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**What is a 4 Pipe Fan Coil System?**

A 4 Pipe Fan coil system is a dual closed loop supply and return water distribution system that serves each suite. The building has a chiller and cooling tower to cool the water in the cold loop and a Boiler to heat the water in the hot loop. There are two separate loops for the building, one for heating and one for cooling. This allows each individual fan coil unit to deliver heat or cool as needed. Each fan coil unit contains two coils; one for the heating loop and one for the cooling loop. The thermostat determines if the cold loop coil or the hot loop coil is used. Each Suites fan has three fan speeds, **low, medium and high**, which are measured in CFMs. (Cubic Feet per Minute). Each Suite is equipped with an **ECM constant air flow motor** which maintains each fan speed at a constant air flow rate. (It automatically increases fan speed if filters become dirty)

EXAMPLE:

***The resident sets their thermostat to heat. The process is:***

1. The fan starts
2. The water flows through the heating coil
3. The air flow delivers heat to the suite
4. When the room temp is satisfied the water flow through the heating coil stops and the fan shuts down

Carma Records whether the suite is operating on heating or cooling and the speed each units fan is operating. The operating time at each fan speed is used to calculate the monthly usage factor by multiplying the operating time at each fan speed by the CFM's for that fan speed

**Sequence of Operations**

When a Four Pipe Fan Coil 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 heating or cooling coil and starts the fan to establish air flow over the heating or cooling coil
- The Four Pipe Fan Coil System 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 and Cooling Function as Follows:***

- Closes the water flow to the Heating or Cooling coil
- Stops the air flow over the Heating or Cooling coil

Notes:

- CARMA Energy Monitoring records fan speed and operational time
- The fan speed, low, medium, or high, is always accurate based on the **Fan Coil Unit 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, Medium 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 heating and cooling water flow is thermostatically controlled and is either full water flow (“on”), or no water flow (“off”)

- The ECM Constant Air Flow Fan Motor is factory calibrated to provide a specific quantity of air flow at each fan speed, low, medium and high.

**How is the Monthly rate calculated?**

The rate is calculated based on the cost to operate the Central Plant (the monthly gas usage and electricity usage) required to operate the central plant with the common area and retail removed. This then leaves the cost to operate the Central Plant for the suites only! Carma records what speed the fan is operating and how long it operates at each speed. Each fan speed has a specific CFM (cubic feet per minute value). Monthly Central Plant operating cost for the suites is divided by the total CFMs for all suites to determine the rate that each unit is charged each month. (Cost per CFM)

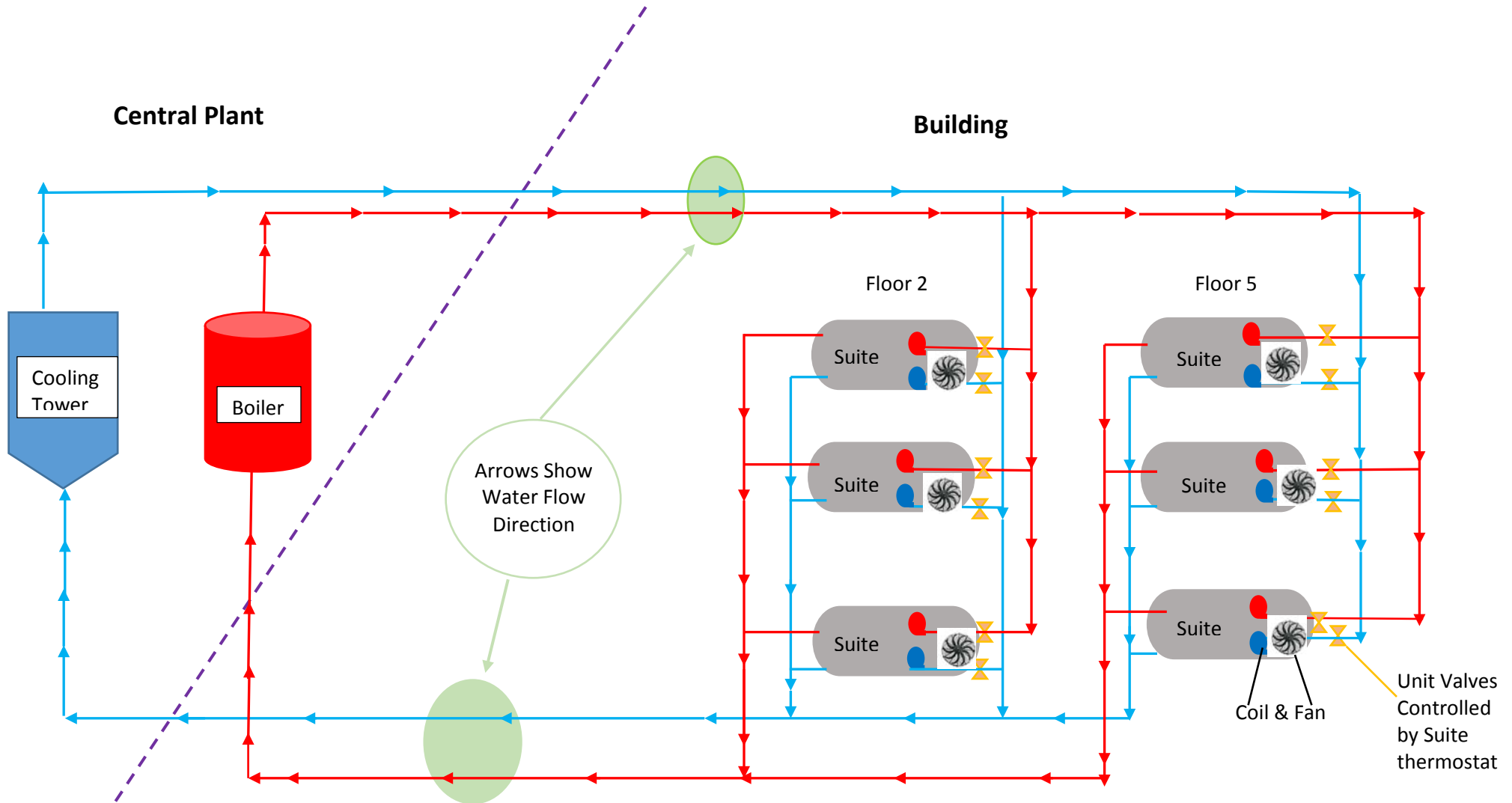
This process is completed for the heating and cooling separately each month, which gives two different rates. One rate for the heating use and one rate for the cooling use.

