ADDENDUM

UNT/ UNTS
OAK STREET HALL DEMOLITION &
ART STUDIO FACILITY
1001 W. MULBERRY STREET
DENTON, TEXAS 76201
VAI Project No. 18012.001

December 2, 2020

ADDENDUM NO. 03
Addendum to Project Manual and Drawings dated November 09, 2020

NOTICE TO BIDDERS:

PROJECT MANUAL

A. **DELETE** Section 072101 Spray Foam Insulation dated 13 January 2015**.** It does not relate to this project.
B. **MODIFY** Section 230800 Commissioning of HVAC dated 09 November 2020. **REMOVE** line Part 1, 1.02.A. Section 23 09 04 – Facility Management Control System (Tridium)

DRAWINGS

A. **MODIFY** Sheet A-631 Room Finish Schedule Finish Material Legend, dated November 09, 2020 to include the following: Room number 108, Elec. Kiln Rm at column heading Ceiling **MODIFY** APC-1 **TO** OPEN. At Column heading Remarks **ADD** "PAINT EXPOSED STRUCTURE".
B. **ADD** Sheet M-601 Mechanical Controls Diagrams dated December 1, 2020.
C. **ADD** Sheet M-602 Mechanical Controls Diagrams dated December 1, 2020.

RESPONSE TO BIDDER'S QUESTIONS:

1. Reference 102600 Wall & Door Protection: Paragraph 2.2.A.3 states that the wing or leg size is to be 4" however the size called out on the Finish Material Legend on drawing sheet A-631 calls for 3" legs. Please clarify.
   RESPONSE: Provide corner guards with 3" legs

2. Regarding the 25 Integrated Automation Standards (pg 382 of the specifications) can the UNT updated master specifications be provided that allow Automated Logic by Logical Solutions to bid on the Energy Management System?
   RESPONSE: This building must be integrated with the UNT Campus automated system as outlined in Appendix E of the UNT Design Guidelines. Other automated systems are not acceptable.

3. Can a sequence of operations and building automation points list be provided for mechanical HVAC equipment?
   Response: See documents M-601 and M-602 provided as part of Addendum 03, dated December 1, 2020.

4. In section 23 08 000, the reference standards refer to Section 23 09 24 – Facility Management Control System (Tridium) but we do not see this section included in the spec book. Can you provide the missing information or let us know if this does not pertain to our project?
   RESPONSE: The section referenced is not valid. The section is not included in the project manual. Ignore and remove reference to section 23 09 24 – Facility Management Control System (Tridium).

5. Reference sheet A-201: Elevation 01 shows the location of three storefront windows that relate to Alternate #10. A width is shown but not a height. Please provide detailed elevations for these windows including width and height dimensions as well as head, sill and jamb sections.
   RESPONSE: Rough opening height of 1'-4" is shown on sheet A-201. Head and sill detail similar to 05/A-501. Jamb detail similar to 05/ A-502.

6. Reference sheet A-111B: At grid lines F/2.0 there is a callout for a Spill Station (key #31). I cannot find any reference as to what this is. Please clarify.
   RESPONSE: Spill kit consists of the following: 1- Gallon wall mount universal spill kit – 2 super sorbent shaker cartons, counter or floor broom, dust pan, 12 disposal bags w/ instruction cards, laminated spill station sign, basis of design LabelMaster KSKUWHB; 55 gallon steel drum with lid, unlined, UN rating 1A2/Y1.6/150, basis of design U-line S-10758; 15 gallon chemical-resistant HDPE spill containment platform, uncovered, spill capacity 2000 lb., basis of design Eagle Model #1633D.

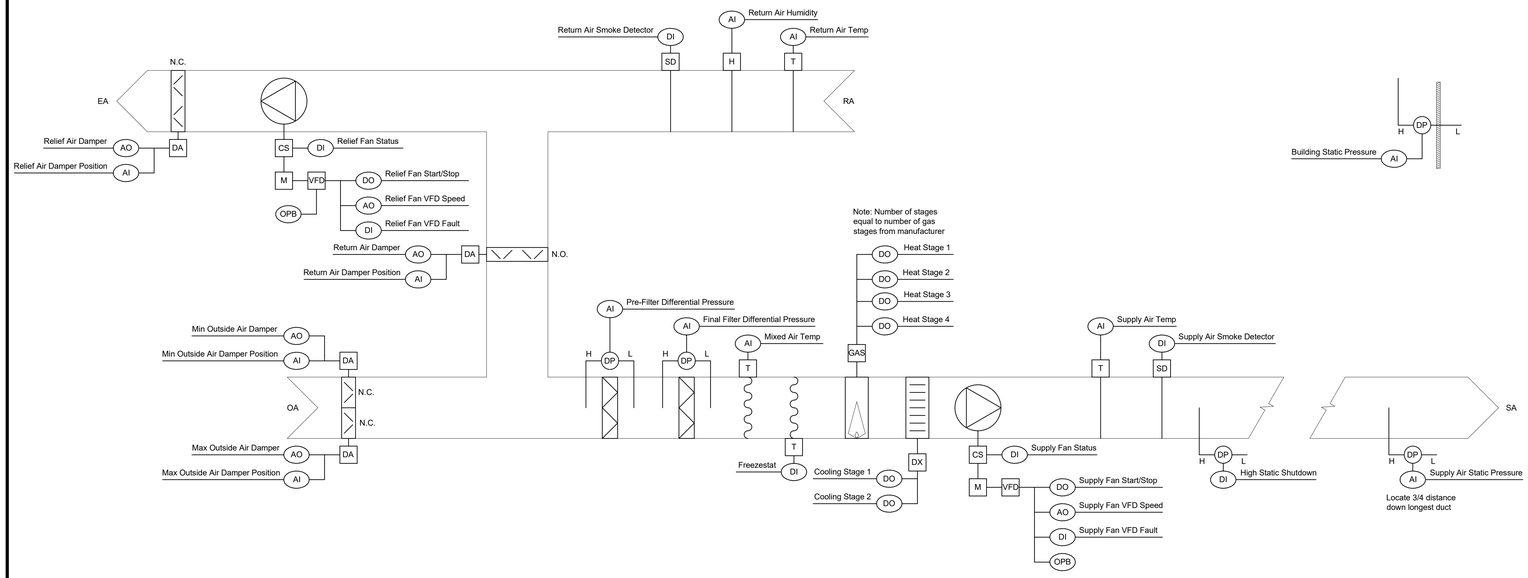
7. Reference sheet A-151c: This plan indicates that room 108 Elec. Kiln Room is to have a painted exposed structure however the room finish schedule on sheet A+631 calls for an APC-1 ceiling. Please clarify.
   RESPONSE: Electric Kiln Room 108 to be open to structure and painted.

