The following is **ADDITIONAL SPECIAL CONDITIONS** to be added to the Bid documents:

FIRE ALARM – A GENERAL NOTES

All fire alarm equipment shall remain operational and in-place as the renovation occurs.
If the construction requires interruption of the building Fire Alarm system, provide a written 7-days notice to the County representative(s) prior to the interruption. Follow all rules and regulations provided by County and all code requirements for a fire alarm interruption.
Any final connection to the building Fire Alarm system shall be performed by the Base building Fire Alarm contractor. The electrical sub-contractor will be responsible for coordinating this work.
The system shall comply to NFPA72.
The existing Fire Alarm system Emergency alarm communications is existing to remain.
Connect any new or relocated fire alarm devices to the existing fire alarm circuitry or new extender panel located on related floors.
At that time, if and when that information is required during construction, the Project Superintendent must coordinate their work directly with the County and the County's fire alarm contractor. If the Contractor's work impacts the operation of the existing fire alarm system, and the system operation is affected, the County will provide the Superintendent with the system code so he/she can request directly the temporary outage. The Superintendent is also responsible to minimize system disruption and notify the County's fire alarm contractor immediately when the system can be reactivated.
The Fire Alarm system cannot remain out of operation in any one day when there is no-one onsite. This includes overnight and daylight hours. If the system is called-out and must remain called-out, then it is the responsibility of the Contractor to always provide a fire-watch and keep the County and their fire alarm contractor advised.

Information B:
The Contractor shall use only the following County contractors for the following work:

1. For sprinkler system - **Simplex**, Andrea Mathews mobile 570.474.6596 email andrea.mathews@jci.com
2. For Fire Alarm system - **MC Dean – Fire Alarm** Jamie Gibbs mobile 443.871.9048 email jamie.gibbs@mcdean.com
3. For HVAC Controls - **Siemens** Brian Bertolino mobile 570.446.8345 email brian.bertolino@siemens.com

The following information concerns the mechanical system renovation work on the 3rd Floor

Note Regarding Work Impacting Occupant Environmental Conditions

In addition to performing all work during non-business hours and restoring work spaces to workable conditions the following work day, the contractor shall also ensure that any work done that could impact temperature or ventilation to work spaces either be performed during days when all daytime and nighttime temperatures during downtimes be accomplished within a 45^0 F minimum, 65^0 F maximum range or, if this is not possible, that any work impacting worker temperatures and ventilation be restored before the following work day. This includes,

but is not limited to any thermostat disconnections, duct removal/replacement, and VAV box removal/replacement.

Information D:

HVAC EQUIPMENT and DEVICES -REQUIRED PRE-INSTALLATION MEETING(S)

Contractor must schedule pre-installation meeting(s) for HVAC Equipment and Devices for verification of sequence of work, work plans and equipment and devices submittals.

Requirements for New VAV DDC Controllers, Thermostats and Electronic Control Valves

1. General Description:

1.1 The purpose of this document is to outline the requirements for the procurement, installation, and integration of new Variable Air Volume (VAV) Direct Digital Control (DDC) controllers, thermostats and electronic control valves as part of a mechanical upgrade project for existing VAV boxes. The new components shall be interoperable with the existing Building Automation System (BAS) and capable of seamless integration to ensure optimal system performance and efficiency.

2. VAV DDC Controllers:

2.1 The controls contractor shall provide new VAV DDC controllers compatible with the existing BAS and communication protocols, ensuring interoperability with the current system architecture.

2.2 Controllers shall feature an intuitive user interface with graphical representation of VAV box parameters, allowing easy configuration, programming, and monitoring of system operation.

2.3 The controllers shall support a wide range of control strategies, including proportional-integral-derivative (PID) control, optimal start/stop, and adaptive control algorithms to maximize energy efficiency and occupant comfort.

2.4 Each controller shall be equipped with sufficient input and output points to accommodate temperature sensors, airflow sensors, damper actuators, Fans, and other peripheral devices required for VAV box operation.

2.5 Built-in diagnostics and fault detection capabilities shall be incorporated into the controllers where available to facilitate proactive maintenance and troubleshooting, minimizing system downtime and optimizing performance.

3. Electronic Thermostats:

3.1 The controls contractor shall provide new electronic thermostats compatible with the VAV DDC controllers and communication protocols utilized within the BAS.

