

May 15, 2025

ADDENDUM NO. 4



RE: Pulaski County Parks and Recreation
Facility Renovation Pulaski County Indoor
Sportsplex and Expo Center
Architect's Project No. 2024148

TO: Prospective Bidders

FROM: ZMM, Inc. Architects and Engineers

This Addendum forms a part of the Contract Documents and modifies the original Bidding Documents.

**ATTACH THIS ADDENDUM TO THE FRONT COVER OF THE PROJECT MANUAL AND
ACKNOWLEDGE RECEIPT OF THIS ADDENDUM IN THE SPACE PROVIDED ON THE BID
FORM.**

PART 1 - INFORMATION FOR BIDDERS

- A. Electrical drawings supersede architectural drawings in regards to material takeoff for lighting fixtures.
- B. Finish schedule for TP-1 on A200 should be Plastic Partitions to match specifications.
- C. In regards to "Gym Equipment", bidders are only responsible for items listed in the relevant specification section. Anything else is considered "Owner Furnished". Portable basketball goals and portable futsal walls are "Owner Furnished".
- D. Motorized Shades will be "Owner Furnished"
- E. In regards to preparing the concrete floor, CSP-1 is defined by the International Concrete Repair Institute.
- F. Omit PLAM-3 as it was removed from scope in Addenda 3.
- G. The "30" x 48" Steel Tables" on A200 are Owner Furnished.
- H. There are 18 scoreboards. 16 are associated with the basketball courts, and 2 are associated with the turf area. The turf scoreboards can be found wall mounted on 1/A256.
- I. Provide 1 hand switch and controller per scoreboard, and provide cases for controls and hand switches.

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- J. For finish SC-1: Use a polymer emulsion sealing compound compliant with ASTM C309 and ASTM C1315. Potential products are L&M PermaGuard SPS, Kaufman Krystal 30, Mapei Mapecure, or equivalent products.
- K. For architectural film application to existing metal panels: preserve existing reveals.
- L. For clarification, only the 4 standalone pickleball courts in Area E will have sleeved standards. All other pickleball courts will use portable nets.
- M. For pricing purposes, assume protective safety pads will ONLY be applied at existing column locations.
- N. Area C: Add mesh window guard to existing storefront adjacent to door 141G, similar to 8/A521.
- O. Retail 005A and IT 005B: Demolish and cap skylights, demolish associated bulkhead, infill area with ceiling as otherwise scheduled.
- P. Action Floor Systems: Action Herculan MF is an approved urethane floor system.
- Q. Interactive video displays are “Owner Furnished”.
- R. T-3 wall finishes are only scheduled at locations with fixtures. All T-3 wall finishes should be installed with bottom at finish floor, and TB-1 can be omitted at these locations.
- S. Rooms 117A and 133 are both to receive RBF-1. Omit all mentions of RBF-2.
- T. Exchange 1 toilet in Men’s Shower 202B with a Urinal. Alter plumbing accordingly.
- U. At all locations where quarry tile is being demolished, new base will need to be 6” tall.
- V. Note that while Fire Cabinets are included in contract, the fire extinguishers themselves will be owner furnished.
- W. In Addenda 3 the locker rooms were rearranged, though too many lockers were shown in the women’s locker room in this revision. Each locker room is intended to have 35 qty of two tier lockers.
- X. Stainless Steel locker hinges are an acceptable alternative to aluminum hinges. Manufacturer’s standard color is acceptable for the interior of lockers. Lockers are required to have ventilation, but the specifics of this mechanism can be left to manufacturer’s standard.
- Y. For the sake of disambiguation: “Window Guards” and “Wire Mesh Partitions” are the same item.
- Z. Electrical Room Addition: If rock is encountered and the structural turndown is not able to be constructed as shown, the turndown may be constructed on rock without excavating the full 2’-0” below grade. The slab shall be a minimum of 4” thick.
- AA. For clarification, a roof renovation contract is planned to be executed independently of this contract.
- BB. For clarification, this project is not pursuing LEED certification.

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- CC. Doors 005A, 101, 102, 123D, 110, and 005B show up in Addendum 3 specifications but do not appear on A511. Consider these doors to not be in scope.
- DD. The building will not be occupied during construction.
- EE. Trane has been added to BAS & Equipment as an acceptable provider.
- FF. There will be combined housekeeping pads for B-1 and B-2 as well as P-1 and P-2.
- GG. Relocated main switch board and relocated L01 will require new $\pm 6"$ pads. Dimensions should be 40" x 36".
- HH. For clarification, all seating surfaces, lockers, tables, desks, televisions, and cabinets shown in GOLF INSTITUTE 138 on A242 are considered as FF&E.
- II. The existing fire alarm system appears to be Honeywell. There are existing camera, access control, and security systems of unknown manufacturers. The main fire alarm control panel is Fire Lite Alarms.

PART 2 - CHANGES TO SPECIFICATIONS

- A. Spec Section 116653: curtains are allowed to be ≥ 18 ounce vinyl.
- B. Disregard all mentions of "Prebuck" in Spec 061000 Rough Carpentry.
- C. Spec 101100 – disregard any mentions of tackboards or display cases as neither are in scope of work.
- D. 101423 INTERIOR SIGNS is an open spec. Manufacturers offering equivalent products that meet the performance specifications are permitted.
- E. Omit spec 096519 3.4D – wax is NOT a finish requirement.
- F. Omit references to "stainless-steel corner guards" in Spec 097720.
- G. Section 012100 – Allowances. Change allowance No. 3 for drop-down batting cages to \$50,000. This will be for the updated quantity of 2 batting cages (altered as per Addenda 3).
- H. Section 230933 – Building Management and Control System has been re-issued as attached to this addendum.
- I. Spec 283102 2.3 and 2.5: The existing fire alarm control panel is to be relocated to a new location, shown on EP108 in CORRIDOR 136. A new FACP does not need to be procured.

PART 3 - CHANGES TO DRAWINGS

- A. Restrooms with washbar style lavatories have integral soap dispensers and do not require standalone units. See P001.
- B. New bench added to underside of spiral stair to act as a buffer to prevent head injuries. See updates to A133 and A333.

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- C. Demolition notes added to A113 to account for existing pad and canopy. See attached updated sheet.
- D. REFLECTED CEILING PLAN – OFFICE AREA (A141) – Replace all existing ceiling tile with new 2x2 ceiling tiles. Existing grid to remain.
- E. Detail 16/A255 should be PT-4, not T-3.
- F. For clarification, Detail 11/S101 is intended to be typical at all slab edges except adjacent to the existing structure where Detail 12/S101 applies.
- G. On MH101, there will be no alternate pricing for updated controls in the dining area.
- H. Additional scope has been added in regards to outdoor media broadcasting capabilities. See updates to attached electrical sheets.
- I. Revision regarding Fire Alarm General Note 4 on the fire alarm drawings (T108 and etc): The existing fire alarm system is to be reused and extended as needed. The system manufacturer needs to be compatible with the existing fire alarm system.
- J. Revision to Technology Keynote 1 on T108 and T109: Devices need to remain as is and remain operational.

END OF ADDENDUM

Attachments:	Section 230933 – Building Management and Control System	37 pages
	A113.....	1 page
	A133.....	1 page
	A333.....	1 page
	EP110.....	1 page
	EP112.....	1 page
	E401	1 page
	E502	1 page
	E504	1 page
	M002	1 page
	M301	1 page

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SECTION 230933 - BUILDING MANAGEMENT AND CONTROL SYSTEM

PART 1 - GENERAL

1.1 SCOPE

- A. Provide and install a complete Building Management and Control System (BMCS), including industrial instrumentation necessary to obtain functions and results specified. A complete system includes items such as sensors, valves, dampers, valve, and damper operators, DDC panels, relays, terminal equipment controllers, mounting brackets and thermowell, etc. Integrate all components to provide a complete and functioning system.
- B. Temperature Control System components:
 - 1. Electronic instruments as specified
 - 2. Electric instruments as specified
 - 3. Microcomputer instruments as specified
- C. All control devices of the same type of product shall be of a single manufacturer.
- D. Control, power, and interlock wiring necessary to accomplish sequences specified in this Section shall be provided and installed by the Control Subcontractor. Materials and methods of execution as specified in Division 26, Electrical.
 - 1. Coordinate current characteristics of all electrical instruments and equipment with Division 26 of the specifications and related electrical drawings.
- E. The entire Building Management and Control System (BMCS) shall be installed by the Automation System Manufacturer or Authorized Distributor.
 - 1. All components and elements
 - 2. The testing and acceptance procedure
- F. The manufacturer of the building automation system shall provide documentation supporting compliance with ISO-9002 (Model for Quality Assurance in Production, Installation, and Servicing). The intent of this specification requirement is to ensure that the products from the manufacturer are delivered through a Quality System and Framework that will assure consistency in the products delivered for this project.
- G. The entire Building Management and Control System (BMCS) shall be installed, Commissioned, and tested; all performed by the Automation System Manufacturer or Authorized Distributor if approved by engineer.
 - 1. All components and elements.
 - 2. Start-up and point verification.
 - 3. The testing and acceptance procedure.

1.2 RELATED WORK

- A. Division 23, Mechanical
- B. Division 26, Electrical

1.3 SUBMITTALS

- A. Submit items of the Building Management and Control System (BMCS).
 - 1. Temperature control equipment & Field devices.
 - 2. Wiring & Flow diagrams.
 - 3. Sequence of operation.
 - 4. Complete, detailed, control and interlock-wiring diagram.
 - 5. Indicate mechanical and electrical equipment furnished and electrical interlocks, indicating terminal designation of equipment. Respective equipment manufacturers shall furnish through the Mechanical Contractor, approved drawings of equipment to be incorporated in this diagram.
 - 6. Submit Input / Output summary of all points.
 - 7. Submit an outline of testing procedures from section Testing and Acceptance.
 - 8. Mark up a copy of the specifications for the product. Indicate in the margin of each paragraph the following: “Comply, “Do Not Comply”, or “Not Applicable”. Explain all “Do Not Comply” statements.
 - 9. Submit sample of space temperature sensor and guards for review prior to purchase or installation.

1.4 COOPERATION WITH OTHER TRADES

- A. Furnish control valves, temperature sensing element wells, flow and pressure sensing devices, dampers, and other similar devices to the Mechanical Contractor in a timely manner for installation under the Building Management and Control System (BMCS), Subcontractor's supervision.

1.5 WARRANTY

- A. Provide with a manufacturer’s parts and labor warranty for a period of two years from substantial completion.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Alerton
- B. Automated Logic
- C. Siemens Building Technologies
- D. Honeywell
- E. Distech
- F. Delta Controls
- G. TRANE

2.2 SYSTEM ARCHITECTURE

- A. The Building Management and Control System (BMCS) shall consist of an information-sharing network of stand-alone Direct Digital Control Panels (DDCP) to monitor and control equipment as specified of the control sequence and input/output summary.
- B. "Information sharing" shall be defined as: The function of each DDCP to exchange data on the network trunk with other DDCP's without the need for additional devices such as network managers, gateways, or central computers.
- C. "Stand-alone" shall be defined as: The function of each DDCP to independently monitor and control connected equipment through its own microcomputer.

2.3 COMMUNICATIONS PROCESSING

- A. The BMCS shall operate as a true token-pass peer-to-peer communication network. Resident processors in each DDCP shall provide for full exchange of system data between other DDCPs on the network trunk. Systems that limit data exchange to a defined number of system points are not acceptable.
- B. Systems that operate via polled response or other types of protocols that rely on a central processor or similar device to manage DDCP-to-DDCP communications may be considered only if a similar device is provided as a standby. Upon a failure or malfunction of the primary device, the standby shall automatically, without any operator intervention, assume all BMCS network management activities.
- C. The failure of any DDCP on the network shall not affect the operation of other DDCPs. All DDCP failures shall be annunciated at the specified alarm printers and terminals.
- D. The network shall support a minimum communications speed of 1 Gbps.
- D. The network shall support a minimum of 500 DDC controllers and PC workstations.
- E. Each PC workstation shall support a minimum of 4 peer-to-peer networks, either by hardwired connection or wireless.
- G. The system shall support integration of third-party systems (fire alarm, security, lighting, PLC, Closed-Circuit Fluid Cooler, boiler) via panel-mounted open protocol processor. This processor shall exchange data between the two systems for inter-process control. All exchange points shall have full system functionality as specified herein for hardwired points. Provide examples of 5 reference projects utilizing gateways required for this project.

2.4 DDCP HARDWARE

- A. Each DDCP shall consist of a 64-bit microprocessor and controller, power supply, input/output boards, and communication board. All program and point databases shall be stored in non-volatile memory. Provide a minimum of 8 GB RAM in each DDCP to allow for point expansion and trend data storage.

- B. Each DDCP shall incorporate a real-time clock.
- C. Each DDCP shall be provided with two Ethernet ports. Connecting an operator terminal, whether portable or stationary, shall allow the user to communicate with the entire network.
- D. Each DDCP shall provide for input/output connections to field equipment. The following point types shall be supported:
 - 1. Analog inputs - for measuring sensed variables. Inputs shall be capable of accepting voltage, resistance, current, or pressure signals.
 - 2. Analog outputs - for controlling end devices. Outputs shall be capable of producing voltage, resistance, current, or pressure signals. Pneumatic outputs shall be provided with a manual override for adjusting outputs in the event of a power loss at the DDCP.
 - 3. Digital inputs - for monitoring dry contacts such as relays, switches, pulses, etc.
 - 4. Digital outputs - to control two-position devices such as starters, actuators, relays, etc.
- F. Each DDCP shall be listed under UL916 (Energy Management Systems) and shall be tested to comply with sub-part J of Part 15 FCC rules for Class A computing equipment.
- F. Each DDC Controller shall have sufficient memory to support its own operating system and databases, including:
 - 1. Control processes.
 - 2. Energy management applications
 - 3. Alarm management applications including custom alarm messages for each level alarm for each point in the system.
 - 4. Historical/trend data for points specified.
 - 5. Maintenance support applications
 - 6. Custom processes
 - 7. Operator I/O
 - 8. Remote communications
 - 9. Manual override monitoring
- G. Operators shall have the ability to manually override automatic or centrally executed commands at the DDC Controller via local, point discrete, onboard hand/off/auto operator override switches for digital control type points and gradual switches for analog control type points.
 - 1. Switches shall be mounted either within the DDC Controller's key-accessed enclosure or externally mounted with each switch keyed to prevent unauthorized overrides.
 - 2. DDC Controllers shall monitor the status of all overrides and inform the operator that automatic control has been inhibited. DDC Controllers shall also collect override activity information for reports.
- H. DDC Controllers shall provide local LED status indication for each digital input and output for constant, up-to-date verification of all point conditions without the need for an operator I/O device. Graduated intensity LEDs or analog indication of value shall also be provided for each analog output. Status indication shall be visible without opening the panel door.

- I. In the event of the loss of normal power, there shall be an orderly shutdown of all DDC Controllers to prevent the loss of database or operating system software. Non-volatile memory shall be incorporated for all critical controller configuration data, and battery backup shall be provided to support the real-time clock and all volatile memory for a minimum of 72 hours.
 1. Upon restoration of normal power, the DDC Controller shall automatically resume full operation without manual intervention.
 2. Should DDC Controller memory be lost for any reason, the user shall have the capability of reloading the DDC Controller via the local Ethernet port, via remote access, or from a network workstation PC.
 3. Upon restoration of normal power, the DDC Controller shall automatically resume full operation without manual intervention.

2.5 PROGRAMMING FUNCTIONS

- A. Resident software in each DDCP shall provide custom programming of control strategies.
 1. Point database
 2. Operator interface
 3. Network communications
 4. Facilities and energy management functions
- B. Programming of control and energy management strategies shall be accomplished via a high-level computer language such as BASIC, JC BASIC, C, or Powers Process Control Language. A standard math processor shall be part of the programming language. All analog loops shall be capable of proportional, integral, and derivative control.
- C. Each DDCP shall incorporate an operator interface program (OIP) that provides an English language user interface. The OIP shall allow the user to program, interrogate, command, and edit the BMCS via a self-prompting method. Operator terminals, whether textual or graphical, shall be able to access the entire network from any DDCP. Access shall be accomplished in a transparent fashion; that is, the operator shall not be required to address specific DDCP's in order to display or command system points.

2.6 FACILITY MANAGEMENT SOFTWARE

- A. The BMCS shall be provided with standard and custom report generation functions that include:
 1. Alarm summaries
 2. Motor status summaries
 3. Point displays by type, system, status, overrides, failures, location, equipment and enabled/disabled.
 4. Program listings
- B. All reports shall be either displayed or printed by:
 1. Operator request.
 2. Time of day.
 3. Event conditions (such as in response to an alarm, interlock, etc.).
- C. All reports shall be time and date stamped.

- D. An alarm-processing program shall be provided to annunciate those points designated as alarmable. Alarm points shall, upon alarm occurrence, be displayed or printed at designated terminals.
- E. Historical trend data shall be collected and stored at each DDCP for later retrieval. Retrieval shall be manual or automatic. Any point, physical or calculated, may be designated for trending. The system shall allow for two methods of trend collection: Either by a pre-defined time interval sample or upon a pre-defined change of value. Trend data shall be presented in a columnar format. Each sample shall be timed stamped. Trend reports may be a single point or may be a group of points, up to a maximum of (8) points in any single group. Any point, regardless of physical location in the system may become part of a multiple point group.
- F. Each BMCS network shall provide a point-monitoring function that can display single or multiple points in a continuous updated fashion for dynamic displays of point values.
- G. A database and configuration report program shall be provided that allows the user to interrogate BMCS status. As a minimum, the user shall be able to: Verify available RAM at each DDCP, verify DDCP status (on-line, off-line, and failed) and set the system clock.
- H. Any invalid operator entry shall result in an error message.
- I. DDCP's shall contain a password access routine that will assign an operator to one of three level of access. Level 1 shall permit display function only, level 2 shall additionally permit commanding of system points and level 3 shall additionally permit full program and database editing.
- J. DDCP's shall provide for the accumulation of totalized values for the purposes of run-time or energy totalization. Totalized values may be displayed or printed automatically or by operator request.

2.7 ENERGY MANAGEMENT SOFTWARE

- A. The BMCS shall be provided with an optimal start program such that the building may be divided into ten zones for optimum start. Warm-up and cool-down shall occur in sequence with succeeding zones starting only after the preceding zone has completed its warm-up or cool-down.
 - 1. The optimum start-up time of assigned equipment shall be determined based on a software calculation that takes into consideration outdoor air conditions, space conditions, and building thermal characteristics ("U" factor).
 - 2. The optimum start program shall control start-up of the cooling and heating equipment to achieve the target occupancy space temperature at the precise time of building occupancy.
 - 3. A Built-In "learning" technique shall cause the BMCS to automatically adjust itself to the most affective time to start equipment based on historical data.
- B. The BMCS shall be provided with an operator interactive time of day (TOD) program. TOD programming and modifying shall be accomplished in a calendar-like format that prompts the user in English language to specify month, year, day and time and associated point commands. It shall be possible to assign single points or groups of points to any on

or off time. Appropriate time delays shall be provided to "stagger" on times.

1. TOD shall incorporate a holiday and special day schedule capability, which will automatically bring up a pre-defined holiday or special day schedule of operation. Holidays or special days can be scheduled up to one year in advance.
2. In addition to the time dependent two-state control, TOD also provides time dependent setpoint control. This control provides the capability to output assignable, proportional setpoint values in accordance with the time of day and day of week. This program shall be used to accomplish night setback, morning warm-up and normal daily operating setpoints of all control system loops controlled by the BMCS. As with the two-state control, time dependent setpoint control shall be subject to the holiday schedule. The setpoints desired shall be user definable at any operator terminal.
3. The operator shall be capable of reading and/or altering all sorted data pertaining to time of day, day of week, on/off times, setpoint values, and holiday designation.
4. The TOD program shall also provide an override function that allows the user to conveniently change a start or stop time for any point up to one week in advance. The override command shall be temporary. Once executed the TOD program shall revert to its original schedule.
5. The TOD program shall interface with the optimal start program (OSP) such that stop times may be assigned by OSP.

C. Additional Program functions required are to be installed and programmed as requested by end user at no additional cost:

1. Enthalpy optimization.
2. Supply air reset.
3. Hot water reset.
4. Condenser water reset.
5. Volumetric control.
6. Dead band control. Install dual set points as requested by user.
7. All specified energy management programs, whether or not applicable to this project shall be provided such that the owner may enable the program at a future date without the need to purchase additional software or modify existing software.

2.8 WEB SERVER ACCESSIBILITY

- A. Industry leading encryption technology to provide accessibility through a web browser.
- B. Building Manager's ability to access, view and command critical building information in real time over the intranet or internet.
 1. Alarm Display
 2. Point Commanding
 3. Graphic Display
 4. Scheduling
 5. Running Reports
 6. Point Details

2.9 REMOTE NOTIFICATION

- A. Remote notification sends Alarm and System Event information to various notification devices as indicated below but not limited to. Operators can receive their building automation system alarms without restricting them to dedicated workstations.
 - 1. Alphanumeric pagers
 - 2. Numeric pagers
 - 3. Email
 - 4. Phones via voice or short message service (SMS)

2.10 POINT EXPANSION MODULES

- A. Capable of extending its input/output capabilities via special purpose modules.
 - 1. Modules may be mounted remote from the DDCP.
 - 2. Shall communicate with the DDCP over a pair of twisted cables.

2.11 TERMINAL EQUIPMENT CONTROLLERS

- A. Provide for control of each piece of equipment, including, but not limited to, the following:
 - 1. Unit Conditioners
 - 2. Heat Pumps
 - 3. Fan Coil Units
 - 4. Water Source Heat pumps
- B. Include the following items:
 - 1. All input and outputs necessary to perform the specified control sequences.
 - a. Analog outputs shall be industry standard signals such as 24V floating control.
 - 2. Sufficient memory to accommodate point database, operating programs, local alarming and local trending.
 - 3. All databases and programs shall be stored in non-volatile EEPROM, EPROM and PROM, or minimum of 100-hour battery backup shall be provided.
 - 4. Return to full normal operation without user intervention after a power outage of unlimited duration.
 - 5. Operation programs shall be field selectable for specific applications.
 - 6. Specific control strategy requirements, allowing for additional system flexibility.
 - 7. Controllers that require factory changes of all applications are not acceptable.

2.12 ELECTRONIC DAMPER ACTUATORS

- A. Two position damper operators:
 - 1. Spring return to full travel position.
 - 2. Built in auxiliary switches (motor end switches)
 - a. Switch shall be fully adjustable so that cut-in/cut-out points may be preset at any point within angular travel of the motor.
 - 3. Minimum torque 60-in-lb
- B. Modulating damper operators:
 - 1. Sized with sufficient reserve power to provide smooth modulating action and

- tight close off against the system pressure
- 2. Select the operator with available torque to exceed the maximum required operating torque by not less than 100%
- 3. Minimum torque 100 in-lb

2.13 ETHERNET CARD

- A. Ethernet Card:
 - 1. Local area network connection interface card.

