PART 3- EXECUTION

3.01 STEAM TO WATER OR GLYCOL HEAT EXCHANGERS

A. 1/3 – 2/3 control valve arrangement unless otherwise specified by FS/DDC

B. Lead/lag pumping

C. OSA temperature reset

D. Control valves fail closed on loss of control signal

E. Typical Sequence of Operations. Designer to use as a guideline:

1. The hydronic heating system consists of one or more steam to glycol converters with steam valves arranged for 1/3 - 2/3 operation and VFD controlled lead/lag heating system pumps.

2. The heating system is enabled in Heating Mode. When enabled the lead pump starts. At proof of flow, the converter steam valves operate. Pumps to cycle off and converter steam valves to close when not in heating mode.

3. The glycol heating supply set point is maintained by modulating the converter steam valves in sequence. The glycol supply set point is reset based on outdoor air temperature.

4. Upon loss of signal, fail 1/3 and 2/3 converter valves closed.

E. Typical points not monitored: Condensate Receiver Status, consultant to determine

F. Non-typical points to monitor: Steam Temperature, Steam Pressure, Heating Fluid Supply Temperature.

3.03 HYDRONIC PUMPING

A. Lead/lag pumps alternate monthly.

B. Pump A is lead in odd numbers months. Lead/lag status will switch on the second Wednesday of the month at 9:00AM.

1. Lead pump runs on call to run. If no Proof is received after 30 seconds then Lead
pump is OFF in emergency and a Maintenance alarm will be generated. Lag pump starts on failure of Lead pump. If Lag pump also fails then generate Critical alarm. If both Lead and Lag are off in Emergency then a Critical alarm will be generated. Provide a manual reset toggle in programming to release all pumps from Emergency status to OFF in Normal status and restart Lead/Lag sequence.

C. Typical points not monitored: (consultant to determine)

D. Non-typical points to monitor: hydronic system pressure at a location in a remote section of the system, supply and return temperature.

3.04 CHILLED WATER PUMPS (Campus Chilled Water Loop)

A. Typical Sequence of Operations. Designer to use as a guideline and only use decoupling pumps as required by FS. In most instances, a two-way control valve at the point of connection to the campus loop is all that will be required.

B. The secondary chilled water system consists of two chilled water pumps with individual variable frequency drives. Chilled water system will be manually enabled and disabled seasonally.

C. Pump A is lead in odd numbers months. Lead/lag status will switch on the second Wednesday of the month at 9:00AM.

D. Lead pump runs on call to run. If no Proof is received after 30 seconds then Lead pump is OFF in emergency and a Maintenance alarm will be generated. Lag pump starts on failure of Lead pump. If Lag pump also fails then generate Critical alarm. If both Lead and Lag are off in Emergency then a Critical alarm will be generated. Provide a manual reset toggle in programming to release all pumps from Emergency status to OFF in Normal status and restart Lead/Lag sequence. Lead/lag pumps alternate monthly

E. Disable pumping system when primary hydronic system pressure alarm is received.

F. Typical points not monitored: (consultant to determine)

G. Non-typical points to monitor: primary and secondary hydronic system pressure, Supply and Return Temperature.

3.04 CHILLED WATER PUMPS (Building Chiller)

A. Lead/lag pumps alternate monthly.

B. Pump A is lead in odd numbers months. Lead/lag status will switch on the second Wednesday of the month at 9:00AM.
C. Lead pump runs on call to run. If no Proof is received after 30 seconds then Lead pump is OFF in emergency and a Maintenance alarm will be generated. Lag pump starts on failure of Lead pump. If Lag pump also fails then generate Critical alarm. If both Lead and Lag are off in Emergency then a Critical alarm will be generated. Provide a manual reset toggle in programming to release all pumps from Emergency status to OFF in Normal status and restart Lead/Lag sequence.

D. Seasonal operation

E. Call to run based on OAT

F. Monitor chiller flow by measuring GPM

G. Non-typical points to monitor: primary and secondary hydronic system pressure. Supply and Return Temperature.

3.07 HUMIDIFICATION

A. Fail steam valve closed

B. Adjustable high limit cut-out, hardwired to valve and monitored by DDC. Monitor humidity at the duct level for high limit cut out.