3.2 Thermostats shall utilize advanced temperature sensing technologies, such as thermistors or thermocouples, to ensure accurate and responsive temperature measurement.

3.3 User-friendly interfaces with intuitive controls and clear display screens shall be incorporated into the thermostat design to facilitate easy operation and adjustment of setpoints.

3.4 Occupancy sensing capabilities shall be integrated into the thermostats to enable demand-based temperature control, allowing for energy savings during unoccupied periods while maintaining occupant comfort.

3.5 The thermostats shall support flexible scheduling options and setback strategies to optimize energy usage based on occupancy patterns and operational requirements.

3.6 The thermostats shall be programmed to allow for zone set point control, enabling end-users to adjust temperature set points within a range of +/- 2/3 degrees Fahrenheit.

4. Electronic Control Valves:

4.1 The controls contractor shall provide new electronic control valves compatible with the VAV DDC controllers, and communication protocols utilized within the BAS.

4.2 Control valves shall be of a modulating type, capable of precise and responsive control of airflow to meet the demands of the HVAC system and maintain optimal comfort conditions.

4.3 Control valves shall be equipped with electronic actuators for precise modulation and control with 0-

4.4 The electronic control valves shall feature one of the below signal inputs to ensure compatibility with new VAV DDC controllers, including:

a. 0-10 V DC signal input

b. 4-20 mA signal input

4.4 The control valves shall be constructed from stainless steel or brass to provide protection from erosion, and wear, ensuring long-term reliability and durability in HVAC applications.

4.5 Fail-safe features shall be incorporated into the control valve design to ensure safe operation in the event of power outages or system failures, preventing potential damage to equipment or discomfort to occupants.

5. BAS Graphics:

5.1 The controls contractor shall provide new BAS graphics on the existing BAS platform, depicting the layout and operation of the new VAVs as part of the mechanical upgrade project.

5.2 Graphics shall be developed to accurately represent the physical layout of the VAV boxes, including placement within the building, airflow paths, and associated equipment such as ductwork, sensors, and control valves.

5.3 All necessary data points, including temperature setpoints, airflow rates, damper positions, and system status indicators, shall be incorporated into the graphics to provide real-time monitoring and control capabilities.

5.4 Graphics shall be designed with user-friendly interfaces and intuitive navigation features, allowing facility personnel to easily access and interact with the VAV system for monitoring, adjustment, and troubleshooting purposes.

5.5 The controls contractor shall work closely with the facility's engineering team to ensure that the BAS graphics meet the specific requirements and preferences of the end-users, incorporating feedback and making revisions as necessary.

5.6 Graphics shall be optimized for compatibility with the existing BAS platform, utilizing industry-standard protocols and software tools for seamless integration and operation.

5.7 Training on BAS navigation and operation of the new VAV Controllers shall be provided to facility personnel, covering topics such as accessing and interpreting BAS graphics, adjusting setpoints, and responding to system alarms and alerts.

6. BAS Integration:

6.1 The controls contractor shall ensure seamless integration of the new VAV DDC controllers, thermostats, and electronic control valves with the existing BAS platform.

6.2 Integration shall utilize industry-standard communication protocols, such as BACnet or Modbus, to facilitate data exchange and interoperability between the VAV system and the BAS.

6.3 Data points for temperature, airflow, damper positions, system status, and alarms shall be mapped and configured within the BAS for real-time monitoring and control.

6.4 The controls contractor shall conduct thorough testing and verification of BAS integration to ensure reliable communication and functionality between all system components.

7. Alarm Configuration:

7.1 The controls contractor shall configure alarm thresholds and notifications within the BAS to promptly alert facility personnel of any abnormal conditions or malfunctions related to the VAV system.

7.2 Alarm thresholds shall be set for critical parameters such as airflow, Space temperature (5 Deg +/- Space Setpoint), damper positions, and valve operation, with appropriate sensitivity to detect deviations from normal operating conditions.

7.3 Alarm notifications shall be prioritized based on severity and urgency, ensuring that critical alarms are promptly addressed to prevent system failures or occupant discomfort.

8. Commissioning:

8.1 Upon completion of installation and integration, the controls contractor shall conduct thorough commissioning of the new VAV system, including functional testing, performance verification, and system optimization.

