



## **ADDENDUM 3**

**PROJECT NAME: Frank Wing HVAC System and Controls Upgrade**

**DATE: 10/3/2017**

This Addendum 3 shall be included in and considered part of the solicitation documents for the construction of the **Frank Wing HVAC System and Controls Upgrade Project**. Contractor shall be required to sign its acknowledgement of the receipt of this Addendum and submit its signed Addendum 3 Acknowledgement Form (attached hereto) with its bid.

**PROJECT NO.: 35-00069**

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### **Formal Invitation for Bid and Contract:**

**Design Clarifications** – Modifications to the drawings and specifications based on questions received during the pre-bid site visit.

### **Bid Forms**

Remove and Replace the following:

- 024 Unit Pricing Form – Addendum #3

**Note: The Addenda Acknowledgement Form for Addendum 3 is attached hereto. This Addenda Acknowledgement Form must be signed and submitted with Contractor's bid package.**



## ADDENDUM # 3

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Date: October 3, 2017

Client: City of San Antonio

Project Name: Frank D. Wing Municipal Court Building – HVAC Controls Upgrade

Project Number: 16-091

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This addendum is generally separated into sections for convenience; however, all contractors, subcontractors, material men and other parties shall be responsible for reading the entire addendum. The failure to list an item or items in all affected sections of this addendum does not relieve any part affected from performing as per instructions, providing that the information is set forth one time any place in this addendum. These documents shall be attached to and become part of the Contract Documents for this project.

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### SPECIFICATION ITEMS

#### RE: Unit Cost 024 Form:

- Item 1: Added unit cost for installation of access panel.
- Item 2: Added unit cost for 6-inch diameter VAV box retrofit kit.
- Item 2: Added unit cost for 8-inch diameter VAV box retrofit kit.
- Item 2: Added unit cost for 10-inch diameter VAV box retrofit kit.
- Item 2: Added unit cost for 12-inch diameter VAV box retrofit kit.

#### RE: Section 23 05 14 Variable Frequency Drivers:

- Item 1: Added Trane to list of acceptable manufacturers.

#### RE: Section 23 09 23 Direct Digital Control System for HVAC:

- Item 1: Added server integration requirements for new control system.
- Item 2: Added Distech by HTS and Yates Controls to list of acceptable controls vendors.
- Item 3: Added locking cover requirements for all non-adjustable temperature sensors located in public areas.
- Item 4: Added air flow measuring station requirements.

### PLAN ITEMS

#### RE: Plan Sheet M1.1:

- Item 1: Revised Keyed Notes #2 and 3.
- Item 2: Added Keyed Notes #8 & 9.
- Item 3: Added temperature sensor note.

#### RE: Plan Sheet M1.2:

Item 1: Revised Keyed Note #2.

Item 2: Added temperature sensor note.

RE: Plan Sheet M2.1:

Item 1: Added keyed notes #9-14.

Item 2: Added removal of existing humidifier.

RE: Plan Sheet M3.2:

Item 1: (Detail #1) Revised control sequences and diagram to include CO2 sensors and a demand control ventilation sequence.

Item 2: (Detail #2) Revised control diagram to include an adjustable temperature sensor.

Item 3: (Detail #3) Revised control diagram to include an adjustable temperature sensor.

Item 4: (Detail #4) Revised control diagram to include non-adjustable temperature sensor.

RE: Plan Sheet M3.3:

Item 1: (Detail #1) Revised control sequences and diagram to include CO2 sensors and a demand control ventilation sequence.

Item 2: (Detail #1) Revised the freeze protection sequence.

Item 3: (Detail #2) Revised control sequences and diagram to include CO2 sensors and a demand control ventilation sequence.

Item 4: (Detail #2) Revised the freeze protection sequence.

RE: Plan Sheet M3.4:

Item 1: (Detail #1) Added a refrigerant monitoring sequence and diagram.

RE: Plan Sheet M4.1:

Item 1: Revised the "Existing Air Handling Unit Schedule".

Item 2: Revised the "Variable Frequency Drive Schedule".

Item 3: (Detail #1) Added "VAV Inlet Retrofit Kit" detail.

RE: Plan Sheet E1.1:

Item 1: Added keyed note to require Contractor to provide conduit for 24V AC wiring from transformers to terminal units.

RE: Plan Sheet E1.2:

Item 1: Added keyed note to require Contractor to provide conduit for 24V AC wiring from transformers to terminal units.

END OF ITEMS FOR ADDENDUM #3

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## 1

PROJECT NAME: Frank Wing HVAC System and Controls Upgrade - ADDENDUM #3

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SECTION 23 05 14

VARIABLE-FREQUENCY DRIVES (VFD)

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes variable frequency drivers.
- B. General:
  - 1. Furnish and install Variable Frequency Drive Packages using Pulse Width Modulation (PWM) variable voltage, variable frequency technology, as specified herein. All of the Variable Frequency Drive Packages shall be shop assembled and tested with all drives supplied by one manufacturer for this project.
  - 2. The Contractor shall furnish Variable Frequency Drive Packages to vary the motor speed of the supply air fans and pumps shown in the fan and pump schedules. Each Package shall have all components sized for the scheduled application.
  - 3. All components of each Package shall comply with the latest applicable provisions of the National Electric Code, NEMA, ETL, and UL.
  - 4. Each Package shall consist of a factory assembled pre-wired "Package Cabinet" containing a Line Side Inductor, a Variable Frequency Drive Section (VFD) integrated with a Proportional-Integral Process Controller, a Bypass-Contactor Section, a 120 Volt Control Section, and terminals for field connection to external circuits.

1.2 REFERENCES

- A. Institute of Electrical and Electronics Engineers:
  - 1. IEEE C62.41 - Recommended Practice on Surge Voltages in Low-Voltage AC Power Circuits.
- B. National Electrical Manufacturers Association:
  - 1. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).
  - 2. NEMA FU 1 - Low Voltage Cartridge Fuses.
  - 3. NEMA ICS 7 - Industrial Control and Systems: Adjustable Speed Drives.
  - 4. NEMA ICS 7.1 - Safety Standards for Construction and Guide for Selection, Installation, and Operation of Adjustable Speed Drive Systems.
- C. International Electrical Testing Association:
  - 1. NETA ATS - Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems.

1.3 SUBMITTALS

- A. Section 23 05 00 – General Mechanical Requirements: Submittal procedures.
- B. Shop Drawings:



1. Indicate front and side views of enclosures with overall dimensions and weights shown; conduit entrance locations and requirements; and nameplate legends.
- C. Product Data:
  1. Submit catalog sheets showing voltage, controller size, ratings and size of switching and overcurrent protective devices, short circuit ratings, dimensions, and enclosure details.
- D. Submittals:
  1. Provide a submittal indicating all salient features listed above. Any deviation or deletion regarding itemized features shall be specifically identified. Also, noise level data, operation manuals, and warranty information should be included.
  2. The manufacturer's representative shall provide a priced list of recommended space parts, arranged by drive size and with indication as to which parts have application to more than one VFD size. These prices shall be good for 365 days from bid opening.
  3. The manufacturer's representative shall provide terminal block to terminal block wiring diagrams coordinated with the owner to provide a complete and functional operating system. Furnish detailed drawings showing construction, dimensions, wiring diagrams, and installation procedures for engineer's approval.
- E. Test Reports:
  1. Indicate field test and inspection procedures and test results.
- F. Manufacturer's Field Reports:
  1. Indicate start-up inspection findings.

#### 1.4 CLOSEOUT SUBMITTALS

- A. Section 23 05 00 – General Mechanical Requirements: Closeout procedures.
- B. Operation and Maintenance Data:
  1. Submit instructions complying with NEMA ICS 7.1. Include procedures for starting and operating controllers, and describe operating limits possibly resulting in hazardous or unsafe conditions. Include routine preventive maintenance schedule.

#### 1.5 QUALIFICATIONS

- A. Manufacturer:
  1. Company specializing in manufacturing products specified in this section with minimum three years documented experience, and with service facilities within 25 miles of project.

#### 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Section 23 05 00 – General Mechanical Requirements: Product storage and handling requirements.
- B. Store in clean, dry space. Maintain factory wrapping or provide additional canvas or plastic cover to protect units from dirt, water, construction debris, and traffic.

- C. Handle in accordance with manufacturer's written instructions. Lift only with lugs provided. Handle carefully to avoid damage to components, enclosure, and finish.

## 1.7 ENVIRONMENTAL REQUIREMENTS

- A. Conform to NEMA ICS 7 service conditions during and after installation of variable frequency controllers.

## 1.8 WARRANTY

- A. Furnish one year manufacturer warranty for variable frequency drivers.

## PART 2 PRODUCTS

### 2.1 VARIABLE FREQUENCY DRIVE

- A. Manufacturers:
  - 1. ABB.
  - 2. Yaskawa.
  - 3. Danfoss.
  - 4. **Trane.**
  - 5. Substitutions: As approved by Engineer prior to bid date.
- B. Product Description:
  - 1. NEMA ICS 7, enclosed variable frequency drive/controller suitable for operating indicated loads. Select unspecified features and options in accordance with NEMA ICS 7.1.
- C. Ratings:
  - 1. Rated Input Voltage: Scheduled.
  - 2. Motor Nameplate Voltage: Scheduled.
  - 3. Displacement Power Factor: Between 1.0 and 0.95, lagging, over entire range of operating speed and load.
  - 4. Operating Ambient: 0 degrees C to 40 degrees C.
  - 5. Minimum Efficiency at Full Load: 98 percent.
- D. Design Features:
  - 1. Employ microprocessor-based inverter logic isolated from power circuits.
  - 2. Employ pulse-width-modulated inverter system.
  - 3. Design for ability to operate controller with motor disconnected from output.
  - 4. Design to attempt five automatic restarts following fault condition before locking out and requiring manual restart.
  - 5. Ride-through feature to allow continuous operation through up to a 3 cycle line loss.
- E. Indicators and Manual Controls:
  - 1. Input Signal: 4 - 20 mA DC, 3 - 15 psi pneumatic or 0-10 mV DC.
  - 2. Display: Furnish integral digital display to indicate output voltage, output frequency, and output current.
  - 3. Status Indicators: Separate indicators for overcurrent, overvoltage, ground fault, over temperature, and input power ON.

4. Volts per Hertz Adjustment: Plus or minus 10 percent.
5. Current Limit Adjustment: 60 - 110 percent of rated.
6. Acceleration Rate Adjustment: 0.5 - 30 300 seconds.
7. Deceleration Rate Adjustment: 1 - 300 seconds.
8. HAND-OFF-AUTOMATIC selector switch and manual speed control.
9. Control Power Source: Integral control transformer.

F. Safeties and Interlocks:

1. Includes under voltage release.
2. Door Interlocks: Mechanical means to prevent opening of equipment with power connected, or to disconnect power when door is opened; include means for defeating interlock by qualified persons.
3. Safety Interlocks: Terminals for remote contact to inhibit starting under both manual and automatic mode.
4. Control Interlocks: Furnish terminals for remote contact to allow starting in automatic mode.
5. Three Contactor Bypass: Includes contactor, motor running overload protection, and short circuit protection for full voltage, non-reversing operation of motor. Includes isolation switch to allow safe maintenance of inverter during bypass operation.
6. Emergency Stop: Use dynamic brakes for emergency stop function.
7. Disconnecting Means: Integral circuit breaker on line side of each controller.

G. Fabrication:

1. Wiring Terminations: Match conductor materials and sizes as indicated on Drawings.
2. Enclosure: NEMA 250, Type 1, suitable for equipment application in places restricted to persons employed on premises.
3. Finish: Manufacturer's standard enamel.

## 2.2 SOURCE QUALITY CONTROL

- A. Shop, inspect and perform standard productions tests for each controller.
- B. Make completed controllers available for inspection at manufacturer's factory prior to packaging for shipment. Notify Architect/Engineer at least seven days before inspection is allowed.

## PART 3 EXECUTION

### 3.1 EXAMINATION

- A. Verify building environment is maintained within service conditions required by manufacturer.

### 3.2 INSTALLATION

- A. Install in accordance with NEMA ICS 7.1.
- B. Tighten accessible connections and mechanical fasteners after placing controller.



- C. Select and install overload heater elements in motor controllers to match installed motor characteristics.
- D. Install engraved plastic nameplates in accordance with Section 23 05 53.
- E. Neatly type label inside controller door identifying motor served nameplate horsepower, full load amperes, code letter, service factor, and voltage/phase rating. Place label in clear plastic holder.
- F. Ground and bond controller in accordance with Div 26 specifications.

### 3.3 FIELD QUALITY CONTROL

- A. Coordinate with General Contractor and Commissioning Agent to provide:
  - 1. Field inspecting, testing, adjusting, and balancing.
- B. Inspect and test in accordance with NETA ATS, except Section 4.
- C. Perform inspections and tests listed in NETA ATS, Section 7.16 and NEMA ICS 7.1.

### 3.4 MANUFACTURER'S FIELD SERVICES

- A. Prepare and startup variable frequency controller under supervision of manufacturer's approved technician.

### 3.5 DEMONSTRATION AND TRAINING

- A. Furnish 4 hours of instruction each for two persons, to be conducted at project site with manufacturer's representative.

END OF SECTION

SECTION 23 09 23  
DIRECT-DIGITAL CONTROL SYSTEM FOR HVAC



PART 1 GENERAL

1.01 REFERENCES

- A. The latest edition of the following standards and codes in effect and amended as of supplier's proposal date, and any applicable subsections thereof, shall govern design and selection of equipment and material supplied:
  - 1. ANSI MC85.1 - Terminology for Automatic Control.
  - 2. American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE).
  - 3. ANSI/ASHRAE Standard 135-2010, BACnet.
  - 4. International Building Code (IBC), including local amendments, IECC and IMC.
  - 5. UL 916 Underwriters Laboratories Standard for Energy Management Equipment. Canada and the US.
  - 6. National Electrical Code (NEC).
  - 7. FCC Part 15, Subpart J, Class A
  - 8. EMC Directive 89/336/EEC (European CE Mark)
- B. City, county, state, and federal regulations and codes in effect as of contract date.
- C. Except as otherwise indicated the system supplier shall secure and pay for all permits, inspections, and certifications required for his work and arrange for necessary approvals by the governing authorities.
- D. All BAS system components (electronic DDC hardware and all software) shall be of one manufacturer as indicated in manufacturer's trade catalog. Hybrid systems assembled from various manufacturers shall not be acceptable. This requirement does not apply to field devices.
- E. All BAS networks and field devices shall be wired in lieu of wireless. Use of wireless networks and/or field devices shall only be used when expressly approved by the Engineer and only in those locations designated by the Engineer.