8. Reference sheet A-201: The Exterior Elevation Legend calls for Glazed Thin Brick in two places. Our question is, do we purchase the thin brick from Acme and supply it to the UNT Ceramics Department for glazing or will the brick be furnished to us already glazed for installation? Please clarify.
   RESPONSE: Unglazed thin brick to be purchased by contractor through ACME Brick, supplied to UNT Ceramics for glazing. UNT Ceramics to return glazed brick to contractor for installation. UNT Ceramics glazing periods are February to early May and August to Mid-December. Not all bricks can be glazed in one period. It is beneficial to the project schedule to begin glazing in March 2021.

9. Specification 051200 section 2.E.2 specifies the coating of all exterior exposed structural steel with a high build epoxy primer which requires a commercial grit blast (SSPC-SP6) to clean and profile the steel surface. It is impossible to grit blast and thoroughly coat all of the surfaces of steel bar joists.
   We are requesting an option to hot dip galvanize all exposed steel in lieu of grit blasting and prime painting.
   RESPONSE: The specification section noted relates to structural steel framing as described in Section 051200 Part 1, item 1.2.A.1. Steel joist paint is specified in Section 052100 Steel Joist Framing, Part 2, Item 2.1.A.5: SSPC – Paint 15, Type I.

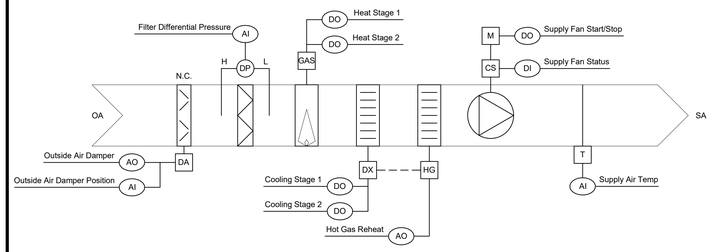
10. Detail references on standing seam roof shows metal panels removable at Kiln Curbs. Please provide detail. The top of the curbs are Mod bit roofing which can easily be replaced. But if the metal roof panels in the middle of a standing seam roof are to be removed we have a problem.
    1—specified panel will not work
    2- the low slope of the metal panel must have a mechanically seamed panel for a water tight warranty.
    3- if panels are removed we would suggest a curb that separates panels or the panels will have to be unseamed and damaged— Please have architect provide more data on what they are trying to achieve
    RESPONSE: Reference detail 05 & 06/ A503. The detail notes a prefab. metal roof curb that separates the metal panel roof from the roof cap that is removable.

END OF ADDENDUM NO. 03



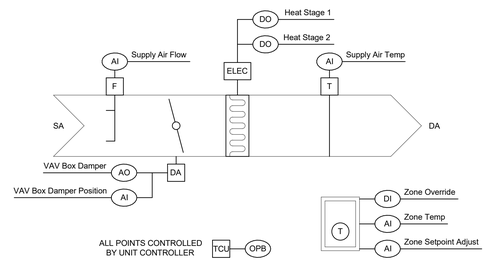
1 VARIABLE AIR VOLUME AIR HANDLING UNIT (RTU-1 & 2) CONTROL DIAGRAM

SCALE: NONE



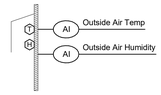
2 MAKEUP AIR UNIT (RTU-3) CONTROL DIAGRAM

SCALE: NONE



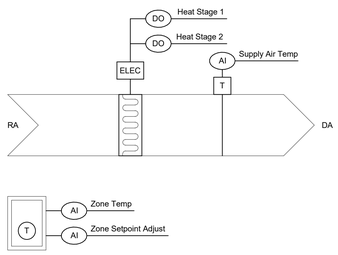
3 SINGLE DUCT VAV BOX WITH ELECTRIC REHEAT CONTROL DIAGRAM