8.2 Commissioning activities shall ensure compliance with design intent, operational requirements, and industry standards.

8.3 Functional testing shall encompass all system modes of operation, control sequences, and alarm response scenarios to validate proper system functionality and performance.

8.4 Performance optimization shall focus on maximizing energy efficiency, occupant comfort, and system reliability through fine-tuning of control parameters and optimization of operating strategies.

9. BAS Operator Training on New Equipment:

9.1 The controls contractor shall provide comprehensive training for facility operators on the operation and maintenance of the new VAV DDC controllers, thermostats, electronic control valves, and BAS graphics.

9.2 Training shall cover topics such as system navigation, setpoint adjustment, troubleshooting procedures, and routine maintenance tasks.

10. Documentation and As-Built Drawings:

10.1 The controls contractor shall provide detailed documentation for all installed components, including technical specifications, wiring diagrams, installation manuals, and operation guides.

10.2 As-built drawings shall be updated to reflect the installation of new VAV DDC controllers, thermostats, electronic control valves, and BAS graphics, ensuring accurate documentation of system configurations and wiring connections.

10.3 Training materials and documentation shall be developed in a clear and concise format, accessible to facility personnel for reference and training purposes.

11. Compliance Verification:

11.1 The controls contractor shall conduct thorough testing and verification of all new components to ensure compliance with specified requirements and performance criteria.

11.2 Verification activities shall include functional testing, calibration checks, integration testing with the existing BAS, and validation of system performance under varying operating conditions.

11.3 Any deviations or non-conformances identified during verification shall be promptly addressed and rectified by the controls contractor to ensure the successful implementation of the upgrade project.

12. Warranty:

12.1 The controls contractor shall provide a warranty for all installed components, covering defects in materials and workmanship for a minimum period of 1 year from the date of final acceptance.

12.2 The warranty shall include provisions for responsive technical support, replacement of faulty components, and on-site service visits as necessary to address warranty claims.

12.3 Any components found to be defective during the warranty period shall be promptly repaired or replaced by the control’s contractor at no additional cost to the client.

12.4 The warranty shall not cover damages resulting from improper installation, misuse, neglect, or acts of nature beyond the contractor's control.

12.5 The controls contractor shall ensure that warranty documentation is provided to the client upon project completion, outlining the terms and conditions of the warranty coverage and procedures for initiating warranty claims.

Controls Related Construction Document Clarifications

I. All new power, data or other wiring shall be plenum rated when installed above ceilings and shall be mounted in conduit for areas where wiring is exposed.

II. Sequences of Operation

a. VAV Terminals: Please ensure new VAV terminals satisfy the following sequence of operation. Note that this sequence of operation is identical to the sequence programmed for the existing VAV terminals.

VAV Terminals Sequence of operation:

A. COOLING ONLY TERMINALS: WITH ROOM TEMPERATURE BELOW THERMOSTAT SETPOINT, AIR FLOW IS AT MINIMUM SETTING. WITH ROOM TEMPERATURE ABOVE SETPOINT AIR FLOW MODULATES ACCORDING TO THE LOAD BETWEEN MINIMUM AND MAXIMUM SETTINGS TO MAINTAIN COOLING THERMOSTAT SETPOINT.

B. PARALLEL FLOW FAN-POWERED TERMINALS

1. OCCUPIED COOLING/HEATING: WITH ROOM TEMPERATURE ABOVE THERMOSTAT SETPOINT, THE PRIMARY (COOLING) AIR FLOW MODULATES ACCORDING TO THE LOAD BETWEEN MINIMUM AND MAXIMUM SETTINGS TO MAINTAIN THERMOSTAT SETPOINT AND THE TERMINAL FAN REMAINS OFF. WHEN ROOM TEMPERATURE FALLS BELOW THERMOSTAT HEATING SETPOINT THE PRIMARY AIR FLOW FALLS TO IT'S MINIMUM SETTING AND THE TERMINAL FAN STARTS IF ROOM TEMPERATURE FALLS FURTHER, THE REHEAT VALVE OPENS AND MODULATES THE WATER FLOW TO MAINTAIN HEATING THERMOSTAT SETPOINT WHILE THE PRIMARY AIR IS AT MINIMUM FLOW.

