What is a Hybrid Heat Pump?

A Hybrid Heat pump system is a closed loop supply and return water distribution system that serves each suite. Each suite has its own heat pump unit that is controlled by the suite's thermostat. Each Suite can have either heating or cooling 365 days a year.

The main water loop for the building is always maintained at a certain temperature by either activating the central boiler or the central cooling tower to heat or cool the water loop. Alternatively the building may be heated and cooled by a ground source geothermal system. Depending on the building the loop temperature can range from 65F to 95F year round. The central system water loop has constant water flow year round.

EXAMPLE:

Tenant sets their thermostat to cool. The process is:

1. The fan starts
2. The water flows to the Condenser
3. The compressor starts
4. The suite fan delivers cooling to the suite
5. When the room temp is satisfied the compressor stops, water flow through the condenser stops and the fan shuts down

Tenant sets their thermostat to Heating. The process is:

1. The fan starts
2. The water flows to the heating coil
3. The suite fan delivers heating to the suite
4. The Fan operates a low fan capacity for ten (10) minutes and increases to high speed until room temperature is satisfied
5. When the room temp is satisfied the water flow through the heating coil stops and the fan shuts down

Sequence of Operations

When a Hybrid Heat Pump unit operates, the following functions occur:

Starting Sequence *– The Thermostat activates the Heating or Cooling Function*

- The thermostat opens the water flow control valve to the Heat Pump Condenser Unit for cooling or the Fan Coil Unit for heating and starts the fan to establish air flow over the heating coil and cooling coil
- In cooling mode the Heat Pump Unit Compressor starts in cooling mode of operation at any time of day, year round based on the suite thermostat temperature set point. The fan operates at high speed only.
- In heating mode the water flows through the heating coil any time of day, year round based on the suite thermostat temperature set point. The fan operates at low speed for ten (10) minutes and increases to high speed to satisfy space temperature requirements.

Stopping the Sequence *– The Thermostat deactivates the Heating or Cooling Function as Follows:*

- Stops the Heat Pump Compressor
- Closes the water flow to the Heat Pump Condenser Unit and the Heating Coil
- Stops the air flow over the Heating coil and Cooling Coils

Notes:

- CARMA Energy Monitoring records fan speed and operational time
- The fan speed, low or high (CFM) air flow, is always accurate based on the Hybrid Heat Pump ECM Constant Air Flow Fan Motor
- A Monthly Suite Usage Factor is derived as follows:
  Monthly Fan Coil Unit Operating Time (x) Fan Speed at Low or High (=) Monthly Suite Usage
- Each suite is allocated a percentage of total Central Plant Utilities costs based on the in-suite usage factor compared to the sum of all building suites usage factors combined, each month
- The suite thermostat diverts building water flow to the water cooled heat pump unit for in-suite cooling and to building loop full flow to the heating coil for in-suite heating.
- The ECM Constant Air Flow Fan Motor is factory calibrated to provide a specific quantity of air flow at each fan speed, low and high.

How is the Monthly Rate Calculated?

The monthly rate is calculated based on the cost to operate the Central Plant (for example the natural gas usage and electricity required to operate the central plant). The cost for the common area is then removed from this amount. We measure the total water flow to each hybrid pump in each suite and total the sum of all units' water flow each month. The cost to operate the central plant minus the common area is then divided amongst the total tenant usage to come up with a rate per unit of suite water flow for **that month.** Alternatively the monthly cost may be a fixed charged determined by the building.

