**CHCP Distribution (Loop) Pump Control Logic:**

**Full Description - Existing Control Logic (From Max Hanson 8/31/20)**

The chilled water loop pumps are controlled by the “balance of plant” PLC. The three chilled water loop pumps are controlled in a lead / lag / follow arrangement. The operator can choose the lead pump, thereby selecting between the following sequences:

|  |  |  |
| --- | --- | --- |
| **Lead** | **Lag** | **Follow** |
| Pump 1 | Pump 2 | Pump 3 |
| Pump 2 | Pump 3 | Pump 1 |
| Pump 3 | Pump 1 | Pump 2 |

If a pump is not available, subsequent pumps are promoted to take its place.

The operator chooses between flow rate or pressure control modes. Separate PID instructions are used for the two modes of operation. Both modes incorporate logic to hold the speed command when a pump has just started. In pressure mode, the speed is held for 5 seconds. In flow mode, the speed is held for 60 seconds.

For the pressure control PID, the process value is chosen from four differential pressure readings:

* Central plant
* Housing Admin
* North Quad
* California Ave

This selection is either automatic or manual. In automatic, each transmitter can be enabled or disabled. If disabled, it will not be used. The logic selects from the enabled transmitters by choosing the transmitter with the greatest error (difference between set point and rolling average of the measured value). Each transmitter has its own target setpoint. In manual mode, the operator selects the desired transmitter. The setpoint for the PID is the setpoint for the selected differential pressure transmitter.

 For the flow control PID, the raw setpoint value is written to the BOP PLC by the Chiller C PLC. The setpoint is a rolling average of the chiller flow rates (FIT2150 + FIT2350 + FIT3150 + FIT3350). The process value is the CHCP 30" CHW Return Flow (CHCP\_CW1C#FIT201.FPFlow).

**Pump Staging**

When the chilled water system is set to ON, the number of loop pumps to operate is set to 1 and the selected lead pump starts.

If the speed command is greater than the add pump setpoint for 10 minutes, the lag pump starts and the add pump timer resets. If it expires again the follow pump starts.

If the speed command is less than the drop pump setpoint for 5 minutes, the most recently called pump stops and the timer resets. This repeats until only the lead pump is running.

The add pump and drop pump speed setpoints are determined by a lookup table. The differential pressure for the lead pump (CHCP\_CW1C#DPIT201 – 203) is converted to an integer and used as an index to find the add and drop setpoints in arrays. The lookup values are shown in the attached file.

**Proposed Modification:**

If CHCP distribution pumps are ON and in flow control and campus DP is greater than 10 PSID, decrease the flow setpoint by 100 gpm every minute.

Flow control when campus DP is less than 10 PSID shall remain the same.

Pump staging shall remain unchanged.

**Proposed Flow Control:**

Upon start up, the flow setpoint shall be 4,500 gpm.

If the transmitter with the greatest deviation from setpoint (Pressure Transmitter – Setpoint) has a deviation greater than 2 PSID, decrease flow setpoint by 100 gpm every 3 minutes.

If the transmitter with the greatest deviation from setpoint (Pressure Transmitter – Setpoint) is less than -2 PSID, increase flow setpoint by 100 gpm every 3 minutes

Min: Number of active chillers \* minimum flow (2,000 gpm)

Max: The setpoint is a rolling average of the chiller flow rates (FIT2150 + FIT2350 + FIT3150 + FIT3350)