2. UNOCCUPIED COOLING: SAME AS OCCUPIED COOLING, EXCEPT SETBACK SETPOINT ONLY NEEDS TO BE SATISFIED.

3. UNOCCUPIED HEATING: PRIMARY AIR IS OFF. IF ROOM TEMPERATURE FALLS BELOW NIGHT SETBACK SETPOINT, TERMINAL FAN STARTS. IF ROOM TEMPERATURE FALLS FURTHER, HOT WATER VALVE OPENS WHILE RAN IS RUNNING. ROOM THERMOSTAT SHALL BE ABLE TO OVERRIDE THE DDC NIGHT SETBACK MODE AND MAINTAIN SPACE OCCUPIED TEMPERATURE WHILE SYSTEM IS IN UNOCCUPIED MODE.

C. SERIES FLOW FAN POWERED TERMINALS

1. OCCUPIED

a. WHEN AHU IS ENERGIZED, A SIGNAL FROM THE DDC SHALL START ALL SERIES FLOW CONSTANT VAV TERMINAL FANS BEFORE AHU SUPPLY AND RETURN FANS START. A 30 SECOND TIME DELAY RELAY SHALL START AHU AFTER TERMINAL FANS ARE FULLY RUNNING.

b. WITH ROOM TEMPERATURE BELOW THERMOSTAT SETPOINT, PRIMARY (COOLING) AIRFLOW IS AT MINIMUM WHILE PLENUM AIR IS AT MAXIMUM. WITH ROOM TEMPERATURE ABOVE SETPOINT: PRIMARY AIRFLOW MODULATES ACCORDING TO THE LOAD BETWEEN MINIMUM AND MAXIMUM PRIMARY AIR SETTINGS TO MAINTAIN COOLING THERMOSTAT SETPOINT.

2. UNOCCUPIED: TERMINAL FAN IS OFF REGARDLESS OF THE AHU OR FINNED TUBE POSITION.

b. AHU-3 Sequence of Operation: Please refer to Drawing M-502 which gives this sequence of operation.

III. For any life safety related items on AHU-3, interface them with the existing controls in the same manner as currently done for the existing AHU-3.

IV. Please add in the following additional specification requirement for the Variable Frequency Drives:

VARIABLE FREQUENCY DRIVE BYPASS SYSTEMS

A. Bypass Operation: Safely transfers motor between power converter output and bypass circuit, manually, automatically, or both. Selector switches set modes and indicator lights indicate mode selected. Unit is capable of stable operation (starting, stopping, and running) with motor completely disconnected from power converter.

B. Bypass Mode: Field-selectable automatic or manual, allows local and remote transfer between power converter and bypass contactor and retransfer, either via manual operator interface or automatic-control system feedback.

C. Bypass Controller: Three-contactor-style bypass allows motor operation via the power converter or the bypass controller arranged to isolate the power converter input and output and permit safe testing of the power converter, both energized and de-energized, while motor is operating in bypass mode.

1. Bypass Contactor: Load-break, IEC-rated contactor.
2. Input and Output Isolating Contactors: Non-load-break, IEC-rated contactors.
3. Isolating Switch: Non-load-break switch arranged to isolate power converter and permit safe troubleshooting and testing of the power converter, both energized and de-energized, while motor is operating in bypass mode; pad-lockable, door-mounted handle mechanism.

D. Bypass Contactor Configuration: Full-voltage (across-the-line)
1. HAND/OFF/AUTO selector switch.
2. Contactor Coils: Pressure-encapsulated type

a. Operating Voltage: Depending on contactor NEMA size and line-voltage rating, manufacturer's standard matching control power or line voltage.
b. Power Contacts: Totally enclosed, double break, and silver-cadmium oxide; assembled to allow inspection and replacement without disturbing line or load wiring.

3. Control Circuits: 120-V ac; obtained from integral CPT, with primary and secondary fuses, with CPT of sufficient capacity to operate all integral devices and remotely located pilot, indicating, and control devices.

a. CPT Spare Capacity: 50 VA.

4. Overload Relays: NEMA ICS 2.

a. *Solid-State Overload Relays:*

   1) *Switch or dial selectable for motor-running overload protection.*
   2) *Sensors in each phase.*
   3) *Class 10 tripping characteristic selected to protect motor against voltage and current unbalance and single phasing.*
   4) *Class II ground-fault protection, with start and run delays to prevent nuisance trip on starting.*
   5) *Analog communication module.*

b. *NC isolated overload alarm contact.*
c. *External overload, reset push button.*

V. Controls Compliance for New Air Terminals (VAV Boxes) and Related Thermostats and Control Valves
Refer to attached "VAV Terminal Devices Controllers, Thermostats, Valves" file.