2.14 CONTROL CABINETS

- A. Fully enclosed NEMA 1 for indoors, NEMA 4 for outdoors.
 - 1. Powder coat painted on all sides
 - 2. Cabinet with continuously piano type hinged door
 - 3. Locking latch
 - 4. All locks shall use a common key
 - 5. Devices on the panel face must be identified with engraved nameplates.
 - 6. Panels or termination panels must be identified with engraved nameplates.
 - 7. Provide enamel beige finish and extruded aluminum alloy frame UL 50 certified.

2.16 AUTOMATIC CONTROL VALVES

- A. Pressure ratings: Minimum 125 psig or 1.25 times maximum system operating pressure.
- B. Construction:
 - 1. 2" and smaller:
 - a. Screwed.
 - b. Bodies and internal parts: Bronze, stainless steel, or other approved corrosion-resistant metal.
 - 2. 2-1/2" and larger:
 - a. Flanged.
 - b. Bodies: Cast iron or cast steel.
 - c. Seats and parts exposed to fluid: Bronze, stainless steel, or other approved corrosion-resistant metal.
 - 3. Characterized port ball valves are acceptable for VAV terminal units only.
- C. Modulating straight through water valves: Equal percentage contoured throttling plugs.
- D. Three Way Mixing Valves: Linear throttling plugs allowing total flow through valve to remain constant regardless of position.
- E. Sizes: By Automatic Control System Manufacturer for fully modulating operation.
 - 1. Minimum pressure drop: Equal to pressure drop of coil or exchanger.
 - 2. Maximum pressure drop: 5.5 psi.
 - 3. Relief and bypass valves: Sized according to pressure available.
 - 4. 2-position valves: Line size.
 - 5. Manual by-pass operator.

- F. Electronic Actuator:
 - 1. Direct coupled installation
 - 2. Visual and electronic stroke indicator
 - 3. Die-cast aluminum housing
 - 4. Manual override
 - 5. Self-lubricating bearing and gear train
 - 6. Automatic calibration
 - 7. Automatic duty cycle protection
 - 8. Overload and stall protection
 - 9. Non-spring return
 - 10. Floating /0-10 VAC / 4-20mA operation
 - 11. UL approved
 - 12. Provide smooth modulating action and tight close off against the system pressure.
 - 13. Torque to exceed the maximum required operating torque by not less than 150%.
 - 14. Actuator input signal shall be compatible with output DDC controller.
 - 15. Provide weatherproof enclosure (exterior use).
 - 16. Damper actuators not acceptable for valves.

- G. Cooling Tower By-Pass / Cooling Tower Isolation Valves & Actuators:
 - 1. Valve Bray (Series 3L)
 - a. Line Size Valve
 - b. Under-cut disk for smooth operation
 - c. Full Lug Valve
 - d. Cast Iron Body
 - e. EPDM – Molded-in Seat
 - f. 416 Stainless Steel Stem
 - g. Nylon Coated Ductile Iron Disc
 - h. Disc-to-stem connection shall utilize a double “D” or key design requiring no screws or pins to connect stem to disc.
 - 2. Electronic Actuator: Bray (Series 70)
 - a. Fully configurable without need for software or handheld settings device
 - b. Direct Mount
 - c. Solid state speed control
 - d. Visual and electronic stroke indicator.
 - e. Anti-Condensation Heater (exterior actuators)
 - f. Die-cast aluminum housing.
 - g. Manual override by means of hand wheel
 - h. Self-lubricating bearing and gear train.
 - i. All steel self-locking output gearing to be provided
 - j. Continuous Duty Rated Motor
 - k. Overload and stall protection.
 - l. Floating /0-10 VAC / 4-20mA operation.
 - m. Mechanical Travel stops
 - n. UL approved.
 - o. Smooth modulating action.
 - p. Tight close off against the system pressure.
 - q. Sized to exceed 150% of the maximum required operating torque of the valve while under the maximum operating shut-off pressure
 - r. Actuator input signal shall be compatible with output DDC controller.
 - s. Provide weatherproof enclosure

- t. Damper actuators not acceptable for valves.

- H. Variable Primary Flow By-Pass Control Valve:
 - 1. Modulating straight through control valve with equal percentage contoured throttling plug and electronic operator.
 - 2. Maximum pressure drop: 10 psi
 - 3. Sized for minimum flow of Closed-Circuit Fluid Cooler
 - 4. Torque to exceed the maximum required operating torque by not less than 150%.

2.17 FLOW DETECTION SWITCHES

- A. Remote Flow Solid-State Flow Detection:
 - 1. Extended length flow probe
 - 2. Cabinet-mounted control monitor
 - 3. Wetted parts, 316 stainless steel probe
 - 4. Optional temperature and wire-break outputs
 - 5. Flow and temperature switch points
 - 6. LED bar graph display for status indication
- B. Approved Manufacturer:
 - 1. IFM Effector

2.18 DIFFERENTIAL PRESSURE SWITCHES

- A. Wet/wet differential pressure switch
 - 1. Integral Mounting Frame
 - 2. Watertight, dust-tight, and corrosion resistant enclosure.
 - 3. Wetted materials of brass and fluor elastomer.
 - 4. Externally adjustable set point
- B. Approved manufacturer:
 - 1. Square D #9012GGW4
 - 2. Dwyer #DXW-11-153-1
 - 3. Carrier #HK06ZC033

2.19 TEMPERATURE LOW LIMIT SWITCH

- A. Responsive to the coldest 1' section of its length.
 - 1. Double pole single throw switch
 - 2. 20' capillary
 - 3. Line voltage with bellows actuated switch
 - 4. Auto reset for outdoor installation
 - 5. Manual reset for indoor installation

2.20 TEMPERATURE AND HUMIDITY SENSORS

- A. Space Temperature Sensors
 - 1. Thermister with resistance of 10,000 ohms at 77°F.
 - 2. Accuracy shall be +/-1/2°F.

3. Range of 55° to 95° F.
 4. Surface Mounted (edit for each project)
 - a. Digital temperature display (edit for each project)
 - c. Override button (edit for each project)
 - d. Color to be approved by Architect / Owner, submit sample for review
 6. Location and height to be approved by Architect/Engineer prior to installation.
 7. Provide guards impact resistant Polycarbonate equal to BAPI-Guard in all public locations.
- B. Space / Duct Humidity Sensor
1. Capacitance element in the space or duct as required and output a 4 to 20 MA signal proportional to 0 to 100% RH to the DDC.
 2. Capacitance element shall be field replaceable and not require calibration.
 3. Accuracy shall be +/-2% in the range from 20 to 95% RH.
 4. Relative humidity sensors shall have the sensing element of inorganic resistance media.
 5. Provide impact resistant Polycarbonate equal to BAPI-Guard covers suitable for institutional use. Submit sample for review.
 6. Provide manufacturers calibration certificate.
 7. Provide impact resistant Polycarbonate equal to BAPI-Guard guards in all public locations
- C. Duct Temperature Sensors
1. Range of 20° to 120°F.
 2. Single point sensing of temperature.
 3. Averaging elements of sufficient length to sense temperature across 2/3 duct width.
 4. Averaging elements of sufficient length to provide accurate, representative indication and control.
 5. Averaging elements of sufficient length to prevent variances in temperature or stratification.
- D. Liquid Immersion Temperature Sensors
1. Platinum type resistance temperature detector (RTD).
 2. Match sensor range to medium being monitored.
 - a. Hot water range 30° to 250°F.
 - b. Condenser Water 30° to ~~70~~100°F.
 3. Furnish stainless steel wells for installation by Mechanical Contractor.
 4. Locate all sensors in field with Owner/Engineer present.
 5. System accuracy for liquid temperature sensing shall be +/-1/2°.
 6. Sensors must be removable from wells.
- E. Outside Air / Freezer / Cooler Sensors
1. Range of -58° to 122°F.
 2. Weatherproof sun shield.
 3. External trim material corrosion resistant with all parts assembled into watertight, vibration-proof, heat resistant assembly.
 4. Minimum of 8' long leads.
 5. Encapsulated into Type 304 stainless steel tubes with low conductivity moisture

proofing material and lag extension for thickness of insulation.

2.21 CURRENT SENSITIVE RELAYS

- A. Ensure compatibility with VFD applications for variable speed motor status.
 - 1. Provide with adjustable set point.
 - 2. Relays must be mounted and not hung by power wires thru CT.
 - 3. Provide split-core type current sensors.
 - 4. Loop powered.
 - 5. LED Status.
 - 6. Acceptable Manufacturer: Veris Industries / Hawkeye
 - 7. Relays shall close status contacts in response to current flow in power leads to the equipment being monitored.

2.22 DIFFERENTIAL PRESSURE TRANSDUCER

- A. Transducers to convert differential pressures to 4-20 MA analog outputs.
 - 1. Solid state pressure sensor with accuracy of +/- 1% of calibration range.
 - 2. Factory calibrated and have zero and span trimmers for field calibration.
 - 3. Range shall be selected to match the medium being monitored.
 - 4. Pressure snubbers to protect from pressure pulses and a 3-way bypass / valve assembly to protect the transducer from overpressure damage during start-up.
 - 5. LCD Display
 - 6. Acceptable Manufacturer: Rosemount 1151 or 3051 Pressure Transmitter

2.23 FLOW DIFFERENTIAL PRESSURE SWITCH

- A. The pressure sensing element shall be of the convoluted diaphragm type for sensitivity to system differential pressure.
 - 1. Select the pressure range based on the sensed differential pressure.
 - 2. The unit shall be protected against overpressure to the full static pressure rating.
 - 3. Accuracy: +/- 2% of full scale.
- B. Switch assembly.
 - 1. Reed switch.
 - 2. NEMA-4 enclosure.
 - 3. Threaded boss conduit entrance.
 - 4. SPST action.
 - 5. Voltage and rating as required for the control circuit.
- C. Wetted parts shall be made of type 303 stainless steel.
- D. Install an isolation valve in each sensing pipe leg to permit servicing without shutting the system down.

2.24 ELECTRIC REMOTE BULB THERMOSTAT

- A. Two position remote bulb thermostat:
 - 1. Bimetal controlled.
 - 2. Sealed mercury switches.

3. Provide specified control action.
4. Adjustment can be made by removing unit cover.
5. Element with capillary length as required for the location.

2.25 ELECTRIC SPACE THERMOSTAT

- A. Two position space thermostat.
 1. Single Pole switch actuated by bi-metal sensing element.
 2. Range shall be 60°F to 90°F.
 3. Removable external knob adjustment means.

2.26 HIGH STATIC PRESSURE SWITCH

- A. With manual reset switch
 1. Approved manufacturer: Cleveland AFS-460.

2.27 INSERTION FLOW SENSORS

- A. Turbine Flow Meter
 1. Retractable hot tap flow sensor
 2. Accuracy: +/- 1% of full scale
 3. Dual Turbine
 4. Custom thread-o-let 400 psi / 250°F rated
 5. Line size from 2-1/2 to 72 inch
 6. Metering ranges from 0.3 to 15 f/sec.
 7. Remote NEMA 4 wall mounted LCD display
 8. Field Pro Software & Communicator
 9. Warranty two years
 10. Approved Manufacturer: Onicon Flow Meter F1200 Series
- B. Electromagnetic Flow Meter
 1. Retractable hot tap flow sensor
 2. Accuracy: +/- 1% of full scale
 3. Electromagnetic
 4. Custom thread-o-let 400 psi / 250-degree F rated.
 5. Line size from 1-1/4 to 72 inch
 6. Metering ranges from 0.3 to 15 f/sec.
 7. Remote NEMA 4 wall mounted LCD display
 8. Field Pro Software & Communicator
 9. Warranty two years
 10. Approved Manufacturer Onicon Flow Meter F3500 or FT3500

2.28 CONTROL DAMPERS

- A. Opposed blade dampers.
 1. Frames of 13-gauge galvanized sheet metal.
 2. Provisions for duct mounting.
 3. Damper blades not exceeding 8" in width.
 4. Blades of two sheets of 16-gauge galvanized sheet metal.
 5. Blades suitable for high velocity performance.

6. Bearings of nylon or oil-impregnated, sintered bronze.
7. Shafts of 1/2" zinc-plated steel
8. Leakage does not exceed 1/2% based on 2000 fpm and 4" static pressure.
9. Replaceable resilient seals along top, bottom and sides of frame and blade edge.
10. Submit leakage and flow characteristics data with shop drawings.
11. Linkage shall be concealed out of the air stream within damper frame.
12. Acceptable Model is Ruskin Model CD60.

2.29 PHOTO-CELL CONTROL

- A. Light Sensitive Resistor.
 1. 4-20 output or switch.
 2. On = 3.0 / fc. Off 10.0 / fc.
 3. UL Approved.

2.30 DRAIN PAN FLOAT SWITCH

- A. Rated at 10 Amps.
 1. Shuts off equipment if water level becomes too high.
 2. DPDT Contacts.

2.31 BY-PASS AUTOMATIC SHUT-OFF TIMERS

- A. Rated at 10 Amps, 125 VAC
 1. Shuts off equipment with timed switch
 2. White decorated timer
 3. Without hold feature
 4. Time Cycle 60 minutes

2.32 CO₂ SENSOR

- A. Telaire Model T5100 CO₂/Temperature Sensor or approved equal
 1. Local visual indication of CO₂ levels in enclosed spaces.
 2. Pre-calibrated with factory default settings of 1000 ppm and 1500 ppm CO₂ levels
 3. Bright LED indicator transitions between green, yellow, and red as the CO₂ threshold is exceeded.
 - a. Accuracy: +/- 30 ppm @ 72°F
 - b. Output: 0-10 V (100Ω output impedance) and NTC 20k Thermister

2.33 AIR FLOW SENSING SWITCH

- A. The pressure sensing element shall be of the convoluted diaphragm type for sensitivity to system positive, negative, or differential pressure.
 1. Select the pressure range based on the sensed differential pressure.
 2. The unit shall be protected against overpressure to the full static pressure rating.
 3. Accuracy: +/- 2% of full scale
- B. Switch assembly:
 1. Reed switch

2. Field adjustable setpoint
3. Threaded boss conduit entrance
4. SPST Action
5. Voltage and rating as required for the control circuit

2.36 HVAC SHUTDOWN STATION

- A. Lockdown Switch:
 1. Mushroom Red Button within a clear plastic cover
 2. Latches when depressed
 3. Twist reset
 4. Sign "HVAC SHUTDOWN"
 5. Manufactured by STI Model #SS2031HV-EN

PART 3 - EXECUTION

3.1 INSTALLATION

- A. The control system shall be installed, and final adjustments made by full-time employees of the factory approved BMCS Building Management Control Subcontractor.
- B. The contractor shall collaborate through Architect / Engineer and Owner to determine the Owner's preference for naming conventions, etc. before entering the data into the system.
- C. Due to actual operational or space conditions, it may be necessary for the Contractor to make sequence of operation modifications and/or controller adjustments, change the location or type of sensor to obtain proper operation and coverage of the system in each room or space. These change, if requested by the Owner or Engineer, shall be performed at no additional cost to the Owner. Therefore, labor allowances should be made for such changes and adjustments if requested.
- D. Points listed within this section are to be connected to the BMCS system as hard-wired points to cards and not connected through BacNet integration. The BacNet interface is for read only points not included within sequences of this specification.

3.2 INTERLOCK AND SAFETY CIRCUITS

- A. Close the outdoor air dampers when the related HVAC unit supply or exhaust fan is de-energized:
 1. The damper and actuators are specified in this section.
 2. Outdoor air damper shall be fully opened before related air handling unit fan is energized for 100% outside air use.
 3. Provide motorized outside air dampers for the following:
 - a. Supply fans
 - b. AHUs
 - c. Exhaust fans (except kitchen exhaust)
- B. Close the condenser and hot water valves to the coil when the related unit is de-energized.

- C. Interlock the closed-circuit fluid cooler to start its dedicated condenser water pumps.
 - 1. On shutdown provide a circuit to permit the condenser water pumps to run while the chillers pump down as required by the manufacturer.
 - 2. As per manufacturer's recommendations
- D. Primary Condenser water control:
 - 1. Operating and safety controls are furnished as an integral part of the unit and not specified in this section.
 - 2. Provide a high limit temperature sensor in each primary chilled water pump loop.
- E. Exhaust/Supply Fans:
 - 1. Interlock the related exhaust and supply fans and the related outside air damper.
 - 2. Interlock the exhaust fans with the related air-handling unit through software.
 - 3. Interlock related exhaust fan for dishwasher with time delay off relay.
 - 4. Interlock related exhaust fan for kiln with time delay off relay
 - 5. Interlock kitchen hood related supply and exhaust fans.
 - 6. Provide additional interlocks as indicated on fan schedule and on drawings.
 - 7. Interlock electrical and mechanical room exhaust fans with thermostat.
 - 8. Interlock refrigerant monitor with mechanical room purge system.
 - 9. Interlock science room related supply and exhaust fans.
 - 10. Interlock outside air supply fans for VAV air-handling unit with air-handling unit status point.
- F. Cooling Tower Fan Safety Interlock: Provide interlock wiring for the vibration sensor, oil level switch and oil pump on each cooling tower fan.
- G. Freeze Protection:
 - 1. Provide a freeze protection sequence to ensure proper operation of equipment during a freeze condition not limited to the following:
 - a. Outside Air Handling Units & Supply Fans with heating and cooling coils: If unit is in occupied or unoccupied mode, upon the triggering of software point indicating a freeze condition or the low temperature sensor (freeze stat) indicates a freeze condition, the system will be disabled, close the outside air damper, open both heating and cooling valves to enable full flow condition. If heating coil discharge air sensor indicates a failure to control and is below setpoint then enable software point indicating a freeze condition, disable unit, close outside air damper, and open both heating and cooling valves to enable full flow condition. Ensure HW & CHW pumps are operational.
 - b. Boilers - Enable during a freeze condition.
 - c. Cooling Tower – Open isolation valves then command by-pass valve to dump water into basin or by-pass tower. Enable condenser water pumps during a freeze condition.
 - e. Protect coils downstream of DX cooling coil with freeze protection. If unit is in occupied or unoccupied mode, upon the triggering of software point indicating a freeze condition or the low temperature sensor (freeze stat) indicates a freeze condition, the system will be disabled, close the outside air damper, disable the DX cooling coil. If coil discharge air sensor indicates a failure to control and is below setpoint then enable

- software point indicating a freeze condition.
- 2. Temperature low limit switch wired with double pole single throw switch with one switch leg hard-wired to de-energize fan and one switch leg to signal BMCS.
- H. Drain Pan Float Protection:
 - 1. Interlock to shut down unit and close valves.
 - 2. Cooling Coils mounted above ceiling and in roof mounted units.
 - 3. Provide for each cooling coil location.
 - 4. Signal BMCS alarm point
- I. Domestic Water System:
 - 1. Interlock in-line circulating pumps at water heaters with return water pipe mounted thermostat to cycle pump with return water temperature.
 - 2. Interlock high temperature entering water solenoid valve with thermostat on discharge side of tempered water mixing valves.
- J. Emergency Shutdown Station:
 - 1. Provide an emergency mushroom style push / pull station shutdown switch in the Administration Area or as directed by Owner / Architect.
 - 2. Signal the building automation system to de-energize the HVAC equipment.
 - 3. This is to stop exhaust fans and outside air units immediately.
 - 4. Other air handling units, closed-circuit fluid cooler and equipment shall be shut down in an orderly manner so as to not damage the equipment.
 - 5. Once stopped, the system may only be restarted with a key operated switch located adjacent to the shutdown switch.
- N. Condensing Hot Water Boilers:
 - 1. Interlock each boiler to start its dedicated pump.
 - 2. Install communication cable between each boiler and master controller specified by boiler manufacturer.
- O. Intrusion Alarm System:
 - 1. Interlock the intrusion alarm system for status of building occupancy.
 - 2. Disable HVAC system when building is in the unoccupied mode and alarm system is enabled. Either Time of Day Schedule and/or contact from the intrusion alarm system shall disable HVAC system.

3.3 GRAPHICS

- A. Furnish as-built drawings indicating finally corrected "as installed" diagram(s) of the complete Building Management Control System.
 - 1. Modification of existing control systems shall be included.
 - 2. These must be as-built and any changes during the warranty period drawings must be revised and updated.
 - 3. Provide final sequence of operation in written format.
- B. Provide a set of the "as installed" diagram(s) of the complete control system laminated in plastic and hung in the main mechanical room or as directed by Owner.
- C. Provide a color-coded floor plan of the building showing the location of each system, and

the area served by each AHU or related zone. These must be of professional quality. Floor plan is to hang in main mechanical room near central control panel.

- D. Provide computer graphics for each system.
- E. Provide final graphic room numbers as selected by Owner / Architect. Obtain a graphic submittal package for review. Construction Drawing room numbers are not to be used unless approved in writing.

3.4 IDENTIFICATION

- A. Provide a laminated engraved nameplate on all control panels and devices shown on the "as installed" control diagrams. Coordinate engraving with nomenclature used on the diagrams.
- B. A black-white-black laminated plastic engraved identifying nameplate shall be secured to each terminal cabinet, and control panels. Identifying nameplates shall have ½ inch high, engraved letters.
- C. A red-white-red 2"x8" laminated plastic engraved identifying nameplate shall be secured to each audible/visual alarm and emergency shutdown device. Provide identification and location of each A/V device laminated in plastic and hung at refrigerant monitor with identification, location of devices and proper operation of system in a graphic floor plan with written sequence of operation. Identifying nameplates shall have ½ inch high, engraved letters. A red-white-red 12"x12" laminated plastic engraved identifying nameplate shall be secured to outside of each door to machine room with "A REFRIGERANT LEAK HAS BEEN DETECTED IN THIS BUILDING WHEN AUDIBLE/VISUAL ALARM IS ENABLED. DO NOT ENTER. CONTACT MAINTENANCE DEPARTMENT."
- D. A black-white-black laminated plastic engraved identifying nameplate shall be secured to ceiling grid directly below the control panel. Identifying name plates shall have ½" inch high engraved letters. White with black letters.

3.5 WIRING FOR BUILDING MANAGEMENT AND CONTROL SYSTEMS

- A. Furnish and install all wire, conduit, raceways, and cable systems required for the complete operation of the Building Management and Control System.
- B. All wiring for the Building Management and Control System is specified in this section and includes, but is not limited to:
 - 1. Wiring of interlock system.
 - 2. Wiring of control instruments.
 - 3. Wiring of control panels.
 - 4. Wiring of related power supplies, i.e. transformers.
 - 5. Wiring of 120 VAC power circuits for control panels and devices.
- C. All materials and methods specified in this section shall comply with the requirements specified in Division 26 of this specification.