SCALE: NONE



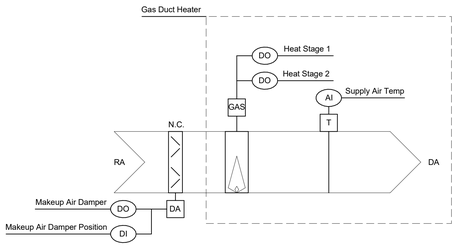
4 OUTSIDE AIR CONDITION CONTROL DIAGRAM

SCALE: NONE



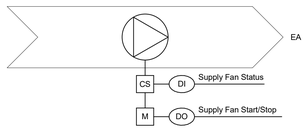
7 ELECTRIC UNIT HEATER CONTROL DIAGRAM

SCALE: NONE



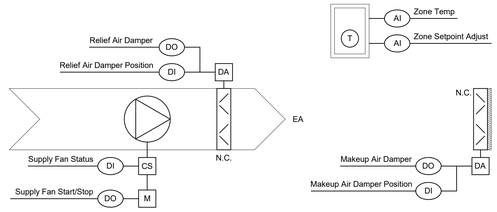
6 GAS DUCT HEATER CONTROL DIAGRAM

SCALE: NONE



5 EXHAUST FAN CONTROL DIAGRAM

SCALE: NONE



4 KILN ROOM EXHAUST FAN CONTROL DIAGRAM

SCALE: NONE

DDC CONTROL SYSTEM - GENERAL NOTES

1. PROVIDE A PROGRAMMABLE ELECTRONIC HVAC CONTROL SYSTEM CAPABLE OF BEING INTEGRATED INTO UNIVERSITY CAMPUS EXISTING SCHNEIDER ELECTRIC BUILDING ENERGY MANAGEMENT AND CONTROL SYSTEM. THE SYSTEM SHALL BE CAPABLE OF INTERFACING TO AND CONTROLLING THE HVAC EQUIPMENT SHOWN ON PLANS. SYSTEM SHALL BE CAPABLE OF ALARMING AND SYSTEM CONTROL DESCRIBED IN THE SEQUENCE OF OPERATION. THE SYSTEM SHALL HAVE 7-DAY PROGRAMMING CAPABILITY AND HAVE A MINIMUM 10 HOUR BATTERY BACK-UP SYSTEM.
2. THE CONTROL SYSTEMS SHALL BE COMPLETE WITH ALL WIRING, CONDUIT, POWER SUPPLIES AND ALL OTHER ITEMS REQUIRED FOR A COMPLETE AND OPERATIONAL SYSTEM THAT WILL ACCOMPLISH THE SEQUENCE OF OPERATIONS AND INTENT OF CONTROL DIAGRAMS. THE MAIN CONTROL PANEL (COMPUTER) SHALL BE LOCATED AS SHOWN ON THE DRAWINGS. IT IS THE CONTRACTOR'S RESPONSIBILITY TO COORDINATE ALL ASPECTS OF THE DDC CONTROL SYSTEM AND THE FIRE ALARM/SUPRESSION SYSTEMS TO ENSURE THAT THE SYSTEMS OPERATE AS REQUIRED BY THESE DOCUMENTS AND NATIONAL AND LOCAL CODES.
3. ALL COMMUNICATIONS WIRING TO BE SHIELDED TWISTED WIRE PAIR.
4. ALL COMMUNICATIONS WIRING TO WALL MOUNTED CONTROLLERS AND INSTALLED IN AREAS WITH EXPOSED STRUCTURE SHALL BE ROUTED IN CONDUIT, CONDUIT TO EXTEND UP TO ABOVE CEILING OR EXPOSED ROOF STRUCTURE. WIRING FOR ROOF MOUNTED EQUIPMENT SHALL BE ROUTED WITHIN THE CONFINES OF THE ROOF CURB. ALL CONTROL DEVICES INSTALLED IN LOCATIONS EXPOSED TO THE WEATHER SHALL BE PROVIDED WITH WEATHER-PROOF ENCLOSURES.
5. THE CONTROLS CONTRACTOR SHALL BE RESPONSIBLE FOR ALL NECESSARY ELECTRICAL POWER NEEDED FOR THE BAS. THE INSTALLATION OF THESE POWER SYSTEMS SHALL BE IN FULL ACCORDANCE WITH ELECTRICAL SPECIFICATIONS. COORDINATE POWER SOURCE, VOLTAGE AND PHASE OF EACH PIECE OF EQUIPMENT BEFORE ORDERING ANY MECHANICAL OR ELECTRICAL EQUIPMENT.
6. LOCATE ROOM THERMOSTATS, HUMIDISTAT, CARBON DIOXIDE SENSORS AND TEMPERATURE AND HUMIDITY SENSORS 4'-0" (CENTERLINE) ABOVE FINISHED FLOOR. MOUNT ALL TEMPERATURE AND HUMIDITY READOUT DEVICES AT 5'-0" (CENTERLINE) ABOVE FINISHED FLOOR (EYE-LEVEL). NOTIFY ARCHITECT WHERE DIMENSION CANNOT BE MAINTAINED OR THERE IS A QUESTION REGARDING LOCATION.
7. ALL DUCT AND EQUIPMENT SMOKE DETECTORS SHALL BE INTERFACED WITH THE BUILDING FIRE ALARM SYSTEM. UPON ACTIVATION, UNIT SHALL BE SHUTDOWN AND A NOTIFICATION SENT TO THE FIRE ALARM SYSTEM.
8. COORDINATE CONTROLLER REQUIREMENTS WITH HVAC EQUIPMENT MANUFACTURER'S SUBMITTAL. CONTROLS CONTRACTOR TO REVIEW SUBMITTAL AND ENSURE ALL NECESSARY CONTACTS, ACTUATORS, SMOKE DETECTORS, ETC. ARE FULLY COORDINATED AND PROVIDED.
9. ALL SET-POINTS CALLED OUT HERE SHALL BE ADJUSTABLE AT THE BAS UNLESS OTHERWISE NOTED
10. THE MAPPING OF NEW DDC POINTS TO THE EXISTING BAS AND THE BUILDING OF GRAPHICS IN THE EXISTING BAS SOFTWARE SHALL BE FULLY COORDINATED AND INCLUDED IN THE MECHANICAL CONTRACT.
11. CONTRACTOR SHALL FIELD VERIFY EXISTING CONDITIONS AND SHALL CONFIRM REQUIRED ADDITIONAL COMPONENTS TO THE EXISTING SYSTEM IN ORDER TO PROVIDE A COMPLETE OPERATING SYSTEM AS INDICATED IN THE SEQUENCE OF OPERATION.
12. THE COMMUNICATIONS PROTOCOL FOR DDC CONTROL HARDWARE SHALL BE BASED UPON LONWORKS STANDARD.
18. FIELD VERIFY EXISTING BUILDING AUTOMATION SYSTEM AND FRONT END PRIOR TO ORDERING CONTROL COMPONENTS AND/OR STARTING ANY PROGRAMMING.
19. CONTROLS CONTRACTOR SHALL ALLOCATE 8 HOURS OF COMMISSIONING TIME WITH THE ENGINEER OF RECORD. THIS DOES NOT RELIEVE THE CONTRACTOR OF COMMISSIONING HIS OWN WORK PRIOR TO REVIEW OF WORK BY ENGINEER OF RECORD.
20. PROVIDE FULL CONTROLS SUBMITTAL PACKAGE AT THE TIME OF GENERAL MECHANICAL SUBMITTALS. SUBMITTALS SHALL INCLUDE COMPLETE BILL OF MATERIALS INDICATING QUANTITY, CONTROL DIAGRAMS, INPUT/OUTPUT POINTS LISTS, ROOM AND EQUIPMENT SCHEDULE, TECHNICAL INFORMATION FOR EQUIPMENT INCLUDED, AND SEQUENCES OF OPERATION.
21. CONTRACTOR SHALL COORDINATE ALL CONTROLS AND TAB WORK REQUIREMENTS PRIOR TO BIDDING.
22. THE CONTRACTOR SHALL BE RESPONSIBLE FOR COMPLETING THE CONTROLS INSTALLATION FOR ALL UNITS INSTALLED UNDER THE SHELL PACKAGE.