VI. Controls Compliance for New AHU-3
Refer to attached "AHU-3 Controls Compliance Requirements" file.

VII. Before purchasing any items or starting any work, please refer to the "Existing Controls Drawing" attachment for all details specific to the existing controls system as installed now as this will help with the above clarifications and with notes on Construction Documents pertaining to any work you may perform that could impact the existing controls.

Replacement of Air Handling Unit (AHU-3)

Controls Performance Requirement:

1. General Description

1.1 The purpose of this document is to outline the requirements for replacing Air Handling Unit (AHU-3) while integrating it with the existing hybrid pneumatic DDC Building Automation System (BAS).

2. Scope of Work

2.1 The controls contractor shall provide all labor, materials, equipment, and services necessary for the successful integration of the new AHU with the existing hybrid pneumatic DDC BAS, as specified herein.

2.2 The scope of work includes but is not limited to:

a. Assessment of the existing hybrid pneumatic DDC controls for compatibility with the new AHU. Reuse of existing controls unless new sensors, controllers, or switches are required for integration.

b. Reuse or replacement of Electro-Pneumatic (E/P) switches for actuators (damper, valve, etc.) as needed. Existing E/P switches may need recalibration to ensure proper operation. Replace E/P Switches if existing is unfunctional, cannot be calibrated or is incompatible with the application required for the new AHU.

c. Development and implementation of control strategies for Variable Frequency Drives (VFDs) provided with AHU-3. VFDs shall be provided with Control Communication Cards utilizing a standard protocol (BACnet or Modbus) compatible with the existing BAS protocol.

d. Creation of new graphical representations depicting the characteristics of the new replaced AHU-3 within the BAS. Graphics shall include critical points such as supply air temperature, air flow rates, and trends for monitoring purposes.

e. Configuration of alarms within the BAS for AHU-3, including standard AHU alarms such as high/low supply air temperature, high/low static pressure, fan failure, filter status, and motor overload.

f. Implementation of energy-efficient strategies such as Demand-Controlled Ventilation (DCV) and Static Pressure Reset where applicable to optimize AHU-3 operation. No additional sensors or devices shall be provided to apply certain strategies unless consulted and approved by the Engineer and Architect.

g. Replacement of existing controllers, sensors, switches, and E/P switches only if required to ensure a fully functional and integrated AHU.

h. Calibration and verification of all sensors and actuators installed as part of the AHU replacement to ensure accurate measurement and control feedback.

3. Graphics

3.1 New graphical representations shall be created to depict the characteristics of AHU-3 within the BAS.

3.2 Graphics shall include critical points such as supply air temperature, return air temperature, mixed air temperature, outside air temperature, air flow rates, static pressure, and trends for monitoring purposes.

3.3 Alarm indications shall be integrated into the graphics to visually represent standard AHU alarms, with clear indications of alarm severity and urgency.

4. Drawings and Documentation

4.1 Detailed drawings and documentation shall be provided, including Piping and Instrumentation Diagrams (P&ID), sequence of operation, point lists, Bill of Materials (BOM), as-built drawings, and commissioning reports.

4.2 Drawings and documentation shall accurately reflect the configuration and integration of AHU-3 with the existing BAS, including control strategies, sensor locations, and alarm configurations.

5. VFDs Integration

5.1 VFDs provided for AHU-3 shall come with Control Communication Cards with a standard protocol (BACnet or Modbus) compatible with the existing BAS Protocol.

5.2 Controls Contractor shall integrate each VFD back to the existing BAS via one of the specified standard protocols (BACnet or Modbus) and shall account for 15 points per VFD to be integrated.

5.3 Integration shall include configuring communication parameters, mapping data points, and establishing control logic for seamless operation within the BAS environment.

5.4 Control strategies for VFDs shall be developed and implemented to optimize AHU-3 operation and energy efficiency, including variable speed control based on demand and airflow requirements.