1.02 SYSTEM DESCRIPTION

- A. The system shall be a web based Building Automation System (BAS) accessible with standard browsers such as Internet Explorer and Google Chrome. Systems requiring workstation software licenses shall not be acceptable.
- B. Systems based on Lonworks shall not be acceptable.
- C. General Description:
  - 1. Install the Building Global Controller in the MDF Room.

2. The direct digital control (DDC) system shall control equipment as indicated on the drawings.
3. **The new controls installed under this contract shall be integrated to and be accessible via the COSA's existing Automated Logic BAS Server. All logic graphical programming associated with the integration shall be performed by Automated Logic and shall not require an upgrade to the existing programming license. Contact Chris Boubel with COSA 210-207-5638.**

#### 1.03 WORK INCLUDED

- A. Provide a complete Facility Management and Control System.
- B. Provide all necessary BACnet-compliant hardware and software to meet the system's functional specifications. Provide Protocol Implementation Conformance Statement (PICS) for Windows-based control software and every controller in system, including unitary controllers.
- C. Prepare individual hardware layouts, interconnection drawings, and software configuration from project design data.
- D. Implement the detailed design for all analog and binary objects, system databases, graphic displays, logs, and management reports based on control descriptions, logic drawings, configuration data, and bid documents.
- E. Design, provide, and install all equipment cabinets, panels, data communication network cables needed, and all associated hardware.
- F. Provide and install all interconnecting cables between supplied cabinets, application controllers, and input/output devices.
- G. Provide and install all interconnecting cables between all operator's terminals and peripheral devices (such as printers, etc.) supplied under this section.
- H. Provide complete manufacturer's specifications for all items that are supplied. Include vendor name of every item supplied.
- I. Provide supervisory specialists and technicians at the job site to assist in all phases of system installation, startup, and commissioning.
- J. Provide a comprehensive operator and technician training program as described herein.
- K. Provide as-built documentation, operator's terminal software, diagrams, and all other associated project operational documentation (such as technical manuals) on approved media, the sum total of which accurately represents the final system.
- L. Provide computer software and hardware, operator input/output devices, control units, local area networks (LAN), sensors, control devices, actuators, control valves, dampers and operators, indicating devices, interface equipment and other apparatus and accessories to operate mechanical systems, and to perform functions specified and detailed.

#### 1.04 SYSTEM REQUIREMENTS

- A. A distributed logic control system complete with all software and hardware functions shall be provided and installed. System shall be based on ANSI/ASHRAE Standard 135-2010, BACnet. This system is to control all mechanical equipment, including all unitary equipment, all air handlers and any other listed equipment using BACnet-compliant components. Non-BACnet-compliant or proprietary equipment or systems (including gateways) shall not be acceptable and are specifically prohibited.

- B. It shall be the responsibility of the Controls Contractor to coordinate all interface requirements with the respective equipment vendors to provide a complete and working system in all respects.
- C. The Web Server should be designed to harness the power of the Internet and provide efficient integration of standard open protocols (i.e. BACnet). The Network Server creates a powerful network environment with comprehensive database management and messaging services. In addition, the Web Server shall provide an engineering environment and graphical user interface.
- D. The web server shall provide the interface between the LAN or WAN and the field control devices, and provide global supervisory control functions over the control devices connected to the web server. It shall be capable of executing application control programs to provide:
  - 1. Calendar functions
  - 2. Scheduling
  - 3. Trending
  - 4. Alarm monitoring and routing
  - 5. Time synchronization
  - 6. Integration of controller data for each applicable protocol
  - 7. Network Management function for all network devices
- E. All application controllers for every terminal unit (VAV, etc.), and any other piece of controlled equipment shall be fully programmable. Application controllers shall be mounted next to controlled equipment and communicate with building controller via BACnet LAN.
- F. Provide installation and calibration, supervision, adjustments, and fine tuning necessary for complete and fully operational system.

#### 1.05 SUBMITTALS

- A. Section 23 05 00 - Submittal Procedures: Submittal procedures.
- B. Shop Drawings:
  - 1. Indicate the following:
    - a. Trunk cable schematic showing programmable control-unit locations and trunk data conductors.
    - b. Connected data points, including connected control unit and input device.
    - c. System graphics showing monitored systems, data (connected and calculated) point addresses, and operator notations. System configuration with peripheral devices, batteries, power supplies, diagrams, modems, and interconnections.
    - d. Description and sequence of operation for operating, user, and application software.
    - e. Electrical drawing showing all system internal and external connection points, terminal block layouts and terminal identification.
    - f. Complete bill of materials, valve schedule and damper schedule.

- g. For all system elements (building controllers) provide BAC net protocol implementation conformance statements (PICS) as per ANSI/ASHRAE Standard 135-2010.
- h. Provide complete description and documentation of all services and/or objects used in the system
- i. Manufacturer's Installation Instructions: Submit installation, maintenance, operation instructions for each control system component.
- j. Use terminology in submittals conforming to ASME MC85.1.
- k. Coordinate submittals with information requested in Section 23 09 93 in tabbed format.

C. Product Data:

- 1. Submit data for each system component and software module.

D. Manufacturer's Installation Instructions:

- 1. Submit installation instruction for each control system component.

E. Manufacturer's Certificate:

- 1. Certify products meet or exceed specified requirements.

1.06 CLOSEOUT SUBMITTALS

A. Project Record Documents:

- 1. Record actual locations of control components, including control units, thermostats, and sensors.
- 2. Revise shop drawings to reflect actual installation and operating sequences.
- 3. Submit data specified in "Submittals" in final "Record Documents" form.

B. Operation and Maintenance Data:

- 1. Submit interconnection wiring diagrams complete field installed systems with identified and numbered system components and devices.
- 2. Submit keyboard illustrations and step-by-step procedures indexed for each operator function.
- 3. Submit inspection period, cleaning methods, cleaning materials recommended, and calibration tolerances.

1.07 QUALIFICATIONS

A. Manufacturer:

- 1. Company specializing in manufacturing products specified in this section with minimum five years experience, and with service facilities within 50 miles of Project.

B. Installer:

- 1. Company specializing in performing Work of this section with minimum three years experience.

1.08 PRE-INSTALLATION MEETINGS

A. Pre-installation meeting.

- 1. Contractor shall attend a pre-installation meeting at the job site with all related contractors and trades on the job. At a minimum the following shall be addressed and coordinated:

- a. BAS wiring diagrams, work assignments and trade responsibilities.
- b. 120VAC power requirements for any and all locations.

2. Convene prior to commencing work of this section.

1.09 FIELD MEASUREMENTS

- A. Verify field measurements prior to fabrication.

1.10 WARRANTY

- A. Warrant work against faulty material or workmanship in accordance with Division 01. If the project is occupied or the systems placed in operation in several phases at the request of the Owner's Representative, then the warranty of each system or piece of equipment used shall begin on the date each system or piece of equipment was placed in satisfactory operation and accepted as such, in writing, by the Owner's Representative. The use of building equipment for temporary service and testing does not constitute the beginning of warranty.
- B. Equipment and material provided under this section shall be periodically inspected and serviced by competent technicians. This function becomes the responsibility of the Owner's Representative when the system is accepted by the Owner's Representative. The one year material and workmanship warranty is not intended to supplant normal inspection or service and shall not be construed to mean the Contractor shall provide free service for normal maintenance items such as periodic lubrication and adjustment due to normal use, nor to correct without charge, breakage, maladjustment and other trouble shooting caused by improper maintenance.

1.11 MAINTENANCE SERVICE

- A. Furnish service and maintenance of control systems for one year from Date of Substantial Completion.
- B. Include systematic examination, adjustment, and lubrication of unit, and controls checkout and adjustments. Repair or replace parts in accordance with manufacturer's operating and maintenance data. Use parts produced by manufacturer of original equipment.
- C. Perform work without removing units from service during building normal occupied hours.
- D. Provide emergency call back service during normal operating hours for this maintenance period.
- E. Maintain locally, near Place of the Work, adequate stock of parts for replacement or emergency purposes. Have personnel available to ensure fulfillment of this maintenance service, without unreasonable loss of time.
- F. Perform maintenance work using competent and qualified personnel under supervision of manufacturer or original installer.
- G. Do not assign or transfer maintenance service to agent or subcontractor without prior written consent of Owner.

1.12 RELATED WORK IN OTHER SECTIONS

- A. Refer to Division 0 and Division 1 for related contractual requirements.
- B. Refer to Section 23 05 00 for General Mechanical Provisions
- C. Refer to Section 23 08 00 for Commissioning Provisions
- D. Refer to Section 26 05 00 for General Electrical Provisions

### 1.13 BAS GENERAL REQUIREMENTS

- A. All electrical control wiring shall be furnished and installed under this section, unless shown on the electrical drawings. Low voltage wiring shall be run in EMT conduit in exposed areas and in vertical risers between floors. Low voltage plenum rated wire may be used without conduit in concealed but assessable areas. All conduit on roofs or exteriors shall be rigid with rain tight fittings. Line voltage wiring control wiring shall be run EMT conduit or rigid if outdoors or on roofs.
- B. Space Sensor Installation:
  - 1. Provide conduit stub-ups with junction box in new walls. Wire mold may be used on existing block walls. Provide nylon bushing at the end of all conduit whips for space sensors to prevent chafing of wire.
- C. All 120 volt and higher power wiring associated with the control system shall be provided by Division 26-Electrical. Electrical contractor under the direction of the controls contractor shall provide 120VAC and higher power to all control panels as required. All transformers with secondary voltages of 24 volts or less shall be provided by controls contractor with the exception of the transformers for factory mounted controls such as VAV boxes. In the case of factory mounted controls the manufacturer doing the mounting shall provide control transformers and coordinate the voltages.
- D. All automatic dampers furnished under this section shall be installed by the Mechanical Contractor. It shall be the responsibility of the Mechanical Contractor to provide and install blank off plates when the control application requires dampers smaller than duct size.
- E. All finished painting required for Control piping and equipment shall be done by the General Contractor.
- F. All cutting and patching necessary for the installation of the Control System shall be done by the General Contractor.
- G. Enclosures:
  - 1. Equipment room controllers or relay packs shall not be installed in the room's ceiling. If the equipment is in a mechanical room, electrical room, MDF/IDF room or other dedicated room the associated controller and relays shall be mounted in a NEMA-1 fabricated and hinged metal enclosure with lock within sight of the equipment it controls. Fabricated panel means built in a shop environment with templates and not constructed on site. Extensions to controllers for additional controlled or monitored items for a given area shall be mounted adjacent to the equipment controls.
- H. Space Local Indication:
  - 1. Each IDS (Indicating Digital Space) sensor, where specified, shall display digital readouts of temperature and temperature setpoint. The Operator shall be able delete these readouts from the Central Workstation on an individual IDS basis as desired.
- I. Local Override Buttons:
  - 1. Shall be integral to the sensor and installed in all areas except common areas such as lobbies, bathrooms, hallways, cafeteria's and auditoriums. Equipment room sensors shall not be equipped with override buttons.
- J. Space Temperature Sensor Local Adjustment:
  - 1. Areas specified to have adjustment shall have a temperature setpoint adjustment

that can be limited in software to plus or minus 2 Deg F adjustment range from setpoint.

- K. Air Balance:
  - 1. The test and balance contractor shall set the OA damper positions on all units to the scheduled and OA amounts by coordination with the controls contractor.
- L. Actuators:
  - 1. All damper actuators shall be electronic type (Belimo or equal). OA dampers actuators shall be spring return as indicated.
- M. DDC Outputs:
  - 1. Separate DDC outputs will be provided for each valve and damper actuator.
- N. DDC Control:
  - 1. All sensors and actuators shall be controlled/monitored by the direct digital control system. Thermostats and humidistats wired to actuators will not be allowed.
- O. Wide Area Network:
  - 1. Connect all networks of points specified above to the owner's network to allow for real time communication. Auto dial up modems are not allowed.

## PART 2 PRODUCTS

### 2.01 DIRECT DIGITAL CONTROLS

- A. Browser based, open protocol, with all components listed by BTL as BACnet compliant  
Acceptable alternate manufactures are:
  - 1. Automated Logic.
  - 2. **Distech by HTS.**
  - 3. **Yates Controls.**
  - 4. Substitutions: None Permitted.

### 2.02 OPERATING SYSTEM SOFTWARE

- A. Input/output Capability From Operator Station:
  - 1. Request display of current values or status.
  - 2. Command selected equipment to specified state.
  - 3. Initiate logs and reports.
  - 4. Change analog limits.
  - 5. Add, delete, or change points within each control unit or application routine.
  - 6. Change point input/output descriptors, status, alarm descriptors, and unit descriptors.
  - 7. Add new control units to system.
  - 8. Modify and set up maintenance scheduling parameters.
  - 9. Develop, modify, delete or display full range of color graphic displays.
  - 10. Automatically archive select data even when running third party software.
  - 11. Capability to sort and extract data from archived files and to generate custom reports.