SYMBOL LIST

SYMBOL	DESCRIPTION
	OPPOSED BLADE DAMPER
	HYDRONIC HEATING OR COOLING COIL
	NATURAL GAS HEATING COIL
	ELECTRIC HEATING COIL
	DIRECT EXPANSION COOLING COIL
	AUTOMATIC 2-WAY VALVE
	AUTOMATIC 3-WAY VALVE
	FAN OR PUMP MOTOR
DP	DIFFERENTIAL PRESSURE SENSOR
PT	PRESSURE TRANSMITTER
AFM	AIR FLOW MONITORING
SD	SMOKE DETECTOR
T	DUCT MOUNTED TEMPERATURE SENSOR
T	WALL MOUNTED TEMPERATURE SENSOR
H	WALL MOUNTED HUMIDITY SENSOR
TCU	TERMINAL CONTROL UNIT
VFD	VARIABLE FREQUENCY DRIVE
VS	VIBRATION SENSOR
AVA	ADJUSTABLE VALVE ACTUATION
	VAV DAMPER W/FLOW MONITOR
DI	DDC DIGITAL INPUT POINT
DO	DDC DIGITAL OUTPUT POINT
AI	DDC ANALOG INPUT POINT
AO	DDC ANALOG OUTPUT POINT
AV	ANALOG VALUE POINT THRU OPB
DV	DIGITAL VALUE POINT THRU OPB
OPB	OPEN PROTOCOL BUS
M	MOTOR
MS	MOTOR STARTER
DA	DAMPER ACTUATOR
BRD	BAROMETRIC RELIEF DAMPER
F	FLOW SENSOR
FR	FREEZE STAT
O/O	ON/OFF SWITCH
HH	HIGH HUMIDITY SENSOR
CO2	DUCT MOUNTED CO2 SENSOR
ES	ENTHALPY SENSOR, ECONOMIZER
HPL	HIGH STATIC PRESS. LIMIT SENS.
VFDP	VFD (DUCT) PRESSURE TRANSMITTER
CO2	WALL MOUNTED CO2 SENSOR
H	DUCT MOUNTED HUMIDITY SENSOR
LTC	LOW TEMPERATURE CUTOFF
SP	STATIC PRESSURE SENSOR
LD	LEAK DETECTION UNIT
CS	CURRENT SENSOR
EC	EXISTING CONTROLS
OC	WALL MOUNTED OCCUPANCY SENSOR
	WATER FLOW MEASURING SENSOR
	PIPE MOUNTED TEMPERATURE SENSOR
H L	WET-WET DIFFERENTIAL PRESSURE SENSOR