- D. All power supply requirements shall be connected to the building electrical distribution system in an approved manner. Do not connect control equipment of circuits common with other building loads or devices.
- E. Temperature control wiring shall be jacketed cables installed with or without conduit as specified below or single conductors installed in conduit. Control wiring shall have minimum 300V insulation for low voltage wiring and 600V insulation for line voltage wiring.
- F. All line voltage control wiring, all low voltage control wiring which is exposed in the central plant, penthouse, and other similar spaces; all low voltage control wiring which is routed through concealed inaccessible locations shall be installed in conduit.
- G. All low voltage control wiring which is routed through concealed accessible locations may be run without conduit provided that the wiring run without conduit is properly supported from the building structure on maximum 5' centers and does not depend upon the ceiling grid or the ceiling support system for support. Wiring run in plenum spaces shall be plenum rated. Support all plenum wiring in accessible locations in bridge rings, J-hooks, D rings. Plenum wiring is not to be supported within building structure or attached to conduit raceways. All low voltage wiring must be installed through supports. Wires shall be supported on 5' centers and identified at each termination point and at 50' centers minimum. Install wire parallel or perpendicular to the structural features of the building.
- H. Line and low voltage control wiring shall not be installed in the same conduit with control wiring and shall not be installed in the same conduit with power wiring.
- I. All wiring associated with building management and control system cover shall be as follows:
 - 1. Sensor jacket color, Green
 - 2. LAN communications, Yellow
 - 3. All THHN wiring shall comply with Division 26 insulation color identification

3.6 EXHAUST FANS

- A. Provide interlocks as scheduled on the plans unless shown on the electrical drawings.
- B. Provide BMCS override to disable operation of all exhaust and supply fans interlocked and/or specified throughout project.

POINT DESCRIPTION	TYPE	DEVICE
Start/stop	DO	Control Relay
Outside Air Damper	DO	Electronic Operator
Fan Status	DI	Current Sensitive Relay

3.7 SYSTEM OVER-RIDE

- A. Provide manual over-ride push buttons and pilot lights installed in a single control panel at the main central plant for all functions.
 - 1. Overrides shall be located within a locked panel.
 - 2. Provide override switch for:
 - a. Condenser water central plant
 - b. Hot water central plant
 - c. Each Air Handling unit
 - d. Existing systems
 - e. Exhaust Fans

3.8 BUILDING ELECTRICAL USAGE

- A. Provide digital monitoring of the building KVA and KWH. Coordinate with the switchgear manufacturer.
- B. Electrical Quality monitoring:
 - 1. Monitor Watts, VA, VAR, Demand, Imbalance, and Power Factor.

3.9 MISCELLANEOUS

- A. Freezer/Cooler Temperature Monitoring:
 - 1. Provide an analog temperature sensor located in the freezer compartment and cooler compartment.

POINT DESCRIPTION	TYPE	DEVICE
Freezer Alarm	AI	RTD
Cooler Alarm	AI	RTD

- B. Lighting Control:
 - 1. Provide individual time/photo-cell and time based control of each lighting contactor specified in Division 26.
 - 2. Provide momentary push buttons located at the central plant control panel, tennis courts, football, baseball, softball fields and/or concession stands to energize exterior lighting for a preprogrammed length of time.
 - a. Provide separate control of each contactor.

POINT DESCRIPTION	TYPE	DEVICE
Lighting Contactor	DO	Control Relay
Momentary Control Switch	DI	Switch

- C. Photocell: Provide a photocell mounted on the north side of the building. Location is to be approved by Owner / Architect / Engineer.

POINT DESCRIPTION	TYPE	DEVICE
Photocell	AI	Contact

- D. Humidity Sensor: Provide a sensor in Library to monitor space conditions.

POINT DESCRIPTION	TYPE	DEVICE
Humidity	AI	Space Sensor

- E. Outside Air: Provide a temperature sensor and a humidity sensor to monitor outside air conditions.

POINT DESCRIPTION	TYPE	DEVICE
Outside Temperature	AI	Thermistor
Outside Humidity	AI	Humidity Sensor

3.13 HOST COMPUTER REQUIREMENTS

- A. Provide a new Building Management and Control System host computer with printer located in the buildings maintenance management office.
1. Provide modem for management tasks.
 2. Make final connections necessary to provide a complete and functioning system.
- B. Provide color graphics software. Complete graphics of all systems specified in this contract.

3.16 VARIABLE FREQUENCY DRIVE INTERFACE

- A. Interface to the VFD directly
- B. Interface may be hardwired or via RS-485
- C. The following points shall be available at a minimum:

Point Name	Type
Start-stop	DO
Drive alarm	DI
Last fault	AI
Reset drive	DO

Percent output	AI
Frequency output	AI
Speed	AI
Current	AI
Power	AI
Drive temperature	AI
KWH	AI
Run time	AI

3.30 DX OUTSIDE AIR UNITS

- A. These units are furnished with a direct expansion coil and electric heating coil in the reheat position. Control shall be as follows:
1. An ambient temperature sensor shall energize the first stage of cooling whenever the ambient temperature rises above 56°F (adjustable) and energize the second stage of cooling whenever the temperature is above 76°F (adjustable).
 2. De-energize the DX cooling whenever the ambient temperature is below 55°F (adjustable).
 3. Internal unit controls shall operate the hot gas bypass and defrost safeties as required.
 4. A discharge air temperature sensor shall stage the electric duct heat to maintain 55°F.
 5. Start/stop of the unit shall be by BMCS.

POINT DESCRIPTION	TYPES	DEVICE
Start/Stop	DO	Control Relay
Condensing Unit	DO	Control Relay(s)
Discharge Air Temperature	AI	Discharge RTD
Electric Heater	AO	Relay(s)
Status	DI	Air Flow Switch
Outside Air Damper	DO	Electronic Operator
Ambient Temperature	AI	Thermistor

ROOF TOP UNITS

3.31 PACKAGED ROOFTOP UNIT

- A. Controller: The unit shall be governed by a programmable controller capable of seamless communication with the building automation system (BAS). The controller will initiate the unit via a predetermined optimum start sequence through bas controls and will de-energize the unit in

accordance with time schedules managed by the bas. The manufacturer shall supply a factory-mounted controller, complete with all necessary sensors, wiring, and controls to ensure the proper execution of the specified sequence of operations.

- B. Morning Warm-up/Cool Down Mode: On a signal from the BAS, the unit controls shall optimally start the unit and energize the DX cooling or gas furnace to reach occupied setpoint by the scheduled occupied time.
- C. Occupied Mode: On a signal from the BAS, the supply air fan shall operate continuously, and the associated outdoor air modulator shall modulate to the balanced position. On a signal from the BAS through the space-mounted temperature sensor, the unit shall enter cooling or heating mode. During cooling mode, the DX cooling shall sequence to maintain a space temperature setpoint of 72°F (adjustable). During heating mode, the gas furnace shall stage to maintain a space temperature setpoint of 70°F (adjustable).
- D. Dehumidification: On a signal from the BAS through the space-mounted humidity the unit shall enter dehumidification mode. The unit shall modulate the hot gas reheat and the unit controller shall energize and stage the DX cooling to maintain a humidity setpoint of 50% RH (adjustable).
- E. Economizer control (enthalpy control): When the outside air enthalpy (global point) is less than the return air enthalpy and there is a request for cooling, economizer mode will be enabled. During economizer mode, the supply cooling signal will modulate the dampers as required to satisfy the current cooling setpoint. If the outside air damper is open 100% and the setpoint cannot be met, then additional cooling control will be enabled. As the mixed air temperature varies within the range of 55°F to 45°F, the outside air damper will modulate closed as required to prevent excessively cold supply air. Measure OSA flow to maintain minimum flow.
- F. Demand control ventilation – On a signal from the BAS through the space-mounted carbon dioxide sensor that the space has exceeded the set carbon dioxide space minimum. The space carbon dioxide sensor shall signal the unit controller through the bas and the unit controller shall modulate the outside air damper opened or closed until space carbon dioxide sensor has been satisfied.
- G. Unoccupied mode: On a signal from the BAS, the supply air fan shall cycle, and the associated outdoor air mod shall modulate fully closed. The DX cooling or gas furnace shall modulate as required to maintain setback temperature.
- H. Safeties and auxiliary controls:
 - Phase failure protection.
 - Condensate overflow switch.
 - Filter alarm (when filter differential is greater than 1” wc, manually adjustable).

POINT DESCRIPTION	TYPES	DEVICE
Start/Stop	DO	Relay
Cooling Stages	DO	Relay
Heating Stages	DO	Relay

Supply Fan Start/Stop	DI	Relay
Supply Fan Status	DI	Relay
Supply Fan Flow	AI	Air Flow Sensor
Outdoor Air / Return Air Damper Command	AI	Relay
Outdoor Air / Return Air Damper Position Feedback	AI	Relay
Space Temperature	AI	Temperature Sensor
Space Humidity	AI	Humidity Sensor
Condensate Overflow	DI	Relay
Filter Alarm	DI	Relay
Return Air Temperature	AI	Duct Thermistor
Return Air Humidity	AI	Humidity Sensor
Outdoor Air Temperature	AI	Duct Thermistor
DX Cooling Status	DI	Relay
Gas Furnace Status	DI	Relay
Discharge Air Humidity	AI	Humidity Sensor
Discharge Air Temperature	AI	Duct Thermistor

FAN COIL UNITS

3.47 DX FAN COIL UNITS

- A. Each fan/coil unit is furnished with a direct expansion coil. Control shall be as follows:
1. A space temperature sensor shall, acting through a terminal equipment controller, stage the DX cooling coil to maintain the desired space temperature.
 2. Start/stop of fan coil unit shall be by terminal equipment controller.

POINT DESCRIPTION	TYPES	DEVICE
Start/Stop	DO	Control Relay
Condensing Unit	DO	Control Relay
Space Temperature	AI	Space Thermistor
Status	DI	Current Relay
Discharge Air Sensor	AI	Duct Thermistor

HEATERS**3.50 ELECTRIC UNIT HEATERS**

- A. An electric thermostat shall activate the unit and stage the electric coil to maintain room setpoint.

3.51 ENERGY RECOVERY UNIT

- A. Each ERU has its own controls. BMCS shall enable unit and open outside air and exhaust air damper. Interlock ERU with the related air handling units.
- B. The BMCS controls for energy recovery unit shall function as follows:
1. The system shall be automatically started and stopped by the BMCS panel whenever the hand-off-automatic switch is in the automatic position, and manually started and stopped by the hand position. The unit shall run when either AHU is enabled.
 2. The energy recovery unit's internal controls shall be energized, and the dampers shall open prior to starting the energy recovery unit outside air and exhaust fans.
 3. The internal controls shall start the energy recovery unit wheel rotation and modulate the wheel speed to maintain a leaving outside air temperature of 56° F in the winter mode and 79° F in the summer mode but not exceeding 50% relative humidity.
 4. The energy recovery unit's internal controls shall shut down fans upon receiving a signal from the BMCS panel showing the AHU's are disabled.
 5. On power interruption or fan shutdown, all the dampers shall close.
 6. Smoke detector in the outside air duct downstream of the energy recovery unit shall automatically shut down the fans.

POINT DESCRIPTION	TYPES	DEVICE
Start/Stop OA Fan	DO	Control Relay
Status OA Fan	DI	Current Relay
Start/Stop EF Fan	DO	Control Relay
Status EF Fan	DI	Current Relay
Energy Recovery Wheel VFD	DO	Control Relay
Energy Recovery Wheel VFD Status	DO	Control Relay
Entering OA Temp	AI	Thermistor
Entering OA Humidity	AI	Relative humidity sensor
Leaving OA Temperature	AI	Thermistor

POINT DESCRIPTION	TYPES	DEVICE
Leaving OA Humidity	AI	Relative humidity sensor
Entering EA Temperature	AI	Thermistor
Entering EA Humidity	AI	Relative humidity sensor
Leaving EA Temperature	AI	Thermistor
Leaving EA Humidity	AI	Relative humidity sensor
Differential Across Filters	DI	High / Low limit Switch
EA & OA Dampers	DO	Control Relay

3.52 WATER SOURCE HEAT PUMPS

A programmable controller capable of stand-alone operation will control the unit. The constant volume water source heat pump will be started via pre-determined optimum start through the Building Automation System (BAS). The unit will be de-energized in accordance with time schedules through the BAS.

General: See the Water Source Heat Pump schedule for unit configurations and requirements.

Unoccupied Mode: The supply fan will be indexed off and will remain off until the start of night high limit, night low limit, warmup, cooldown, or occupied mode. The outside air damper will remain closed. Loop requests are generated by the heat pumps during unoccupied periods if the WSHPs enter Warmup, Cooldown, NHL, or NLL modes.

Night Low Limit Mode (NLL): On a drop in space temperature below the night low limit setpoint (NLL, 55°F adj.), the supply fan and space temperature heating control will be enabled. When the space temperature increases above the NLL setpoint and the NHL/NLL minimum runtime has expired (2 hrs, adj.); or the occupied schedule becomes active, NLL will be disabled.

Night High Limit Mode (NHL): On a rise in space temperature above the night high limit setpoint (NHL, 85°F adj.) the supply fan and space temperature cooling control will be enabled. When the space temperature decreases below the NHL setpoint, and the NHL/NLL minimum runtime has expired (2 hrs, adj.); or the occupied schedule becomes active, NHL will be disabled.

Warmup Mode: An optimum start algorithm will determine how early the unit needs to enable to satisfy the occupied heating setpoint before the scheduled occupied mode begins. In warmup mode, the supply fan and space temperature heating control will be enabled. When the occupied schedule becomes active warmup mode will be disabled and the unit will begin occupied mode control.

Cooldown Mode: An optimum start algorithm will determine how early the unit needs to enable to satisfy the occupied cooling setpoint before the scheduled occupied mode begins. In cooldown mode, the

supply fan and space temperature cooling control will be enabled. When the occupied schedule becomes active cooldown mode will be disabled and the unit will begin occupied mode control.

Afterhours Mode: On a call for afterhours operation, by pressing the center of the wall mounted space temperature sensor, the supply fan will be enabled, and the unit will control as if it were in occupied mode. The unit will stay in afterhours override until the override timer expires or until the start of an occupied cycle; whichever occurs first. The override time (2 hrs.) can be adjusted at the Operator's Workstation.

Occupied Mode: The supply fan will be enabled and will run continuously.

Space Temperature Control: Heating and cooling signals will generate based on the deviation of the space temperature from current space temperature heating and cooling setpoints. On a drop in space temperature below the current heating setpoint, the unit will enter heating mode. On a rise in space temperature above the current space temperature cooling setpoint, the unit will enter cooling mode.

Space Humidity Control: On a raise in space humidity above the current humidity setpoint (60% RH), the unit will enter dehumidification mode. The unit shall remain in dehumidification mode until space humidity is stratified.

Compressor Control: The compressor will enable based on the space heating and cooling signals. In cooling mode, the reversing valve will be commanded to the cooling position. As the cooling signal increases, the compressor will enable. In heating mode, the reversing valve will be commanded to the heating position. As the heating signal increases, the compressor will enable. Once enabled, the compressor will stay commanded for a minimum ON time of 5 minutes (adj.). After the compressor has disabled, it will not be commanded to run again for a minimum OFF time of 3 minutes (adj.).

Alarms: The following software alarms will be generated and displayed at the Operator's Workstation:

- Space Too Warm (3°F greater than cooling setpoint)
- Space Too Cold (3°F less than heating setpoint)
- Bad Space Temp Sensor Alarm (greater than 120°F or less than 40°F)
- High Supply Air Temp (greater than 180°F)
- Low Supply Air Temp (less than 45°F)
- Bad Supply Temp Sensor Alarm (greater than 180°F or less than -20°F)
- Supply Fan Alarm (command with no status)
- Filter Alarm (when runtime exceeds 3000 hours, (adj.))

Safeties: The following safeties will be monitored as a status input and will be displayed at the Operator's Workstation:

- Condensate Switch: A Condensate Switch will, when activated, disable the unit.
- Condenser Water Loop System Fault: The unit will shutdown if the Heat Pump Water Loop System temperature > high temperature shutdown setpoint (95°F, adj.) or < low temperature shutdown setpoint (55°F, adj.), or if both Loop Water Pumps (P-1, P-2) fail.

Manual System Operation: In the event of DDC failure, the system can be operated in manual ("Hand") mode. The supply fan can be started manually through its H-O-A switch.

3.51 WATER LOOP SYSTEM

A programmable controller capable of stand-alone operation will control the Water Loop System. The Water Loop system will be indexed to run through the Building Automation System (BAS). Once enabled the boilers will operate under their own factory supplied controls, safeties, and interlocks using the manufacturer's sequence of operation. Pertinent points will be monitored and displayed at the Operator's Workstation.

General: The Water Loop control system consists of a heating loop and a cooling loop. The heating loop is comprised of two boilers with their own heating loop pumps. Hot water supply temp is regulated by a HW mixing valve. The cooling loop is comprised of one ~~evaporative-cooler~~ closed-circuit fluid cooler with its own pumps and a heat exchanger. Two condenser water loop distribution supply the Water Loop.

Condenser Loop Pumps (P-1, P-2): The condenser loop pumps are variable speed pumps setup in a lead/standby configuration. The lead pump shall be enabled during occupied hours, if a unit is in afterhours mode, or a minimum number of loop requests (5 requests, adj.) are met. The lead pump shall be rotated on a weekly basis by the BAS. On failure of the lead pump to run once indexed on the lead pump command will be disabled and the lag pump will be enabled.

Heating Loop Control:

Boiler Pump Control:

1. The boiler circulation pumps are constant speed pumps setup in a lead/standby configuration. The lead pump shall be enabled by the BAS when the hot water system is enabled. The lead pump shall be rotated on a weekly basis by the BAS. On failure of the lead pump to run once indexed on the lead pump command will be disabled and the lag pump will be enabled. Once a heating loop pump status is proven the lead boiler recirculation pump will be enabled. Once a boiler recirculation pump is enabled, its associated boiler will enable 30 seconds later. If a boiler has been enabled to run for 15 minutes (adj.) and the condenser loop return temperature is below 55°F (adj.) or the hot water supply temperature is below 100°F (adj.), the lag boiler recirculation pump will be enabled. If the lag pump is enabled because of a low hot water supply temperature, a lead boiler failure alarm will generate.

Boiler Control:

2. The boiler controls shall be indexed to run when the condenser loop water return temperature is <60° F (adj.). The boilers shall be disabled when the condenser loop water pump (P-1, P-2) is disabled, when the closed-circuit fluid cooler is enabled or when outside air temperature is >50° F (adj.). The boiler water pump shall be indexed to run when a boiler is activated. Upon activation, after the purge cycle is completed, the burner shall start at low fire and the temperature control valve (V1) shall open to a minimum position (10%, adj.). Each boiler shall be set to maintain the water temperature leaving the boiler at 85° F. Low load condition shall allow only one boiler to operate with water circulating through both boilers at the same time. The lag boiler shall be activated when the circulated mixed water temperature entering the boilers is <60° F (adj.). The lag boiler shall be deactivated when the circulated mixed water temperature entering the boilers is >80° F (adj.). The BAS will alternate the boilers on a weekly basis to determine the lead boiler.

Mixing Valve Control (V2):

3. The HW loop mixing valve (V2) will modulate as necessary to maintain the condenser loop return temperature heating setpoint 75° F(adj.). If the HW loop mixing valve is fully closed to the

loop (not supplying any HW) for 10 minutes (adj.) and the condenser loop water return temperature continues to rise, the heating loop will be disabled.

Closed-Circuit Fluid Cooler Loop Control: The closed-circuit fluid cooler pump is a constant speed pump. Once condenser loop pump status is proven and the condenser loop water return temperature rises above the cooling setpoint 80°F (adj.) the lead closed-circuit fluid cooler pump will be enabled. On failure of the pump to run once indexed from the BAS, the BAS shall be alarmed. Enabling the closed-circuit fluid cooler pump will be the first stage of cooling. If the condenser water temperature continues to rise after 10 minutes (adj.), the closed-circuit fluid cooler fan will be enabled on low speed. If temp continues to rise after another 10 minutes (adj.), the closed-circuit fluid cooler fan will be enabled on high speed.

The closed-circuit fluid cooler pump and closed-circuit fluid cooler fan will disable will when the condenser return temperature drops below 75°F(adj.), for 10 min.(adj).

Temperature Control: The temperature control valve position shall be limited so that water temperature leaving the boiler is >95° F or water entering the boiler is >70° F. The temperature control valve (V1) shall remain closed to HWS when the boilers are not in operation.

Freeze Protection: If outside air temperature falls below 35° (adj.) the heating loop pumps shall be enabled, and the boilers shall be enabled.

Alarms: The following software alarms will be generated and displayed at the Operator's Workstation:

- Heating Loop Pump Failure (BP-1) (command with no status)
- Heating Loop Pump Failure (BP-2) (command with no status)
- Heating Loop Pump Failure (BP-1) "In Hand" (status with no command)
- Heating Loop Pump Failure (BP-2) "In Hand" (status with no command)
- Loop Water Pump Failure (P-1) (command with no status)
- Loop Water Pump "In Hand" (P-2) (status with no command)
- Cooling Tower Pump Failure (CP-1) (command with no status)
- Cooling Tower Fan Failure (command with no status)
- Bad Heat Pump Loop Supply Temp Sensor (greater than 180°F or less than -20°F)
- Bad Heat Pump Loop Return Temp Sensor (greater than 180°F or less than -20°F)
- Bad Cooling Tower Return Temp Sensor (greater than 180°F or less than -20°F)
- Low Hot Water Supply Temp (<95°F, adj.)
- High Hot Water Supply Temp (>185°F, adj.)
- Low Loop Water Supply Temp (<55°F, adj.)
- High Loop Water Supply Temp (>95°F, adj.)
- Low Cooling Tower Water Supply Temp (<55°F, adj.)
- High Cooling Tower Water Supply Temp (>95°F, adj.)

3.71 CONDENSER WATER CONTROL

- A. A sensor located in the condenser water supply shall, through a DDC panel:
1. Modulate the three-way valve located in the condenser water piping.
 2. When the three-way control valve is in the full cooling position with all the water flowing over the tower and no water being by-passed enable the tower fan.
 3. Cycle the tower fan to maintain water temperature entering each condenser at 85°F.