12. Support printer operations.
13. Accommodate daylight savings time adjustments.
- B. Operator System Access:
  1. Via software password with multiple access levels at work stations and at each control unit.
- C. Data Base Creation and Support:
  1. Control unit automatically checks workstation data base files upon connection and verify data base match. Include the following minimum capabilities:
    - a. Add and delete points.
    - b. Modify point parameters.
    - c. Change, add, or delete English language descriptors.
    - d. Add, modify, or delete alarm limits.
    - e. Add, modify, or delete points in start/stop programs, trend logs, and other items.
    - f. Create custom relationship between points.
    - g. Create or modify DDC loops and parameters.
    - h. Create or modify override parameters.
    - i. Add, modify, and delete applications programs.
    - j. Add, delete, develop, or modify dynamic color graphic displays.
- D. Dynamic Color Graphic Displays:
  1. Utilizes custom symbols or system supported library of symbols.
  2. Sixteen (16) colors.
  3. Real-time live dynamic data for each graphic.
  4. Dynamic graphic data.
- E. Operator Station:
  1. Accept data from LAN as needed without scanning entire network for updated point data.
  2. Interrogate LAN for updated point data when requested.
  3. Allow operator command of devices.
  4. Allow operator to place specific control units in or out of service.
  5. Allow parameter editing of control units.
  6. Store duplicate data base for every control unit and allow down loading while system is on line.
  7. Control or modify specific programs.
  8. Develop, store and modify dynamic color graphics.
  9. Data archiving of assigned points and support overlay graphing of this data
- F. Alarm Processing:

1. Off normal condition: Cause alarm and appropriate message, including time, system, point descriptor, and alarm condition. Select alarm state or value and alarms causing automatic dial-out.
  2. Critical alarm or change-of-state: Display message, stored on disk for review and sort, or print.
  3. Print on line changeable message, up to 60 characters in length, for each alarm point specified.
  4. Display alarm reports on video. Display multiple alarms in order of occurrence.
  5. Define time delay for equipment start-up or shut down.
  6. Allow unique routing of specific alarms.
  7. Operator specifies when alarm requires acknowledgment.
  8. Continue to indicate unacknowledged alarms after return to normal.
  9. Alarm notification:
  10. Print automatically.
  11. Display indicating alarm condition.
  12. Selectable audible alarm indication.
- G. Event Processing:
1. Automatically initiate commands, user defined messages, take specific control actions or change control strategy and application programs resulting from event condition. Event condition may be value crossing operator defined limit, change of state, specified state, or alarm occurrence or return to normal.
- H. Automatic Restart:
1. Automatically start field equipment on restoration of power. Furnish time delay between individual equipment restart and time of day start/stop.
- I. Messages:
1. Automatically display or print user-defined message subsequent to occurrence of selected events.
  2. Compose, change, or delete message.
  3. Display or log message at any time.
  4. Assign any message to event.
- J. Reports:
1. Manually requested with time and date.
  2. Long term data archiving to hard disk.
  3. Automatic directives to download to transportable media for storage.
  4. Data selection methods to include data base search and manipulation.
  5. Data extraction with mathematical manipulation.
  6. Data reports to allow development of XY curve plotting, tabular reports (both statistical and summary), and multi-point timed based plots with not less than four (4) variables displayed.
  7. Generating reports either normally at operator direction, or automatically under workstation direction.

8. Either manually display or print reports. Automatically print reports on daily, weekly, monthly, yearly or scheduled basis.
  9. Include capability for statistical data manipulation and extraction.
  10. Capability to generate four types of reports: Statistical detail reports, summary reports, trend graphic plots, x-y graphic plots.
- K. Parameter Save/Restore:
1. Store most current operating system, parameter changes, and modifications on disk or diskette.
- L. Data Collection:
1. Automatically collect and store.
  2. Archiving of stored data for use with system supplied custom reports.
- M. Graphic Display:
1. Support graphic development on work station with software features:
    - a. Page linking.
    - b. Generate, store, and retrieve library symbols.
    - c. Single or double height characters.
    - d. Sixty (60) dynamic points of data for each graphic page.
    - e. Pixel level resolution.
    - f. Animated graphics for discrete points.
    - g. Analog bar graphs.
    - h. Display real time value of each input or output line diagram fashion.
- N. Maintenance Management:
1. Run time monitoring, for each point.
  2. Maintenance scheduling targets with automatic annunciation, scheduling and shutdown.
  3. Equipment safety targets.
  4. Display of maintenance material and estimated labor.
  5. Target point reset, for each point.
- 2.03 LOAD CONTROL PROGRAMS
- A. Systems shall be capable of all programs listed; however not all are required by the current sequences of operations.
- B. Demand Limiting:
1. Monitor total power consumption for each power meter and shed associated loads automatically to reduce power consumption to an operator set maximum demand level.
- C. Duty Cycling:
1. Periodically stop and start loads, based on space temperature, and according to various On/Off patterns.
- D. Automatic Time Scheduling:

1. Self-contained programs for automatic start/stop/scheduling of building loads. Support up to seven (7) normal day schedules, seven (7) "special day" schedules and two (2) temporary schedules.
  - E. Start/Stop Time Optimization:
    1. Perform optimized start/stop as function of outside conditions, inside conditions, or both.
    2. Adaptive and self-tuning, adjusting to changing conditions.
    3. For each point under control, establish and modify:
      - a. Occupancy period.
      - b. Desired temperature at beginning of occupancy period.
      - c. Desired temperature at end of occupancy period.
  - F. Night Setback/Setup Program:
    1. Reduce heating space temperature set point or raise cooling space temperature set-point during unoccupied hours; in conjunction with scheduled start/stop and optimum start/stop programs.
  - G. Calculated Points:
    1. Define calculations and totals computed from monitored points (analog/digital points), constants, or other calculated points.
  - H. Event Initiated Programming:
    1. Any data point capable of initiating event, causing series of controls in a sequence.
  - I. Direct Digital Control:
    1. Furnish software so operator is capable of customizing control strategies and sequences of operation by defining appropriate control loop algorithms and choosing optimum loop parameters.
  - J. Trend logging:
    1. Each control unit capable of storing samples of control unit's data points.
    2. Update file continuously at operator assigned intervals.
    3. Automatically initiate upload requests and then stores data on hard disk.
    4. Time synchronize sampling at operator specified times and intervals with sample resolution of one minute.
    5. Co-ordinate sampling with specified on/off point- state.
    6. Display trend samples on workstation in graphic format. Automatically scale trend graph with minimum 60 samples of data in plot of time versus data.
- 2.04 HVAC CONTROL PROGRAMS
- A. Optimal Run Time:
    1. Control start-up and shutdown times of HVAC equipment for both heating and cooling. Base on occupancy schedules, outside air temperature, seasonal requirements, and interior room temperature. Employ adaptive model prediction for how long building takes to warm up or cool down under different conditions.

## 2.05 PROGRAMMING APPLICATION FEATURES

- A. Trend Point:
  - 1. Sample points, real or computed, with each point capable of collecting samples at intervals specified in minutes, hours, days, or month. Output trend logs as line-graphs or bar graphs.
- B. Alarm Messages:
  - 1. Allow definition of messages, each having sufficient characters for each individual message.
  - 2. Assign alarm messages to system messages including point's alarm condition, point's off-normal condition, totaled point's warning limit, hardware elements advisories.
  - 3. Output assigned alarm with "message requiring acknowledgment".
  - 4. Operator commands include define, modify, or delete; output summary listing current alarms and assignments; output summary defining assigned points.
- C. Weekly Scheduling:
  - 1. Automatically initiate equipment or system commands, based on selected time schedule for points specified.
  - 2. Program times for each day of week, for each point, with one minute resolution.
  - 3. Automatically generate alarm output for points not responding to command.
  - 4. Allow for holidays
- D. Interlocking:
  - 1. Permit events to occur, based on changing condition of one or more associated master points.

## 2.06 BUILDING COMMUNICATIONS CONTROLLER

- A. General Requirements
  - 1. BACnet Conformance
    - a. Building Controller shall be approved by the BTL as meeting the BACnet Building Controller requirements.
    - b. Please refer to section 22.2, BACnet Functional Groups, in the BACnet standard, for a complete list of the services that must be directly supported to provide each of the functional groups listed above. All proprietary services, if used in the system, shall be thoroughly documented and provided as part of the submittal data. All necessary tools shall be supplied for working with proprietary information.
  - 2. Building controller shall be of modular construction such that various modules may be selected to fit the specific requirements of a given project. At a minimum, modules shall consist of a power supply module, a BACnet Ethernet-MS/TP (master slave token passing) module, a BACnet MS/TP-only module, and a modem module for telephone communication. Those projects that require special interfaces may use Modbus modules as needed. However, all Ethernet communications and all controllers—including central plant controllers, advanced application controllers and unitary controllers—supplied by BAS manufacturer shall utilize the BACnet protocol standard.
  - 3. Modules shall be selected to fit the particular project application. Up to seven

modules shall be powered by a single power supply module. All modules shall be panel-mounted on DIN rail for ease of addition and shall be interconnected using a simple plug-in cable. A module in the middle shall be replaceable without removing any other modules.

4. All modules shall be capable of providing global control strategies for the system based on information from any objects in the system, regardless if the object is directly monitored by the building controller module or by another controller. The software program implementing these strategies shall be completely flexible and user-definable. All software tools necessary for programming shall be provided as part of project software. Any systems utilizing factory pre-programmed global strategies that cannot be modified by field personnel on-site, using a WAN or downloaded through remote communications are not acceptable. Changing global strategies using firmware changes is also unacceptable.
5. Programming shall be object-oriented using control function blocks, and support DDC functions, 1000 Analog Values and 1000 Binary Values. All flowcharts shall be generated and automatically downloaded to controller. Programming tool shall be supplied and be resident on workstation. The same tool shall be used for all controllers.
6. Provide means to graphically view inputs and outputs to each program block in real-time as program is executing. This function may be performed using the operator's workstation or field computer.
7. Controller shall have sufficient memory to ensure high performance and data reliability. Battery shall provide power for orderly shutdown of controller and storage of data in nonvolatile flash memory. Battery backup shall maintain real-time clock functions for a minimum of 20 days.
8. Global control algorithms and automated control functions shall execute using 32-bit processor.
9. Schedules
  - a. Each building controller module shall support a minimum of 80 BACnet Schedule Objects and 80 BACnet Calendar Objects.
  - b. Building controller modules shall provide normal seven-day scheduling, holiday scheduling and event scheduling.
10. Logging Capabilities
  - a. Each building controller shall log as minimum 320 values. Any object in the system (real or calculated) may be logged. Sample time interval shall be adjustable at the operator's workstation.
  - b. Logs may be viewed both on-site and off-site using WAN or remote communication.
  - c. Building controller shall periodically upload trended data to networked operator's workstation for long-term archiving if desired.
  - d. Archived data stored in database format shall be available for use in third-party spreadsheet or database programs.
11. Alarm Generation
  - a. Alarms may be generated within the system for any object change of value or state (either real or calculated). This includes things such as

analog object value changes, binary object state changes, and various controller communication failures.

- b. Each alarm may be dialed out as noted elsewhere.
- c. Alarm log shall be provided for alarm viewing. Log may be viewed on-site at the operator's terminal or off-site using remote communications.
- d. Controller must be able to handle up to 320 alarm setups stored as BACnet event enrollment objects, with system destination and actions individually configurable.

12. Demand Limiting

- a. Demand limiting of energy shall be a built-in, user-configurable function. Each controller module shall support shedding of up to 200 loads using a minimum of two types of shed programs.

2.07 APPLICATION CONTROLLERS

- A. Provide one or more native BACnet application controllers as needed for all equipment. All controllers shall interface to building controller via BACnet/IP or BACnet MS/TP. Controllers shall include input, output and self-contained logic program as needed for complete control of units. Controllers shall be fully programmable using graphical programming blocks. Programming tool shall be system resident. No auxiliary or non-BACnet controllers shall be used.

- B. BACnet Conformance

- 1. Application controllers shall as a minimum support MS/TP BACnet LAN types. They shall communicate directly via this BACnet LAN at 9.6, 19.2, 38.4 and 76.8 Kbps, as native BACnet devices. Application controllers shall be of BACnet conformance class 3 and support all BACnet services necessary to provide the following BACnet functional groups:
  - a. Files Functional Group
  - b. Reinitialize Functional Group
  - c. Device Communications Functional Group
- 2. Refer to section 22.2, BACnet Functional Groups, in the BACnet standard, for a complete list of the services that must be directly supported to provide each of the functional groups listed above. All proprietary services, if used in the system, shall be thoroughly documented and provided as part of the submittal data. All necessary tools shall be supplied for working with proprietary information.
- 3. Standard BACnet object types supported shall include as a minimum—Analog Input, Analog Output, Analog Value, Binary Input, Binary Output, Binary Value, Device, File, and Program object types. All proprietary object types, if used in the system, shall be thoroughly documented and provided as part of the submittal data. All necessary tools shall be supplied for working with proprietary information.

- C. Application controllers shall include universal inputs with 10-bit resolution that accept 3K and 10K thermostats, 0–10VDC, 0–5 VDC, 4–20 mA and dry contact signals. Any input on a controller may be either analog or digital with a minimum of 3 inputs that accept pulses. Controller shall also include support and modifiable programming for interface to Intelligent Room Sensor with digital display. Controller shall include binary and analog outputs on board. Analog outputs shall be switch selectable as either 0–10VDC or 0–20mA. Software shall include scaling features for analog outputs.

Application controller shall include 24VDC voltage supply for use as power supply to external sensors.

- D. All program sequences shall be stored on board application controller in EEPROM. No batteries shall be needed to retain logic program. All program sequences shall be executed by controller 10 times per second and capable of multiple PID loops for control of multiple devices. All calculations shall be completed using floating-point math and system shall support display of all information in floating-point nomenclature at operator's terminal. Programming of application controller shall be completely modifiable in the field over installed BACnet LANs or remotely via modem interface. Operator shall program logic sequences by graphically moving function blocks on screen and tying blocks together on screen. Application controller shall be programmed using programming tools as described in operator's terminal section.
- E. Application controller shall include support for Intelligent Room Sensor (see Sensors and Miscellaneous Devices section). Display on Intelligent Room Sensor shall be programmable at application controller and include an operating mode and a field service mode. All button functions and display data shall be programmable to show specific controller data in each mode based on which button is pressed on the sensor.

