SECTION 25 35 28
GUIDELINES FOR CONTROL SEQUENCES

PART 1 - GENERAL

1.1 SUMMARY
a. Section includes control sequence guidelines for building control systems. The project will develop the required sequence of operations. This section provides Stanford’s desired theory of operation for key processes.
b. Related Sections:
   1) 25 00 00 Integrated Automation

1.2 REFERENCES
a. Refer to 25 00 00 Integrated Automation
b. 23 05 00 Common Work Results for HVAC

1.3 DEFINITIONS
a. Refer to 25 06 11 Integrated Automation Definitions

1.4 SYSTEM DESCRIPTION
a. Refer to 25 00 00 Integrated Automation

1.5 SUBMITTALS
a. Refer to 25 00 00 Integrated Automation

1.6 QUALITY ASSURANCE
a. Refer to 25 00 00 Integrated Automation

PART 2 - PRODUCTS

2.1 NOT USED

PART 3 - EXECUTION

3.1 UTILITY HOT WATER TO BUILDING HEATING HOT WATER INTERFACE
A. Heating Hot Water temperature set point shall be reset based upon outside air temperature or other Owner approved demand based reset input.
B. Heating Hot Water temperature set point shall be reset as needed to always be at least 5 deg F below the actual Utility Hot Water supply temperature.
C. The Utility Hot Water return temperature should be kept as low as possible through control and monitoring all applicable systems.

3.2 CHILLED WATER INTERFACE
A. Reference Stanford drawing MS-10
B. The building control system shall include two selectable sequences. One for differential pressure control and one for chilled water mixed temperature control.

C. Differential Pressure Control
   1. With the pump(s) off the chilled water interface control valve shall modulate to maintain the pressure differential between the building supply and return lines (initially set at 12 psid).
   2. When the required differential pressure is not met for five minutes (adjustable) with the interface control valve at 100% open, the control system shall enable the lead chilled water pump. The VFD controlling the speed of the pump shall be modulated to maintain the required differential pressure. If the VFD speed goes above 85% (adjustable) for more than 5 minutes (adjustable) the lag pump will be energized. Both pumps will run until the VFD speed is reduced to 55% of full speed (adjustable), at which time the lag pump shuts off. The lead pump continues to run until the speed is reduced to 15% (adjustable) for 5 minutes (adjustable), at which time it shuts off and pressure control reverts back to the interface control valve. If the lead chilled water pump is commanded to operate and the pump differential pressure switch indicates no flow, the lag pump starts and the lead is locked-out. The lead pump will stay locked-out until the pump is checked and reset from the user interface. The control system shall rotate the lead/lag arrangement weekly for even wear.
   3. The pressure differential set point shall be reset based upon building chilled water demand. Building demand will be estimated by a proxy metric approved for use by Owner. Options include:
      a. Seasonally adjusted Outside Air Temperature profiles.
      b. Zone Valve Position – The building control system shall identify the highest zone chilled water valve position. The differential pressure set point shall be reset to control the highest zone valve position at 85% (adjustable) open. As the valve position goes up the differential pressure set point is reset up to deliver more water to the zones. As the valve position goes down the differential pressure set point is reset down to reduce the water flow.

D. Chilled Water Mixed Temperature Control
   1. When a pump is on and controlling the differential pressure, the control system shall use the interface control valve to control the mixed temperature to the building. The control system shall identify the highest zone chilled water valve position. The mixed temperature set point shall be reset to control the highest zone valve position at 75% (adjustable). As the zone valve position goes up the mixed temperature set point is reset down to deliver colder water to the zones. As the zone valve position goes down the mixed temperature is reset up to deliver warmer water. When the pump is turned off the interface control valve operates under normal differential control mode as per above.

3.3 AIR HANDLING UNIT

A. Include supply static pressure reset based on VAV requests

B. Include supply temperature reset based on VAV requests. Supply temperature sequence shall initiate when static pressure sequence has reached its minimum value.

C. Include optimal start sequence.

D. Include economizer sequences such as damper sequencing, and economizer set point offset from supply air set point.

E. Include freeze protection for chilled water coil.

F. Use of hot water coil as pre-heat only (55° fixed set point)

3.4 VARIABLE AIR VOLUME WITH RE-HEAT

A. Include box minimum flow set point

B. Include heating max and cooling max flow
C. Cooling PI loop to reset actual flow set point
D. Heating PI loop to reset supply air temp set point and min/max heating flow
E. Effective room set point shall be the combination of center set point +/- thermostat adjustment and global offsets.
F. Room temperature, damper and valve requests multiplied by zone priority with be summed together with similar rooms to generate resets to serving air handlers.
G. AHU supply air temperature shall never be set less than 60°.

3.5 CURTAILMENT EVENTS
A. All curtailment events negate the local thermostat temperature setpoint offset (t-stat slider offset).
B. If an Operator changes the Zone Criticality of any Zone, that Zone shall automatically be included in the correct curtailment event, corresponding to the Zone Criticality of the Zone.
C. Curtailment Event Level 0: The Zone Cooling setpoint for all zones shall be increased by the Lab occupied cooling offset, office/admin occupied cooling offset.
D. Curtailment Event Level 1: The Zone Cooling setpoint for all zones with a Zone Criticality of 1 or less shall be increased by the Lab curtailment cooling offset, office/admin curtailment cooling offset.
E. Curtailment Event Level 2: The Zone Cooling setpoint for all zones with a Zone Criticality of 2 or less shall be increased by the Lab curtailment cooling offset, office/admin curtailment cooling offset.
F. Curtailment Event Level 3: The Zone Cooling setpoint for all zones with a Zone Criticality of 3 or less shall be increased by the Lab curtailment cooling offset, office/admin curtailment cooling offset.
G. Curtailment Event Level 4: The Zone Cooling setpoint for all zones with a Zone Criticality of 4 or less shall be increased by the Lab curtailment cooling offset, office/admin curtailment cooling offset.
H. Curtailment Event Level 5: The Zone Cooling setpoint for all zones with a Zone Criticality of 5 or less shall be increased by the Lab curtailment cooling offset, office/admin curtailment cooling offset.
I. Curtailment Event Level 6-9: Reserved for Custom Curtailment

3.6 SETPOINT OFFSETS
A. Separate sets of setpoint offsets shall be used for lab and office/admin type spaces. Values are:
   1. Lab occupied heating offset
   2. Office/admin occupied heating offset
   3. Lab occupied cooling offset
   4. Office/admin occupied cooling offset
   5. Lab standby heating offset
   6. Office/admin standby heating offset
   7. Lab standby cooling offset
   8. Office/admin standby cooling offset
   9. Lab unoccupied heating setpoint
  10. Office/admin unoccupied heating setpoint
  11. Lab unoccupied cooling setpoint
  12. Office/admin unoccupied cooling setpoint
  13. Lab curtailment heating offset
  14. Office/admin curtailment heating offset
  15. Lab curtailment cooling offset
16. Office/admin curtailment cooling offset

3.7 VAV AND CAV CONTROL OF LAB FUME HOODS AND CABINETS (FUTURE SECTION)

A.

END OF SECTION