

**What is a Water Source Heat Pump?**

A water Source 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. When the thermostat is set to heating or cooling the system provides heating or cooling energy to the suite by activating the compressor and fan in the suite.

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. Depending on the building the loop temperature can range from 65F to 95F year round. The central system water loop has constant water flow.

**EXAMPLE:**

Tenant sets their thermostat to cool. The process is:

1. The fan starts
2. The water flow to the heat pump condenser is activated
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

**Sequence of Operations**

When a Water Source 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 and starts the fan to establish air flow over the combined heating/cooling coil
- The Heat Pump Unit Compressor then starts in heating or cooling mode of operation at any time of day, year round based on the suite thermostat temperature set point.

***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
- Stops the air flow over the combined Heating/Cooling Coil

**Notes:**

- CARMA Energy Monitoring records Compressor Operating Time
- The Water Flow GPM U.S. Gallons Per Minute (GPM) is regulated accurately by the Automatic Flow Valve located on the return water line from each Heat Pump Unit
- A Monthly Suite Usage Factor is derived as follows:  
Monthly Minutes of Operation (x) U.S. Gallons Per Minute (=) Monthly Total Gallons of Suite Usage from the Central Plant
- 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 heat pump water flow is thermostatically controlled in the suite and is either full water flow (“on”), or no water flow (“off”)
- The “automatic flow valve” that controls the accuracy of water flow in each Heat Pump is located in the condenser outlet water return pipe

**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 heat 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.**

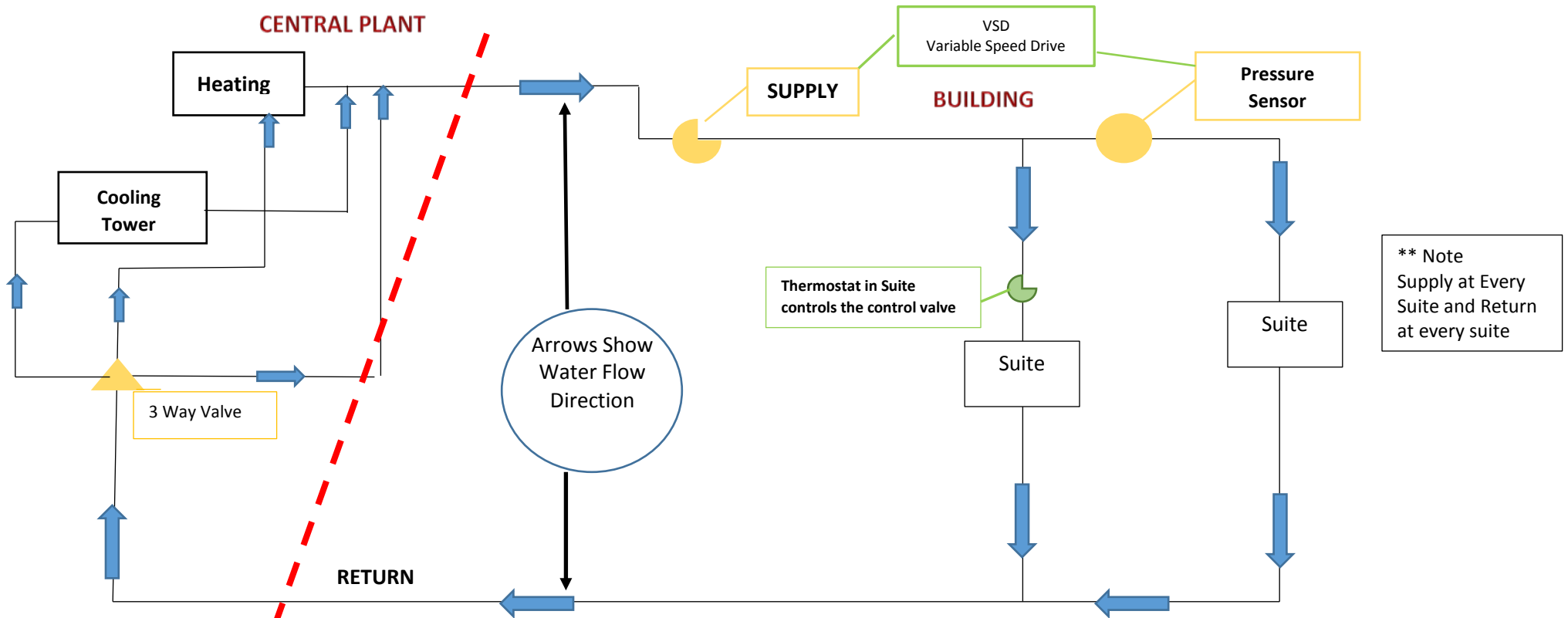
The suite resident is charged for the U.S. Gallons of water flow through each resident’s suite each month