## 2.08 SENSORS AND MISCELLANEOUS DEVICES

- A. Temperature Sensors
  - 1. All temperature sensors to be solid state electronic, factory-calibrated to within 0.5°F, totally interchangeable with housing appropriate for application. Wall sensors to be installed as indicated on drawings. Mount 44 inches about finished floor. Duct sensors to be installed such that the sensing element is in the main air stream. Immersion sensors to be installed in wells provided by control contractor, but installed by mechanical contractor. Immersion wells shall be filled with thermal compound before installation of immersion sensors. Outside air sensors shall be installed away from exhaust or relief vents, not in an outside air intake and in a location that is in the shade most of the day.
- B. Wall Sensor (Adjustable & Non-Adjustable)
  - 1. Standard wall sensor shall use solid-state sensor and shall be packaged in aesthetically pleasing enclosure. Adjustable sensor shall provide override function, warmer/cooler lever for set point adjustment and port for plug-in of Field Service Tool for field adjustments. Override time shall be stored in controller and be adjustable on a zone-by-zone basis. Adjustment range for warmer/cooler lever shall also be stored in EEPROM on controller. All programmable variables shall be available to Field Service Tool through wall sensor port. Sensors shall fit neatly over the rough-in box without the need for additional dress plates. **All non-adjustable temperature sensors located in public areas shall be installed in a translucent locking cover.**
- C. Outside air relative humidity sensor
  - 1. Provide outside air relative humidity sensors as indicated per the control diagrams. Humidity sensors shall meet, at minimum, the following requirements:
    - a. Non-corroding outdoor shield to minimize wind effects and solar heating. Wall mount weather proof enclosure with conduit fitting.
    - b. Two wire, 4-20 mA output proportional to relative humidity range of 0% to 100%.



- c.  $\pm 2\%$  accuracy (5 - 95% RH).
  - d. Humidity sensor shall be replaceable.
- D. Wall mounted relative humidity sensor
  - 1. Provide wall mounted relative humidity sensors as indicated per the control diagrams. Humidity sensors shall meet, at minimum, the following requirements:
    - a. Wall mount enclosure with white cover.
    - b. Two wire, 4-20 mA output or digitally communicating proportional to relative humidity range of 0% to 100%.
    - c. Humidity sensor shall be replaceable.
    - d.  $\pm 2\%$  accuracy (5 - 95% RH).
    - e. Mounted 44 inches above floor .
- E. Duct mounted relative humidity sensor
  - 1. Provide duct mounted relative humidity sensors as indicated per the control diagrams. Humidity sensors shall meet, at minimum, the following requirements:
    - a. Duct mounted moisture resistant enclosure with conduit fitting.
    - b. Two wire, 4-20 mA output proportional to relative humidity range of 0% to 100%.
    - c. Humidity sensor shall be replaceable.
    - d.  $\pm 2\%$  accuracy (5 - 95% RH).
    - e. 8 inch probe length.
- F. Carbon Dioxide Sensors – Duct and Wall Mount
  - 1. Output signal: 4 – 20ma signal.
  - 2. Accuracy: +/- 30 ppm.
  - 3. Range: 0 – 2000 ppm.
  - 4. Calibration interval: 5 years.
  - 5. Response time: 2 minutes or less.
  - 6. Display: 4 digit LCD.
  - 7. Operating Humidity: 0% to 95% non-condensing.
  - 8. Operating temperature: 32F to 122F.
  - 9. Enclosure: NEMA 1.
- G. Photohelic Differential Pressure Switch and Gauge – Auto Reset – Filter Monitoring
  - 1. Contact Type: Two DPDT
  - 2. Indication: Visible magnehelic pressure indication.
  - 3. Range: Select appropriate range.
  - 4. Accuracy: 2% full scale.
  - 5. Setpoints: Visible.
  - 6. Dial: 4"
- H. Static Pressure Switches – Manual Reset
  - 1. Range: Select appropriate range for anticipated pressures.

2. Duct Static Pressure Tip: Provide tips as required.
3. Contact Type: One DPDT
4. Operating Temperature: -30F to 180F.
5. Reset Type: Manual
- I. Differential Pressure Transmitters - Duct
  1. Output Signal: 4 – 20 ma.
  2. Overpressure: 10 psig.
  3. Accuracy: 1% full scale.
  4. Diaphragm: Stainless steel.
  5. Non-Repeatability: 0.1% full scale.
  6. Hysteresis: 0.2% full scale.
  7. Compensated Temperature Range: 0F to 155F.
- J. **Outside air flow measuring stations:**
  1. **Ebtron Model GTx116-PC (or Engineer approved equal)**
  2. **The equipment vendor shall include in its price the cost to attend a pre-installation meeting and shall include the costs to commission its devices certifying proper operation.**

## 2.09 ENCLOSURES

- A. All controllers, power supplies and relays shall be mounted in enclosures.
- B. Enclosures may be NEMA 1 when located in a clean, dry, indoor environment.
- C. Outdoor enclosures shall be NEMA 3R.
- D. Enclosures shall have hinged, locking doors.
- E. Provide laminated plastic nameplates for all enclosures. Include location and unit served on nameplate. Laminated plastic shall be 1/8" thick sized appropriately to make label easy to read.

## 2.10 ELECTRONIC ACTUATORS

## 2.11 ELECTRONIC ACTUATORS AND VALVES

- A. Execution Details for Actuators and Valves
  1. Install "Hard Wire" interlock to disconnect the mechanical spring return actuator power circuit for fail-safe operation. Use of the control signal to drive the actuators closed is not acceptable.
  2. Each DDC analog output point shall have an actuator feedback signal, independent of control signal, wired and terminated in the control panel for true position information and troubleshooting.
  3. VAV box damper actuation shall be Floating type or Analog (2-10vdc, 4-20ma).
  4. Primary valve control shall be Analog (2-10vdc, 4-20ma).
- B. Actuators for Damper and Control Valves ½" to 6" shall be Electric unless otherwise specified, provide actuators as follows:
  1. UL Listed Standard 873 shall certify Actuators.
  2. 5 year Manufacturers Warranty. Two-year unconditional + Three year product defect from date of installation.

3. Mechanical spring shall be provided when specified. Capacitors or other non-mechanical forms of fail-safe are not acceptable.
  4. Position indicator device shall be installed and made visible to the exposed side of the Actuator. For damper short shaft mounting, a separate indicator shall be provided to the exposed side of the Actuator.
  5. Overload Protection: Actuators shall provide protection against actuator burnout by using an internal current limiting circuit or digital motor rotation sensing circuit. Circuit shall insure that actuators cannot burn out due to stalled damper or mechanical and electrical paralleling. End switches to deactivate the actuator at the end of rotation are acceptable only for Butterfly Valve actuators.
  6. A push button gearbox release shall be provided for all non-spring actuators.
  7. Modulating actuators shall be 24Vac and consume 10VA power or less.
  8. Conduit connectors are required when specified and when code requires it.
- C. Damper Actuators:
1. Outside Air and Exhaust Air Damper Actuators shall be Mechanical Spring Return. Capacitors or other non-mechanical forms of fail-safe are not acceptable. The actuator mounting arrangement and spring return feature shall permit normally open or normally closed positions of the damper as required.
  2. Economizer Actuators shall utilize Analog control 2-10 VDC, Floating control is not acceptable.
  3. Electric damper actuators (including VAV box actuators) shall be direct shaft mounted and use a V-bolt and toothed V-clamp causing a cold weld effect for positive gripping. Single bolt or setscrew type fasteners are not acceptable.
  4. One electronic actuator shall be direct shaft mounted per damper section. No connecting rods or jackshafts shall be needed. Small outside air and return air economizer dampers may be mechanically linked together if one actuator has sufficient torque to drive both and damper drive shafts are both horizontal installed.
  5. Multi-section dampers with electric actuators shall be arranged so that each damper section operates individually. One electronic actuator shall be direct shaft mounted per damper section. (See below execution section for more installation details.)
- D. Valve Actuators ½" to 6"
1. Mechanical spring shall be provided on all actuators for AHU heating or cooling coil when units are mounted outside. See plans for fail save flow function: Normal Open or Normal Closed. Capacitors or other non-mechanical forms of fail-safe are not acceptable.
  2. All zone service actuators shall be non-spring return unless otherwise specified.
  3. The valve actuator shall be capable of providing the minimum torque required for proper valve close off for the required application.
  4. All control valves actuators shall have an attached 3-foot cable for easy installation to a junction box.
  5. Override handle and gearbox release shall be provided for all non-spring return valve actuators.
- E. Control Dampers. The control contractor shall furnish and size all automatic control dampers unless provided with packaged equipment. The sheet metal contractor shall install all dampers unless provided with packaged equipment.
1. All dampers used for modulating service shall be opposed blade type arrange for normally open or normally closed operation as required. The damper is to be

sized so that when wide open the pressure drop is a sufficient amount of its close-off pressure drop for effective throttling.

2. All dampers used for two-position or open-close control shall be parallel blade type arranged for normally open or closed operation as required.
3. Damper linkage hardware shall be constructed of corrosion resistant zinc & nickel-plated steel.
4. Frame shall utilize a heavy duty 5in. by 1 in. 13 gauge galvanized steel hat channel frame designed for installation inside the ductwork. Frame shall have reinforced corners and low profile head and sill on dampers less than 17 in high.
5. Blades shall be 3-V, single thickness of 16 gauge galvanized steel
6. Shafts shall be ½ in. diameter square plated steel axles positively locked to the blades to eliminate slippage between blades and axles. Actuator shaft shall be removable.
7. Provide molded synthetic (acetal) bearings in a polished extruded frame raceway.
8. Blade-to-blade linkage shall be concealed within the frame
9. Provide dampers with flexible metal compression-type jamb seals and extruded vinyl blade seals for low leakage performance. Seals shall be silicone.
10. Dampers shall be Model D642 manufactured by Honeywell or equal.

F. Characterized Control Valves

1. NPS 2.0 and Smaller: Nickel-plated forged brass body rated at no less than 400 psi, stainless steel ball and blowout proof stem, female NPT end fittings, with a dual EPDM O-ring packing design, fiberglass reinforced Teflon seats, and a TEFZEL flow characterizing disc. NPS ¾" and Smaller for Terminal Units: Nickel plated forged brass body rated at no less than 600 psi, chrome plated brass ball and blowout proof stem, female NPT end fittings, with a dual EPDM O-Ring packing design, fiberglass reinforced Teflon seats, and a TEFZEL flow characterizing disc.
2. NPS 2-1/2 and 3: GG25 cast iron body according to ANSI Class 125, standard class B, stainless steel ball and blowout proof stem, flange to match ANSI 125 with a dual EPDM O-ring packing design, PTFE seats, and a stainless steel flow characterizing disc.
3. Close off pressure rating: 200 psi.
4. The actuator shall be the same manufacturer as the valve, integrally mounted to the valve at the factory with a single screw on a four-way DIN mounting-base.
5. NPS 2" and smaller characterized control valves for individual coil control shall be provided as part of a pipe package supplied by the valve manufacturer. The supply side of the coil shall contain a strainer/shut-off ball valve/drain with a P/T port. The return side of the coil shall contain a union fitting with a P/T port, characterized control valve, an integrated pressure independent automatic balancing valve/union/isolation ball valve/manual air vent with P/T port. Shut-off valves as an integrated part of the characterized control valve are prohibited. For 3-way installations, supply an integrated 100% port isolation valve/manual air vent with a P/T port for field installation in the bypass of the circuit.

G. Butterfly Valves – High Performance

1. Valve body shall be full lugged carbon steel ANSI Class 150 body with a 316 stainless steel disc without a nylon coating, RTFE seat, and be ANSI Class 150300 flange standards. Blowout-proof shaft shall be 17-4ph stainless steel and shall be supported at four locations by glass-backed TFE bushings. Valve packing shall be Chevron TFE and shall include fully adjustable packing flange and separable packing gland. Valve body shall have long stem design to allow

- for 2" insulation (minimum). Valve face-to-face dimensions shall comply with API 609 and MSS-SP-68. Valve assembly shall be completely assembled and tested, ready for installation.
2. Disk: Full rated disk @ 200 psi.
  3. Sizing:
    - a. Two-Position: Line size or size using a pressure differential of 1 psi.
    - b. Modulating: 5 psig or twice the load pressure drop, whichever is more. Size for the design flow with the disc in a 60-degree-open-position with the design velocity less than 32 feet per second.
  4. Flow Characteristics: Modified equal percentage, unidirectional
  5. Close-Off Pressure Rating: 150 psi bubble tight shut-off.
  6. Media Temperature Range: ANSI Class 150 limitations
  7. Differential Pressure: 285 psi @ 100 deg F for ANSI 150 (725 psi @ 100 deg F for ANSI 300).

### PART 3 EXECUTION

#### 3.01 EXAMINATION

- A. Verify conditioned power supply is available to control units.
- B. Verify field end devices, wiring, and pneumatic tubing is installed prior to installation proceeding.

#### 3.02 INSTALLATION

- A. Install control units and other hardware in position on permanent walls where not subject to excessive vibration.
- B. Install software in control units. Implement features of programs to specified requirements and appropriate to sequence of operation.
- C. Install with 120 volts alternating current, 15 amp circuit to each programmable control unit. Controls for life safety equipment shall be on emergency power circuit.
- D. Install conduit and electrical wiring in accordance with requirements of Division 26.
- E. Install electrical material and installation in accordance with appropriate requirements of Division 26.

#### 3.03 MANUFACTURER'S REPRESENTATIVE FIELD SERVICES

- A. Start and commission systems. Allow adequate time for start-up and commissioning prior to placing control systems in permanent operation.
- B. Furnish service technician employed by system installer to instruct Owner's representative in operation of systems plant and equipment.

#### 3.04 DEMONSTRATION AND TRAINING

- A. Furnish basic operator training for multiple persons on data display, alarm and status descriptors, requesting data, execution commands and log requests. Include a minimum of 12 hours instructor time for onsite training and 12 hours of hands on class environment training.
- B. Demonstrate complete and operating system to Owner, Engineer and Commissioning Authority.