5.5 The VFDs shall also be hardwired to provide hardwire control of the following points:

- Start/Stop Command
- Status
- Speed (Hz)
- Alarm

5.6 Hardwiring shall ensure reliable and direct control of the VFDs if required.

6. Alarms

6.1 The controls contractor shall configure alarm thresholds within the BAS for AHU-3 to ensure timely detection and notification of abnormal conditions or system malfunctions.

6.2 Alarm indications shall be integrated into the graphical user interface of the BAS to provide visual alerts to facility operators.

6.3 Standard AHU alarms shall be configured, including but not limited to:

a. High/low supply air temperature. b. High/low return air temperature. c. High/low mixed air temperature. d. High/low outside air temperature. e. High/low static pressure. f. Fan failure. g. Filter status. h. Motor overload. i. VFD alarm status (if applicable).

6.4 Alarms shall be prioritized based on severity and urgency, with clear indications of alarm conditions and recommended actions for resolution.

6.5 Alarm configurations shall be documented as part of the as-built documentation package, including alarm thresholds, escalation procedures, and contact information for maintenance personnel.

7. Recalibration of Pneumatic System and E/P Switches

7.1 Prior to integration with the new replaced AHU, the existing pneumatic system shall be evaluated and recalibrated to ensure compatibility with the replaced AHU.

7.2 The contractor shall recalibrate all existing Electro-Pneumatic (E/P) switches to match the characteristics and requirements of the new AHU, specifically addressing pneumatic damper and valve actuator operation.

7.3 Recalibration shall include adjustment of control ranges, setpoints, response times, and other parameters as necessary to optimize performance and ensure seamless integration with the hybrid BAS system.

8. Testing and Balancing (TAB)

8.1 The controls contractor shall be responsible for providing Testing and Balancing (TAB) services to ensure the proper integration and functionality of the AHU within the overall HVAC system.

8.2 The TAB activities shall include comprehensive testing and balancing procedures to verify the performance of the new AHU, encompassing airflow rates, temperature differentials, and pressure differentials.

8.3 Testing and balancing activities shall adhere to industry standards and best practices, with the controls contractor responsible for documenting and reviewing the test results.

8.4 Any discrepancies or issues identified during testing and balancing shall be addressed promptly by the controls contractor to ensure optimal performance and alignment with design specifications.

8.5 Final acceptance of the AHU replacement shall be contingent upon the successful completion of testing and balancing activities, with approval required from both the TAB team and facility management.

9. Commissioning

9.1 Commissioning of AHU-3 and its associated control systems shall be conducted, including functional testing, performance verification, and point-to-point checkouts. The Controls Contractor shall support all commissioning requirements and provide the labor required to ensure effective and successful commissioning of the systems/equipment provided.

9.2 Commissioning activities shall ensure compliance with design intent, operational requirements, and energy-efficient strategies, with documentation of commissioning results and any adjustments made.

10. Compliance Verification

10.1 Compliance with all specified requirements and performance criteria shall be verified through documentation, testing, and inspection.

10.2 Any deviations or non-conformances shall be promptly addressed and rectified to ensure the successful integration of AHU-3 with the existing BAS.

11. Training

11.1 The controls contractor shall provide comprehensive training sessions for facility operators on the operation and maintenance of AHU-3 and its associated control systems and sequences of operation.

11.2 Training sessions shall cover the following topics:

a. Overview of the new AHU-3 system components and their sequences of operations.

b. Operation of the control interface, including navigation, setpoint adjustments, and alarm acknowledgment.

c. Troubleshooting procedures for common issues and alarms, including corrective actions and escalation procedures.

d. Preventive maintenance tasks and schedules for AHU-3 components, including filter replacement, motor inspection, and sensor calibration.

e. Emergency procedures and shutdown protocols in the event of system malfunctions or failures.

11.3 Training sessions shall be conducted onsite and tailored to the specific needs and skill levels of the facility operators.

11.4 Comprehensive training materials, including manuals, checklists, and reference guides, shall be provided to support ongoing operation and maintenance activities.

11.5 Training sessions shall be scheduled and coordinated with facility management to ensure participation and effectiveness.

12. Trending Requirements

12.1 The controls contractor shall implement trending capabilities within the BAS for AHU-3 to monitor and analyze key performance parameters over time.

12.2 Trending shall include, but not be limited to, data such as:

a. Supply air temperature.

b. Return air temperature.

c. Mixed air temperature.

d. Outside air temperature.

e. Static pressure.

f. Fan speed.

