maintain its setpoint (105 deg F, adj)
  - o When temperature rises above auxiliary domestic water heater setpoint (105 deg F, adj.), auxiliary heater cycles off and solar pre-heat exchanger takes over heating domestic water.
  - o Refer to Solar Thermal Collector for control of solar portion of subsystem.

- \* Occupied - Windows and Doors Open
  - o Same as Occupied - Windows and Doors Closed hours heating mode.

- \* Unoccupied
  - o Same as Occupied - Windows and Doors Closed hours for domestic water mixing valve MV-1 control heating mode.
  - o Auxiliary domestic water heater is disabled by time or day schedule or electronic timer during Unoccupied hours.

- \* Emergency
  - o Domestic water heater and pre-heat exchanger are equipped with temperature and pressure relief valves as required by local codes.
  - o Refer to Emergency modes of operation for related subsystems for further detail.

## Radiant Floor

### Sequence of Operations

#### Heating (Winter) Modes

- \* Occupied - Windows and Doors Closed
  - o During heating modes, radiant floor supply water 3-way mixing valve, V-7, blends hot water from the mass thermal storage tank with the return water from the radiant floor distribution system to maintain heating hot water supply temperature T-7 setpoint (90 deg F, adj).
  - o Variable speed pump PP-3 operates to distribute the mixed hot water to the various thermal zones.
  - o A differential pressure sensor located near the end of the primary distribution piping monitors the pressure difference between the supply and return lines and controls the pump variable frequency drive to maintain the differential pressure setpoint (adjustable - to be determined during system testing and balancing).
  - o Manifolds supply water to the various spaces zoned with individual thermostats.
  - o Space stat cycles manifold 2-way valve on and off as required to maintain space temperature setpoint.

- \* Occupied - Windows and Doors Open
  - o During heating modes, if Occupied - Windows and Doors Open hours are designated, radiant floor heating and cooling system is deactivated and locked out from operation.

- \* Unoccupied
  - o Same as Occupied - Windows and Doors Closed hours heating mode.

- \* Emergency
  - o Radiant floor system allows for manual override to full flow for emergency operation during the heating season.
  - o Supply water 3-way mixing valve discharge setpoint or valve itself may be overridden to increase temperature of supply water in emergency heating conditions.
  - o If the pump is called to run and does not run as indicated by its status monitoring sensor (current sensor), an alarm is generated in the control system.

#### Cooling (Summer) Modes

- \* Occupied - Windows and Doors Closed
  - o During cooling modes, radiant floor supply water 3-way mixing valve blends cooling water from mass thermal storage tank with return water from radiant floor distribution system to maintain cooling water supply setpoint (68 deg F).
  - o Pump controls, distribution, and space stat controls are the same as heating mode.

- \* Occupied - Windows and Doors Open
  - o During Occupied - Windows and Doors Open hours, radiant floor cooling system is deactivated and locked out from operation.

- \* Unoccupied
  - o Same as Occupied - Windows and Doors Closed hours cooling mode.

- \* Emergency
  - o With minimum supply water set for 68 deg F and ventilation systems maintained low indoor humidity levels, there should not be condensation on the radiant cooling surfaces, if condensation is observed or if space temperature and humidity sensors indicate system is approaching dewpoint, supply water temperature setpoint may be raised temporarily until the humidity situation is resolved.

#### Shoulder (Spring - Fall) Modes

- \* Occupied - Windows and Doors Closed
  - o Either manually or automatically (still to be determined), as selected by the building operator, radiant floor heating and cooling system will operate in either the heating mode or the cooling mode, depending on anticipated outdoor air conditions.
  - o Supply water will be drawn 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.
  - o Refer to heating and cooling modes listed above.

- \* Occupied - Windows and Doors Open
  - o During Occupied - Windows and Doors Open hours, radiant floor heating and cooling system is deactivated and locked out from operation.

- \* Unoccupied
  - o Operation during Unoccupied hours is the same as during Occupied - Windows and Doors Closed hours for the mode of operation, heating or cooling, selected by the building operator.

- \* Emergency
  - o Operation during Emergency conditions is the same as during Emergency mode of operation related to mode of operation, heating or cooling, selected by the building operator.

DATE	ISSUE FOR	DATE	BY	REVISIONS
8-17-09				

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RADIANT FLOOR/SOLAR DHW