#### 3.05 SEQUENCES OF OPERATION

- A. See drawings for sequences.

### 3.06 SYSTEM GRAPHICS - BROWSER BASED DISPLAYS

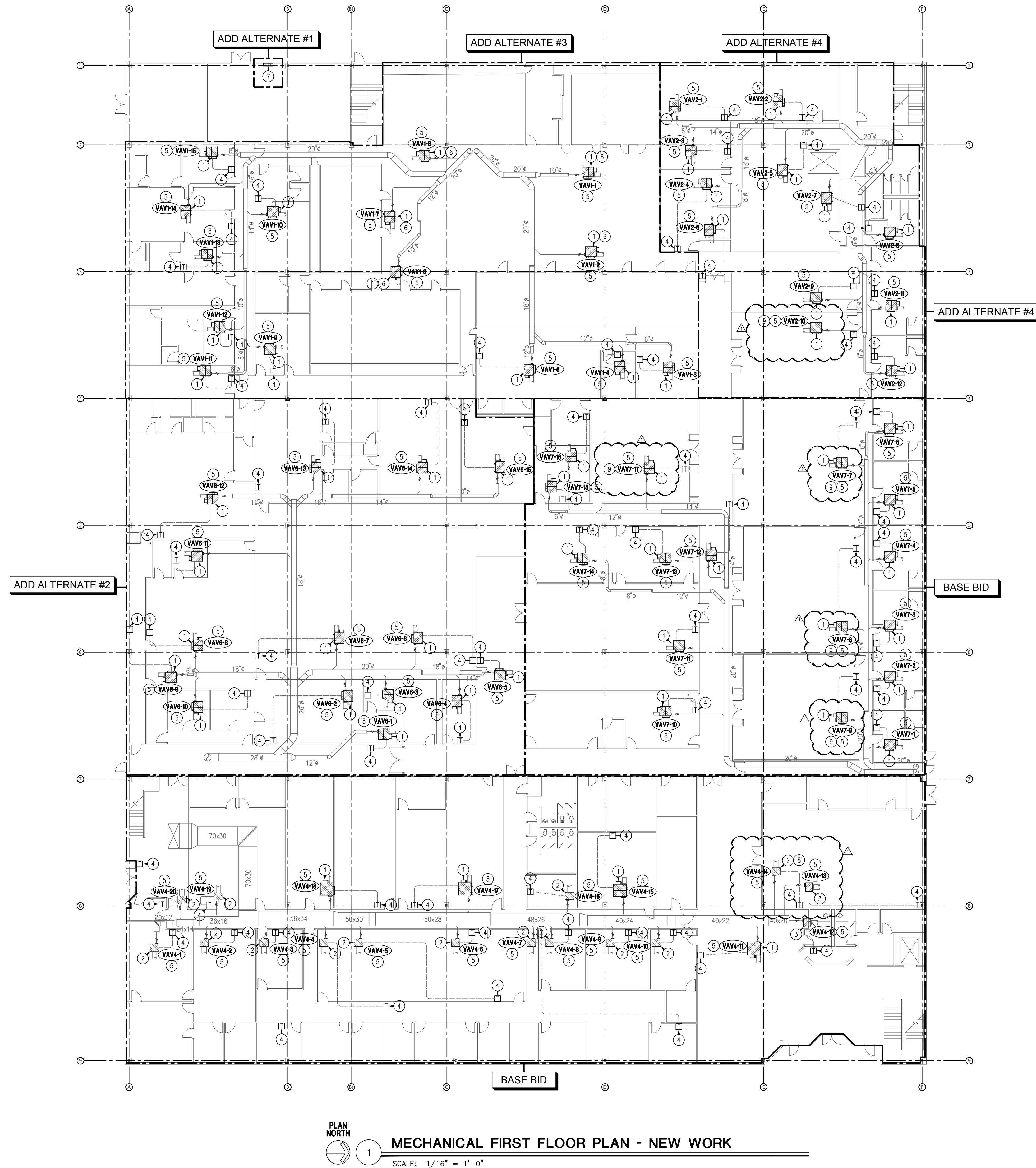
- A. General – on all graphics
  - 1. Display time, outside air temperature and outside air humidity on each graphic.
  - 2. Provide navigation links to scheduling, trends, alarms.
  - 3. Provide navigation link to the campus level graphic and building level graphic.
  - 4. Ensure standard operation of backward and forward button on browser.
  - 5. Provide color animation to indicate run status.
- B. Campus Level Graphic
  - 1. Display each building on a geographical map
  - 2. Display time, outside air temperature and outside air humidity.
- C. Building Level Graphic
  - 1. Display equipment on floorplans.
  - 2. Outline each HVAC zone with bold lines.
  - 3. Display thermograph on floorplan (i.e. color shading to represent temperature deviation from setpoint).
  - 4. Display if system is following occupied/unoccupied schedule.
- D. Equipment Graphics
  - 1. Display equipment graphic that depicts the actual configuration of the equipment.
  - 2. Display each point value in the appropriate place on the equipment.
  - 3. Provide override capability for output points from equipment graphic.
  - 4. Provide animation to indicate operational points.
  - 5. Provide indication of program outputs such as, but not limited to cooling mode, dehumidification, occupied/unoccupied, etc.
- E. Summary Page Graphics
  - 1. Provide summary list of AHU's, schedule status, discharge air temperature and discharge air temperature setpoint.
  - 2. Provide summary list of terminal units, schedule status, zone air temperature and zone air temperature setpoint.
  - 3. Provide summary list of all equipment with out of service flags.
  - 4. Provide summary list of all exhaust fans and status.

### 3.07 Trend Points List

- A. Control contractor to start trends on all points during commissioning.

END OF SECTION





### GENERAL NOTES:

- ALL WORK SHALL BE IN ACCORDANCE WITH THE INTERNATIONAL BUILDING CODE, THE INTERNATIONAL MECHANICAL CODE, AND THE OTHER CODES AND ORDINANCES OF THE AUTHORITY HAVING JURISDICTION.
- MOUNT ALL THERMOSTATS/TEMPERATURE SENSORS AT 3'-8" A.F.F.
- ALL UNITS MUST BE INSTALLED LEVEL.
- CAREFULLY PROTECT ALL EQUIPMENT AND MATERIAL PRIOR TO INSTALLATION. SEE SPECIFICATIONS.
- DEMOLITION DOCUMENTATION WAS OBTAINED FROM EXISTING BUILDING RECORD DRAWINGS AND SURVEY OF THE FACILITY. PRIOR TO CONSTRUCTION, THE CONTRACTOR SHALL VISIT THE PROJECT SITE AND SHALL FIELD VERIFY ALL EXISTING CONDITIONS.
- COORDINATE ALL WORK WITH OTHER TRADES AND OWNER'S REPRESENTATIVE FOR APPROVAL PRIOR TO REMOVING EXISTING ITEMS.
- THE CONTRACTOR SHALL TAKE CARE TO PROTECT ALL EXISTING EQUIPMENT/ITEMS TO REMAIN.
- ALL EQUIPMENT THAT IS REMOVED BUT NOT REUSED SHALL BE MADE AVAILABLE TO THE OWNER. ANY SUCH ITEMS SHALL BE STORED AT THE SITE FOR A MINIMUM OF (1) WEEK UNLESS INDICATED OTHERWISE BY OWNER'S REPRESENTATIVE. ALL EQUIPMENT/ITEMS NOT RETAINED BY THE OWNER SHALL BE DISCARDED AT THE CONTRACTOR'S EXPENSE.
- ALL EXISTING SYSTEMS/EQUIPMENT SHALL REMAIN IN SERVICE UNLESS OTHERWISE NOTED.
- INSPECT AND CLEAN ALL EXISTING TERMINAL UNITS AS REQUIRED TO ENSURE PROPER/EFFICIENT OPERATION.
- ENSURE DUCTWORK SERVING TERMINAL UNITS IS PROPERLY CONNECTED AND SEALED. REPAIR/REPLACE DUCTWORK AS NECESSARY.
- PROVIDE ACCESS PANEL IN ALL COURT ROOM CEILINGS AS REQUIRED TO ALLOW PROPER SERVICE OF VAV BOX.

### KEYED NOTES:

(APPLIES TO THIS SHEET) ○

- EXISTING PARALLEL FAN POWERED TERMINAL UNIT TO REMAIN IN SERVICE. REMOVE EXISTING PNEUMATIC CONTROLS AND REPLACE WITH NEW DDC CONTROLS. RE: CONTROL DIAGRAM FOR NEW OPERATING SEQUENCE.
- EXISTING SINGLE DUCT COOLING ONLY TERMINAL UNIT TO REMAIN IN SERVICE. REMOVE EXISTING PNEUMATIC CONTROLS AND REPLACE WITH NEW DDC CONTROLS. RE: CONTROL DIAGRAM FOR NEW OPERATING SEQUENCE. INSTALL VAV INLET RETROFIT KIT EQUAL TO TITUS M# DEC. REFERENCE DETAIL #1/M4.1.
- EXISTING SINGLE DUCT TERMINAL UNIT WITH HOT WATER COILS TO REMAIN IN SERVICE. REMOVE EXISTING PNEUMATIC CONTROLS & VALVE, AND REPLACE WITH NEW DDC CONTROLS. RE: CONTROL DIAGRAM FOR NEW OPERATING SEQUENCE. INSTALL VAV INLET RETROFIT KIT EQUAL TO TITUS M# DEC. REFERENCE DETAIL #1/M4.1.
- TRACE AND DOCUMENT EXISTING TEMPERATURE SENSOR TO THE ASSOCIATED TERMINAL UNIT. REMOVE EXISTING PNEUMATIC TEMPERATURE SENSOR AND REPLACE WITH NEW DDC TEMPERATURE SENSOR. NEW ELECTRONIC TEMPERATURE SENSOR TO BE MOUNTED A 3'-8" AFF. PATCH AND REPAIR WALL TO MATCH EXISTING, AS NECESSARY, WHERE EXISTING PNEUMATIC TEMPERATURE SENSOR IS REMOVED.
- PROVIDE NEW EQUIPMENT LABEL FOR TERMINAL UNIT. LABEL TERMINAL UNIT AS INDICATED. RE: SPECIFICATIONS FOR LABEL REQUIREMENTS.
- FIELD LOCATE EXISTING PNEUMATIC TEMPERATURE SENSOR SERVING TERMINAL UNIT. REPLACE EXISTING SENSOR WITH NEW ELECTRONIC TEMPERATURE SENSOR. COORDINATE NEW TEMPERATURE SENSOR LOCATION WITH OWNER'S REPRESENTATIVE PRIOR TO INSTALLATION (MOUNTING HEIGHT OF TEMPERATURE SENSOR TO BE 3'-8" AFF.).
- DDC PANEL.
- REPLACE EXISTING HOT WATER REHEAT VALVE. FIELD VERIFY SIZE REQUIREMENTS.
- PROVIDE ACCESS PANEL. ACCESS PANEL SHALL ALLOW FULL ACCESS TO VAV BOX. CONTRACTOR SHALL FIELD COORDINATE SIZE OF ACCESS PANEL WITH EXISTING GYP. FURR DOWN.

PROVIDE NON-ADJUSTABLE TEMPERATURE SENSORS IN PUBLIC AREAS. NON-ADJUSTABLE TEMPERATURE SENSORS SHALL BE INSTALLED IN A TRANSLUCENT LOCKING COVER.

REVISIONS:  
ADDENDUM #3 10/03/17

THESE DRAWINGS, ACCOMPANYING SPECIFICATIONS AND ANY OTHER DOCUMENTS, HEREBY CONSTITUTE THE ENTIRE AGREEMENT BETWEEN THE ENGINEER AND THE OWNER. THE ENGINEER'S SERVICES ARE FOR THE DESIGN AND CONSTRUCTION OF THE PROJECT. THE ENGINEER SHALL NOT BE RESPONSIBLE FOR THE ACCURACY OF THE INFORMATION PROVIDED BY THE OWNER. THE ENGINEER SHALL NOT BE RESPONSIBLE FOR THE CONSTRUCTION OF THE PROJECT. THE ENGINEER SHALL NOT BE RESPONSIBLE FOR THE OPERATION OF THE PROJECT. THE ENGINEER SHALL NOT BE RESPONSIBLE FOR THE MAINTENANCE OF THE PROJECT. THE ENGINEER SHALL NOT BE RESPONSIBLE FOR THE REPAIR OF THE PROJECT. THE ENGINEER SHALL NOT BE RESPONSIBLE FOR THE REPLACEMENT OF THE PROJECT. THE ENGINEER SHALL NOT BE RESPONSIBLE FOR THE REMOVAL OF THE PROJECT. THE ENGINEER SHALL NOT BE RESPONSIBLE FOR THE DEMOLITION OF THE PROJECT. THE ENGINEER SHALL NOT BE RESPONSIBLE FOR THE DISPOSITION OF THE PROJECT. THE ENGINEER SHALL NOT BE RESPONSIBLE FOR THE RETURN OF THE PROJECT. THE ENGINEER SHALL NOT BE RESPONSIBLE FOR THE REUSE OF THE PROJECT. THE ENGINEER SHALL NOT BE RESPONSIBLE FOR THE RECYCLING OF THE PROJECT. THE ENGINEER SHALL NOT BE RESPONSIBLE FOR THE REPAIR OF THE PROJECT. THE ENGINEER SHALL NOT BE RESPONSIBLE FOR THE REPLACEMENT OF THE PROJECT. THE ENGINEER SHALL NOT BE RESPONSIBLE FOR THE REMOVAL OF THE PROJECT. THE ENGINEER SHALL NOT BE RESPONSIBLE FOR THE DEMOLITION OF THE PROJECT. THE ENGINEER SHALL NOT BE RESPONSIBLE FOR THE DISPOSITION OF THE PROJECT. THE ENGINEER SHALL NOT BE RESPONSIBLE FOR THE RETURN OF THE PROJECT. THE ENGINEER SHALL NOT BE RESPONSIBLE FOR THE REUSE OF THE PROJECT. THE ENGINEER SHALL NOT BE RESPONSIBLE FOR THE RECYCLING OF THE PROJECT.