12.3 Trending data shall be logged at regular intervals or change of value (COV) as applicable and shall be stored within the BAS system for historical analysis and performance tracking.

12.4 The controls contractor shall configure trend logs to be accessible to authorized personnel for review and analysis, with the ability to generate reports as needed.

12.5 Trending requirements shall be designed to facilitate proactive maintenance, energy optimization, and system troubleshooting, with trends utilized to identify patterns, anomalies, and potential issues for further investigation and resolution.

Requirements for New VAV DDC Controllers, Thermostats and Electronic Control Valves

1. General Description:

1.1 The purpose of this document is to outline the requirements for the procurement, installation, and integration of new Variable Air Volume (VAV) Direct Digital Control (DDC) controllers, thermostats and electronic control valves as part of a mechanical upgrade project for existing VAV boxes. The new components shall be interoperable with the existing Building Automation System (BAS) and capable of seamless integration to ensure optimal system performance and efficiency.

2. VAV DDC Controllers:

2.1 The controls contractor shall provide new VAV DDC controllers compatible with the existing BAS and communication protocols, ensuring interoperability with the current system architecture.

2.2 Controllers shall feature an intuitive user interface with graphical representation of VAV box parameters, allowing easy configuration, programming, and monitoring of system operation.

2.3 The controllers shall support a wide range of control strategies, including proportional-integral-derivative (PID) control, optimal start/stop, and adaptive control algorithms to maximize energy efficiency and occupant comfort.

2.4 Each controller shall be equipped with sufficient input and output points to accommodate temperature sensors, airflow sensors, damper actuators, Fans, and other peripheral devices required for VAV box operation.

2.5 Built-in diagnostics and fault detection capabilities shall be incorporated into the controllers where available to facilitate proactive maintenance and troubleshooting, minimizing system downtime and optimizing performance.

3. Electronic Thermostats:

3.1 The controls contractor shall provide new electronic thermostats compatible with the VAV DDC controllers and communication protocols utilized within the BAS.

3.2 Thermostats shall utilize advanced temperature sensing technologies, such as thermistors or thermocouples, to ensure accurate and responsive temperature measurement.

3.3 User-friendly interfaces with intuitive controls and clear display screens shall be incorporated into the thermostat design to facilitate easy operation and adjustment of setpoints.

3.4 Occupancy sensing capabilities shall be integrated into the thermostats to enable demand-based temperature control, allowing for energy savings during unoccupied periods while maintaining occupant comfort.

3.5 The thermostats shall support flexible scheduling options and setback strategies to optimize energy usage based on occupancy patterns and operational requirements.

3.6 The thermostats shall be programmed to allow for zone set point control, enabling end-users to adjust temperature set points within a range of +/- 2/3 degrees Fahrenheit.

4. Electronic Control Valves:

4.1 The controls contractor shall provide new electronic control valves compatible with the VAV DDC controllers, and communication protocols utilized within the BAS.

4.2 Control valves shall be of a modulating type, capable of precise and responsive control of airflow to meet the demands of the HVAC system and maintain optimal comfort conditions.

4.3 Control valves shall be equipped with electronic actuators for precise modulation and control with 0-

4.4 The electronic control valves shall feature one of the below signal inputs to ensure compatibility with new VAV DDC controllers, including:

a. 0-10 V DC signal input

b. 4-20 mA signal input

4.4 The control valves shall be constructed from stainless steel or brass to provide protection from erosion, and wear, ensuring long-term reliability and durability in HVAC applications.

4.5 Fail-safe features shall be incorporated into the control valve design to ensure safe operation in the event of power outages or system failures, preventing potential damage to equipment or discomfort to occupants.

5. BAS Graphics:

5.1 The controls contractor shall provide new BAS graphics on the existing BAS platform, depicting the layout and operation of the new VAVs as part of the mechanical upgrade project.

5.2 Graphics shall be developed to accurately represent the physical layout of the VAV boxes, including placement within the building, airflow paths, and associated equipment such as ductwork, sensors, and control valves.

5.3 All necessary data points, including temperature setpoints, airflow rates, damper positions, and system status indicators, shall be incorporated into the graphics to provide real-time monitoring and control capabilities.