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

**Diagram 2:** Tenant Suite

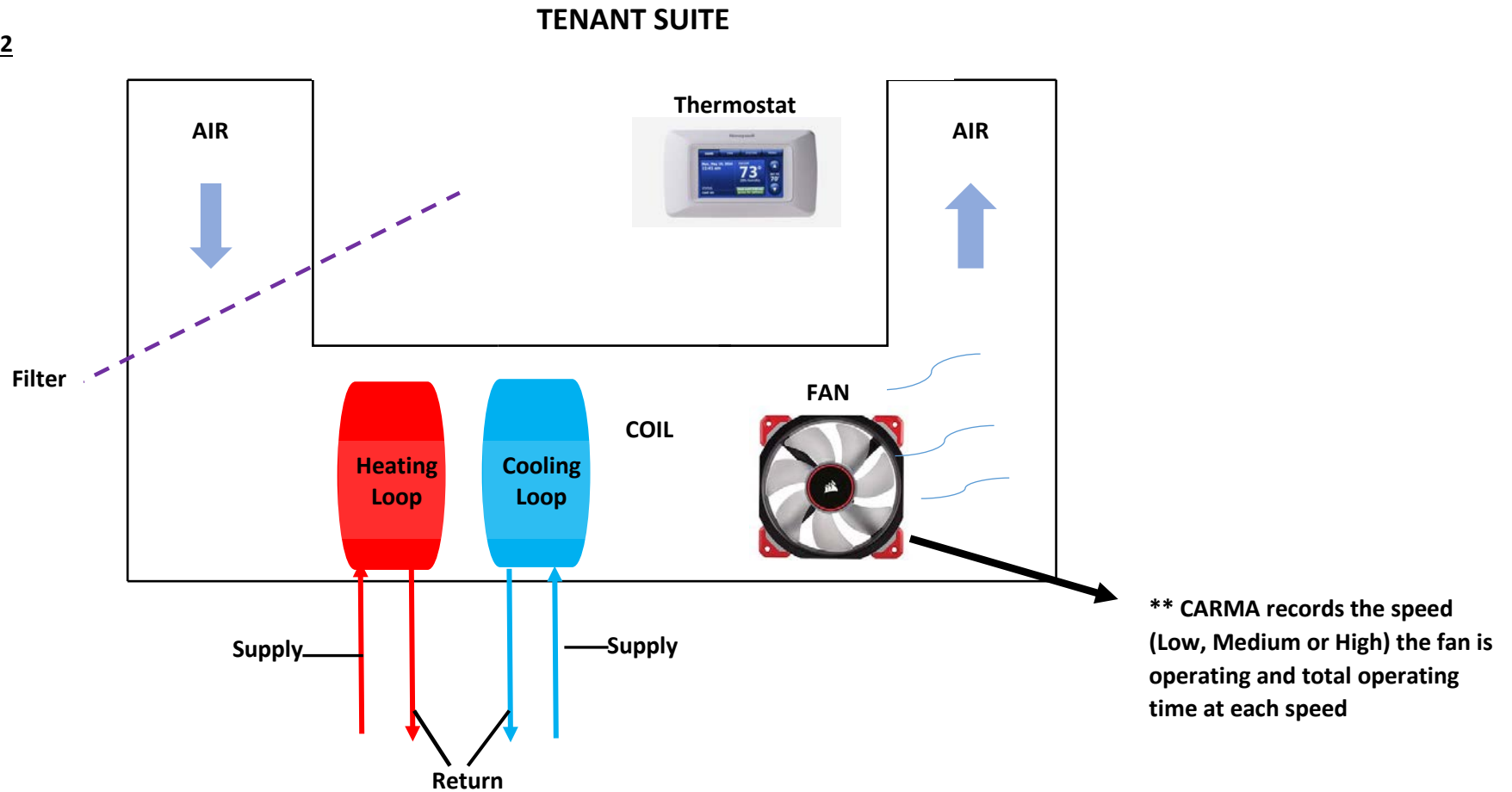
Diagram 1

# 4 PIPE FAN COIL SYSTEM



- Each suite has the option for heating or cooling at any time of the year.
- There is a dedicated heating water loop and a separate dedicated cooling water loop
- Each suite has a separate coil for heating and a separate coil for cooling. The fan will circulate air to provide heating or cooling depending on the suite thermostat set point.

DIAGRAM 2



- **Steps:**

1. The tenant sets the thermostat
2. The fan turns on
3. The Control Valve opens and allows heating or cooling water flow
4. The fan circulates heating or cooling into the suite depending on the thermostat set point.
5. When temperature set point is achieved water flow through either coil stops
6. The fan shuts down