4. As the temperature decreases cycle the fan to the off condition and modulate the three-way control valve towards the by-pass position.
- B. Controller sequence:
1. Throttling range: - 20°F.
 2. Set point: 85°F (adjustable)
 3. At set point the condenser water shall be full flow to the tower riser.
 4. Maximum condenser water supply: 85°F.
 5. Energize the tower fan at 82°F.
- C. Provide wiring for vibration switch, with manual reset, to de-energize the fan in the event of a sensed malfunction.
1. Set limits as recommended by the tower manufacturer.

POINT DESCRIPTION	TYPE	DEVICE
Start/Stop Pump	DO	Control Relay
Start/Stop Tower Fan	DO	Control Relay
Tower Bypass Valve	AO	Electronic Operator
Status (Pumps)	DI	Current Sensitive Relay
Status (Tower Fan)	DI	Current Sensitive Relay

3.73 CONDENSER WATER SYSTEM BYPASS

- A. The system consists of condenser water system pressure sensors and a system bypass valve controlled as follows:
1. A system differential pressure sensor shall modulate the condenser water bypass valve to maintain system pressure.

POINT DESCRIPTION	TYPES	DEVICE
System Differential Pressure	AI	Pressure Sensor
Bypass Valve	AO	Electronic Operator

3.78 CHEMICAL TREATMENT SYSTEM

- A. Monitor water treatment power circuit and alarm contacts from water treatment controllers. Provide with cooling tower systems only.

3.82 START-UP AND POINT VERIFICATION

- A. Final startup and point verification shall include the following information.
 - 1. Field panel checkout:
 - a. Verify enclosure is not mounted on vibrating surface.
 - b. Verify class I and class II wiring is separated within enclosure.
 - c. Check for shorts/grounds/induced voltages/proper voltages.
 - d. Verify proper point terminations in accordance with as-builts.
 - e. Verify that all modules are in proper place and addressed.
 - f. Verify proper power voltage.
 - g. Load database and programming.
 - h. Startup the panel.
 - i. Point and device checkout.
 - 2. Analog input point checkout:
 - a. Verify the correct wiring terminations per the design documentation package, at the field panel. Verify that all wiring and terminations are neat and dressed.
 - b. Verify the point address by checking that the analog input instrument is wired to the correct piece of field equipment. Do this by altering the environment at the sensing element or by disconnecting one of the wires at the sensor, and verifying that the reading at the field panel has reacted to this change.
 - c. Verify the point database to be correct, (i.e., alarmability, alarm limits, slope/intercept, engineering units, etc.). Verify that the correct change of value (COV) limit has been defined.
 - d. Verify the sensor has the correct range and input signal. (i.e., 20-120°F, 4 - 20 ma). Verify that the device is mounted in the correct location and is wired and installed correctly per the design documentation package.
 - e. Set-up and/or calibrate any associated equipment (i.e., panel LCD meters, loop isolators, etc.). Verify that these auxiliary devices are mounted in the correct location and are wired and installed correctly per the design documentation package.
 - f. Verify the correct reading at the field panel using appropriate MMI devices. Verify that any associated LCD panel meters indicate the correct measured value.
 - 3. Digital input point checkout:
 - a. Verify the device is correctly wired and terminated as shown in the design documentation package. Verify that all wiring and terminations are neat and properly secured.
 - b. Verify the point address by verifying that the digital input is correctly terminated at the controlled piece of equipment.
 - c. Verify the point database is correct (i.e., point name, address, alarmability, etc.).
 - d. Set-up and/or calibrate the associated equipment, i.e. smoke detector, high/low temp detector, high/low static switch, end switch, current relay, pressure switch, etc. is mounted in the correct location, and is wired and installed correctly per the control system installation drawings.
 - e. With the controlled equipment running or energized as described in the digital output checkout procedures, verify the correct operation of the digital input point and associated equipment by putting the digital input

monitored equipment into its two states. Verify that the proof or status point indicates the correct value at the operator's terminal and that the status led is giving the proper indication in each mode of operation (on/off).

4. Digital output point checkout:
 - a. Verify that device is correctly wired and terminated as shown in the design documentation package.
 - b. Verify that the correct voltage is utilized in the circuit.
 - c. Verify the point database to be correct (i.e. point name, address, etc.).
 - d. Check and verify that the end device responds appropriately to the digital output(s).
 - e. After verifying the set-up and operation of any associated digital input/proof points, check and verify correct operation of the logical point and associated equipment by commanding the point to all possible states (i.e. off, on, fast, slow, auto, etc.). Verify that the defined proof delay is adequate for all modes of operation.
 - f. If any interlocked equipment exists that has independent hand-off-auto or auxiliary control wiring, verify correct operation of same. Also check that any interlocked equipment such as EP switches for damper operation or exhaust and return fans are wired correctly and operate correctly.
 - g. Verify that the controlled piece or pieces of equipment cannot be caused to change state via the digital output if an associated hand-off-auto switch is in the hand/on or hand/off mode of operation, unless specified as a fireman's override point etc.
5. Analog output point checkout:
 - a. Verify the correct wiring or piping terminations per the design documentation package, at the field panel. Verify that all wiring and piping terminations are neat and dressed.
 - b. Insure that the correct output device(s) are installed per the Control System Installation Drawings. (i.e., I/P or P/I transducers, transformers, power supply, etc.). Verify that these devices are installed, wired and piped correctly. Verify that any configuration jumpers are in the proper settings for the required application. Verify related transformers are fused in accordance with installation drawings.
 - c. Verify the point database to be correct. Verify that the correct COV limit has been defined.
 - d. Verify the point address by checking that the analog output is wired and/or piped to the correct output transducer and/or equipment.
 - e. Verify that the controlled device is calibrated (i.e., 3-8PSI valve, 8-13 PSI damper motor, 4-20 ma variable frequency drive, etc.) and is in the correct location, and is wired or piped and installed correctly per the design documentation package. If the controlled device is not calibrated, then a three-point (high, low and mid-point) calibration procedure must take place. Verify proper operation of the end device. When calibration has been verified, ensure that installation drawings, point database, and PPCL have been updated.
 - f. Set-up and or calibrate any associated equipment, (i.e., panel LCD meters, loop isolators, pneumatic gauges, etc.). Also verify that these auxiliary devices are mounted in the correct location, and are wired or piped and installed correctly per the design documentation package.
 - g. After verifying the set-up and operation of any associated equipment check for the correct operation of the logical point and associated

- equipment by commanding the analog output to the top and bottom of its range. Verify that the control device(s) responded appropriately as indicated by the design documentation package. Check to insure that all network terminals, host console devices, etc. can also command these outputs.
- h. Check that all pneumatic gauges, pilot positioners and LCD panel meters indicate the correct values.
- 6. Terminal equipment controller checkout:
 - a. Load program database
 - b. Enable programs
 - c. Verify sequence of operations
- 7. Programming checkout:
 - a. Provide checkout for each system and sequence of operation.
 - b. The following are sample sequence of operations tests. The intent of these procedures is to provide a plan of action to verify system operations via block checks of the project specific sequence of operations. The procedures may be used in this format, or one procedure to a page should more detail be required. The procedures outlined below should be verified for accuracy and may be modified to meet your specific requirements.
 - c. Description of Test: AHU Alarm Checkout. Verify AHU-1 discharge air temperature alarming is operational and is received at the designated terminal.
 - d. Input to Trigger Test: Change discharge temperature high alarm limit through software to a value below the current discharge temperature (discharge temperature - 10°F).
 - e. Expected Outcome: A high temperature alarm will be received per the Alarm Definition Report at its designated terminal.
 - f. Provide signoff sheet with indication for test Pass, Fail, Date of test and Initials for signoff.
- 8. Workstation checkout:
 - a. Verify the operation of all trunk interface equipment.
 - b. Verify all workstation software, including options, based upon the installation instructions for the PC.
 - c. Perform software backup (site, options, etc.)
 - d. Complete workstation configuration report for owner signoff.
 - e. Provide verification that all graphics have been created, as required by project bid documents.

3.83 TESTING AND ACCEPTANCE

- A. General:
 - 1. After completion of installation and start-up procedures, commence the specified 3-phase verification and testing sequence leading to final acceptance.
 - a. Follow in the order specified.
 - b. Each testing phase shall be satisfactorily completed before entering the next phase.
 - 2. Prior to entering each phase of the sequence, submit for approval, a written agenda describing in detail the procedure to be followed to meet the requirements for each specified verification, test or demonstration.
 - 3. Submit for approval, a sample of the form on which the test will be reported.
 - a. Identify project.

- b. Provide a list of all points, arrange in numerical order of point addresses.
 - 1) Show point descriptor and location of each.
 - 2) Indicate DDC panel that processes each point.
 - 3) Use the list as a basis for the specified report form.
 - c. Signatures of participants and observers.
 - d. Results.
 - e. Description of adjustment or corrections of points in error.
 - f. Date.
 4. Provide schedule of tests. Estimate dates of significant events.
 5. Test, calibrate and adjust each point in the system as specified.
 6. Provide documentation of all tests and verifications as specified.
 7. Provide trend reports indicating proper control of all points for an extended period of time.
- B. Phase 1 - Testing, Calibrating, and Adjusting:
 1. Operate each analog point in the entire system.
 - a. At a point in the upper quarter of its range.
 - b. At a point in the lower quarter of its range.
 - c. At its operating point.
 2. Provide personnel and diagnostic instruments at both the central and remote locations.
 3. Provide testing stimulants for alarms.
 4. Use digital meters of double the accuracy of the instruments being calibrated.
 5. Provide an approved test device for simulating high and low temperatures.
 6. When the function is performed, read values at the central control and observe the actual function at the field instrument.
 7. Exercise each binary point and observe indication at console and simultaneously observe operation in the field.
 8. Submit an operation report for each point in the system, in approved format, and describe any corrective or adjusting action taken.
 9. Test all power transducers with a Dranetz Power Analyzer.
- C. Phase 2 - Equipment and Point Verification:
 1. Verify calibration or function of each point.
 - a. Verify analog points at operating value.
 - b. Record on specified form.
 - c. Make approved adjustments to out of tolerance points.
 - 1) Identify these points for ready reference.
 2. After verification procedure is completed:
 - a. Verify corrected points.
 - b. Record on specified form.
 - c. Points requiring correction.
 - 1) Replace sensor or actuator if electrical measurements indicated components are out of specified tolerance.
- D. Phase 3 - Software Verification:
 1. Submit agenda and report format for software demonstrations.
 2. Demonstrate to the Owner and the Engineer that all software programs and automatic control sequences function as specified.
 3. Demonstrate compliance with response time specifications.

- a. Simulate normal heavy load conditions.
 - b. Initiate at least ten successive occurrences on normal heavy load conditions as specified, and measure response time of typical alarms and status changes.
- 04. Provide written documentation of demonstration, signed by representatives of the Contractor and Engineer.
- E. Provide the following reports to Engineer at final completion of all Testing:
 - 1. List of all points.
 - 2. List of all points currently in alarm.
 - 3. List of all disabled points.
 - 4. List of all points in over-ride status.
 - 5. List of all points currently locked out.
 - 6. List of user accounts and access levels.
 - 7. List all weekly schedules.
 - 8. List of holiday programming schedules.
 - 9. List of limits and deadbands.
 - 10. System diagnostics reports including, list of DDC panels on line and communicating, status of all DDC terminal units device points.
 - 11. List of programs.
 - 12. Provide trend data reports to ensure proper operation and sequence control of BMCS.
- F. Substantial Completion of the BMCS will not occur until completion and acceptance of all testing and acceptance procedures.

3.84 TRAINING

- A. The contractor shall provide factory-trained instructor to give full instruction to designated personnel in the operation of the system installed. Instructors shall be thoroughly familiar with all aspects of the subject matter they are to teach. The contractor shall provide all students with a student binder containing product specific training modules for the system installed. All training shall be held during normal working hours of 8:00 am to 4:30 PM weekdays.
- B. Provide 40 hours of training for Owner's designated operating personnel. Training shall include:
 - Explanation of drawings, operations and maintenance manuals
 - Walk-through of the job to locate control components
 - Operator workstation and peripherals
 - DDC controller and ASC operation/function
 - Operator control functions including graphic generation and field panel programming
 - Operation of portable operator's terminal
 - Explanation of adjustment, calibration and replacement procedures
 - Student binder with training modules
- B. Since the Owner may require personnel to have more comprehensive understanding of the hardware and software, additional training must be available from the Contractor.

3.85 PROJECT MANAGEMENT

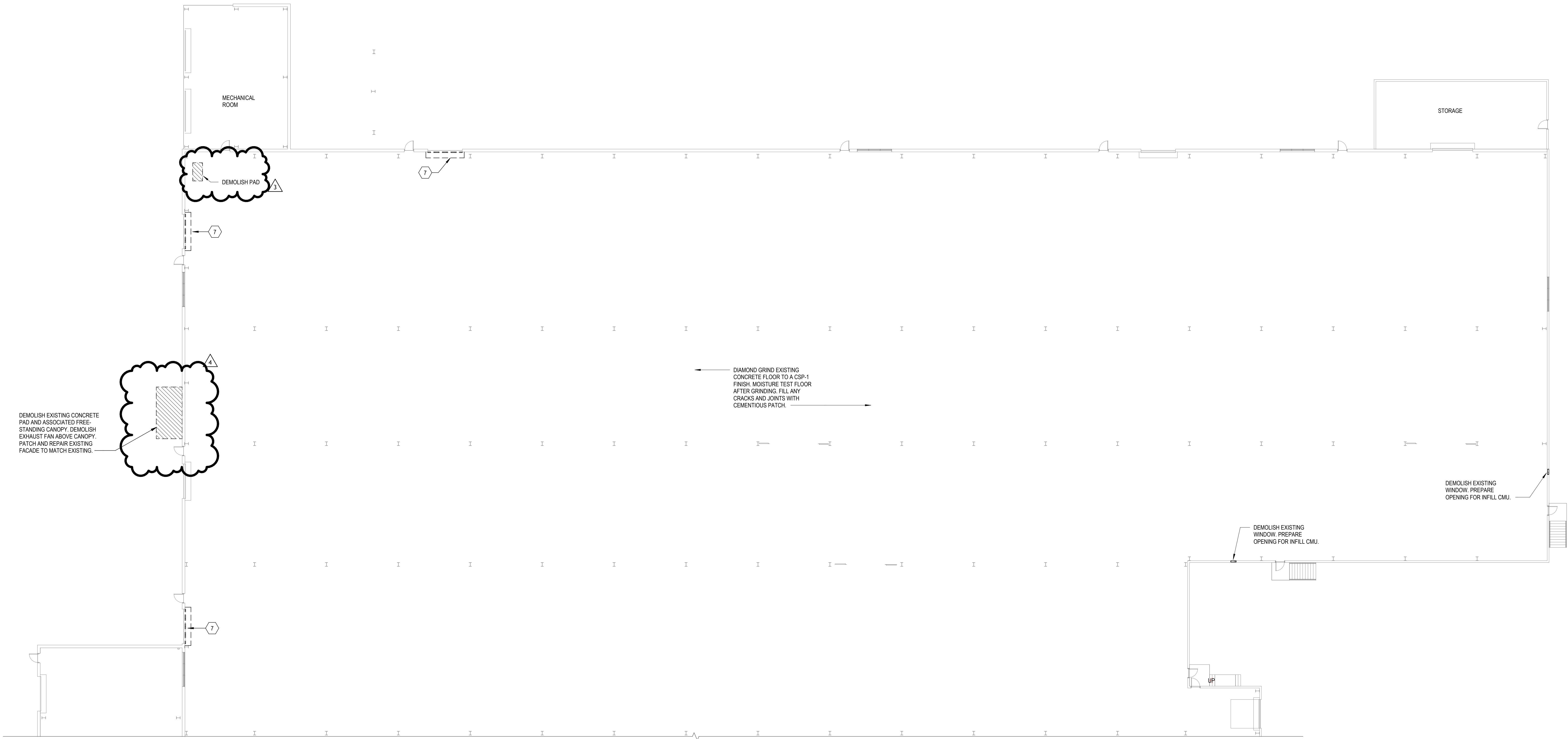
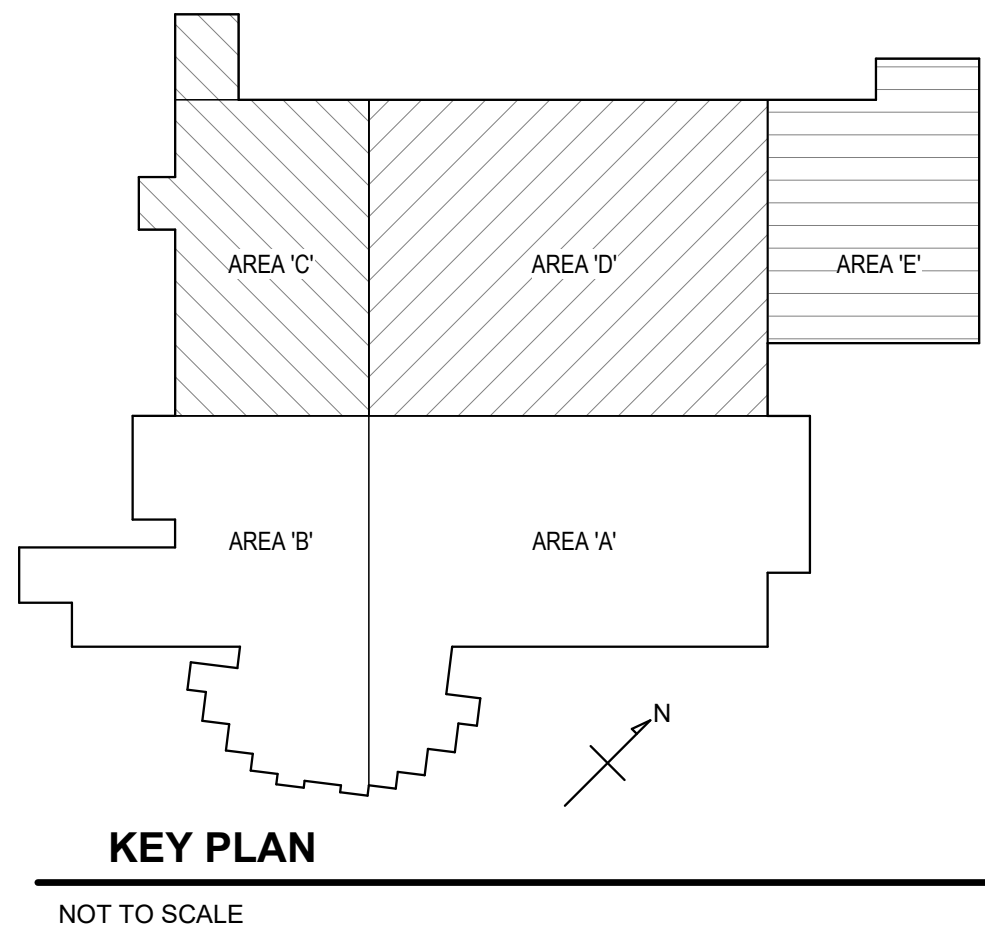
- A. Provide a designated project manager who will be responsible for the following:
 - 1. Construct and maintain project schedule.
 - 2. Authorized to accept and execute orders or instructions from General Contractor, Owner / Architect & Engineer.
 - 3. Attend project meetings as necessary to avoid conflict and delays.
 - 4. Make necessary field decisions relating to this section.
 - 5. Coordination / Single point contact.
 - 6. Have Internet access for project management.