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seal / disclaimer

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project

OAK STREET HALL DEMOLITION & ART STUDIO FACILITY

1001 W. MULBERRY STREET DENTON, TEXAS 76201

revision no:	issue date:
ADDENDUM 03	12/01/2020

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issue title: ISSUED FOR CONSTRUCTION

sheet title: MECHANICAL CONTROLS DIAGRAMS

sheet no: M-601

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VARIABLE AIR VOLUME AIR HANDLING UNIT SEQUENCE OF OPERATION (RTU-1 & 2):

1. Run Conditions - Requested:
   - 1.a. The unit shall run whenever
     - 1.a.1. Any zone is occupied
     - 1.a.2. OR a definable number of unoccupied zones need heating or cooling
2. Emergency Shutdown:
   - 2.a. The unit shall shut down and generate an alarm upon receiving an emergency shutdown signal.
3. Freeze Protection:
   - 3.a. The unit shall shut down and generate an alarm upon receiving a freezestat status.
4. High Static Shutdown:
   - 4.a. The unit shall shut down and generate an alarm upon receiving a high static shutdown signal.
5. Return Air Smoke Detection:
   - 5.a. The unit shall shut down and generate an alarm upon receiving a return air smoke detector status.
6. AHU Optimal Start
   - 6.a. The unit shall start prior to scheduled occupancy based on the time necessary for the zones to reach their occupied setpoints. The start time shall automatically adjust based on changes in outside air temperature and zone temperatures.
7. Supply Fan:
   - 7.a. The supply fan shall run anytime the unit is commanded to run, unless shutdown on safeties. To prevent short cycling, the supply fan shall have a user definable (adj.) minimum runtime.
   - 7.b. Alarms shall be provided as follows:
     - 7.b.1. Supply Fan Failure: Commanded on, but the status is off.
     - 7.b.2. Supply Fan in Hand: Commanded off, but the status is on.
     - 7.b.3. Supply Fan Runtime Exceeded: Status runtime exceeds a user definable limit (adj.)
8. Supply Air Duct Static Pressure Control:
   - 8.a. The controller shall measure duct static pressure and modulate the supply fan VFD speed to maintain a duct static pressure setpoint. The speed shall not drop below 30% (adj.). The static pressure setpoint shall be reset based upon the position of the zone dampers, with a goal of reducing the static pressure until at least one zone damper is nearly wide open.
     - 8.a.1. The initial duct static pressure setpoint shall be 1.5 in. H2) (adj.)
     - 8.a.2. If no zone damper is nearly wide open, the setpoint shall incrementally reset down to a minimum of 1.3 in H2O (adj.).
     - 8.a.3. As one or more dampers nears the wide open position, the setpoint shall incrementally reset up to a maximum of 1.8 in H2O (adj.).
   - 8.b. Alarms shall be provided as follows:
     - 8.b.1. High Supply Air Static Pressure: If the supply air static pressure is 25% (adj.) greater than setpoint.
     - 8.b.2. Low Supply Air Static Pressure: If the supply air static pressure is 25% (adj.) less than setpoint.
     - 8.b.3. Supply Fan VFD Fault.
9. Relief Fan:
   - 9.a. The relief fan shall run whenever the supply fan runs AND the economizer is active.
   - 9.b. Alarms shall be provided as follows:
     - 9.b.1. Relief Fan Failure: Commanded on, but the status is off.
     - 9.b.2. Relief Fan in Hand: Commanded off, but the status is on.
     - 9.b.3. Relief Fan Runtime Exceeded: Status runtime exceeds a user definable limit (adj.).
     - 9.b.4. Relief Fan VFD Fault.
   - 9.c. Relief Fan Tracking:
     - 9.c.1. The controller shall measure building static pressure and modulate the relief fan VFD speed to maintain a building static pressure setpoint of 0.05 in H2O (adj.). The relief fan VFD speed shall not drop below 20% (adj.).
10. Supply Air Temperature Setpoint - Fixed:
    - 10.a. The controller shall monitor the supply air temperature and shall maintain fixed supply air temperature setpoint of 55°F.
11. DX Cooling Stages:
    - 11.a. The controller shall measure the zone temperature and stage the cooling to maintain its cooling setpoint. To prevent short cycling, there shall be a user definable (adj.) delay between stages, and each stage shall have a user definable (adj.) minimum runtime. The cooling shall be enabled whenever:
      - 11.a.1. Outside air temperature is greater than 60°F (adj.)