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PROJECT # 16091

CITY OF SAN ANTONIO  
FRANK D. WING MUNICIPAL COURT BUILDING  
HVAC CONTROLS UPGRADE  
401 S. FRIO STREET, SAN ANTONIO, TX 78207

MECHANICAL FIRST  
FLOOR PLAN -  
NEW WORK

PROJECT: 16-091  
DRAWN: AN  
CHECKED: PEP  
DATE: 6/29/2017  
SHEET  
M1.1





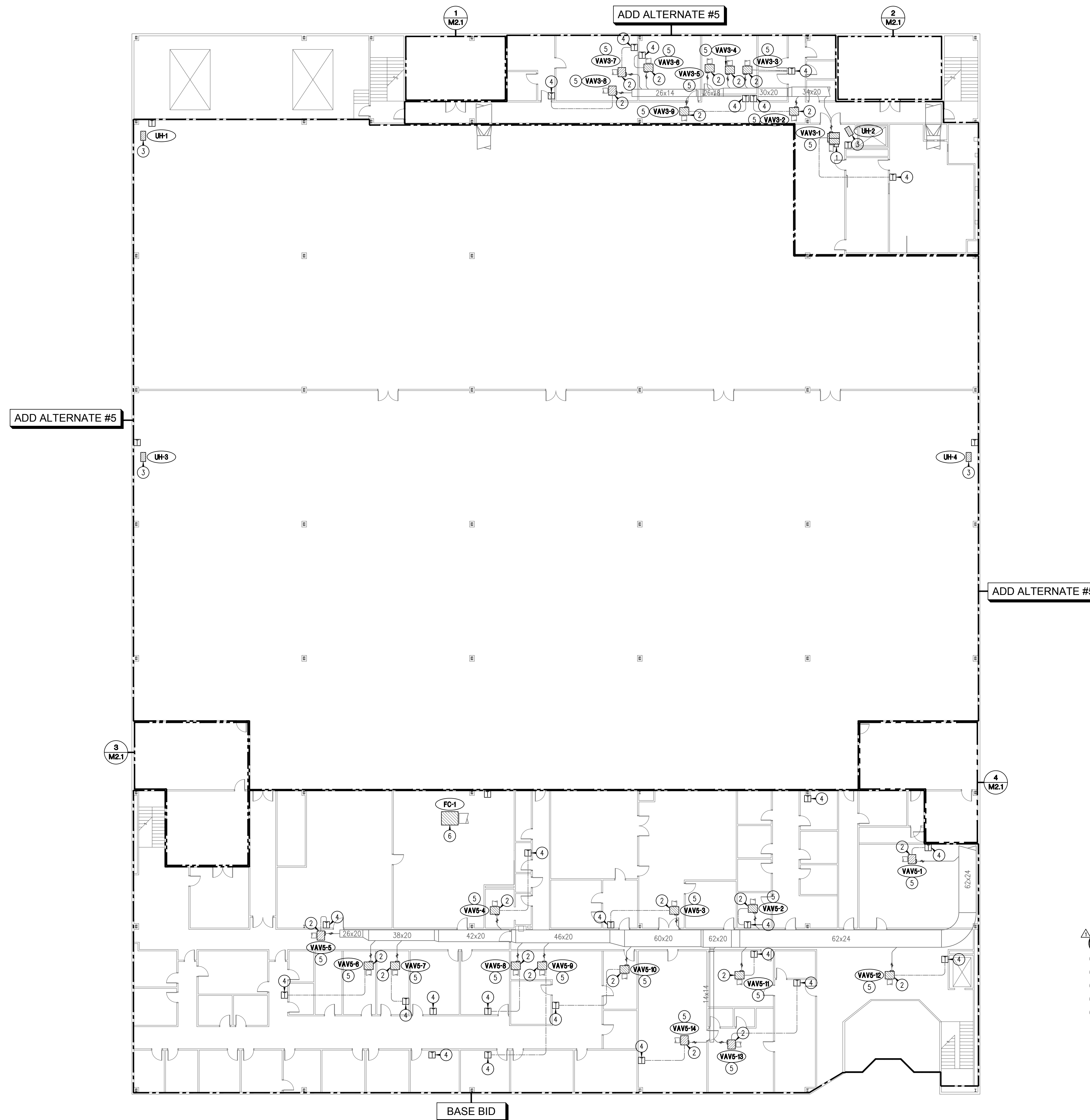
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1. ALL WORK SHALL BE IN ACCORDANCE WITH THE INTERNATIONAL BUILDING CODE, THE INTERNATIONAL MECHANICAL CODE, AND THE OTHER CODES AND ORDINANCES OF THE AUTHORITY HAVING JURISDICTION.
2. MOUNT ALL THERMOSTATS/TEMPERATURE SENSORS AT 5'-8" A.F.F.
3. ALL UNITS MUST BE INSTALLED LEVEL.
4. CAREFULLY PROTECT ALL EQUIPMENT AND MATERIAL PRIOR TO INSTALLATION. SEE SPECIFICATIONS.
5. DEMOLITION DOCUMENTATION WAS OBTAINED FROM EXISTING BUILDING RECORD DRAWINGS AND SURVEY OF THE FACILITY. PRIOR TO CONSTRUCTION, THE CONTRACTOR SHALL VISIT THE PROJECT SITE AND SHALL FIELD VERIFY ALL EXISTING CONDITIONS.
6. COORDINATE ALL WORK WITH OTHER TRADES AND OWNER'S REPRESENTATIVE FOR APPROVAL PRIOR TO REMOVING EXISTING ITEMS.
7. THE CONTRACTOR SHALL TAKE CARE TO PROTECT ALL EXISTING EQUIPMENT/ITEMS TO REMAIN.
8. ALL EQUIPMENT THAT IS REMOVED BUT NOT REUSED SHALL BE MADE AVAILABLE TO THE OWNER. ANY SUCH ITEMS SHALL BE STORED AT THE SITE FOR A MINIMUM OF (1) WEEK UNLESS INDICATED OTHERWISE BY OWNER'S REPRESENTATIVE. ALL EQUIPMENT/ITEMS NOT RETAINED BY THE OWNER SHALL BE DISCARDED AT THE CONTRACTOR'S EXPENSE.
9. ALL EXISTING SYSTEMS/EQUIPMENT SHALL REMAIN IN SERVICE UNLESS OTHERWISE NOTED.
10. INSPECT AND CLEAN ALL EXISTING TERMINAL UNITS AS REQUIRED TO ENSURE PROPER/EFFICIENT OPERATION.
11. ENSURE OUTDOOR SERVING TERMINAL UNITS IS PROPERLY CONNECTED AND SEALED. REPAIR/REPLACE DUCTWORK AS NECESSARY.

(APPLIES TO THIS SHEET) ☐

1. EXISTING PARALLEL FAN POWERED TERMINAL UNIT TO REMAIN IN SERVICE. REMOVE EXISTING PNEUMATIC CONTROLS AND REPLACE WITH NEW DDC CONTROLS. RE: CONTROL DIAGRAM FOR NEW OPERATING SEQUENCE.
2. EXISTING SINGLE DUCT TERMINAL UNIT TO REMAIN IN SERVICE. REMOVE EXISTING PNEUMATIC CONTROLS AND REPLACE WITH NEW DDC CONTROLS. RE: CONTROL DIAGRAM FOR NEW OPERATING SEQUENCE. *RE-EXISTING PNEUMATIC CONTROLS TO BE REMOVED. SEE SCHEDULE 10A UNIT 1.*
3. RETROFIT KIT EQUAL TO TITUS M-60, REFERENCE DETAIL #1/M-61.
4. EXISTING UNIT HEATER TO REMAIN IN SERVICE. PROVIDE NEW TEMPERATURE SENSOR MOUNTED AT 3'-8" AFF. RE: CONTROL DIAGRAM FOR NEW OPERATING SEQUENCE.
5. TRACE AND DOCUMENT EXISTING TEMPERATURE SENSOR TO THE ASSOCIATED TERMINAL UNIT. REMOVE EXISTING PNEUMATIC TEMPERATURE SENSOR AND REPLACE WITH NEW ELECTRONIC TEMPERATURE SENSOR. NEW ELECTRONIC TEMPERATURE SENSOR TO BE MOUNTED A 3'-8" AFF. PATCH AND REPAINT WALL TO WHICH EXISTING, AND IF NECESSARY, THESE EXISTING TEMPERATURE SENSOR IS REMOVED.
6. PROVIDE NEW EQUIPMENT LABEL FOR TERMINAL UNIT. LABEL TERMINAL UNIT AS INDICATED. RE: SPECIFICATIONS FOR LABEL REQUIREMENTS.
7. EXISTING FAN COIL UNIT TO REMAIN IN SERVICE. PROVIDE NEW TEMPERATURE SENSOR. RE: CONTROL DIAGRAM FOR NEW OPERATING SEQUENCE.

PROVIDE NON-ADJUSTABLE TEMPERATURE SENSORS IN PUBLIC AREAS. NON-ADJUSTABLE TEMPERATURE SENSORS SHALL BE INSTALLED IN A TRANSLUCENT LOCKING COVER.



PLAN  
NORTH

A circular symbol with a horizontal line through the center, and an arrow pointing to the right, indicating North.

MECHANICAL SECOND FLOOR PLAN - NEW WORK

SCALE:  $1/16" = 1'-0"$

CITY OF SAN ANTONIO

# FRANK D. WING MUNICIPAL COURT BUILDING

## HVAC CONTROLS UPGRADE

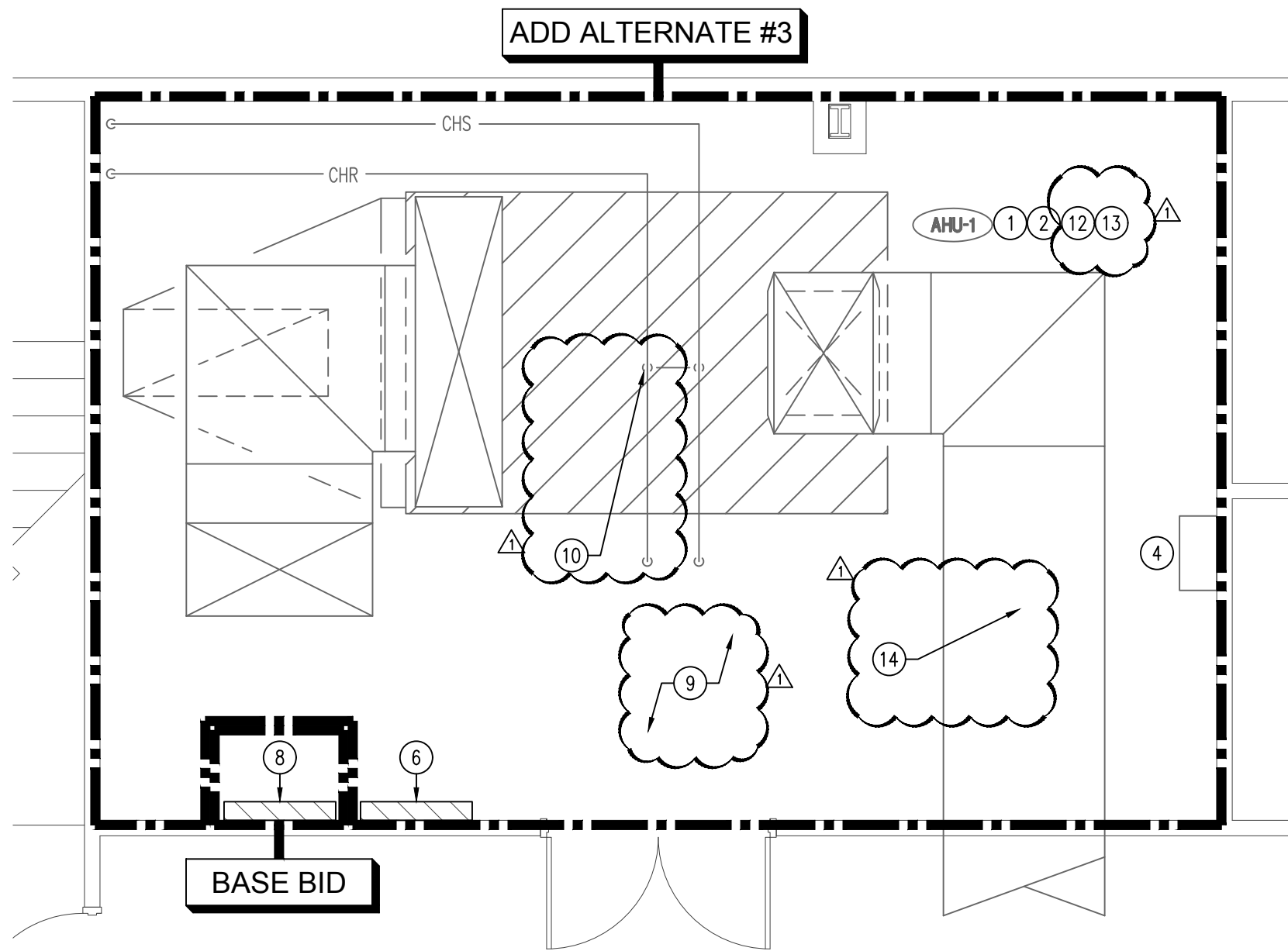
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MECHANICAL SECOND  
FLOOR PLAN -  
NEW WORK