5.4 Graphics shall be designed with user-friendly interfaces and intuitive navigation features, allowing facility personnel to easily access and interact with the VAV system for monitoring, adjustment, and troubleshooting purposes.

5.5 The controls contractor shall work closely with the facility's engineering team to ensure that the BAS graphics meet the specific requirements and preferences of the end-users, incorporating feedback and making revisions as necessary.

5.6 Graphics shall be optimized for compatibility with the existing BAS platform, utilizing industry-standard protocols and software tools for seamless integration and operation.

5.7 Training on BAS navigation and operation of the new VAV Controllers shall be provided to facility personnel, covering topics such as accessing and interpreting BAS graphics, adjusting setpoints, and responding to system alarms and alerts.

6. BAS Integration:

6.1 The controls contractor shall ensure seamless integration of the new VAV DDC controllers, thermostats, and electronic control valves with the existing BAS platform.

6.2 Integration shall utilize industry-standard communication protocols, such as BACnet or Modbus, to facilitate data exchange and interoperability between the VAV system and the BAS.

6.3 Data points for temperature, airflow, damper positions, system status, and alarms shall be mapped and configured within the BAS for real-time monitoring and control.

6.4 The controls contractor shall conduct thorough testing and verification of BAS integration to ensure reliable communication and functionality between all system components.

7. Alarm Configuration:

7.1 The controls contractor shall configure alarm thresholds and notifications within the BAS to promptly alert facility personnel of any abnormal conditions or malfunctions related to the VAV system.

7.2 Alarm thresholds shall be set for critical parameters such as airflow, Space temperature (5 Deg +/- Space Setpoint), damper positions, and valve operation, with appropriate sensitivity to detect deviations from normal operating conditions.

7.3 Alarm notifications shall be prioritized based on severity and urgency, ensuring that critical alarms are promptly addressed to prevent system failures or occupant discomfort.

8. Commissioning:

8.1 Upon completion of installation and integration, the controls contractor shall conduct thorough commissioning of the new VAV system, including functional testing, performance verification, and system optimization.

8.2 Commissioning activities shall ensure compliance with design intent, operational requirements, and industry standards.

8.3 Functional testing shall encompass all system modes of operation, control sequences, and alarm response scenarios to validate proper system functionality and performance.

8.4 Performance optimization shall focus on maximizing energy efficiency, occupant comfort, and system reliability through fine-tuning of control parameters and optimization of operating strategies.

9. BAS Operator Training on New Equipment:

9.1 The controls contractor shall provide comprehensive training for facility operators on the operation and maintenance of the new VAV DDC controllers, thermostats, electronic control valves, and BAS graphics.

9.2 Training shall cover topics such as system navigation, setpoint adjustment, troubleshooting procedures, and routine maintenance tasks.

10. Documentation and As-Built Drawings:

10.1 The controls contractor shall provide detailed documentation for all installed components, including technical specifications, wiring diagrams, installation manuals, and operation guides.

10.2 As-built drawings shall be updated to reflect the installation of new VAV DDC controllers, thermostats, electronic control valves, and BAS graphics, ensuring accurate documentation of system configurations and wiring connections.

10.3 Training materials and documentation shall be developed in a clear and concise format, accessible to facility personnel for reference and training purposes.

11. Compliance Verification:

11.1 The controls contractor shall conduct thorough testing and verification of all new components to ensure compliance with specified requirements and performance criteria.

11.2 Verification activities shall include functional testing, calibration checks, integration testing with the existing BAS, and validation of system performance under varying operating conditions.

11.3 Any deviations or non-conformances identified during verification shall be promptly addressed and rectified by the controls contractor to ensure the successful implementation of the upgrade project.

12. Warranty:

12.1 The controls contractor shall provide a warranty for all installed components, covering defects in materials and workmanship for a minimum period of 1 year from the date of final acceptance.

12.2 The warranty shall include provisions for responsive technical support, replacement of faulty components, and on-site service visits as necessary to address warranty claims.

12.3 Any components found to be defective during the warranty period shall be promptly repaired or replaced by the control’s contractor at no additional cost to the client.

12.4 The warranty shall not cover damages resulting from improper installation, misuse, neglect, or acts of nature beyond the contractor's control.

12.5 The controls contractor shall ensure that warranty documentation is provided to the client upon project completion, outlining the terms and conditions of the warranty coverage and procedures for initiating warranty claims.