      - 11.a.2. AND the economizer (if present) is disabled or fully open.
      - 11.a.3. AND the zone temperature is above cooling setpoint
      - 11.a.4. AND the supply fan is on and status proven
      - 11.a.5. AND the heating is not active
12. Natural Gas Heating Stages:
    - 12.a. The controller shall measure the zone temperature and stage the heating to maintain its heating setpoint. To prevent short cycling, there shall be a user definable (adj.) delay between stages, and each stage shall have a user definable (adj.) minimum runtime. The heating shall be enabled whenever:
      - 12.a.1. Outside air temperature is less than 60°F (adj.)
      - 12.a.2. AND the zone temperature is below heating setpoint
      - 12.a.3. AND the supply fan is on and status proven
      - 12.a.4. AND the cooling is not active
13. Economizer:
    - 13.a. The controller shall measure the mixed air temperature and modulate the economizer dampers in sequence to maintain a setpoint 2°F (adj.) less than the supply air temperature setpoint. The outside air dampers shall maintain a minimum adjustable position of 20% (adj.) open whenever occupied.
    - 13.b. The economizer shall be enable whenever:
      - 13.b.1. Outside air temperature is less than 65°F (adj.)
      - 13.b.2. AND the outside air enthalpy is less than 22 Btu/lb (adj.)
      - 13.b.3. AND the outside air temperature is less than the return air temperature
      - 13.b.4. AND the outside air enthalpy is less than the return air enthalpy
      - 13.b.5. AND the supply fan status is on
    - 13.c. The economizer shall close whenever:
      - 13.c.1. Mixed air temperature drops from 40°F to 35°F (adj.)
      - 13.c.2. OR the freezestat (if present) is on.
      - 13.c.3. OR on loss of supply fan status
    - 13.d. The outside and exhaust air dampers shall close and the return air damper shall open when the unit is off. If Optimal Start Up is available, the mixed air damper shall operate as described in the occupied mode except that the outside air damper shall modulate to fully closed.
14. Minimum Outside Air Ventilation - Fixed Percentage:
    - 14.a. The outside air dampers shall maintain a minimum adjustable position during building occupied hours and be closed during unoccupied hours.
15. Building Pressurization (RTU-2 Only):
    - 15.a. The controller shall measure building static pressure and modulate the outside air damper between Minimum Position and Maximum Position to maintain a building static pressure setpoint of 0.05 in H2O (adj.).
16. Filter Differential Pressure Monitor:
    - 16.a. The controller shall monitor the differential pressure across the filter.
    - 16.b. Alarms shall be provided as follows:
      - 16.b.1. Filter Change Required: Filter differential pressure exceeds a user definable limit (adj.)
17. Mixed Air Temperature
    - 17.a. The controller shall monitor the mixed air temperature and use as required for economizer control (if present) or preheating control (if present).
    - 17.b. Alarms shall be provided as follows:
      - 17.b.1. High Mixed Air Temp: If the mixed air temperature is greater than 90°F (adj.)
      - 17.b.2. Low Mixed Air Temp: If the mixed air temperature is less than 45°F (adj.)
18. Return Air Humidity:
    - 18.a. The controller shall monitor the return air humidity and use as required for economizer control (if present) or humidity control (if present).
    - 18.b. Alarms shall be provided as follows:
      - 18.b.1. High Return Air Humidity: If the return air humidity is greater than 70% (adj.)
      - 18.b.2. Low Return Air Humidity: If the return air humidity is less than 35% (adj.)
19. Return Air Temperature
    - 19.a. The controller shall monitor the return air temperature and use as required for setpoint control or economizer control (if present).
    - 19.b. Alarms shall be provided as follows:
      - 19.b.1. High Return Air Temp: If the return air temperature is greater than 90°F (adj.)
      - 19.b.2. Low Return Air Temp: If the return air temperature is less than 45°F (adj.)
20. Supply Air Temperature
    - 20.a. The controller shall monitor the supply air temperature
    - 20.b. Alarms shall be provided as follows:
      - 20.b.1. High Supply Air Temp: If the supply air temperature is greater than 120°F (adj.).
      - 20.b.2. Low Supply Air Temp: If the supply air temperature is less than 45°F (adj.).

MAKEUP AIR UNIT SEQUENCE OF OPERATIONS (RTU-3)