PROJECT:	16-091
DRAWN:	AAJ
CHECKED:	PEP
DATE:	6/29/2017
SHEET	

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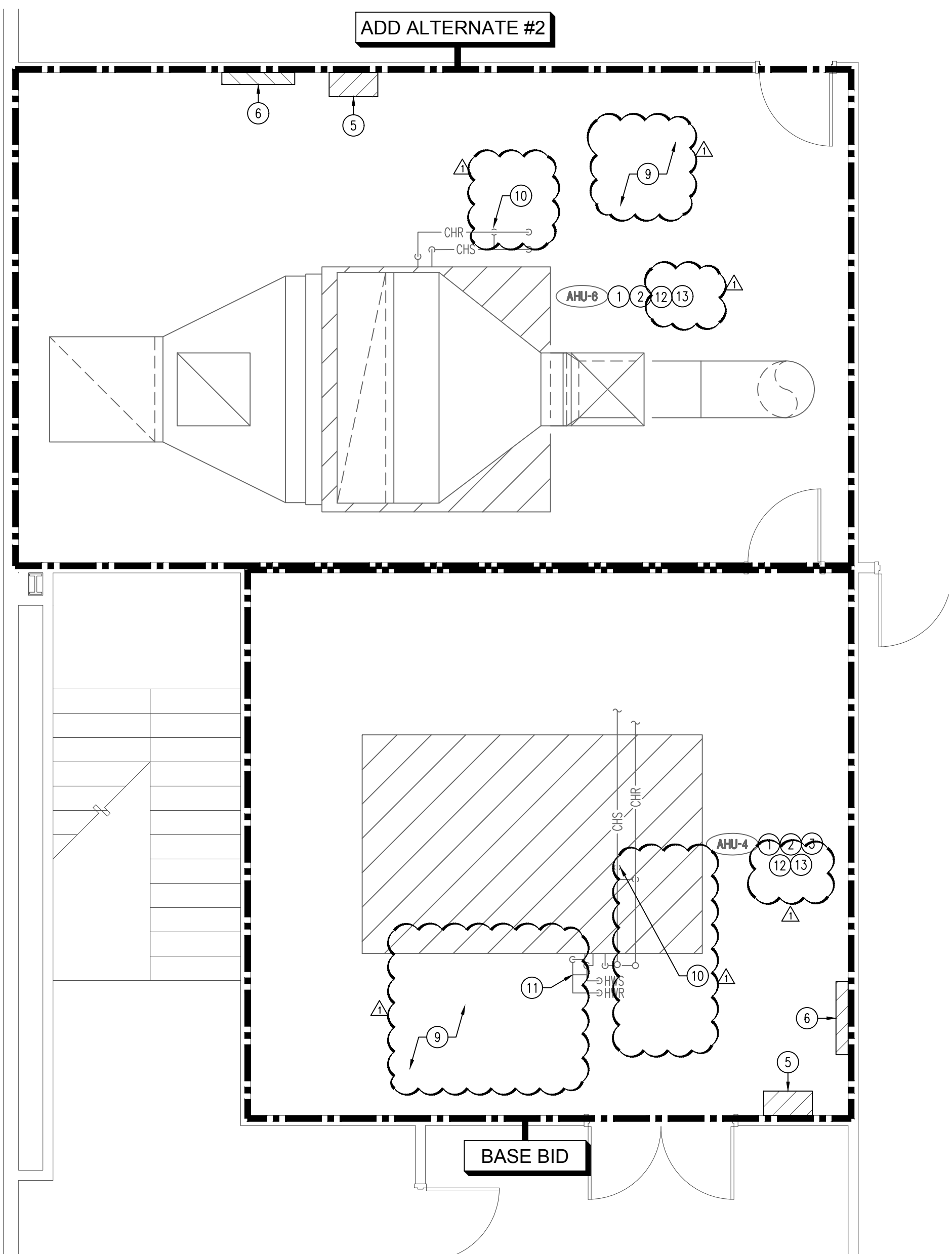




1

### ENLARGED MECHANICAL FLOOR PLAN - MECHANICAL ROOM 1

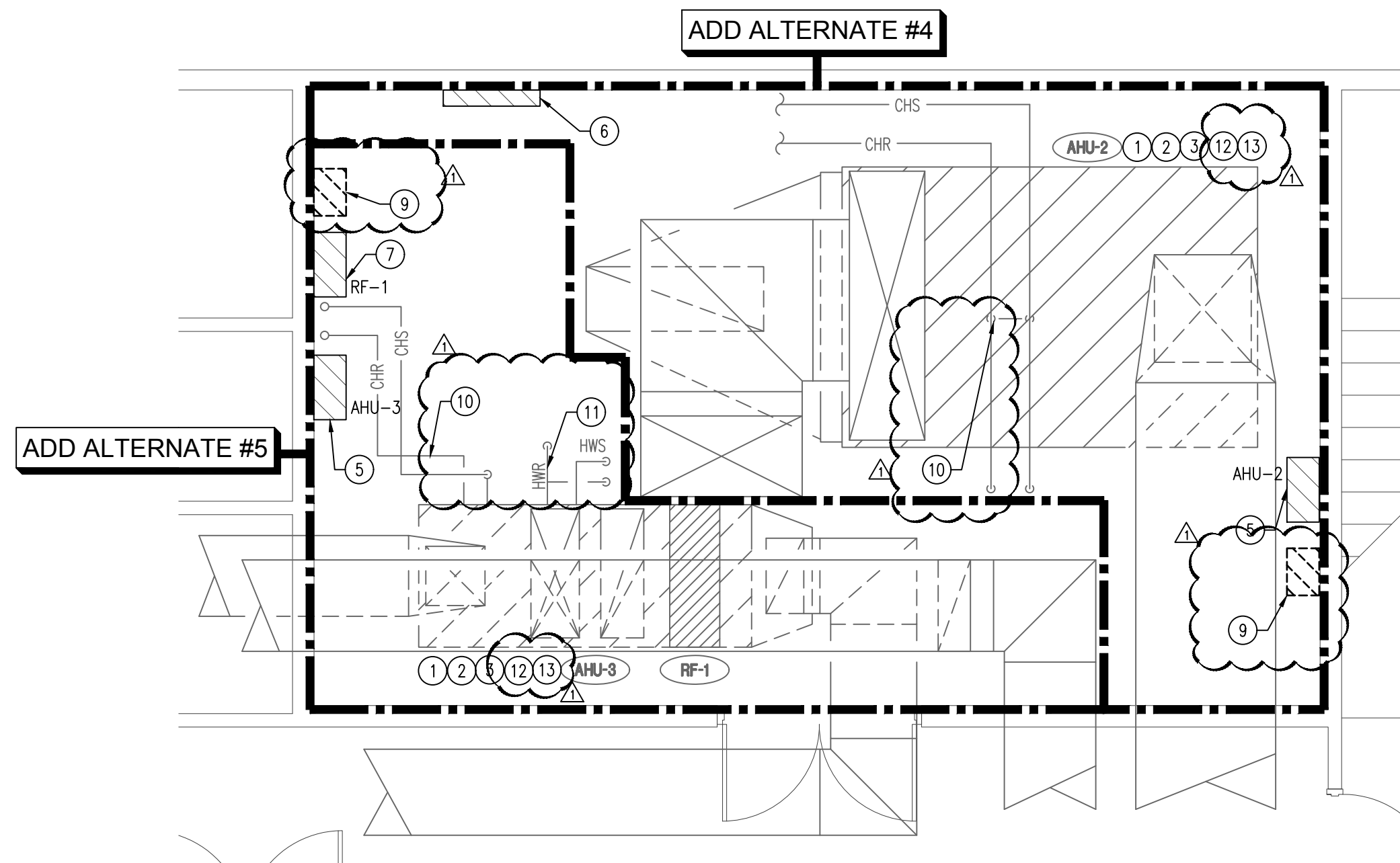
SCALE: 1/4" = 1'-0"



3

### ENLARGED MECHANICAL FLOOR PLAN - MECHANICAL ROOM 3

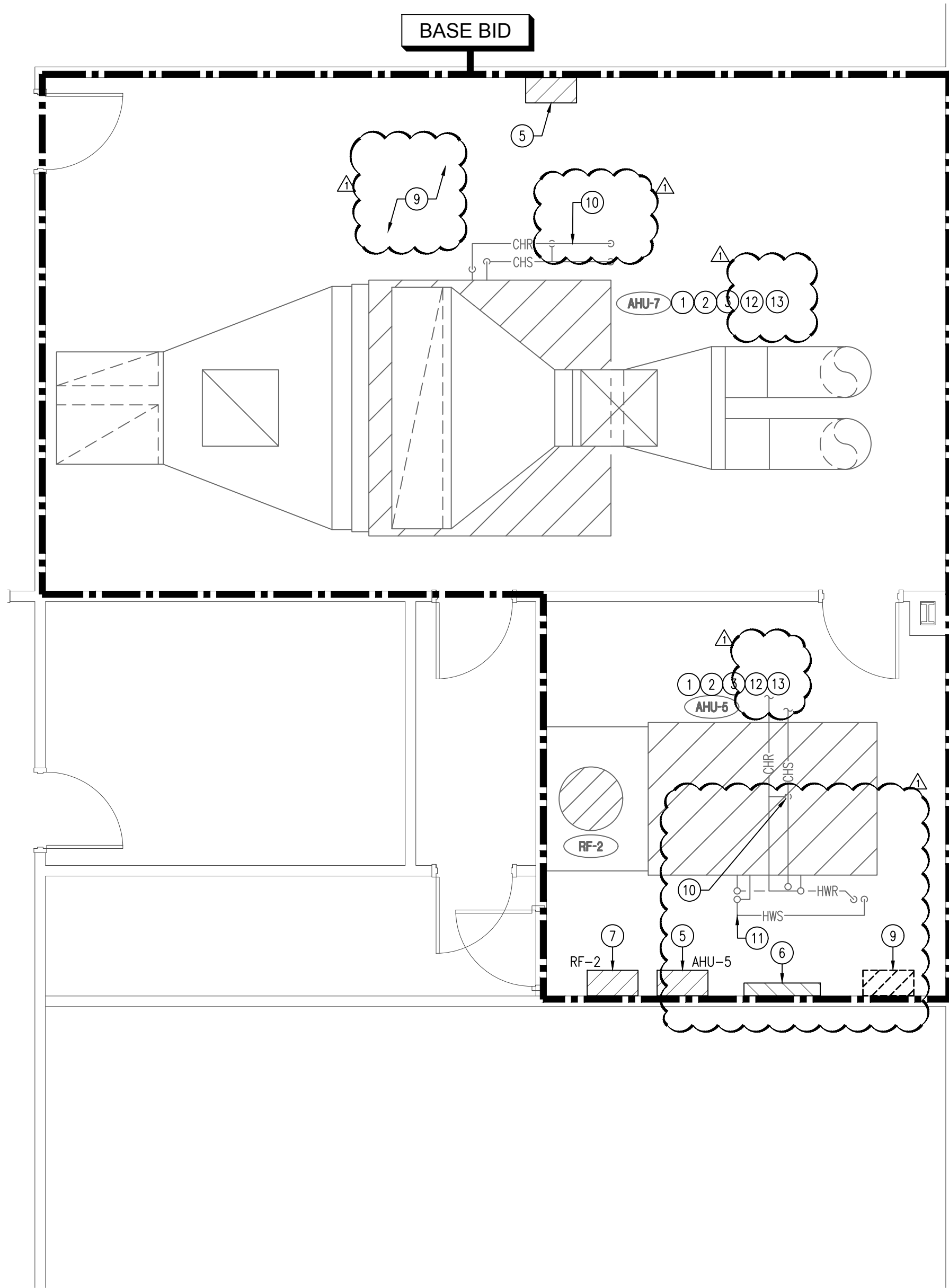
SCALE: 1/4" = 1'-0"



2

### ENLARGED MECHANICAL FLOOR PLAN - MECHANICAL ROOM 2

SCALE: 1/4" = 1'-0"



4

### ENLARGED MECHANICAL FLOOR PLAN - MECHANICAL ROOM 4

SCALE: 1/4" = 1'-0"

#### GENERAL NOTES:

- ALL WORK SHALL BE IN ACCORDANCE WITH THE INTERNATIONAL BUILDING CODE, THE INTERNATIONAL MECHANICAL CODE, AND THE OTHER CODES AND ORDINANCES OF THE AUTHORITY HAVING JURISDICTION.
- MOUNT ALL THERMOSTATS/TEMPERATURE SENSORS AT 3'-8" A.F.F.
- ALL UNITS MUST BE INSTALLED LEVEL.
- CAREFULLY PROTECT ALL EQUIPMENT AND MATERIAL PRIOR TO INSTALLATION. SEE SPECIFICATIONS.
- DEMOLITION DOCUMENTATION WAS OBTAINED FROM EXISTING BUILDING RECORD DRAWINGS AND SURVEY OF THE FACILITY. PRIOR TO CONSTRUCTION, THE CONTRACTOR SHALL VISIT THE PROJECT SITE AND SHALL FIELD VERIFY ALL EXISTING CONDITIONS.
- COORDINATE ALL WORK WITH OTHER TRADES AND OWNER'S REPRESENTATIVE FOR APPROVAL PRIOR TO REMOVING EXISTING ITEMS.
- THE CONTRACTOR SHALL TAKE CARE TO PROTECT ALL EXISTING EQUIPMENT/ITEMS TO REMAIN.
- ALL EQUIPMENT THAT IS REMOVED BUT NOT REUSED SHALL BE MADE AVAILABLE TO THE OWNER. ANY SUCH ITEMS SHALL BE STORED AT THE SITE FOR A MINIMUM OF (1) WEEK UNLESS INDICATED OTHERWISE BY OWNER'S REPRESENTATIVE. ALL EQUIPMENT/ITEMS NOT RETAINED BY THE OWNER SHALL BE DISCARDED AT THE CONTRACTOR'S EXPENSE.
- ALL EXISTING SYSTEMS/EQUIPMENT SHALL REMAIN IN SERVICE UNLESS OTHERWISE NOTED.