C. Ramp up on start-up

D. Maintenance shutdown/start-up routine

E. Measure humidity at the room level based on percent needed, reset humidity setpoint levels to be lowest possible during winter.

3.08 UNIT HEATERS AND CABINET UNIT HEATERS

A. Unit and Cabinet Unit Heaters will be controlled by DDC if they are serving spaces with exterior doors and/or have critical temperature monitoring needs. Units serving utility spaces without exterior zones will be non-DDC controlled with line-voltage type thermostats.

B. Coils on constant volume systems are typically wild flow, and systems on variable flow are typically controlled with control valves unless otherwise specified. Confirm preference with UAF Facilities Services. Provide control valves in small entry vestibules where solar gain provides sufficient space heating.
C. Non-DDC Control Sequence: Line-voltage thermostat cycles unit heater fan (and valve, if applicable) to maintain space temperature setpoint, XX F. Thermostat has blank cover and concealed setpoint adjustment. Locking cover is non-typical.

D. DDC Control Sequence: DDC controller monitors space temperature and cycles fan (and valve if applicable) to maintain space temperature setpoint XX F. Temperature sensor has blank cover with setpoint adjustment through DDC system. Locking cover is non-typical. If DDC control is through application specific controller (Siemens TEC), provide backup aux. temp sensor behind room sensor cover for backup control if the space temperature drops below 55 degrees F. If wet pipe fire sprinklers are provided in the space heated by a unit heater or cabinet unit heater, temp sensor shall alarm is space temperature drops below 40 degrees F.

3.09 VAV AIR HANDLER – SUPPLY/RETURN AIR ONLY:

A. The air handling unit is scheduled for automatic operation on a time of day basis for Occupied, Unoccupied and Night modes. Within the Unoccupied mode, Night Heating is available when the perimeter heat fails to maintain a minimum temperature of 50 F adjustable. Modes are determined by operator adjustable schedule.

B. When the outside air dry bulb temperature is below the economizer changeover value 75F, the heating coil valve, mixed air dampers, and cooling coil valve modulate in sequence without overlap to maintain the supply air temperature set point 55F. The cooling coil valve is closed when in Heating Mode. Minimum outside air damper position is a certain percentage of full flow volume, based on the facility type and system design parameters.

C. When the outside air dry bulb temperature is above the economizer changeover value 75F, the mixing dampers are placed in the minimum outdoor air position and the heating valve is closed. Modulate the cooling coil to maintain the supply air temperature set point 53F.

D. The air handling unit operates in Unoccupied mode as follows:

1. The supply fan stops. The cooling coil valve closes, mixing dampers fully close to the outdoor air and the heating coil valve maintains set point as sensed by the nearest practical sensor location.

E. The air handling unit operates in Night mode as follows: Heating is available when the perimeter heat fails to maintain a minimum temperature of 50 F adjustable.

1. Night Heating: The supplyfan is on with the heating coil valve open to maintain a minimum discharge air temperature of 65 degrees F. The mixing dampers remain closed to the outdoor air and the cooling coil valve remains closed.
F. Static Pressure Control:

1. The supply fan variable frequency drive modulates to maintain a constant duct static pressure as sensed at sensor located at appropriate field duct location.

2. Upon initial startup of the air handling system, the supply fan speed slowly ramps to the desired static pressure set point. Upon shutdown of the air handling system, the supply fan variable frequency drive stops and the speed signal goes to zero speed.

3. Safety: Discharge high static cutout and supply fan VFD fault alarms de-energize the supply fan upon activation. A low temperature detector located downstream of fan de-energizes the supply fan when temperatures below 40 degrees F are sensed. All dampers and valves position to their normal position after the fan is de-energized.

G. The DDC system generates a VFD trouble alarm as reported by the VFD.

K. Typical points not monitored: air filter differential pressure, coil temperatures, smoke sensors (UAF does not install smoke detection in most typical air handler units, rather doing fan shut down on general fire alarm)

L. Non-typical points to monitor: total flow or velocity

3.10 VAV LABORATORY AIR HANDLER

A. 100% Outside Air Supply Variable Air Volume, 100% Exhaust Air.

B. System controls laboratory pressurization in conjunction with fully integrated laboratory pressurization control system. See below for laboratory ventilation controls sequence of operations.