1. Run Conditions
   - 1.a. The unit shall be interlocked to run whenever the associated wall timer switch is activated at the Dry Kiln Room.
2. Emergency Shutdown
   - 2.a. The unit shall shut down and generate an alarm upon receiving an emergency shutdown signal.
3. Freeze Protection
   - 3.a. The unit shall shut down and generate an alarm upon receiving a freezestat status.
4. Outside Air Damper
   - 4.a. The outside air damper shall open anytime the unit runs and shall close anytime the unit stops. The supply fan shall start only after the damper status has proven the damper is open. The outside air damper shall close 4 sec (adj.) after the supply fan stops.
   - 4.b. Alarms shall be provided as follows:
     - 4.b.1. Outside Air Damper Failure: Commanded open, but the status is closed.
     - 4.b.2. Outside Air Damper in Hand: Commanded closed, but the status is open.
5. Supply Fan
   - 5.a. The supply fan shall run anytime the unit is commanded to run. To prevent short cycling, the supply fan shall have a user definable (adj.) minimum runtime, unless shutdown on safeties.
   - 5.b. Alarms shall be provided as follows:
     - 5.b.1. Supply Fan Failure: Commanded on, but the status is off.
     - 5.b.2. Supply Fan in Hand: Commanded off, but the status is on.
     - 5.b.3. Supply Fan Runtime Exceeded: Status runtime exceeds a user definable limit (adj.)
6. Supply Air Temperature Setpoint - Fixed
   - 6.a. The controller shall monitor the supply air temperature and shall maintain a fixed supply air temperature setpoint of 80°F (adj.)
7. Cooling Stages
   - 7.a. The controller shall measure the supply air temperature and stage the cooling to maintain its cooling setpoint of 55°F (adj.) off of the coiling coil. To prevent short cycling, there shall be a user definable (adj.) delay between stages, and each stage shall have a user definable (adj.) minimum runtime.
   - 7.b. The cooling shall be enabled whenever:
     - 7.b.1. Outside air temperature is greater than 60°F (adj.)
     - 7.b.2. AND the supply air temperature is above cooling setpoint.
     - 7.b.3. AND the fan status is on
8. Hot Gas Reheat
   - 8.a. The controller shall measure the supply air temperature and modulate the hot gas reheat coil valve to maintain the discharge air temperature setpoint of 70°F (adj.).
   - 8.b. The hot gas reheat shall be enabled whenever:
     - 8.b.1. The RTU is in cooling mode
     - 8.b.2. AND the fan status is on
9. Gas Heating Stages
   - 9.a. The controller shall measure the supply air temperature and stage the heating to maintain its heating setpoint. To prevent short cycling, there shall be a user definable (adj.) delay between stages, and each stage shall have a user definable (adj.) minimum runtime.
   - 9.b. The heating shall be enabled whenever:
     - 9.b.1. Outside air temperature is less than 65°F (adj.)
     - 9.b.2. AND the supply air temperature is below heating setpoint.
     - 9.b.3. AND the fan status is on.
10. Filter Differential Pressure Monitor
    - 10.a. The controller shall monitor the differential pressure across the filter.
    - 10.b. Alarms shall be provided as follows:
      - 10.b.1. Filter Change Required: Filter differential pressure exceeds a user definable limit (adj.)
11. Supply Air Temperature
    - 11.a. The controller shall monitor the supply air temperature.
    - 11.b. Alarms shall be provided as follows:
      - 11.b.1. High Supply Air Temp: If the supply air temperature is greater than 120°F (adj.)
      - 11.b.2. Low Supply Air Temp: If the supply air temperature is less than 45°F (adj.)

SINGLE DUCT VAV BOX WITH SUPPLEMENTAL HEAT SEQUENCE OF OPERATION

1. Run Conditions: The unit shall run according to a user definable time schedule in the following modes:
   - 1.a Occupied Mode: The unit shall maintain
     - 1.a.1. A 75°F (adj.) cooling setpoint
     - 1.a.2. A 70°F (adj.) heating setpoint
   - 1.b. Unoccupied Mode (night setback): The unit shall maintain
     - 1.b.1. A 85°F (adj.) cooling setpoint
     - 1.b.2. A 55°F (adj.) heating setpoint
   - 1.c. Alarms shall be provided as follows:
     - 1.c.1. High Zone Temp: If the zone temperature is greater than the cooling setpoint by a user definable amount (adj.)
     - 1.c.2. Low Zone Temp: If the zone temperature is less than the heating setpoint by a user definable amount (adj.)
2. Zone Setpoint Adjust
   - 2.a. The occupant shall be able to adjust the zone temperature heating and cooling setpoints at the zone sensor.
3. Zone Optimal Start:
   - 3.a. The unit shall use an optimal start algorithm for morning start-up. This algorithm shall minimize the unoccupied warm-up or cool-down period while still achieving comfort conditions by the start of scheduled occupied period.
4. Zone Unoccupied Override:
   - 4.a. A timed local override control shall allow an occupant to override the schedule and place the unit into an occupied mode for an adjustable period of time. At the expiration of this time, control of the unit shall automatically return to the schedule.
5. Reversing Variable Volume Terminal Unit - Flow Control:
   - 5.a. The unit shall maintain zone setpoints by controlling the airflow through one of the following:
   - 5.b. Occupied:
     - 5.b.1. When zone temperature is greater than its cooling setpoint, the zone damper shall modulate between the minimum occupied airflow (adj.) and the maximum cooling airflow (adj.) until the zone is satisfied.
     - 5.b.2. When the zone temperature is between the cooling setpoint and the heating setpoint, the zone damper shall maintain the minimum required zone ventilation (adj.)
     - 5.b.3. When zone temperature is less than its heating setpoint, the controller shall enable heating to maintain the zone temperature at its heating setpoint. Additionally, if warm air is available from the AHU, the zone damper shall modulate between the minimum occupied airflow (adj.) and the maximum heating airflow (adj.) until the zone is satisfied.
   - 5.c. Unoccupied:
     - 5.c.1. When the zone is unoccupied the zone damper shall control to its minimum unoccupied airflow (adj.)
     - 5.c.2. When the zone temperature is greater than its cooling setpoint, the zone damper shall modulate between the minimum unoccupied airflow (adj.) and the maximum cooling airflow (adj.) until the zone is satisfied.
     - 5.c.3. When zone temperature is less than its unoccupied heating setpoint, the controller shall enable heating to maintain the zone temperature at the setpoint. Additionally, if warm air is available from the AHU, the zone damper shall modulate between the minimum unoccupied airflow (adj.) and the auxiliary heating airflow (Adj.) until the zone is satisfied.
6. Electric Reheating Stage:
   - 6.a. The controller shall measure the zone temperature and stage the reheating to maintain its setpoint. To prevent short cycling, the stage shall have a user definable (Adj.) minimum runtime.
   - 6.b. The reheating shall be enabled whenever:
     - 6.b.1. Outside air temperature is less than 65°F (adj.)
     - 6.b.2. AND the zone temperature is below setpoint.
     - 6.b.3. AND sufficient airflow is provided
7. Discharge Air Temperature:
   - 7.a. The controller shall monitor the discharge air temperature.
   - 7.b. Alarms shall be provided as follows:
     - 7.b.1. High Discharge Air Temp: If the discharge air temperature is greater than 120°F (adj.)
     - 7.b.2. Low Discharge Air Temp: If the discharge air temperature is less than 40°F (adj.)
8. Timed Switch Override (VAV-211 Only):
   - 8.a. When the local room mounted timer switch is activated, the controller shall override the current operation of the VAV box and perform the following:
     - 8.a.1. The air valve damper shall open to it's maximum setting
     - 8.a.2. The electric heating stages shall be engaged as described prior in this sequence to maintain room setpoint.
   - 8.b. When the timed override has expired, the VAV shall be allowed to return to normal operating conditions.