**Diagram 1:** High Overview of the system

**Diagram 2:** Tenant Suite

## WATER SOURCE HEAT PUMPS High Overview

**DIAGRAM 1**

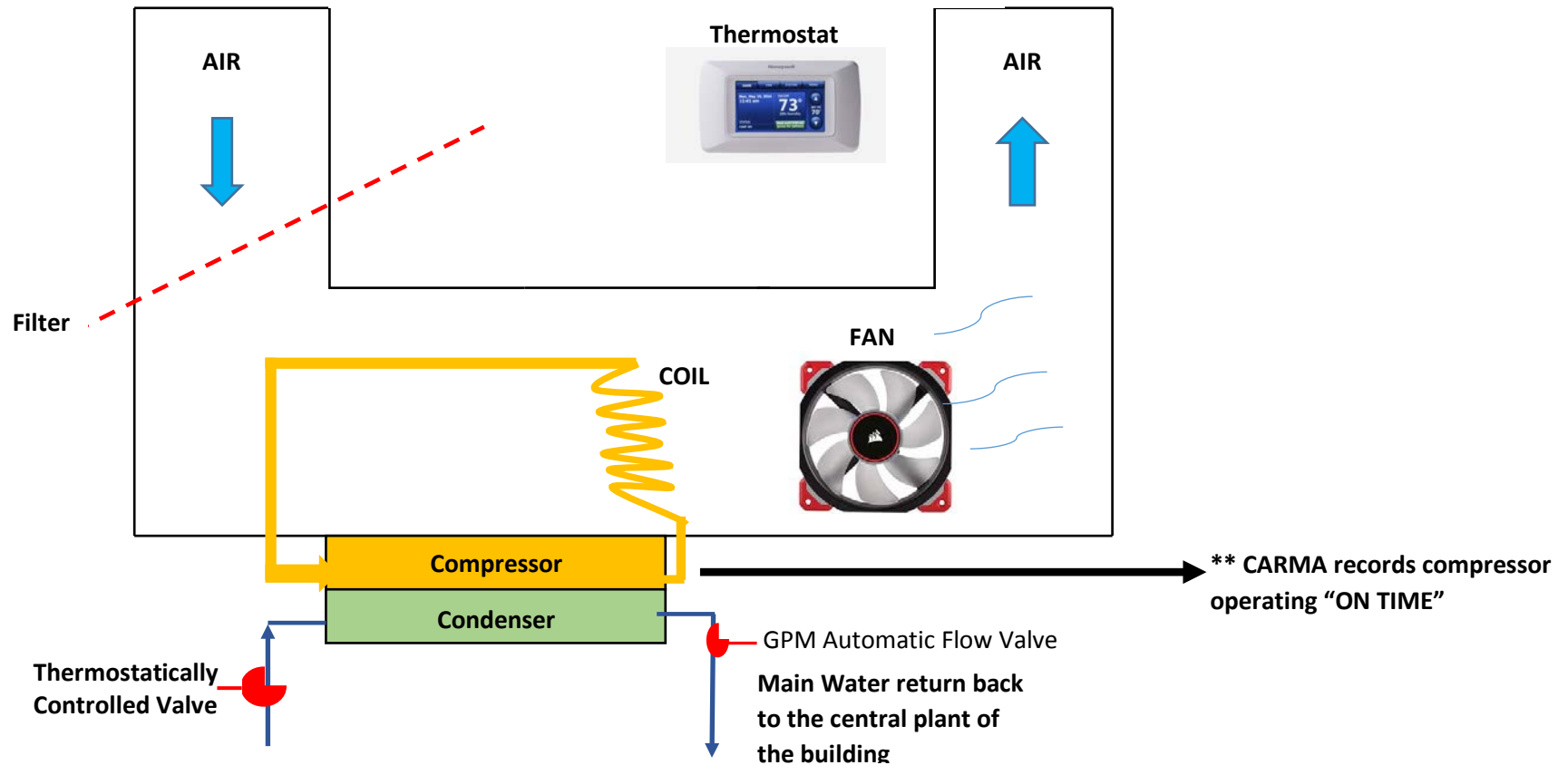


**\*\* Note**  
Supply at Every Suite and Return at every suite

- The Water Source loop has a constant flow of water through it
- The building water loop is maintained at a temperature between 65F and 95F year round
- If the loop needs to be cooled down it activates the cooling tower to reduce the temperature of the water loop. If the loops temperature needs to be increased it activates the boiler to heat. If the temp is normal it will bypass the cooling tower and boiler and continue to flow through the loop
- Each suite has a valve that is controlled by the thermostat that will open and allow water into their heat pump to cool or heat the suite
- The boiler is normally powered by natural gas which is metered and used to calculate the monthly cost of the central plant
- The cooling tower has fans and pumps that are submetered. The electricity consumption is also used to calculate the monthly cost of the central plant.

DIAGRAM 2

## TENANT SUITE



- Think of the coil the same as a refrigerator coil (the coil has refrigerant liquid running through it)
- Steps:
  1. The tenant sets the thermostat
  2. The fan turns on
  3. The Control Valve opens and sends water through the condenser
  4. The compressor starts and pushes the refrigerant through the coil
  5. The fan circulates Air either heating or cooling out of the coil
  6. When temperature is met the compressor stops
  7. Water flow to the condenser stops and control valve closes
  8. Fan turns off
- Note there is a Valve that reverses the flow in the coil to provide heating or cooling.
- Note when the compressor operates, the suite monitoring system records and accumulates monthly operating time at each fan coil unit