END OF SECTION

GENERAL NOTES

- ALL DEMOLITION WORK SHALL BE PERFORMED IN COMPLIANCE WITH ALL APPLICABLE LOCAL, STATE AND FEDERAL CODES AND REGULATIONS.
- THE DEMOLITION PLANS ARE INTENDED TO REASONABLY REPRESENT EXISTING CONDITIONS. ACTUAL CONDITIONS MAY DEViate FROM THAT SHOWN ON THE DRAWINGS. THE CONTRACTOR SHALL VISIT THE JOBSITE AND VERIFY ACTUAL CONDITIONS AND COORDINATE THE DEMOLITION WORK WITH THE NEW WORK SO THAT DEMOLITION IS COMPLETE. FIELD VERIFY ALL DIMENSIONS SHOWN ON DRAWINGS PRIOR TO CONSTRUCTION AND NOTIFY ARCHITECT OF ANY DISCREPANCIES.
- PROVIDE ALL LABOR, MATERIAL, EQUIPMENT AND SERVICES AND PERFORM ALL OPERATIONS REQUIRED FOR COMPLETE INTERIOR DEMOLITION AND RELATED WORK AS DESCRIBED HEREIN, AND AS MAY BE REASONABLY IMPLIED AS NECESSARY TO COMPLETE NEW CONSTRUCTION WORK.
- THE CONTRACTOR SHALL BE AWARE THAT THE BUILDING WILL BE OCCUPIED AND IN-USE DURING THE LENGTH OF THE CONTRACT. THE CONTRACTOR SHALL CONDUCT THEIR OPERATIONS SO THAT THERE WILL BE MINIMUM INTERFERENCE WITH THE CONTINUED OPERATIONS OF THE BUILDING AND STAFF. COORDINATE TIMING AND HOURS OF DEMOLITION OPERATIONS WITH THE OWNER. MINIMIZE NOISE FROM DEMOLITION OPERATIONS PARTICULARLY WHEN CONDUCTED DURING REGULAR WORKING HOURS.
- CONDUCT DEMOLITION OPERATIONS TO PREVENT INJURY TO PEOPLE AND DAMAGE TO ADJACENT BUILDING AREAS. THE CONTRACTOR SHALL TAKE ALL PRECAUTIONS TO ENSURE SAFE PASSAGE OF PEOPLE THROUGH AND AROUND SELECTIVE DEMOLITION AREAS. MAINTAIN SAFE MEANS OF EGRESS FROM THE BUILDING AT ALL TIMES.
- THE CONTRACTOR IS RESPONSIBLE FOR INSURING THE STRUCTURAL STABILITY OF THE EXISTING BUILDING IN THE AREAS INVOLVING NEW WORK OR FOR PROTECTING THE EXISTING BUILDING FROM DAMAGE DURING THE COURSE OF THE WORK. DO NOT ALTER THE STRUCTURAL INTEGRITY OF THE EXISTING BUILDING OR ITS ASSEMBLIES UNLESS SPECIFICALLY DIRECTED TO BY THE ARCHITECT.
- NO DEMOLITION SHALL OCCUR WHICH LEAVES THE BUILDINGS INTERIOR WITHOUT WEATHER PROTECTION. ALL DEMOLITION AT EXTERIOR SURFACES SHALL BE FOLLOWED IMMEDIATELY BY PROTECTIVE CONSTRUCTION. THE CONTRACTOR SHALL PROVIDE AND INSTALL SECURE TEMPORARY PROTECTION IN ALL OPENINGS.
- EXISTING CONSTRUCTION TO REMAIN UNLESS OTHERWISE NOTED. THE CONTRACTOR SHALL TAKE ALL POSSIBLE PRECAUTIONS AGAINST DAMAGE TO ALL EXISTING CONSTRUCTION INTENDED TO REMAIN. TAKE CARE NOT TO ENCRDACH ON ADJACENT OCCUPIED AREAS OR AREAS NOT WITHIN THE SCOPE OF WORK. ANY DAMAGE CAUSED BY THE CONTRACTORS DEMOLITION OPERATIONS SHALL BE REPAIRED AT CONTRACTOR'S EXPENSE TO THE COMPLETE SATISFACTION OF THE ARCHITECT AND OWNER.
- GENERAL CONTRACTOR SHALL MAINTAIN A SEPARATION BETWEEN AREAS WITHIN THE SCOPE OF THE WORK AND AREAS OUTSIDE THE SCOPE OF THE WORK BY PROVIDING A DUST BARRIER FOR PROTECTION OF EXISTING AREAS TO REMAIN AS REQUIRED. USE ALL MEANS NECESSARY TO PREVENT THE SPREAD OF DUST TO ADJACENT AREAS.
- REMOVE FROM SITE ALL DEMOLISHED MATERIALS, DEBRIS AND RUBBISH ON A DAILY BASIS. DO NOT ACCUMULATE DEBRIS ON THE FLOOR OR AT THE SITE. DISPOSE OF ALL DEMOLISHED OR REMOVED MATERIALS LEGALLY OFF THE SITE COMPLYING WITH ALL LOCAL HAULING AND DISPOSAL REQUIREMENTS. UPON COMPLETION, CLEAN ALL AREAS IMPACTED BY THE DEMOLITION, INCLUDING, BUT NOT LIMITED TO, ADJACENT OCCUPIED AREAS AND AREAS NOT WITHIN THE SCOPE OF WORK.
- REMOVAL AS DESCRIBED HEREIN SHALL BE ACCOMPLISHED WITHOUT STORING ON THE FLOOR EXCESSIVE QUANTITIES OF ANY MATERIALS OR WASTE RESULTING FROM THE REMOVAL OPERATIONS ON THE FLOOR.
- THE ARCHITECT HAS NO KNOWLEDGE OF AND SHALL NOT BE HELD LIABLE FOR ANY ASBESTOS OR OTHER HAZARDOUS MATERIALS ON JOBSITE. IF THE CONTRACTOR ENCOUNTERS WHAT APPEARS TO BE HAZARDOUS MATERIALS DURING CONSTRUCTION, HE SHALL IMMEDIATELY ISOLATE THE AFFECTED AREAS AND FOLLOW THE PROCEDURES OUTLINED IN THE PROJECT MANUAL FOR RESOLUTION.
- CONTRACTOR TO REVIEW WITH ARCHITECT ALL ITEMS SCHEDULED TO BE DEMOLISHED, SALVAGED AND RELOCATED. SAID ITEMS TO BE REMOVED CAREFULLY, PROTECTED AND STORED PRIOR TO RELOCATION.
- DEMO PLAN KEYED NOTES APPLY TO ITEMS TAGGED, AND REPETITIVE/TYPICAL ITEMS & CONDITIONS WHICH MAY ONLY BE TAGGED AT ONE LOCATION AND NOT AT EVERY OCCURRENCE.
- REFER TO STRUCTURAL, MECHANICAL, PLUMBING AND ELECTRICAL DRAWINGS FOR SPECIFIC DEMOLITION INFORMATION NOT INDICATED ON THESE DRAWINGS.
- REPAIR ALL AREAS DAMAGED DURING DEMOLITION TO MATCH ADJACENT CONSTRUCTION.
- PREPARE ALL AREAS REMAINING AFTER DEMOLITION TO RECEIVE NEW FINISH AND/OR CONSTRUCTION.
- REFER TO MECHANICAL, ELECTRICAL, AND PLUMBING DRAWINGS FOR ADDITIONAL DEMOLITION.
- PARGE ALL CMU DAMAGED DURING DEMOLITION IN AREAS TO REMAIN EXPOSED TO MATCH ADJACENT CONSTRUCTION.
- PATCH ALL HOLES IN WALLS, ROOFS, FLOOR SLABS, ETC. FROM DEMOLITION OF EXISTING MECHANICAL, ELECTRICAL, AND PLUMBING EQUIPMENT TO MATCH ADJACENT CONSTRUCTION.

#	KEYED NOTES - DEMO PLAN
1	REMOVE EXISTING CMU WALL TO THE EXTENT SHOWN AS REQUIRED FOR INSTALLATION OF A DOOR. REPAIR AND PREPARE ADJACENT SURFACES TO RECEIVE NEW WORK.
2	REMOVE EXISTING CMU WALL AND ASSOCIATED OPENINGS TO EXTENT SHOWN. REPAIR AND PREPARE ADJACENT SURFACES TO RECEIVE NEW WORK.
3	REMOVE EXISTING DOOR(S), FRAME AND HARDWARE. REPAIR AND PREPARE ADJACENT SURFACES TO RECEIVE NEW WORK.
4	REMOVE EXISTING PARTITION WALL AND ASSOCIATED OPENINGS TO EXTENT SHOWN. REPAIR AND PREPARE ADJACENT SURFACES TO RECEIVE NEW WORK.
5	DEMOLISH EXISTING PLUMBING FIXTURES, PIPES, PARTITIONS, AND CHASE WALLS TO EXTENT SHOWN. REPAIR AND PREPARE ADJACENT SURFACES AND FLOOR TO RECEIVE NEW WORK.
6	DEMOLISH EXISTING STOREFRONT WINDOW. REPAIR AND PREPARE FOR NEW INFILL CMU WALL.
7	DEMOLISH EXISTING OVERHEAD DOOR AND ASSOCIATED HARDWARE. REPAIR AND PREPARE FOR NEW STUD INFILL WALL.
8	DEMOLISH EXISTING SHOWER PARTITIONS AND PLUMBING.
9	DEMOLISH EXISTING FLOOR SURFACE. REPAIR AND PREPARE SURFACE FOR NEW FLOORING.
10	DEMOLISH EXISTING CASEWORK. REPAIR AND PREPARE FOR NEW WORK.
11	DEMOLISH EXISTING DOOR PANEL(S) ONLY. FRAME TO REMAIN. PREPARE EXISTING FRAME FOR NEW PANEL AND HARDWARE.
12	DEMOLISH COUNTER AND LAVATORIES. REPAIR AND PREPARE FOR NEW LAVATORIES.



DEMO PLAN - FIRST FLOOR AREA 'C', 'D', AND 'E'

1/16" = 1'-0"



NO.	REVISIONS	DATE
3	ADDENDA 3	MAY 5, 2025
4	ADDENDA 4	MAY 15, 2025

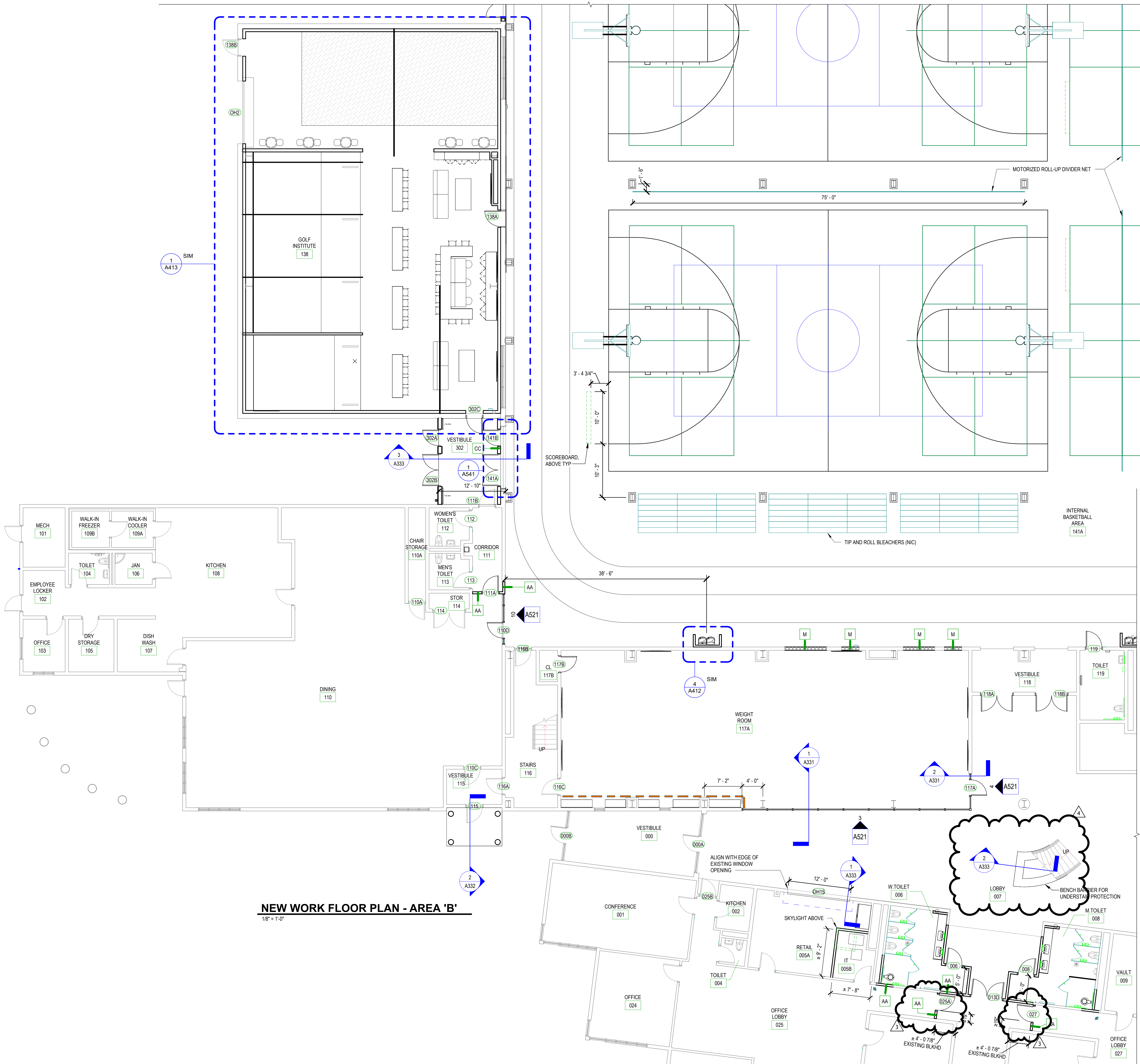
FACILITY RENOVATION
PULASKI COUNTY INDOOR SPORTSPLEX AND EXPO CENTER
PULASKI COUNTY PARKS AND RECREATION
DUBLIN, VA
CONSTRUCTION DOCUMENTS

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DEMO FIRST FLOOR PLAN - AREA 'CDE'

DRAWN KSM	CHECKED JFH
	DATE APR 10, 2025
	COMM. NO. 24060





NEW WORK FLOOR PLAN - AREA 'B'
1/8" = 1'-0"

GENERAL NOTES

- INTERIOR PARTITIONS ARE DIMENSIONED TO FACE OF NEW STUD, CMU FACE, OR EXISTING FINISHED SURFACE UNLESS NOTED OTHERWISE.
- THE HINGE SIDE OF NEW INTERIOR DOOR FRAMES ARE LOCATED 4" FROM FACE OF ADJACENT WALL (METAL STUD) AND 4" FROM FACE OF ADJACENT WALL (MASONRY) UNLESS NOTED OTHERWISE.
- PROVIDE FIRE-TREATED WOOD BLOCKING IN CAVITY OF METAL STUD PARTITIONS FOR ALL WALL-MOUNTED ITEMS.
- TIP AND ROLL BLEACHERS ARE NOT IN CONTRACT.
- APPLY SAFETY PADDING AT ALL EXPOSED STEEL COLUMN LOCATIONS IN THE ACTIVITY AREA.
- AT ALL MASONRY INFILL LOCATIONS, TOOTH NEW CMU INTO EXISTING WALL. PAINT AND REPAIR TO MATCH EXISTING.
- ABUSE RESISTANT GWB TO BE INSTALLED UP TO 8'-0" AFF. STANDARD GWB TO BE USED ABOVE 8'-0" AFF.

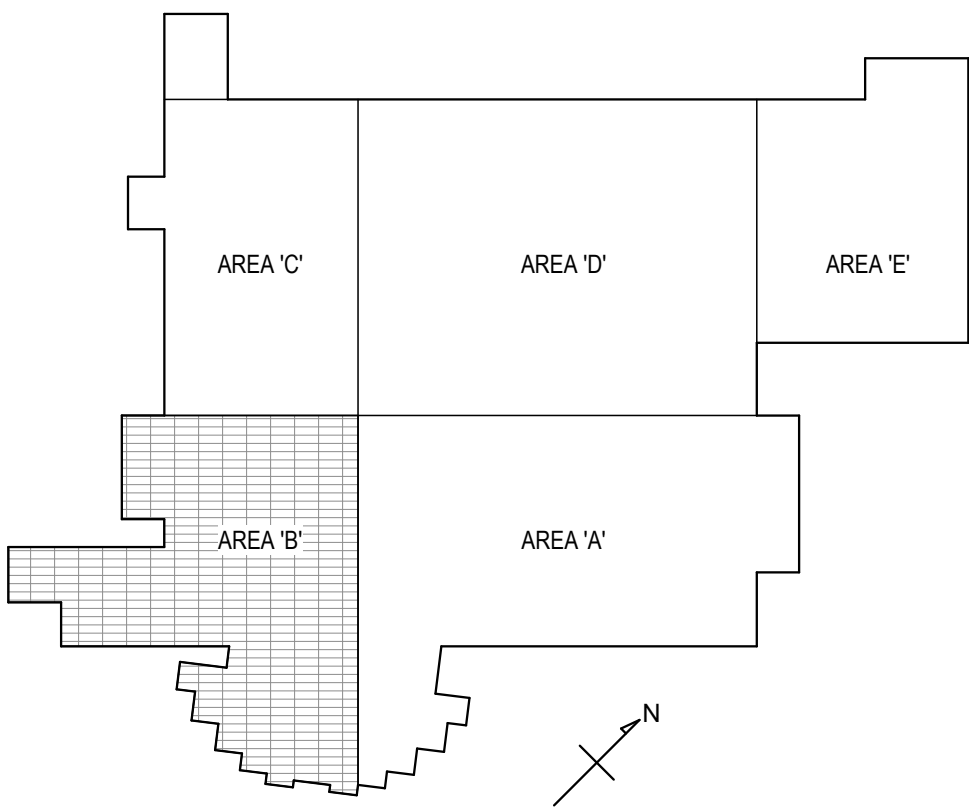
LEGEND

- DOOR TAG
- PARTITION TYPE TAG
- ROOM TAG
- INTERIOR WINDOW ELEVATION
- BUILDING SECTION, ELEVATION, AND ENLARGED PLAN

WALL SCHEDULE

MARK	CORE	HEAD	FINISH SIDE A	FINISH SIDE B
A	3-5/8" MTL STUD	ABOVE CEILING	5/8" GWB	5/8" GWB
AA	3-5/8" MTL STUD	TIGHT TO STRUCTURE	5/8" GWB	5/8" GWB
B	3-5/8" MTL STUD	ABOVE CEILING	5/8" GWB	----
BB	3-5/8" MTL STUD	TIGHT TO STRUCTURE	5/8" GWB	----
C	6" MTL STUD	ABOVE CEILING	5/8" GWB	5/8" GWB
CC	6" MTL STUD	TIGHT TO STRUCTURE	5/8" GWB	5/8" GWB
D	6" MTL STUD	ABOVE CEILING	5/8" GWB	----
DD	6" MTL STUD	TIGHT TO STRUCTURE	5/8" GWB	----
E	2-1/2" MTL STUD	ABOVE CEILING	5/8" GWB	----
M	CMU - MATCH EXIST	INFILL	----	----
T1	3-5/8" MTL STUD	TIGHT TO STRUCTURE	TILE	TILE
T2	6" MTL STUD	ABOVE CEILING	TILE	----
T3	6" MTL STUD	TIGHT TO STRUCTURE	TILE	TILE
T4	6" MTL STUD	TIGHT TO STRUCTURE	TILE ON WET WALL	5/8" MR GWB

SEE A130 FOR WALL TYPE DETAILS



KEY PLAN

NOT TO SCALE



NO.	REVISIONS	DATE
3	ADDENDUM 3	MAY 5, 2025
4	ADDENDUM 4	MAY 15, 2025

FACILITY RENOVATION
PULASKI COUNTY INDOOR SPORTSPLEX AND EXPO CENTER
PULASKI COUNTY PARKS AND RECREATION
DUBLIN, VA

CONSTRUCTION DOCUMENTS

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**FIRST FLOOR
PLAN - AREA 'B'**

DRAWN KSM	CHECKED JFH
DATE APR 10, 2025	COMM. NO. 24060



[illegible]

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DRAWN KSM CPM	CHECKED
	DATE APR 10, 2025
	COMM. NO. 24060



1. SEE SHEET E001 FOR ELECTRICAL LEGEND, GENERAL NOTES AND DEMOLITION NOTES.
2. SEE SHEET E401 FOR ELECTRICAL ONE-LINE DIAGRAM.
3. SEE SHEET SERIES E500s FOR PANEL SCHEDULES.

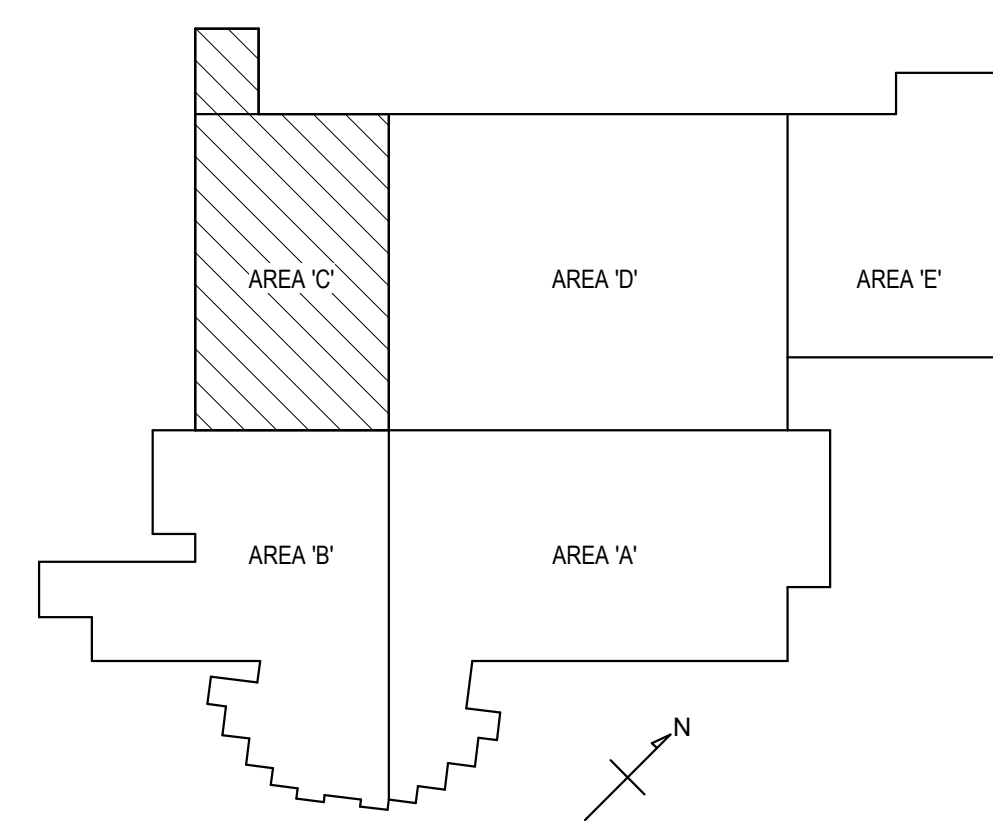

1. CEILING MOUNTED RECEPTACLE FOR SCOREBOARDS. CONTRACTOR TO COORDINATE EXACT LOCATION AND MOUNTING HEIGHTS WITH ARCHITECTURE.
2. JUNCTION BOX FOR BATTING CAGE NET POWER. CONTRACTOR TO COORDINATE SPECIFIC REQUIREMENTS WITH EQUIPMENT SELECTION.

[illegible]

CONSTRUCTION DOCUMENTS

**FIRST FLOOR PLAN -
AREA 'C' - POWER**

DRAWN ALQ	CHECKED
	SRL
	DATE APR 10, 2025
	COMM. NO. 24060

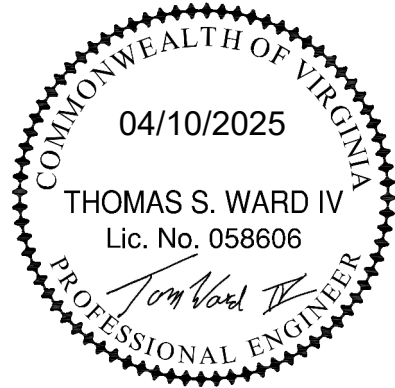


NOT TO SCALE

Scale: 1/8" = 1'-0"

Autodesk Docs/2450-70822-00 Pulaski County Recreation Center Renovation Ph 1 - Dublin, VA/2450-70822-00 Pulaski County Recreation Center Renovation Ph 1_MEP R24.rvt

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GENERAL NOTES:

- SEE SHEET E001 FOR ELECTRICAL LEGEND, GENERAL NOTES AND DEMOLITION NOTES.
- SEE SHEET E401 FOR ELECTRICAL ONE-LINE DIAGRAM.
- SEE SHEET SERIES E500s FOR PANEL SCHEDULES.
- SEE SHEETS EP108 THROUGH EP112 AND EP114 FOR NEW WORK PLAN AREAS.