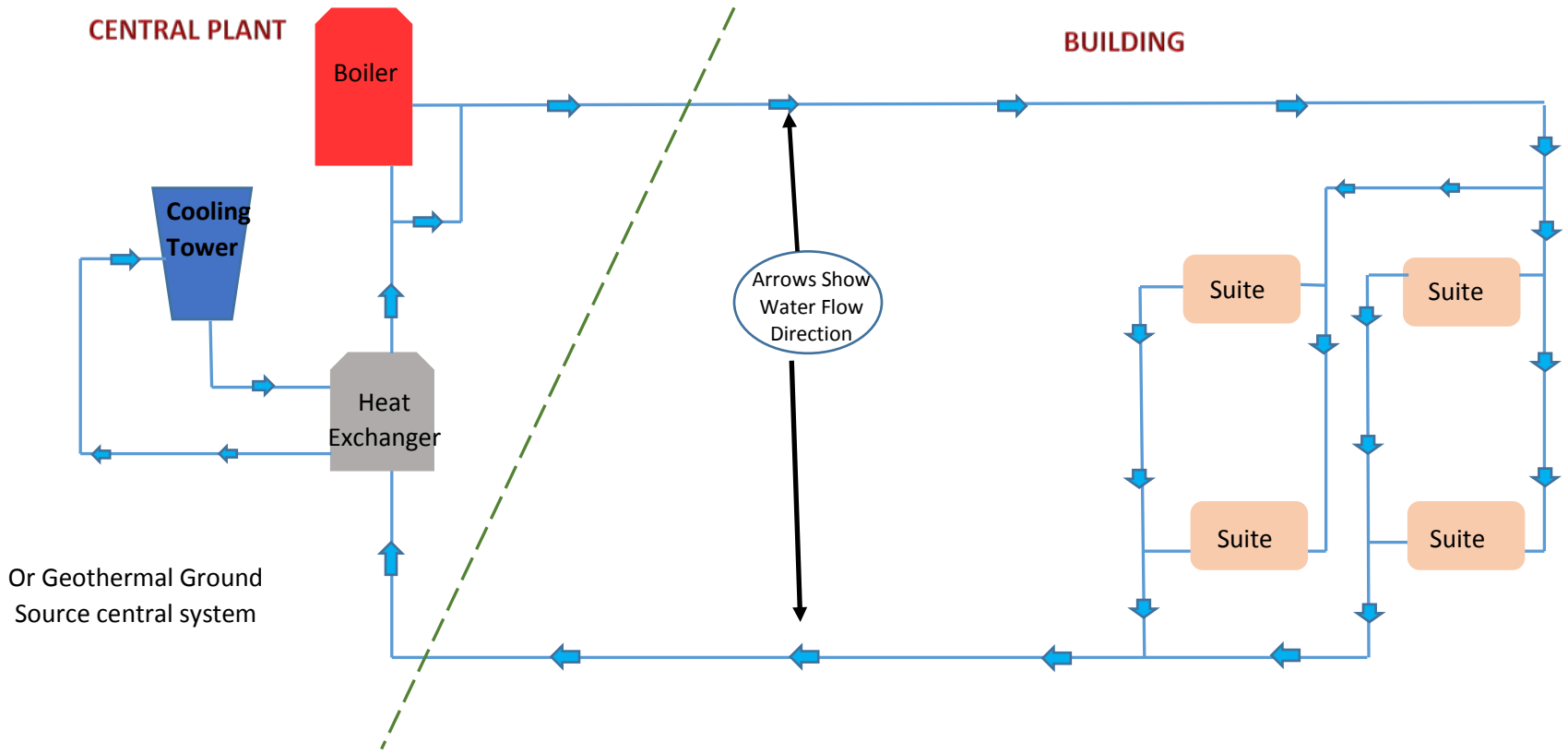
The suite resident is charged for the Fan air flow through each resident's suite heat pump each month

