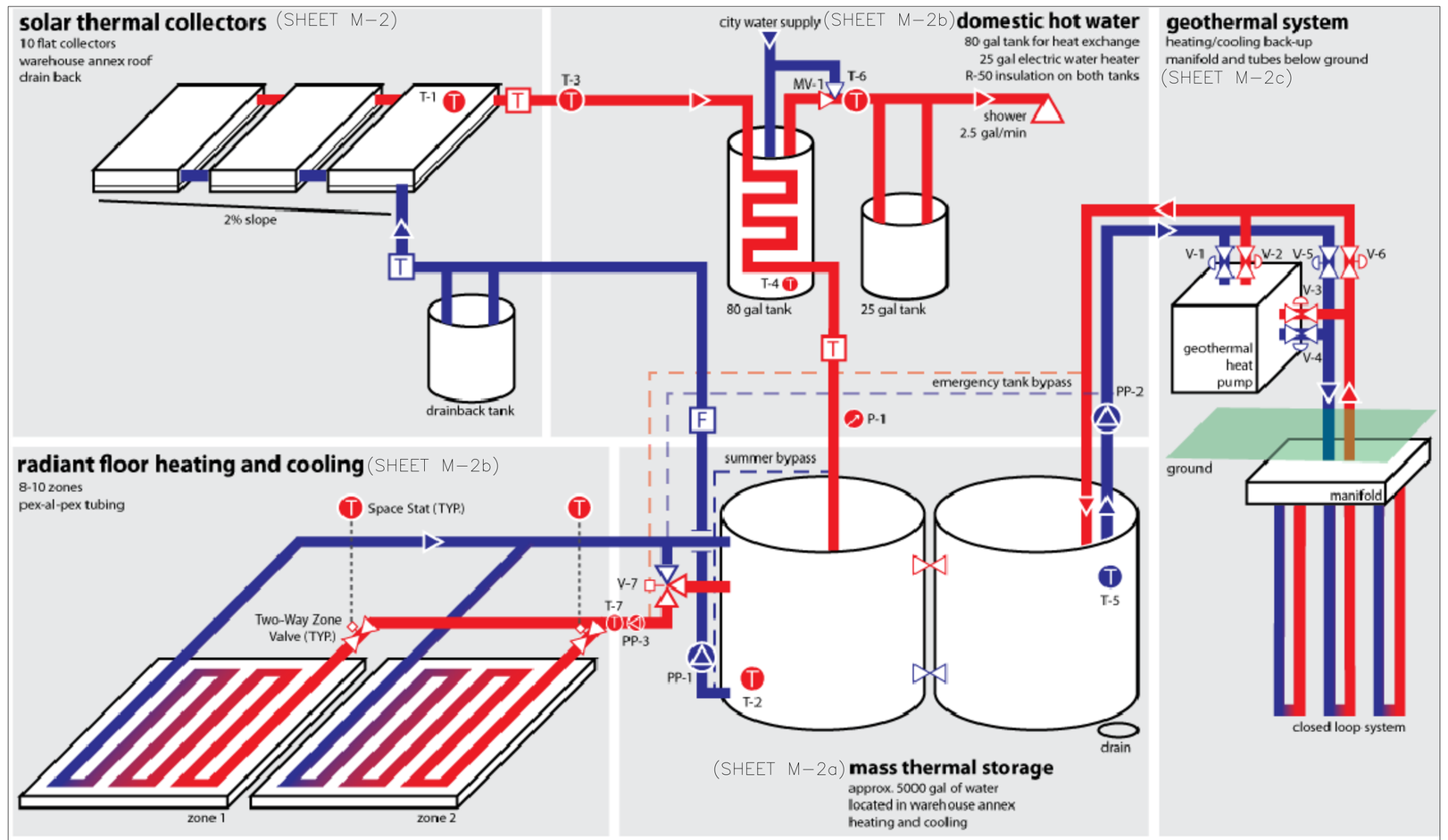

Geo-Solar Hybrid Heating/Cooling System Control Diagram

No Scale

Geothermal System

Sequence of Operations

Heating (Winter) Modes

*** Occupied - Windows and Doors Closed**

- **o During heating modes, when the solar thermal collector subsystem is active and the mass thermal storage tank(s) (temperature sensor T-2 minimum heating Btu temperature) setpoint is not met, the system controls are activated and the geothermal unit is allowed to operate starting at the next off-peak rate period and operating until that minimum heating Btu temperature setpoint (90 deg F, adj.) is reached.**
- **o When the mass thermal storage tank temperature sensor T-2 reaches minimum heating Btu setpoint (90 deg F, adj.), the geothermal system is deactivated and is not allowed to run again until the next off-peak period, if needed.**
- **o Hot water is circulated from the geothermal system to the mass thermal storage tank during geothermal system operation by pump PP-2. Valves V-1, V-2, V-3, and V-4 open, and valves V-5 and V-6 close. Pump PP-2 and the geothermal ground loop pump turn on.**
- **o Geothermal system only runs when required to meet the "minimum heating BTU" demand.**
- **o Priority is to meet this demand in off-peak hours. Only when it cannot be met in off-peak hours is it allowed to continue to run into on-peak periods.**
- **o Refer to Ventilation System for control of geothermal coil for ventilation system moisture control.**