PLAN NOTES:

- CEILING MOUNTED RECEPTACLE FOR SCOREBOARDS. CONTRACTOR TO COORDINATE EXACT LOCATION AND MOUNTING HEIGHTS WITH ARCHITECTURE.
- JUNCTION BOX FOR MOTORIZED NET SWITCH. CONTRACTOR TO CONNECT TO EACH NET WITH A JUNCTION BOX MOUNTED WITHIN 6' OF THE MOTOR. REFER TO MANUFACTURERS INSTRUCTION FOR THE SPECIFIC NET PRECIPUURED.
- PROVIDE FIVE (5) HUBBELL CAM-LOCK RECEPTACLES (ONE FOR EACH PHASE, ONE NEUTRAL, AND ONE GROUND. MAX AMPACITY RATING OF 400A) MOUNTED TO THE BOTTOM OF A NEMA-3R WIRE TROUGH. INSTALL THE WIRE TROUGH ON THE EXTERIOR WALL BELOW THE DISCONNECT SWITCH. THE CAM-LOCK RECEPTACLES SHALL BE FED FROM THE CIRCUIT INDICATED VIA THE ADJACENT DISCONNECT SWITCH. THE WIRING FROM THE DISCONNECT SWITCH TO EACH RECEPTACLE SHALL BE #80 COPPER. PROVIDE THE FOLLOWING HUBBEL PANEL-MOUNT DOUBLE SET SCREW RECEPTACLES, EACH WITH A MATCHING HUBBEL PROTECTIVE CAP:
PHASE A: HBLFRBK
PHASE B: HBLFRBK
PHASE C: HBLFRBK
NEUTRAL: HBLMRW
GROUND: HBLMRGN
- PROVIDE FIVE (5) HUBBELL CAM-LOCK RECEPTACLES (ONE FOR EACH PHASE, ONE NEUTRAL, AND ONE GROUND. MAX AMPACITY RATING OF 400A) MOUNTED TO THE BOTTOM OF A NEMA-3R WIRE TROUGH. INSTALL THE WIRE TROUGH ON THE EXTERIOR WALL BELOW THE DISCONNECT SWITCH. THE CAM-LOCK RECEPTACLES SHALL BE FED FROM THE CIRCUIT INDICATED VIA THE ADJACENT DISCONNECT SWITCH. THE WIRING FROM THE DISCONNECT SWITCH TO EACH RECEPTACLE SHALL BE #80 COPPER. PROVIDE THE FOLLOWING HUBBEL PANEL-MOUNT DOUBLE SET SCREW RECEPTACLES, EACH WITH A MATCHING HUBBEL PROTECTIVE CAP:
PHASE A: HBLFRBK
PHASE B: HBLFRBK
PHASE C: HBLFRBK
NEUTRAL: HBLMRW
GROUND: HBLMRGN
- PROVIDE FIVE (4) HUBBELL CAM-LOCK RECEPTACLES (ONE FOR EACH PHASE, ONE NEUTRAL, AND ONE GROUND. MAX AMPACITY RATING OF 400A) MOUNTED TO THE BOTTOM OF A NEMA-3R WIRE TROUGH. INSTALL THE WIRE TROUGH ON THE EXTERIOR WALL BELOW THE DISCONNECT SWITCH. THE CAM-LOCK RECEPTACLES SHALL BE FED FROM THE CIRCUIT INDICATED VIA THE ADJACENT DISCONNECT SWITCH. THE WIRING FROM THE DISCONNECT SWITCH TO EACH RECEPTACLE SHALL BE #80 COPPER. PROVIDE THE FOLLOWING HUBBEL PANEL-MOUNT DOUBLE SET SCREW RECEPTACLES, EACH WITH A MATCHING HUBBEL PROTECTIVE CAP:
PHASE A: HBLFRBK
PHASE B: HBLFRBK
PHASE C: HBLFRBK
NEUTRAL: HBLMRW
GROUND: HBLMRGN

FACILITY RENOVATION

PULASKI COUNTY INDOOR SPORTSPLEX AND EXPO CENTER

PULASKI COUNTY PARKS AND RECREATION

DUBLIN, VA

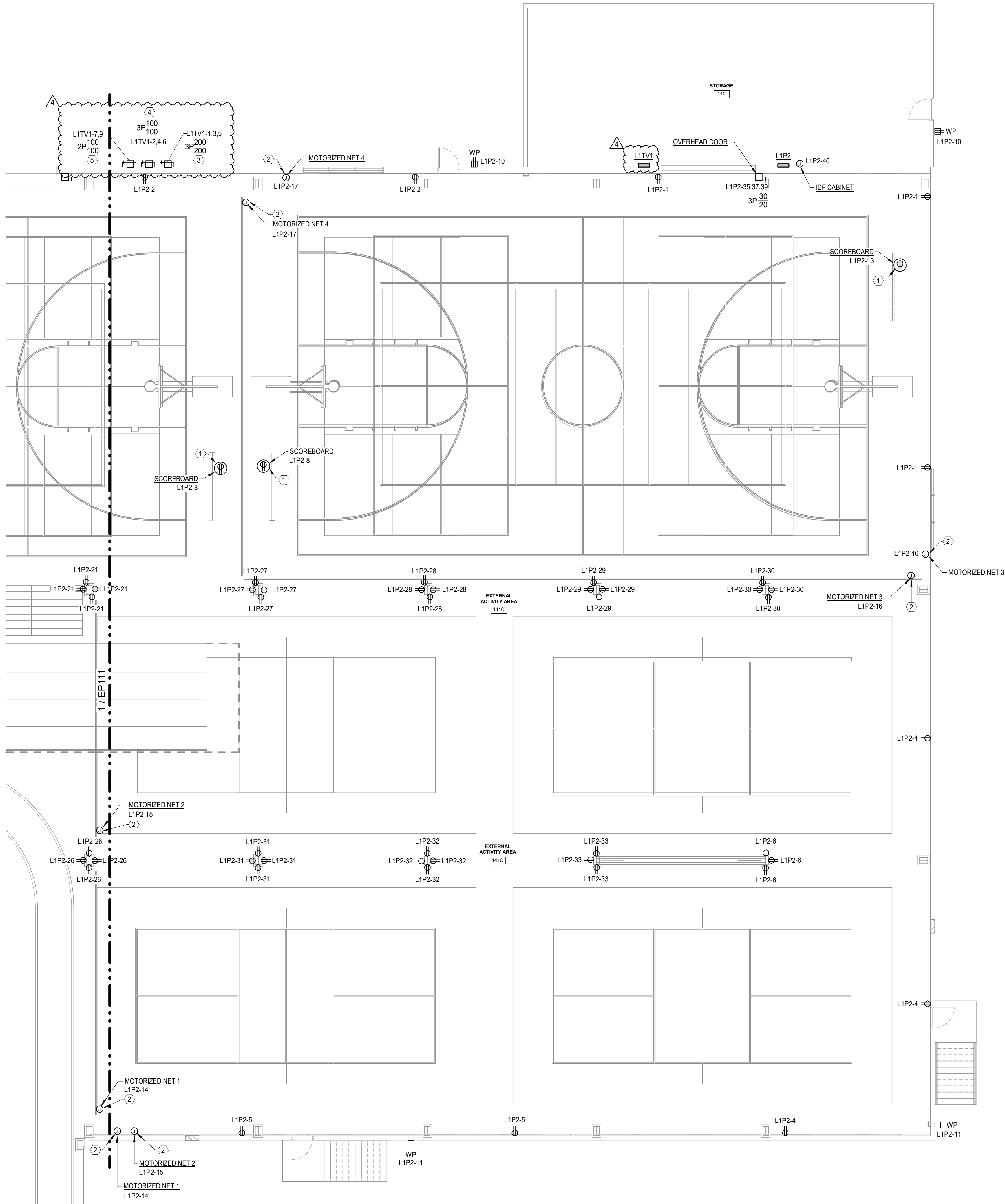
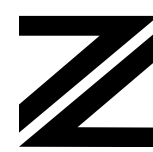
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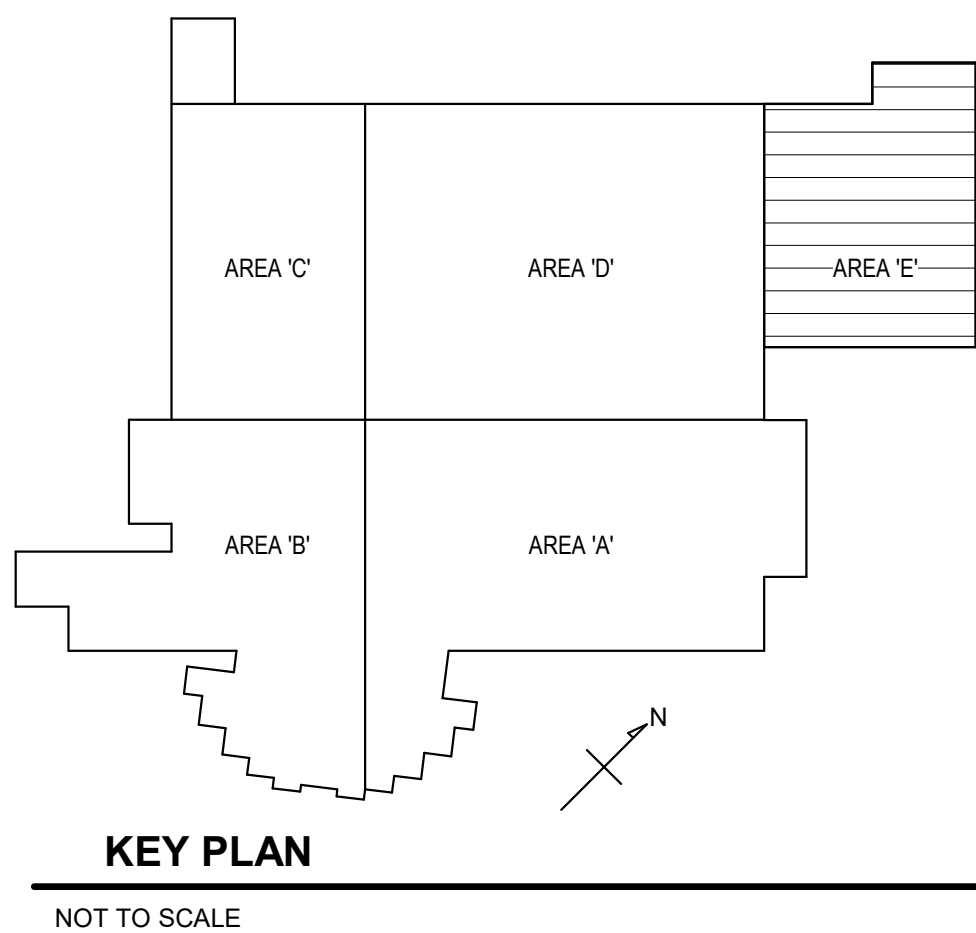
FIRST FLOOR PLAN - AREA 'E' - POWER

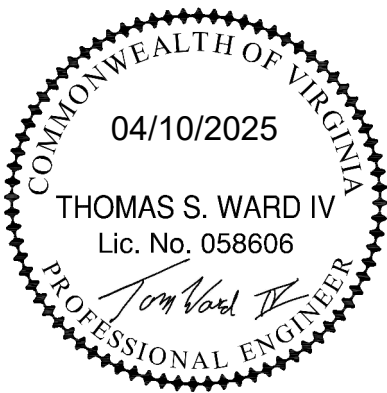
DRAWN ALQ	CHECKED SRL
DATE APR 10, 2025	COMM. NO. 24060

EP112



1 FIRST FLOOR PLAN - AREA 'E' - POWER
Scale: 1/8" = 1'-0"



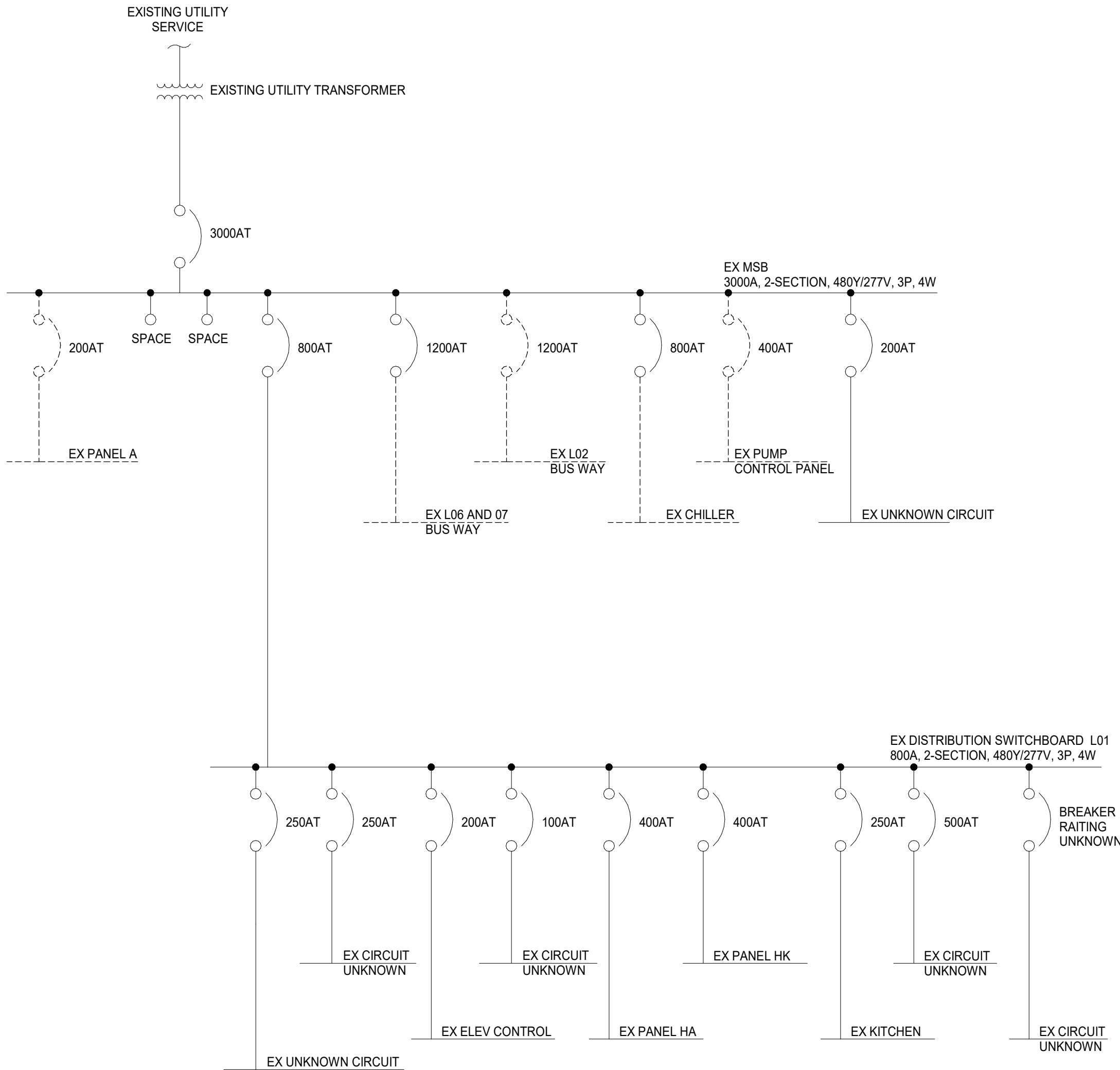


GENERAL NOTES:

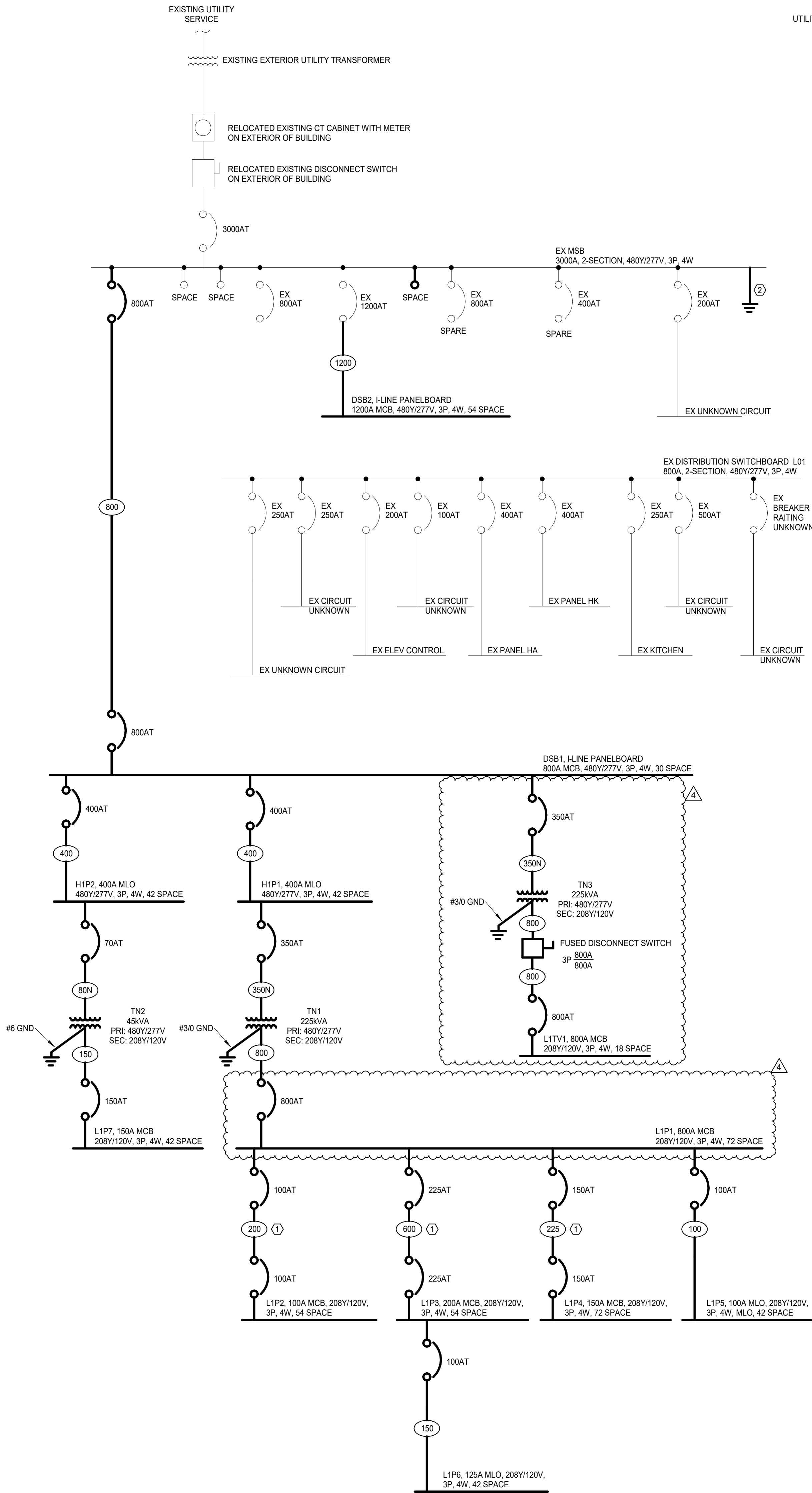
- SEE SHEET E001 FOR ELECTRICAL LEGEND, GENERAL NOTES AND DEMOLITION NOTES.
- SEE SHEET E002 FOR SPECIFICATIONS.
- SEE SHEET E501 FOR PANEL SCHEDULES.
- FOR SIMPLIFICATION, NOT ALL PANELS ARE SHOWN.

PLAN NOTES:

- WIRE UPSIZED FOR VOLTAGE DROP.
- SEE GROUNDING SCHEMATIC ON SHEET E501.



2 ELECTRICAL ONE-LINE DIAGRAM - DEMOLITION
Scale: N.T.S.

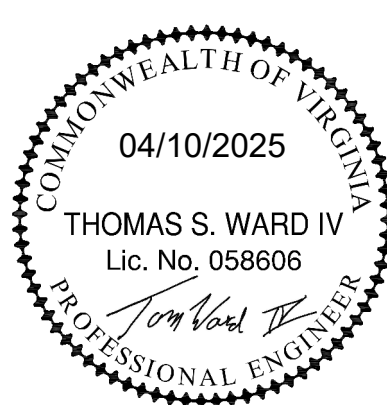


Branch Panel: DSB1																
Location: ELECTRICAL 301						Volts: 277/480 Wye				A.I.C. Rating: 25,000						
Supply From: MSB						Phases: 3				Enclosure: Type 1						
Mounting: Surface						Wires: 4				Mains: 800A MCB						
Phase in kVA																
NOTE	CKT	CIRCUIT DESCRIPTION	WIRE	GND	CONDUIT	BKR	A	B	C	BKR	CONDUIT	GND	WIRE	CIRCUIT DESCRIPTION	CKT	NOTE
	1						87.9 / 32.7								2	
	3	H1P1	1-L	1-L	1-L	400	3	85.6 / 25.5		3	600	1-L	1-L	1-L	H1P2	4
	5						37.1 / 0.0		83.9 / 28.5						6	
	7														8	
	9	L1TV1 VIA TN3	1-L	1-L	1-L	350	3	37.1 / 0.0		3	20	--	--	--	SPARE	10
	11								28.8 / 0.0						12	--
	13						0.0 / 0.0								14	
	15	SPARE	--	--	--	20	3	0.0 / 0.0		3	20	--	--	--	SPARE	16
	17								0.0 / 0.0						18	--
	19	SPACE	--	--	--	--	1	0.0 / 0.0		1	--	--	--	--	SPACE	20
	21	SPACE	--	--	--	--	1	0.0 / 0.0		1	--	--	--	--	SPACE	22
	23	SPACE	--	--	--	--	1	0.0 / 0.0		1	--	--	--	--	SPACE	24
	25	SPACE	--	--	--	--	1	0.0 / 0.0		1	--	--	--	--	SPACE	26
	27	SPACE	--	--	--	--	1	0.0 / 0.0		1	--	--	--	--	SPACE	28
	29	SPACE	--	--	--	--	1	0.0 / 0.0		1	--	--	--	--	SPACE	30
Total Load:							157.7 kVA	148.3 kVA	139.2 kVA							
Total Amps:							574 A	540 A	503 A							
Load Classification			Connected Load			Demand Factor			Estimated Demand			Panel Totals				
HVAC			89.2 kVA			100.00%			89.2 kVA			Total Conn. Load: 445.2 kVA				
Kitchen Equipment			12.5 kVA			65.00%			8.1 kVA			Total Est. Demand: 401.4 kVA				
Lighting			83.6 kVA			125.00%			104.5 kVA			Total Conn. Current: 535 A				
Motor			52.0 kVA			100.00%			52.0 kVA			Total Est. Demand Current: 483 A				
Power			77.3 kVA			100.00%			77.3 kVA							
Receptacles			130.6 kVA			53.83%			70.3 kVA							
Notes:																
Abbreviations: G - PROVIDE GFCI CIRCUIT BREAKER 1-L - REFER TO ELECTRICAL RISER DIAGRAMS																