C. Low temperature safety protects all associated HVAC systems.

D. Typical points not monitored: air filter differential pressure, coil temperatures, smoke sensors (UAF does not install smoke detection in most typical air handler units, rather doing fan shut down on general fire alarm)

E. Non-typical points to monitor: total flow or velocity

3.11 VARIABLE AIR VOLUME (VAV Boxes) PACKAGED SYSTEMS

A. Application Specific Controller (Siemens TEC) have specific points and functions depending on the Application Number.

B. Controlled within user defined maximum and minimum supply air volume settings.
C. Monitor room temperature sensors and air velocity sensors.

D. In Unoccupied mode: system controls using night setpoint. May reset the Occupied mode for predetermined time period upon a signal from the control system, or manually at the room sensor.

1. Cooling Only: Occupied mode – monitors room temp sensor and air velocity sensor, modulates SA damper to maintain room temperature.

2. Cooling with Baseboard: Occupied mode – modulates SA damper in sequence with radiation valve to maintain room temperature, SA volume to remain at minimum when HW radiation valve is modulated.

3. VAV with Reheat Coil: Occupied mode - modulates the SA damper in sequence with the reheat valve to maintain the room temperature, SA volume remains at minimum when HW reheat valve is modulated.

4. VAV with Reheat Coil and Baseboard: Occupied mode - modulates the SA damper in sequence with the reheat and radiation valves to maintain the room temperature at set point, SA volume remains at minimum when HW reheat and radiation is modulated.

E. Typical points not monitored:

F. Non-typical points to monitor: auxiliary temperature sensor in air discharge from units with coils, VAV w/RHC, Duct RHC, FCU w/RHC or CC. Not applicable for Unit heaters or cabinet unit heaters.

3.12 BOILER CONTROLS

A. Alarmable primary controller

B. Avoid packaged controller on the Fairbanks Campus.

C. Outside air temperature reset

D. Staging for multiple boilers

E. Enabling by DDC system unless approved packaged controller is allowed.

F. Typical points not monitored: (consultant to determine)

G. Non-typical points to monitor: Alarmable primary controller
3.13 BOILER ALARMS – set up at substantial completion

   A. Use Honeywell R7184U Interrupted Electronic Oil Primary at remote campus sites.

   B. Provide relays or sensors as required for each individual alarm.

   C. Alarms:
      1. Flame Failure
      2. Low Water Cut Off
      3. High Limit Cut Off
      4. Low Return Water Temperature
      5. Low System Pressure

3.14 MAINTENANCE – provide typical list

   A. Equipment failure – Pump A or Pump B

3.15 CRITICAL – provide typical list

   A. System failure – Pump A and Pump B

3.16 SPECIAL CASES – Designer to describe alarming

3.17 NON-DDC Systems – Review means and methods with Facilities Services during design

3.18 FREEZERS – Alarm individual freezers using dry-contacts provided on equipment. No gang alarming. Use L10-20 plug for NC contacts.

3.19 ELEVATOR SUMP HIGH LEVEL – Use in hydraulic elevators with hydrocarbon switch in sump. Use stand-alone level switch or pick up dry contacts in packaged pump high level alarm

3.20 LIFT STATIONS – Use manufacturer supplied dry contacts

3.21 CHILLER INTERFACE – DDC system to provide enable, setpoint and staging signal. Manufacturer is to provide interface, gateways and current software. Use BacNet over IP

3.22 ROOM TEMPERATURE CONTROL – Facilities Engineers preference is for individual room control. Otherwise there are many control/operations problems

3.23 EXTERIOR LIGHTING CONTROL – Each exterior lighting system will be controlled off one common campus control point.

3.24 DOMESTIC WATER HEATER – Recirculating control via occupancy schedule
3.25 HEAT TRACE – Control via DDC on seasonal schedule on or off based on outside air temperature

A. Hydronic Heat Trace
   1. Circulating pump, CP, runs continuously from September 1 to June 1 (adjustable)

   2. Glycol supply temp in teat trace supply temp setpoint, 80 degrees F, is maintained by modulating 3-way control as needed.