*** Occupied - Windows and Doors Open**

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

*** Unoccupied**

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

*** Emergency**

- **o By design, the geothermal system is a backup system to the solar thermal collector subsystem. Where it may be necessary, flexible piping arrangements are provided so that the radiant heating system may be operated directly from the geothermal unit (in a manual emergency operation mode), to prevent the building from freezing.**
- **o If either pump is called to run and it does not run as indicated by its status monitoring point (current sensor), an alarm is generated in the controls system.**
- **o Refer to manufacturer's operation and maintenance information for emergency information on controls.**

Cooling (Summer) Modes

*** Occupied - Windows and Doors Closed**

- **o During cooling modes, when the mass thermal storage temperature sensor T-5 minimum cooling Btu temperature setpoint is not met, pump PP-2 cycles on and the geothermal system is allowed to operate for one cycle in cooling mode during off-peak hours to reach that minimum cooling Btu temperature setpoint (68 deg F).**
- **o Geothermal system controls sequence the system to run first in economizer mode, where water circulates from the mass storage tanks directly through the ground loops, bypassing the geothermal heat pump exchanger. Valves V-1, V-2, V-3, and V-4 close and valves V-5 and V-6 open. Pump PP-2 turns on, and geothermal ground loop pump remains off.**
- **o If the required tank minimum cooling Btu temperature setpoint cannot be reached using just the ground loops, then system is changed over automatically to utilize the geothermal heat pump exchanger. Valves V-5 and V-6 close, and valves V-1, V-2, V-3, and V-4 open. Pump PP-2 remains on and geothermal ground loop pump turns on.**
- **o When mass thermal storage temperature sensor T-5 reaches the minimum cooling Btu temperature setpoint (68 deg F, adj.), the geothermal system and pumps are deactivated and is not allowed to run again until the next off-peak period, if needed.**
- **o Geothermal system only runs when required to meet the "minimum cooling Btu" demand.**
- **o Priority is to meet this demand in off-peak hours. Only when it cannot be met in off-peak hours is it allowed to run during on-peak periods.**
- **o Refer to Ventilation System for control of geothermal coil for ventilation system and moisture control.**

*** Occupied - Windows and Doors Open**

- **o Same as Occupied - Windows and Doors Open cooling mode.**

*** Unoccupied**

- **o During Unoccupied hours when on-peak electrical rates apply, geothermal subsystem is not enabled to run.**
- **o During Unoccupied hours when off-peak electrical rates apply, geothermal subsystem is activated for one cycle, if necessary, to bring mass storage tank to minimum cooling Btu temperature setpoint. After this, the geothermal heat pump is not allowed to cycle again until the next off-peak period.**

*** Emergency**

- **o Refer to manufacturer's operation and maintenance information for emergency information on controls.**

Shoulder (Spring - Fall) Modes

*** Occupied - Windows and Doors Closed**

- **o During shoulder season modes, the geothermal system may be used to cool mass thermal storage tank water designated for days requiring cooling as described above.**
- **o As determined by the building operator, geothermal system may be allowed to cycle in cooling mode during off-peak hours to maintain mass thermal storage cooling Btu temperature setpoint. Setpoint may be selected based on the anticipated weather conditions or building loading, or may be released to normal cooling mode control to tank minimum cooling Btu temperature setpoint (user selectable).**
- **o Refer to Hybrid Ventilation System Integration and Control Design for control of geothermal heat pump for ventilation system and moisture control.**

*** Occupied - Windows and Doors Open**

- **o Same as Occupied - Windows and Doors Open hours cooling mode.**

*** Unoccupied**

- **o Same as Unoccupied hours cooling mode.**

*** Emergency**

- **o Same as during Emergency cooling mode.**

8-17-09	FOR PERMIT	DATE	BY	BULLETIN
DATE	ISSUE FOR	REVISIONS		

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DESIGNED TLB			PROJECT NO. 0923
DRAWN KAL	CHECKED		
APPROVED TLB	DATE		
SHEET TITLE: GEOTHERMAL SYSTEM			SHEET NO. M-2c