EXHAUST FAN SEQUENCE OF OPERATION (EF-1)

1. The exhaust fan shall run continuously.
2. Fan Status:
   - 2.a. The controller shall monitor the fan status.
   - 2.b. Alarms shall be provided as follows:
     - 2.b.1. Fan Failure: Commanded on, but the status is off.
     - 2.b.2. Fan in Hand: Commanded off, but the status is on.
     - 2.b.3. Fan Runtime Exceeded: Fan status runtime exceeds a user definable limit (adj.).

KILN ROOM EXHAUST FAN SEQUENCE OF OPERATION (EF-2)

1. The controller shall monitor the room mounted thermostat and upon a rise in temperature above 90° F (adj.), enable the following sequence:
   - 1.a. The motorized makeup air damper/louver shall be commanded open.
   - 1.b. The motorized relief air damper shall be commanded open.
   - 1.c. After status is proven on both the makeup and relief air dampers, the exhaust fan shall be commanded on and run continuously.
   - 1.d. The reverse occurs when room temperature drops below setpoint.
2. Exhaust/Makeup Air Damper
   - 2.a. The exhaust and makeup air dampers shall open anytime the unit runs and shall close anytime the unit stops. The exhaust air damper shall close 30 sec (adj.) after the fan stops.
3. Fan Status:
   - 3.a. The controller shall monitor the fan status.
   - 3.b. Alarms shall be provided as follows:
     - 3.b.1. Fan Failure: Commanded on, but the status is off.
     - 3.b.2. Fan in Hand: Commanded off, but the status is on.
     - 3.b.3. Fan Runtime Exceeded: Fan status runtime exceeds a user definable limit (adj.).

OUTSIDE AIR CONDITIONS SEQUENCE OF OPERATIONS

1. Outside Air Conditions
   - 1.a. The controller shall monitor the outside are temperature and humidity and calculate the outside air enthalpy on a continual basis. These values shall be made available to the system at all times.
   - 1.b. Alarms shall be generated as follows:
     - 1.b.1. Sensor Failure: Sensor reading indicates shorted or disconnected sensor. In the event of a sensor failure, an alternate outside air conditions sensor shall be made available to the system without interruption in sensor readings.
   - 1.c. If an OA Temp Sensor cannot be read, a default value of 65°F will be used
   - 1.d. If an OA Humidity Sensor cannot be read, a default value of 50% will be used
2. Outside Air Temperature Hhry
   - 2.a. The controller shall monitor and record the high and low temperature readings for the outside air. These readings shall be recorded on a daily, month-to-date, and year-to-date basis.

CLAY MIXING ROOM SEQUENCE OF OPERATIONS

1. Gas Duct Heater Run Conditions
   - 1.a. The unit shall be run whenever the associated wall timer switch is activated at the Clay Mixing Room AND the outside air temperature is below 55°F (adj.).
2. Natural Gas Heating Stages:
   - 2.a. The controller shall measure the discharge air temperature and stage the heating to maintain its heating setpoint 70°F (adj.). To prevent short cycling, there shall be a user definable (adj.) delay between stages, and each stage shall have a user definable (adj.) minimum runtime. The heating shall be enabled whenever:
     - 2.a.1. Outside air temperature is less than 55°F (adj.)
     - 2.a.2. AND the wall timer switch is activated
     - 2.a.3. AND the makeup air damper is proven open
3. Makeup Air Damper
   - 3.a. The makeup air damper shall open anytime the associated wall timer switch is activated at the Clay Mixing Room and shall close anytime the timer switch is off.

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