Diagram 1: High Overview of the system

Diagram 2: Tenant Suite

DIAGRAM 1

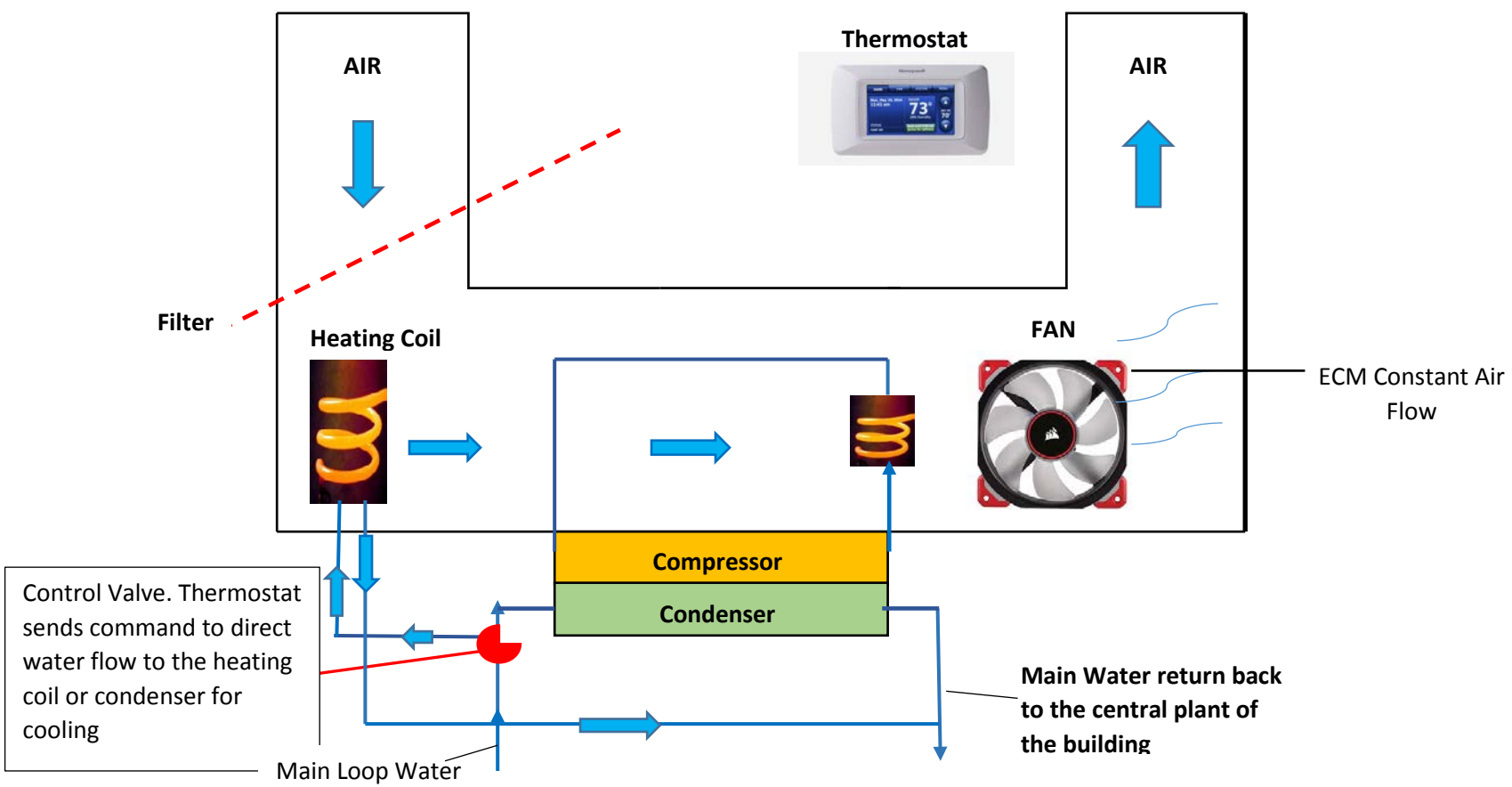
HYBRID HEAT PUMPS
High Overview



- Hybrid Heat pump is a closed loop water supply and return system
- Each Suite can have either cooling or heating 365 Days a year
- In winter when the loop temperature decreases due to outdoor weather the water will circulate through the boiler to increase the loop temperature
- In the summer if the loop temperature increases the water will circulate through the cooling tower

It is important to note that individuals may feel that their heating is not working as the air flow from the vents may feel cool, **this is normal

DIAGRAM 2



Steps:

Heating:

1. The thermostat is set
2. The fan starts
3. The water flows to the heating coil
4. If the heating does not increase in a reasonable time i.e. 10 minutes the fan speed and air volume will increase
5. When the temperature is satisfied the water flow to the coil will stop
6. The fan will turn off

Cooling:

1. The thermostat is set
2. The fan starts
3. The water flows to the condenser
4. The compressor starts
5. When the temperature is satisfied the compressor shuts down
6. The water flow to the condenser stops
7. The fan will turn off