Branch Panel: H1P1																		
Location: ELECTRICAL 301						Volts: 277/480 Wye						A.I.C. Rating: 25,000						
Supply From: DSB1						Phases: 3						Enclosure: Type 1						
Mounting: Surface						Wires: 4						Mains: 400A MLO						
Phase in kVA																		
NOTE	CKT	CIRCUIT DESCRIPTION	WIRE	GND	CONDUIT	BKR	A	B	C	BKR	CONDUIT	GND	WIRE	CIRCUIT DESCRIPTION	CKT	NOTE		
	1						70.2 / 0.7			1	20	3/4"	#12	GOLF INSTITUTE LIGHTING	2			
	3	TN1	1-L	1-L	1-L	350	3	65.8 / 0.5		1	20	3/4"	#12	LIGHTING ELEC & MECH	4			
	5								66.6 / 4.0	1	20	3/4"	#8	LIGHTING GYM	6	1		
	7	LIGHTING GYM	2#8	#8	3/4"	20	1	4.3 / 4.0		1	20	3/4"	#8	2#8	LIGHTING GYM	8	1	
	9	LIGHTING GYM	2#8	#8	3/4"	20	1		4.3 / 4.0	1	20	3/4"	#8	2#8	LIGHTING GYM	10	1	
	11	LIGHTING GYM	2#6	#6	3/4"	20	1		4.3 / 4.0	1	20	3/4"	#6	2#6	LIGHTING GYM	12	1	
	13	LIGHTING GYM	2#6	#6	3/4"	20	1	4.0 / 4.0		1	20	3/4"	#6	2#6	LIGHTING GYM	14	1	
	15	LIGHTING GYM	2#6	#6	3/4"	20	1		4.3 / 4.3	1	20	3/4"	#6	2#6	LIGHTING GYM	16	1	
	17	LIGHTING GYM	2#6	#6	3/4"	20	1		4.0 / 0.3	1	20	3/4"	#8	2#8	LIGHTING STORAGE 140	18	1	
	19	EXTERIOR BUILDING LIGHTING	2#12	#12	3/4"	20	1	0.7 / 0.1		1	20	3/4"	#12	2#12	EXTERIOR BUILDING LIGHTING	20	1	
	21	EXTERIOR BUILDING LIGHTING	2#10	#10	3/4"	20	1	1.2 / 1.4		1	20	3/4"	#10	2#10	EXTERIOR BUILDING LIGHTING	22	1	
	23	FLAGPOLE AND SIGNAGE	2#12	#12	3/4"	20	1			0.1 / 0.8	1	20	3/4"	#10	2#10	RECONNECTED SITE LIGHTING	24	1
--	25	SPARE	--	--	--	20	1	0.0 / 0.0		1	20	--	--	--	SPARE	26	--	
--	27	SPARE	--	--	--	20	1		0.0 / 0.0	1	20	--	--	--	SPARE	28	--	
--	29	SPARE	--	--	--	20	1			0.0 / 0.0	1	20	--	--	SPARE	30	--	
--	31	SPARE	--	--	--	20	1	0.0 / 0.0		1	20	--	--	--	SPARE	32	--	
--	33	SPACE	--	--	--	--	1		0.0 / 0.0	1	--	--	--	--	SPACE	34	--	
--	35	SPACE	--	--	--	--	1			0.0 / 0.0	1	--	--	--	SPACE	36	--	
--	37	SPACE	--	--	--	--	1	0.0 / 0.0		1	--	--	--	--	SPACE	38	--	
--	39	SPACE	--	--	--	--	1		0.0 / 0.0	1	--	--	--	--	SPACE	40	--	
--	41	SPACE	--	--	--	--	1			0.0 / 0.0	1	--	--	--	SPACE	42	--	
Total Load:							87.9 kVA	85.6 kVA	83.9 kVA									
Total Amps:							318 A	310 A	303 A									
Load Classification			Connected Load			Demand Factor			Estimated Demand			Panel Totals						
HVAC			7.7 kVA			100.00%			7.7 kVA			Total Conn. Load: 257.3 kVA						
Kitchen Equipment			12.5 kVA			65.00%			8.1 kVA			Total Est. Demand: 208.0 kVA						
Lighting			54.8 kVA			125.00%			68.5 kVA			Total Conn. Current: 310 A						
Motor			52.0 kVA			100.00%			52.0 kVA			Total Est. Demand Current: 250 A						
Power			3.0 kVA			100.00%			3.0 kVA									
Receptacles			127.3 kVA			53.93%			68.7 kVA									
Notes:							Abbreviations:											
1. WIRE UPSIZED FOR VOLTAGE DROP.							G - PROVIDE GFCI CIRCUIT BREAKER											
							1-L - REFER TO ELECTRICAL RISER DIAGRAMS											

Branch Panel: DSB2																	
Location: ELECTRICAL 301						Volts: 277/480 Wye				A.I.C. Rating: 25,000							
Supply From: MSB						Phases: 3				Enclosure: Type 1							
Mounting: Surface						Wires: 4				Mains: 1200A MCB							
Phase in kVA																	
NOTE	CKT	CIRCUIT DESCRIPTION	WIRE	GND	CONDUIT	BKR	A	B	C	BKR	CONDUIT	GND	WIRE	CIRCUIT DESCRIPTION	CKT	NOTE	
	1						20.3 / 32.4								2		
	3	ERV-1 ROOF	3#3	#8	1-1/4"	100	3	20.3 / 32.4		3	125	1-1/2"	#8	3#1	RTU-1A ROOF	4	
	5						32.4 / 32.4		20.3 / 32.4						6		
	7	RTU-1B ROOF	3#1	#8	1-1/2"	125	3	32.4 / 32.4		3	125	2"	#8	3#1	RTU-1C ROOF	8	
	9						32.4 / 32.4		32.4 / 32.4						10	1	
	11	RTU-1D ROOF	3#1	#8	1-1/2"	125	3	32.4 / 32.4		3	125	1-1/2"	#8	3#1	RTU-1E ROOF	12	
	13						32.4 / 0.6		32.4 / 32.4						14		
	15	RTU-1F ROOF	3#1	#8	1-1/2"	125	3	32.4 / 0.6		3	125	1-1/2"	#8	3#1	REF-2 ROOF	16	
	17						32.4 / 0.6		32.4 / 0.6				#12	3#12	REF-3 ROOF	18	
	19	REF-3 ROOF	3#12	#12	3/4"	20	3	0.6 / 0.6		3	20	3/4"	#12	3#12	REF-1 ROOF	20	
	21						0.6 / 0.6		0.6 / 0.6				#12	3#12	CT-1 EXTERIOR	22	
	23	SPARE	--	--	--	125	3	0.0 / 11.2		3	60	3/4"	#10	3#6		24	
	25						0.0 / 11.2		0.0 / 11.2							26	
	27						0.0 / 0.0		0.0 / 0.0				--	--	SPARE	28	
	29	SPACE	--	--	--	20	3	0.0 / 0.0		3	60	--	--	--	SPACE	30	
	31						0.0 / 0.0		0.0 / 0.0				--	--	SPACE	32	
	33	SPACE	--	--	--	--	1	0.0 / 0.0		1	--	--	--	--	SPACE	34	
	35						0.0 / 0.0		0.0 / 0.0				--	--	SPACE	36	
	37	SPACE	--	--	--	--	1	0.0 / 0.0		1	--	--	--	--	SPACE	38	
	39						0.0 / 0.0		0.0 / 0.0				--	--	SPACE	40	
	41	SPACE	--	--	--	--	1	0.0 / 0.0		1	--	--	--	--	SPACE	42	
	43						0.0 / 0.0		0.0 / 0.0				--	--	SPACE	44	
	45	SPACE	--	--	--	--	1	0.0 / 0.0		1	--	--	--	--	SPACE	46	
	47						0.0 / 0.0		0.0 / 0.0				--	--	SPACE	48	
	49	SPACE	--	--	--	--	1	0.0 / 0.0		1	--	--	--	--	SPACE	50	
	51						0.0 / 0.0		0.0 / 0.0				--	--	SPACE	52	
	53	SPACE	--	--	--	--	1	0.0 / 0.0		1	--	--	--	--	SPACE	54	
Total Load:							227.7 kVA	227.7 kVA	227.7 kVA								
Total Amps:							822 A	822 A	822 A								
Load Classification		Connected Load		Demand Factor		Estimated Demand		Panel Totals									
HVAC		683.0 kVA		100.00%		683.0 kVA		Total Conn. Load: 683.0 kVA									
								Total Est. Demand: 683.0 kVA									
								Total Conn. Current: 822 A									
								Total Est. Demand Current: 822 A									
Notes:							Abbreviations:										
1. WIRE UPSIZED FOR VOLTAGE DROP.							G - PROVIDE GFCI CIRCUIT BREAKER										
							14L - REFER TO ELECTRICAL RISER DIAGRAMS										

222 Lee Street, West
Charleston, West Virginia 25302
Phone: 304.342.0159
Fax: 304.345.8144



REVISIONS		
NO.	DESCRIPTION	DATE
3	AUDENCIA 3	08/12/2025
4	AUDENCIA 4	

<p>FACILITY RENOVATION</p> <p>PULASKI COUNTY INDOOR SPORTSPLEX AND EXPO CENTER</p> <p>PULASKI COUNTY PARKS AND RECREATION</p> <p>DUBLIN, VA</p> <p>CONSTRUCTION DOCUMENTS</p>
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ELECTRICAL PANEL SCHEDULES

ALQ

APR 10, 2025

2406



Abbreviations:
G - PROVIDE GFCI CIRCUIT BREAKER
1-L - REFER TO ELECTRICAL RISER DIAGRAMS

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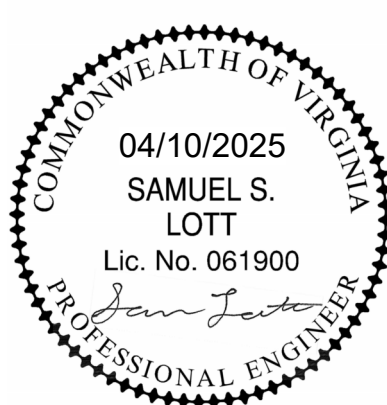
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Abbreviations:
G - PROVIDE GFCI CIRCUIT BREAKER
1-L - REFER TO ELECTRICAL RISER DIAGRAMS
N - PROVIDE NEW CIRCUIT BREAKER

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FACILITY RENOVATION

PULASKI COUNTY INDOOR SPORTSPLEX AND EXPO CENTER

PULASKI COUNTY PARKS AND RECREATION

DUBLIN, VA

CONSTRUCTION DOCUMENTS

MECHANICAL SCHEDULES

APR 10, 2025
COMM NO



ENERGY RECOVERY UNIT																																											
MARK	OUTSIDE AIR SUPPLY FAN			EXHAUST FAN			ELECTRICAL CONNECTION				ENERGY WHEEL RECOVERY										COOLING COIL				GAS HEATING SECTION				WEIGHT (LBS)	MANUFACTURER	MODEL	REMARKS											
	AIRFLOW CFM	EXT. SP (IN.W.C)	HORSE POWER	AIRFLOW CFM	EXT. SP (IN.W.C)	HORSE POWER	V	PH	F	MCA	MOCP	SUMMER PERFORMANCE						WINTER PERFORMANCE						TOTAL CAPACITY (MMB)	SENSIBLE CAPACITY (MMB)	ENT. AIR TEMP. DB	ENT. AIR TEMP. WB	LEAV. AIR TEMP. DB					LEAV. AIR TEMP. WB	HOT GAS REHEAT CAPACITY(BTU/H)	TOTAL CAPACITY (MMB)	TOTAL CAP. (OUT) (MMB)	AFUE%	ENT. AIR TEMP. DB	LEAV. AIR TEMP. DB				
												OUTSIDE AIR			EXHAUST AIR			OUTSIDE AIR			EXHAUST AIR																			ENT. AIR TEMP. DB	ENT. AIR TEMP. WB	LEAV. AIR TEMP. DB	LEAV. AIR TEMP. WB
												EAT DB	EAT WB	EAT LAT	EAT WB	EAT DB	EAT WB	EAT LAT	EAT WB	EAT DB	EAT WB	EAT LAT	EAT WB																				
ERV-1	9.375	1.5	5.0	9.130	1.0	5.0	460	3	60	73.3	90.0	90.4	70.7	75.4	62.2	70.0	58.8	85.3	67.8	12.2	54.9	72.0	55.7	271	229	75.4	62.2	51.8	51.8	184	166	81	55.1	102.9	7.819	GREENHECK	RVE-150-74C-25-1	ALL					

2. EXTERNAL STATIC PRESSURE INCLUDES LOSSES DUE TO DUCTWORK, AIR DEVICES, DAMPERS, AND DUCT MOUNTED HOT WATER COILS WHERE APPLICABLE. DIRTY FILTER AND UNIT CASING MUST BE ADDED TO EXTERNAL STATIC PRESSURE TO OBTAIN TOTAL PRESSURE LOSS. INCREASE HORSEPOWER AS REQUIRED TO MEET YOUR TOTAL PRESSURE LOSS. COORDINATE WITH ELECTRICIAN

3. MAINTAIN MINIMUM CLEARANCE FOR COIL PULL AS RECOMMENDED BY UNIT MANUFACTURER. MAINTAIN MINIMUM CLEARANCE AS REQUIRED TO OPEN ACCESS AND CONTROL DOORS ON UNIT FOR SERVICE, MAINTENANCE, AND INSPECTION. MAINTAIN MINIMUM ELECTRICAL CLEARANCE AS REQUIRED BY NEC.

1. PROVIDE VARIABLE FREQUENCY DRIVE FOR SUPPLY AND EXHAUST FAN.
2. GAS HEATER AND HOT GAS REHEAT SHALL BE MODULATING TYPE.
3. PROVIDE FACTORY MOUNTED DISCONNECT SWITCH AND FACTORY WIRED GFCI OUTLET.
4. PROVIDE UNIT WITH FACTORY MOUNTED SWITCHES WITH TEMPERATURE AND HUMIDITY SENSOR TO BE CONTROLLED AND MONITORED BY THE BMS.
5. UNIT TO BE CURB MOUNTED ON ROOF CURB AND ADJUST TO MATCH ROOF PITCH. CONTRACTOR SHALL COORDINATE WITH UNIT MANUFACTURER TO VERIFY THAT THE CURB SHALL BE SIZED FOR DUCTWORK PENETRATIONS AS SHOWN ON THE DRAWINGS.
6. PROVIDE LEVEL SENSING IN THE PRIMARY DRAIN PAN. THIS DEVICE SHALL SHUT OFF THE APPLIANCE IN THE EVENT THE PRIMARY DRAIN LINE BECOMES RESTRICTED.
7. ELECTRICAL CONTRACTOR TO PROVIDE UNIT MOUNTED SMOKE DETECTOR IN BOTH THE SUPPLY AND RETURN DUCT.
8. PROVIDE UNIT WITH CONDENSER PUMP AND SUMP.
9. PROVIDE GAS FURNACE SIZED FOR 90° DELTA T₁ IN THE CASE OF WHEAT FAILURE.

FAN															
MARK	EXHAUST AIRFLOW (CFM)	EXT. STATIC PRESSURE (IN. W.C.)	FAN RPM	HORSE POWER (HP)	ELECTRICAL CONNECTION					INTERLOCKED WITH	FAN TYPE	WEIGHT (LBS)	MANUFACTURER	MODEL	REMARKS
					V	PH	F	MCA	MCCP						
REF-1	2,500	0.50	1,098	0.50	460	3	60	2	20	BMS	ROOF MOUNTED	110.0	COOK	ACED	ALL
REF-2	1,930	0.50	934	0.50	460	3	60	2	20	BMS	ROOF MOUNTED	70.0	COOK	ACED	ALL
REF-3	1,930	0.50	934	0.50	460	3	60	2	20	BMS	ROOF MOUNTED	70.0	COOK	ACED	ALL

1. EXTERNAL STATIC PRESSURE INCLUDES LOSSES DUE TO DUCTWORK, AIR DEVICES AND DAMPERS. UNIT CASING MUST BE ADDED TO EXTERNAL STATIC PRESSURE TO OBTAIN TOTAL PRESSURE LOSS. INCREASE HORSEPOWER AS REQUIRED TO MEET YOUR TOTAL PRESSURE LOSS. COORDINATE WITH ELECTRICIAN.

2. MAINTAIN MINIMUM CLEARANCE AS REQUIRED TO OPEN ACCESS AND CONTROL DOORS ON UNIT FOR SERVICE, MAINTENANCE, AND INSPECTION. MAINTAIN MINIMUM ELECTRICAL CLEARANCE AS REQUIRED BY NEC.

1. PROVIDE FAN WITH INTEGRAL DISCONNECT.
2. PROVIDE FAN WITH AUTOMATIC BACKDRAFT DAMPER.
3. PROVIDE 14" ROOF CURB TO MATCH SLOPE OF ROOF.
4. PROVIDE FAN WITH VARIABLE FREQUENCY DRIVE.
5. FAN TO BE INTERLOCKED AND MONITORED BY BUILDING MANAGEMENT SYSTEM

ELECTRIC UNIT HEATER											
MARK	CFM	KW	ELECTRIC CONNECTION						MANUFACTURER	MODEL	REMARKS
			V	PH	F	MCA	MCCP				
EUH-1	175	1.00	120	1	60	9	20	MARKEL	E3322TD-RP	ALL	

1. REFER TO FLOOR PLANS FOR UNIT QUANTITIES.
2. PROVIDE FACTORY INSTALLED THERMAL OVERLOAD PROTECTION, BUILT-IN THERMOSTAT, AND

3. PROVIDE ACCESSORIES NECESSARY FOR SURFACE MOUNTING UNIT ON FIRE RATED WALLS. ALL OTHER UNITS SHALL BE PROVIDED WITH THE NECESSARY ACCESSORIES TO BE RECESSED IN THE WALL.

GRILLES, REGISTERS AND DIFFUSERS											
MARK	DESCRIPTION	MOUNTING TYPE	FACE WIDTH	FACE LENGTH	NECK SIZE	MAX AIR FLOW (CFM)	MAX AIR P.D., IN. H ₂ O	MAX N.C.	MANUFACTURER	MODEL	REMARKS
A	SQUARE PLAQUE DIFFUSER	SURFACE MOUNTED	24.0	17.5	8"	175	0.1	25	PRICE	ASPD	1.2
B	SQUARE PLAQUE DIFFUSER	SURFACE MOUNTED	24.0	24.0	9"	300	0.1	25	PRICE	<varies>	<varies>
C	SQUARE PLAQUE DIFFUSER	LAY-IN DIFFUSER	24.0	24.0	10"	430	0.1	25	PRICE	ASPD	1.2
E	ROUND PLAQUE DIFFUSER	DUCT MOUNTED	8.0	8.0	8"	280	0.1	25	PRICE	RPD	1.2
F	45° DOUBLE DEFLECTION BLADES W/ 3/4" SPACING	SURFACE MOUNTED	8.0	8.0	8"	320	0.1	25	PRICE	AMD	1.2
G	PERFORATED RETURN DIFFUSER	LAY-IN DIFFUSER	24.0	24.0	12"	1000	0.1	20	PRICE	PDR	3
Y	45° DOUBLE DEFLECTION BLADES W/ 3/4" SPACING	SURFACE MOUNTED	12.0	12.0	12"	400	0.05	20	PRICE	630	3
Z	45° DOUBLE DEFLECTION BLADES W/ 3/4" SPACING	SURFACE MOUNTED	10.0	10.0	10"	340	0.05	20	PRICE	630	3

1. COORDINATE EXACT GRILLE AND DIFFUSER LOCATIONS WITH ARCHITECTURAL REFLECTED CEILING PLANS.
2. WHERE MULTIPLE WALL MOUNTED REGISTERS ARE INSTALLED IN A ROOM, THE REGISTERS SHALL BE ALIGNED ON THE CENTER POINT OF EACH REGISTER.
3. ALL CEILING DIFFUSERS SHALL BE 4-WAY THROW TYPE UNLESS NOTED OTHERWISE.

1. DUCT MOUNTED BALANCING DAMPERS SHALL BE FURNISHED AND INSTALLED WHERE RUNOUT IS ABOVE AN ACCESSIBLE CEILING. IN LOCATIONS ABOVE HARD CEILINGS, DIFFUSERS SHALL BE FURNISHED WITH OPPOSED BLADE DAMPER OPERABLE THRU DIFFUSER FACE.
2. THE HARD DUCT TAP FITTING AND FLEXIBLE DUCT CONNECTION SHALL BE SIZED TO EQUAL THE DIAMETER FOR THE DIFFUSER CONNECTION.
3. REGISTERS SHALL BE FURNISHED WITH OPPOSED BLADE DAMPER OPERABLE THRU REGISTER FACE.

HVAC-KITCHEN HOOD SCHEDULE											
TAG	SERVICE	EXHAUST FAN		ELECTRICAL CONNECTION					MANUFACTURER	MODEL	REMARKS
		AIRFLOW (CFM)	ESP (IN. W.C.)	V	PH	F	MCA	MCCP			
H-1	WARMING KITCHEN RANGE	500	0.4	120	1	60	5	15	DENLAR	D1038-RF	ALL

1. UNIT TO WALL MOUNTED PER UNIT MANUFACTURERS RECOMMENDATIONS.
2. DENLAR ROOF MOUNTED FAN AND ROOF CURB ADAPTER TO BE PROVIDED WITH UNIT
3. PROVIDE UNIT WITH INTEGRAL DISCONNECT.