   3. The following DDC points are available at the Host Room DDC Server and operator workstations:
      a. Glycol Supply Temp (F)
      b. Glycol Return Low Temp Alarm
      c. CP Status (On/Off)
      d. CP Failure Alarm

B. Electric Heat Trace
   1. DDC Controller provide an enable signal to each electrical heat trace when OSA temperature is below 35 degrees F and above negative 10 degrees F (adjustable)

3.26 FIRE ALARM INTERFACE – hardwired input from Fire Alarm system to enable restart after fire alarm reset.

3.27 INTERIOR SPACE HEATING – SUMMER.

A. Designer should anticipate interior building spaces that will sub-cool during summer months when building heating system is seasonally disabled.

3.28 VOLUMETRIC OFFSET LABORATORY ROOM VENTILATION CONTROLS

A. Fume Hood Control: The fume hood controller calculates the total fume hood open area based on the fume hood’s fixed openings, bypass opening, leakage area and sash position as indicated by the sash sensor(s). The fume hood controller also continuously calculates the fume hood exhaust CFM required to maintain the average face velocity set point based on the total open area of the fume hood and the average face velocity (adjustable) set point. The fume hood controller uses a FUME HOOD EXHAUST TERMINAL to measure actual fume hood exhaust CFM and modulate the fume hood exhaust to control and maintain the required fume hood average face velocity using a proportional, integral and derivative (PID) closed loop control algorithm.
The fume hood controller maintains the fume hood exhaust CFM at the desired minimum set point value (adjustable) when the total fume hood open area results in less than the desired minimum fume hood exhaust CFM. This minimum fume hood exhaust set point is set to the value recommended by the fume hood manufacturer to maintain adequate fume containment and dilution.

B. Room Ventilation Control: The Lab Room Controller (LRC) receives the total value of the fume hood exhaust CFM set point via a totalizing device connected to any fume hood controllers and measures the actual room general exhaust CFM. The LRC calculates total room exhaust CFM by adding the room general exhaust CFM and the total fume hood exhaust set points together. The LRC modulates the room general exhaust to ensure that a minimum total room exhaust necessary to meet the required room ventilation rate is continuously maintained using a proportional, integral and derivative (PID) closed loop control algorithm.

C. Room Pressurization Control: The LRC uses airflow sensors in the ROOM SUPPLY AIR to continuously measure the actual ROOM SUPPLY AIR CFM. The LRC calculates the required ROOM SUPPLY AIR CFM necessary to maintain the predetermined FLOW TRACKING DIFFERENTIAL by subtracting the flow tracking differential CFM set point (adjustable) from the total room exhaust CFM. The LRC modulates the ROOM SUPPLY AIR CFM to ensure that the flow tracking differential CFM is always maintained by a proportional, integral and derivative (PID) closed loop control algorithm.

D. Room Temperature Control: The LRC measures the temperature in the room by means of the ROOM TEMPERATURE SENSOR and maintains the room temperature at the set point by adjusting the supply airflow and modulating the NORMALLY CLOSED (N.C.) HEATING VALVE using a proportional, integral and derivative (PID) closed loop control algorithm. Room supply air temperature is controlled to the room set point. The LRC temperature control loop calculates a supply airflow required for cooling TEMPERATURE CONTROL VOLUME. If the ROOM SUPPLY AIR is at its minimum limit and the room requires increased cooling beyond the amount of ROOM SUPPLY AIR CFM necessary to maintain the required FLOW TRACKING DIFFERENTIAL, the LRC increases the ROOM SUPPLY AIR CFM as well as the ROOM GENERAL EXHAUST CFM to maintain the room temperature set point and the FLOW TRACKING DIFFERENTIAL.

3.29 HEAT RECOVERY AIR HANDLER SYSTEMS – Consult with UAF FS on means and methods of controlling heat recovery systems based on the type of system.