PACKAGED ROOFTOP UNIT - GAS HEAT																																	
MARK	SUPPLY FAN				EXHAUST FAN				ELECTRICAL CONNECTION				HOT GAS REHEAT										HEATING				WEIGHT (LBS)	MANUFACTURER	MODEL	REMARKS			
	SUPPLY CFM	OUTSIDE AIR CFM	EXT. STATIC PRESS. (IN. W.C.)	HORSE POWER (HP)	EXHAUST CFM	EXT. STATIC PRESS. (IN. W.C.)	HORSE POWER (HP)	V	PH	FC	MCA	MOCP	MIXED AIR DRY BULB	AIR TEMPERATURE (°F)	LEAVING DRY BULB	COILING	MIN. TOTAL CAPACITY (MBH)	MIN. SENS. CAPACITY (MBH)	MINIMUM EER / IER	NUMBER STAGES	TOTAL CAPACITY (MBH)	LEAVING DRY BULB	LEAVING WET BULB	MIXED AIR TEMP (°F)	LEAVING DRY BULB	INPUT (MBH)					OUTPUT (MBH)	AFUE %	NUMBER STAGES
RTU-1A	13,405	4,020	1.50	7.0	2,558	0.5	2	460	3	60	103	125	79.6	64.8	51.4	50.8	527.9	405	9.99/13.23	4	328	74.3	60.0	55.5	105.3	900	729	81	4	7.016	AAON	RNA-040	ALL
RTU-1B	13,405	4,020	1.50	7.0	2,558	0.5	2	460	3	60	103	125	79.6	64.8	51.4	50.8	527.9	405	9.99/13.23	4	328	74.3	60.0	55.5	105.3	900	729	81	4	7.016	AAON	RNA-040	ALL
RTU-1C	13,405	4,020	1.50	7.0	2,558	0.5	2	460	3	60	103	125	79.6	64.8	51.4	50.8	527.9	405	9.99/13.23	4	328	74.3	60.0	55.5	105.3	900	729	81	4	7.016	AAON	RNA-040	ALL
RTU-1D	13,405	4,020	1.50	7.0	2,588	0.5	2	460	3	60	103	125	79.6	64.8	51.4	50.8	527.9	405	9.99/13.23	4	328	74.3	60.0	55.5	105.3	900	729	81	4	7.016	AAON	RNA-040	ALL
RTU-1E	13,405	4,020	1.50	7.0	2,588	0.5	2	460	3	60	103	125	79.6	64.8	51.4	50.8	527.9	405	9.99/13.23	4	328	74.3	60.0	55.5	105.3	900	729	81	4	7.016	AAON	RNA-040	ALL
RTU-1F	13,405	4,020	1.50	7.0	2,588	0.5	2	460	3	60	103	125	79.6	64.8	51.4	50.8	527.9	405	9.99/13.23	4	328	74.3	60.0	55.5	105.3	900	729	81	4	7.016	AAON	RNA-040	ALL

1. EXTERNAL STATIC PRESSURE INCLUDES LOSSES DUE TO DUCTWORK, AIR DEVICES, DAMPERS, AND DUCT MOUNTED HOT WATER COILS WHERE APPLICABLE. DIRTY FILTER AND UNIT CASING MUST BE ADDED TO EXTERNAL STATIC PRESSURE TO OBTAIN TOTAL PRESSURE LOSS. INCREASE HORSEPOWER AS REQUIRED TO MEET YOUR TOTAL PRESSURE LOSS. COORDINATE WITH ELECTRICIAN.
2. MAINTAIN MINIMUM CLEARANCE FOR COIL PULL AS RECOMMENDED BY UNIT MANUFACTURER. MAINTAIN MINIMUM CLEARANCE AS REQUIRED TO OPEN ACCESS AND CONTROL DOORS ON UNIT FOR SERVICE, MAINTENANCE, AND INSPECTION. MAINTAIN MINIMUM ELECTRICAL CLEARANCE AS REQUIRED BY NEC.

1. PROVIDE UNIT WITH DISCONNECT SWITCH, ROOF CURB AND MOTORIZED OUTSIDE AIR DAMPER.
2. PROVIDE UNIT FACTORY MOUNTED GFCI RECEPTACLE FOR ELECTRICIAN TO WIRE TO SEPARATE CIRCUIT.
3. PROVIDE UNIT WITH BI-POLAR IONIZATION ZONE PER MANUFACTURER'S RECOMMENDATIONS.
4. PROVIDE UNIT WITH CO2 DETECTOR.
5. PROVIDE UNIT WITH LOW AMBIENT CONTROL.
6. UNIT TO BE INTERLOCKED AND MONITORED BY BUILDING MANAGEMENT SYSTEM.
7. PROVIDE UNIT WITH FLOW SWITCH IN THE PRIMARY DRAIN PIPING. THIS DEVICE SHALL SHUT OFF THE APPLIANCE IN THE EVENT THE PRIMARY DRAIN LINE BECOMES RESTRICTED.
8. PROVIDE LOW LEAK ENTHALPHY ECONOMIZER WITH BAROMETRIC RELIEF DAMPER.
9. MECHANICAL CONTRACTOR IS RESPONSIBLE FOR ALL ELECTRICAL COSTS IF ALTERNATE UNIT IS PROVIDED WITH GREATER ELECTRICAL CHARACTERISTICS THAN SHOWN.
10. PROVIDE UNIT WITH 1/2" GAS COMPRESSOR, MODULATING HOT GAS REHEAT AFTER STAGE 1.
11. PROVIDE UNIT WITH MODULATING HOT GAS REHEAT SEED PER MANUFACTURERS RECOMMENDATIONS.
12. ELECTRICAL CONTRACTOR TO PROVIDE UNIT DUCT MOUNTED SMOKE DETECTOR IN BOTH THE SUPPLY AND RETURN DUCT.
13. PROVIDE UNIT WITH DEMAND CONTROL VENTILATION.

AIR COOLED CONDENSING UNIT													
MARK	MIN. TOTAL COOLING CAPACITY (BTU/H)	MIN. TOTAL HEATING CAPACITY (BTU/H)	EFFICIENCY		ELECTRICAL CONNECTION					RELATED UNIT MARK	MANUFACTURER	MODEL	REMARKS
			MINIMUM EER / SEER	HEATING EFFICIENCY (COP)	V	PH	F	MCA	MCCP				
ACC-1	12,000	13,600	13.2 / 25.2	4.4	208	1	60	12.3	15.0	DMS-1	DAIKIN	RMX12VJU	ALL
ACC-2	21,600	24,000	12.5 / 22	3.54	208	1	60	19.8	20.0	DMS-2	DAIKIN	RMX24VJU	ALL

1. MINIMUM RECOMMENDED CLEARANCE AROUND ROOFTOP UNIT IS 12 INCHES ON NON-SERVICE SIDES AND 30 INCHES ON SERVICE SIDES. MAINTAIN MINIMUM CLEARANCE FOR CONDENSER AIR FLOW AS RECOMMENDED BY UNIT MANUFACTURER. MAINTAIN MINIMUM CLEARANCE AS REQUIRED TO OPEN ACCESS AND CONTROL DOORS ON UNIT FOR SERVICE, MAINTENANCE, AND INSPECTION. MAINTAIN MINIMUM ELECTRICAL CLEARANCE AS REQUIRED BY NEC.

1. PROVIDE WITH LOW AMBIENT CONTROL DOWN TO 20°F.
2. REFRIGERANT LINES TO BE SIZED PER MANUFACTURER'S REQUIREMENTS.
3. PROVIDE WITH COIL GUARD.
4. UNIT TO BE INTERLOCKED AND MONITORED BY BUILDING MANAGEMENT SYSTEM.
5. UNIT TO BE MOUNTED ON ROOF RAILS SIZED PER MANUFACTURER'S RECOMMENDATIONS.
6. OUTDOOR UNIT TO POWER THE INDOOR UNIT.

DUCTLESS MINI-SPLIT - INDOOR UNIT													
MARK	SUPPLY AIR CFM	ELECTRICAL CONNECTION					COOLING		HEATING		MANUFACTURER	MODEL	REMARKS
		V	PH	F	MCA	MOCP	RATED CAPACITY (BTU/H)	MIN. EER2 / SEER2	RATED CAPACITY (BTU/H)	COOP (%)			
DMS-1	557	208	1	60	12.3	15	12,000	13.925/2	13,800	4.4	DAIKIN	FTXM12VJUJ	1.23.4.5
DMS-2	845	208	1	60	19.8	20	21,600	12.952/2	24,000	3.54	DAIKIN	FTXM24VJUJ	ALL

1. UNIT TO BE INSTALLED PER MANUFACTURER'S INSTALLATION INSTRUCTIONS.
2. PROVIDE UNIT WITH TEMPERATURE SENSOR CONTROLLED BY THE BUILDING MANAGEMENT SYSTEM.
3. REFRIGERANT LINES TO BE SIZED PER MANUFACTURER'S REQUIREMENTS.
4. COOLING CAPACITY BASED ON AHRI CONDITIONS.
5. PROVIDE UNIT WITH CONDENSATE OVER FLOW SWITCH.
6. PROVIDE UNIT WITH WALL MOUNTED DRIIP PAN UNDER UNIT.

HVAC-AIR SEPARATOR SCHEDULE										
TAG	SERVICE	FLOW (GPM)	MAX PRESSURE (PSIG)	CONNECTION DIAMETER (INCHES)	HEIGHT (INCHES)	DIAMETER (INCHES)	WEIGHT (LBS)	MANUFACTURER	MODEL	REMARKS
AS-1	MECHANICAL HYDRONIC PIPING	197	150.0	4	31.4	14.6	120	SPIROTHERM	VD7400	ALL

1. PROVIDE UNIT WITH NECESSARY MOUNTING ACCESSORIES, SIZED PER MANUFACTURER'S RECOMMENDATIONS
2. PROVIDE UNIT WITH THREADED INLET CONNECTION.
3. PROVIDE UNIT WITH LIFT RING FOR INSTALLATION.
4. PROVIDE UNIT WITH AUTOMATIC AIR VENT, BLOW DOWN VALVE, AND DRAIN CONNECTION.
5. PROVIDE UNIT WITH NECESSARY ACCESSORIES TO MOUNT PER MANUFACTURER'S RECOMMENDATIONS.

MECHANICAL EXPANSION TANK								
MARK	MAXIMUM WORKING PRESSURE (PSI)	TANK VOLUME (GALLONS)	HEIGHT (INCHES)	DIAMETER (INCHES)	WEIGHT (LBS)	MANUFACTURER	MODEL	REMARKS
ET-1	125.0	115.0	66	24	325	ARMSTORG	AX-200V	ALL

1. PROVIDE ASME PRE-PRESSURIZED DIAPHRAGM TO SYSTEM FILL PRESSURE.
2. PROVIDE TANK WITH THE RING BASE, LIFT RING, AND NPT SYSTEM CONNECTION.
3. PROVIDE TANK WITH THREADED INLET AIR CHARGING VALVE CONNECTION.
4. MOUNT TANK ON THE FLOOR ON A 4" THICK CONCRETE HOUSEKEEPING PAD SIZED PER UNIT MANUFACTURER'S RECOMMENDATIONS.
5. PROVIDE PRESSURE RELIEF VALVE, ISOLATION VALVE, AND DRAIN VALVE.

HVAC-PUMP SCHEDULE															
TAG	SERVICE	TYPE	MINIMUM FLOW (GPM)	DESIGN FLOW (GPM)	HEAD (FT)	EFFICIENCY (%)	SPEED (RPM)	BRAKE MOTOR SIZE (HP)	MOTOR SIZE (HP)	ELECTRICAL CONNECTION			MANUFACTURER	MODEL	REMARKS
										V	PH	F			
P-1	M-CDS	END SUCTION	82.5	197	150.0	62.5	1,730	11.94	20	460	3	60	ARMSTRONG	SERIES 4030-3X2X134P-20	ALL
P-2	M-CDS	END SUCTION	82.5	197	150.0	62.5	1,730	11.94	20	460	3	60	ARMSTRONG	SERIES 4030-3X2X134P-20	ALL

1. UNIT TO BE MOUNTED ON 4" CONCRETE HOUSEKEEPING PAD SIZED PER MANUFACTURER'S RECOMMENDATIONS.
2. PROVIDE UNIT WITH DISCONNECTING MEANS.
3. PROVIDE UNIT WITH VARIABLE FREQUENCY DRIVE.
4. PROVIDE UNIT WITH SUCTION GUIDE MODEL SG-151TF.
5. UNIT TO BE INTERLOCKED AND MONITORED BY BUILDING MANAGEMENT SYSTEM.
6. PUMPS ARE TO BE SIZED FOR 100% STANDBY OPERATIONS.
7. PROVIDE PUMP WITH NEOPRENE VIBRATION ISOLATION PADS.

HVAC-COOLING TOWER SCHEDULE															
TAG	TYPE	CAPACITY (TONS)	FLOW (GPM)	MAX WPD (PSI)	EWT (F)	LWT (F)	AMBIENT WET BULB (FWB)	FANS		ELECTRICAL CONNECTION			MANUFACTURER	MODEL	REMARKS
								NUMBER OF FANS	FAN MOTOR SIZE (HP)	V	PH	F			
CT-1	CLOSED LOOP	65	197	2.82	95	85	78	4	2.5	460	3	60	MARLEY	LWA604NE	ALL

1. UNIT TO BE MOUNTED ON COOLING TOWER SUPPORT STRUCTURE BY STRUCTURAL ENGINEER.SIZED PER MANUFACTURER'S RECOMMENDATIONS

2. PROVIDE UNIT WITH FACTORY WIRED NEMA 3R DISCONNECTING MEANS.
3. PROVIDE UNIT WITH VARIABLE FREQUENCY DRIVE.
4. PROVIDE UNIT WITH ELECTRIC IMMERSION BATH HEATER WITH THERMOSTAT FOR FREEZE PROTECTION.
5. PROVIDE UNIT WITH FACTORY MOUNTED GFCI RECEPTACLE FOR ELECTRICIAN TO WIRE TO SEPARATE CIRCUIT.
6. PROVIDE UNIT PUMP AND EXTERIOR PIPE WITH HEAT TRACING AND INSULATION.
7. UNIT TO BE INTERLOCKED AND MONITORED BY BUILDING MANAGEMENT SYSTEM.

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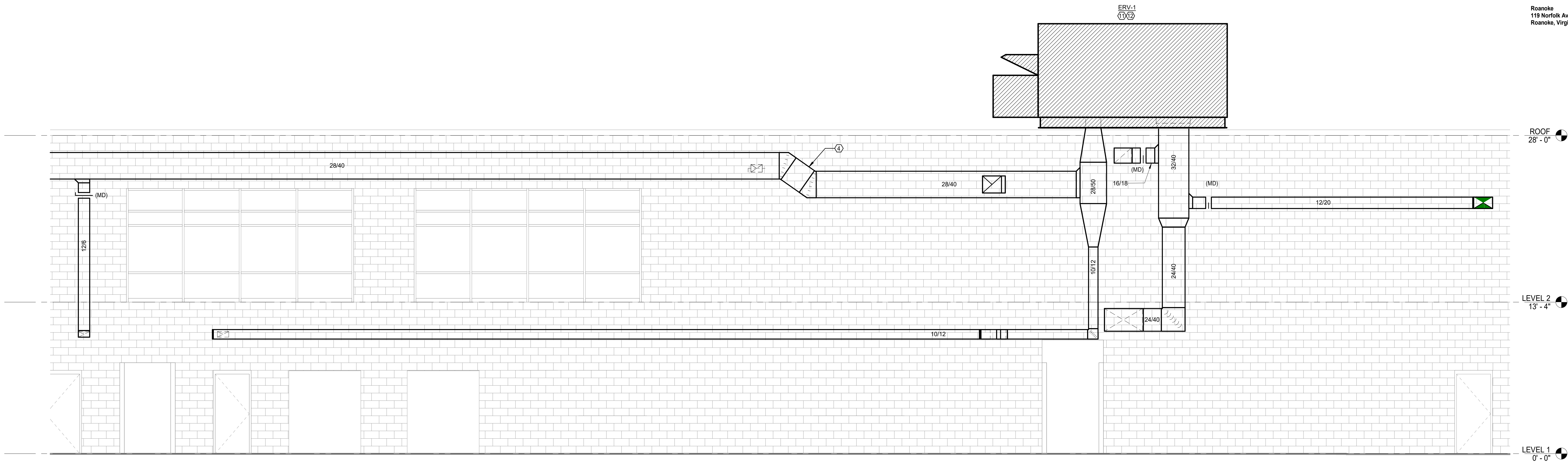
PULASKI COUNTY PARKS AND RECREATION

DUBLIN, VA

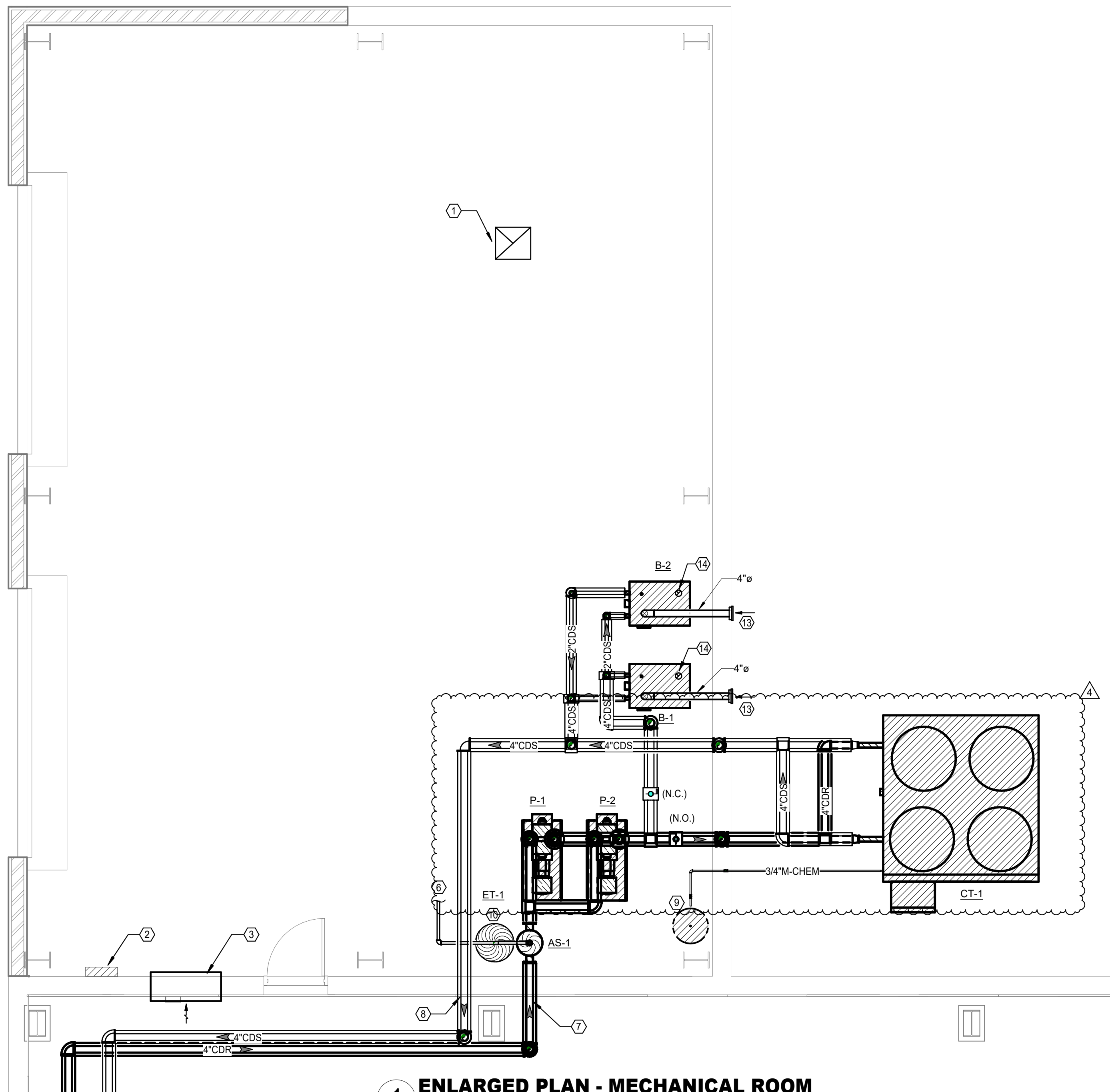
CONSTRUCTION DOCUMENTS

FIRST FLOOR PLAN ENLARGEMENTS - DUCTWORK

COMM. NO.
24060



2 ELEVATION VIEW - ERV DUCTWORK CONNECTION
Scale: 1/4" = 1'-0"



1 ENLARGED PLAN - MECHANICAL ROOM
Scale: 1/4" = 1'-0"

1. ROUTE 22" X 2" EXHAUST DUCT UP TO AND THROUGH ROOF TO REFL-1, CONTRACTOR TO TERMINATE EXHAUST DUCT AT REFL-10 ABOVE FINISHED FLOOR AND COVER WITH 1/4" WIRE MESH SCREEN. CONTRACTOR TO TRANSITION AS REQUIRED TO MAKE CONNECTION.
2. APPROXIMATE LOCATION OF BUILDING MANAGEMENT SYSTEM PANEL. CONTRACTOR TO CONFIRM FINAL LOCATION WITH ELECTRICAL DRAWINGS PRIOR TO CONSTRUCTION.
3. L-1: BASIS OF DESIGN GREENHECK ESD-633-4432; MOUNT BOTTOM OF EXHAUST DUCT TO REFL-10, 18" ABOVE FINISHED FLOOR.
4. ROUTE 28" X 4" EXHAUST DUCT UP AND OVER OBSERVATION DECK WINDOW.
5. PROVIDE 3/4" THICK REINFORCED CONCRETE HOUSEKEEPING PAD, 502 PBD PER UNIT. MANUFACTURERS RECOMMENDATION. COORDINATE CONDENSING UNIT LOCATION TO MAINTAIN THE MANUFACTURER'S REQUIRED CLEARANCES AND ADJUST CLEARANCES AS NECESSARY. EXPOSED PIPING SHALL BE WEATHERPROOFED AND COVERED WITH PVC JACKETING. PIPING SHALL BE SUPPORTED BY HANGERS. PIPING SHALL BE INSULATED, SLEEVE AND SEALED AIR AND WATER TIGHT.
6. EXTEND 1-1/2" DOMESTIC COLD WATER MAIN. REFER TO PLUMBING DRAWINGS FOR CONTINUATION.
7. ROUTE CENTER OF 4" CONDENSER RETURN WATER PIPE THROUGH WALL AT 10'-0" ABOVE FINISHED FLOOR.
8. ROUTE CENTER OF 4" CONDENSER SUPPLY PIPE THROUGH WALL A 14'-0" ABOVE FINISHED FLOOR.
9. ROUTE 3/4" CHEMICAL PIPE UP FROM CCL-2 MECHANICAL CHEMICAL STORAGE AND PIP TO COOLING TOWER CT-1. EXIST. ROUTE DRAIN PIPE TO NEAREST FLOOR DRAIN. CONTRACTOR TO TRANSITION TO EXISTING PLUMBING DRAWINGS FOR CONTINUATION.
10. MOUNT E-1T TANK ON THE FLOOR ON A 4" THICK CONCRETE HOUSEKEEPING PAD SIZED PER UNIT MANUFACTURER'S RECOMMENDATIONS. ROUTE DRAIN PIPE TO NEAREST FLOOR DRAIN. CONTRACTOR TO REFER TO EXISTING PLUMBING DRAWINGS FOR CONTINUATION.
11. ROUTE 28" X 3" 40° EXHAUST DUCTWORK DOWN FROM ERL-1 THROUGH ROOF. CONTRACTOR TO TRANSITION AS REQUIRED TO MAKE CONNECTION TO ERL-1.
12. ROUTE 28" X 50° EXHAUST DUCTWORK UP TO AND THROUGH ROOF TO ERL-1. CONTRACTOR TO TRANSITION AS REQUIRED TO MAKE CONNECTION TO ERL-1.
13. ROUTE 4" OUTDOOR DUCTWORK FROM MANUFACTURER APPROVED EXHAUST AIR INTAKE. CONTRACTOR TO TRANSITION AS REQUIRED TO MAKE CONNECTION WITH RESPECTIVE BOILER.
14. ROUTE 4" EXHAUST DUCTWORK UP TO AND THROUGH ROOF TO MANUFACTURER APPROVED TERMINAL. CONTRACTOR TO TRANSITION AS REQUIRED TO MAKE CONNECTION WITH RESPECTIVE BOILER.