#### KEYED NOTES:

(APPLIES TO THIS SHEET) ○

- EXISTING AIR HANDLING UNIT (AHU) TO REMAIN IN SERVICE. INSPECT, CLEAN, AND REPAIR/REPLACE COMPONENTS AS NECESSARY TO ENSURE PROPER FUNCTIONALITY OF AHU. REMOVE EXISTING FAN INLET GUIDE VANES. REMOVE EXISTING PNEUMATIC DEVICES AND REPLACE WITH NEW ELECTRONIC DEVICES AS REQUIRED PER AHU SEQUENCES, PIPING SCHEMATICS, AND COIL CONNECTION DETAIL(S). RE: CONTROL DIAGRAMS AND DETAILS.
- RE-BALANCE EXISTING AHU'S AIRFLOWS, CHILLED WATER, AND HOT WATER FLOW RATES PER EQUIPMENT BALANCING SCHEDULE. RE: SCHEDULES.
- REMOVE EXISTING SUPPLY AIR FAN MOTOR AND REPLACE WITH NEW PREMIUM EFFICIENCY INVERTER DUTY MOTOR. PROVIDE NEW VFD IN ORDER TO MODULATE FAN. VFD TO BE FURNISHED BY DIVISION 23 AND INSTALLED BY DIVISION 26. RE: SPECIFICATIONS.
- EXISTING VFD TO REMAIN IN SERVICE.
- REMOVE EXISTING PNEUMATIC CONTROLLER AND REPLACE WITH NEW VFD. PATCH AND PAINT WALL AS REQUIRED TO MATCH EXISTING CONDITIONS.
- NEW DDC PANEL. COORDINATE LOCATION WITH EXISTING SYSTEMS.
- PROVIDE NEW VFD FOR EXISTING RETURN AIR FAN.
- CONTRACTOR TO INSTALL DATA DROP FOR CONNECTION TO GLOBAL BAS/DDC PANEL. CONTRACTOR TO FIELD COORDINATE ROUTING OF NEW COMM CABLE FROM NEAREST IDF ROOM. NEW DATA DROP AND CABLING SHALL COMPLY WITH TIA/EIA-568 STANDARDS.
- REMOVE EXISTING HUMIDIFIER AND CAP ASSOCIATED WATER LINE. FIELD VERIFY LOCATION OF EXISTING HUMIDIFIER.
- REMOVE THE EXISTING CHILLED WATER VALVE AND REPLACE WITH NEW VALVE PER SPECIFICATIONS. CONTRACTOR SHALL VERIFY THE SIZE OF THE EXISTING VALVE PRIOR TO DEMOLITION.
- REMOVE EXISTING HOT WATER VALVE AND REPLACE WITH NEW VALVE PER SPECIFICATIONS. CONTRACTOR SHALL VERIFY THE SIZE OF THE EXISTING VALVE PRIOR TO DEMOLITION.
- REMOVE EXISTING RETURN AIR AND OUTSIDE AIR DAMPERS AND REPLACE WITH NEW DAMPERS PER SPECIFICATIONS. SAME SIZE AS EXISTING. CONTRACTOR SHALL VERIFY THE SIZE OF THE EXISTING DAMPER PRIOR TO DEMOLITION.
- REMOVE EXISTING FAN INLET GUIDE VANES ON AHU FAN.
- REINFORCE EXISTING DUCTWORK AS REQUIRED.

REVISIONS:	
ADDENDUM #3	10/03/17
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PROJECT # 16091

**CITY OF SAN ANTONIO**  
**FRANK D. WING MUNICIPAL COURT BUILDING**  
**HVAC CONTROLS UPGRADE**  
**401 S. FRIO STREET, SAN ANTONIO, TX 78207**

ENLARGED FLOOR  
MECHANICAL PLAN -  
NEW WORK

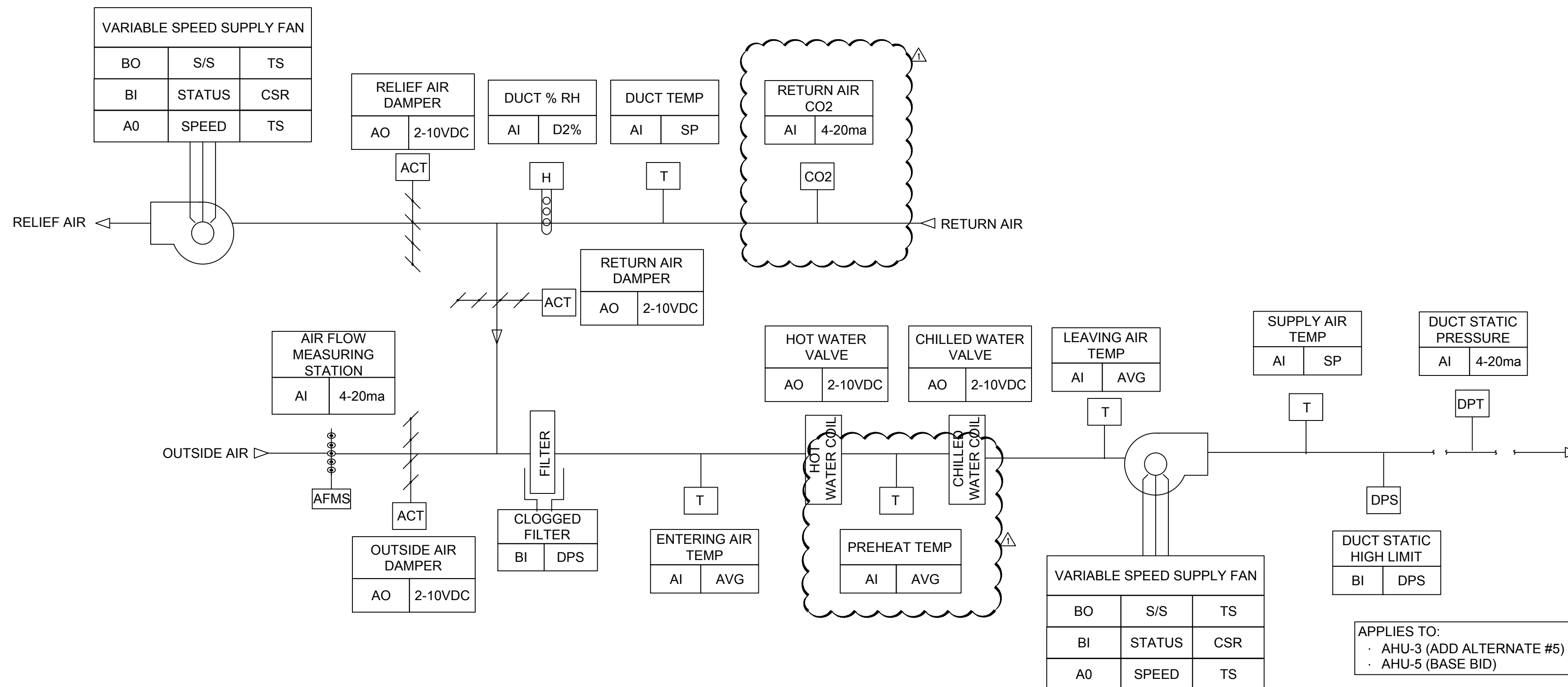
PROJECT: 16-091  
DRAWN: AN  
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DATE: 6/29/2017  
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M2.1



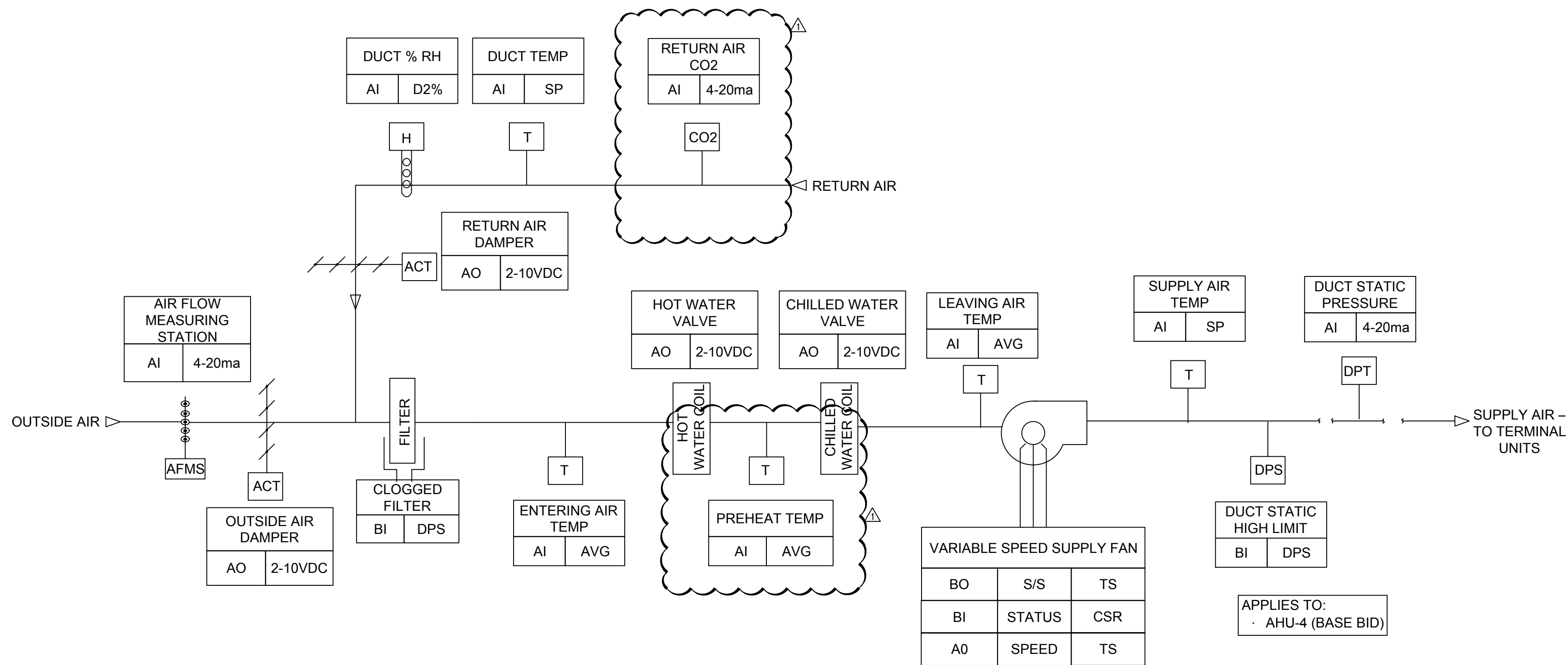






**VAV AHU CONTROL DIAGRAM - HW PREHEAT**

NO SCALE



**VAV AHU CONTROL DIAGRAM - HW PREHEAT/NO RELIEF**

NO SCALE

**VAV AIR HANDLING UNIT SEQUENCE OF OPERATION:**

THE AHU SHALL RUN SUBJECT TO THE OCCUPIED AND UNOCCUPIED SCHEDULES ADJUSTED FOR OPTIMAL START.

ANYTIME AN AHU IS ACTIVE (OCCUPIED OR UNOCCUPIED) THE BAS SHALL COMMAND THE CHILLER PLANT TO OPERATE AND MAINTAIN THE CHILLED WATER SUPPLY SETPOINT.

UNIT START: THE BAS SHALL OPEN THE RETURN AIR DAMPER 100% AND AFTER A 60 SECOND DELAY START THE SUPPLY FAN, AND MODULATE THE CHILLED WATER VALVE TO MAINTAIN LEAVING AIR TEMPERATURE SETPOINT. AFTER 60 SECONDS OF SUPPLY FAN OPERATION, THE BAS SHALL OPEN THE OUTSIDE AIR DAMPER TO THE OUTSIDE AIRFLOW SETPOINT.

DEHUMIDIFICATION MODE: THE BAS SHALL CONTINUOUSLY MONITOR THE RETURN AIR HUMIDITY LEVEL. ANYTIME THE HUMIDITY, AS MEASURED AT THE DUCT MOUNTED HUMIDITY SENSOR, EXCEEDS 60%, THE BAS SHALL OPEN THE CHILLED WATER VALVE 100% AND THE TERMINAL UNITS SHALL MODULATE TO MAINTAIN SPACE TEMPERATURE. THE BAS SHALL TERMINATE THE DEHUMIDIFICATION MODE WHEN THE ZONE HUMIDITY LEVEL REACHES 55%.

SUPPLY DUCT STATIC PRESSURE CONTROL: THE BAS SHALL SMOOTHLY MODULATE THE SPEED OF THE SUPPLY FAN VARIABLE FREQUENCY DRIVE IN RESPONSE TO THE DUCT STATIC PRESSURE SETPOINT. THE DUCT STATIC PRESSURE SETPOINT SHALL BE RESET BASED ON ZONE AIR FLOW REQUESTS, DERIVED FROM DAMPER POSITION AND MEETING AIRFLOW AND SPACE TEMPERATURE REQUIREMENTS AS FOLLOWS:

WHEN ALL ZONE DAMPERS ARE THROTTLING CLOSED - DAMPER ACTUATORS ARE LESS THAN 90% OPEN AND ACTUAL/SETPOINT AIRFLOW RATIO IS GREATER THAN 95%. THE DUCT STATIC PRESSURE SETPOINT SHALL BE INCREMENTALLY RESET DOWN BY 0.10"WC AT A FREQUENCY OF 10 MINUTES TO A MINIMUM OF 0.50"WC OR THE VFD HAS REACHED ITS LOWEST OPERATING SPEED LIMIT.

WHEN AIRFLOW REQUESTS INCREASE: AT LEAST ONE ZONE DAMPER IS GREATER THAN 90% OPEN AND ACTUAL/SETPOINT AIRFLOW RATIO IS LESS THAN 90% AND SPACE TEMPERATURE IS NOT SATISFIED THE DUCT STATIC PRESSURE SETPOINT SHALL INCREMENTALLY RESET UP BY 0.10"WC AT A FREQUENCY OF 3 MINUTES TO A MAXIMUM OF 2.0"WC.

SUPPLY AIR RESET: THE SUPPLY AIR TEMPERATURE SETPOINT SHALL BE RESET BASED ON OUTSIDE AIR TEMPERATURE AS MEASURED BY THE BAS. WHEN THE BAS REGISTERS AN OUTSIDE AIR TEMPERATURE BELOW 57F (ADJ.), THE SUPPLY AIR DISCHARGE TEMPERATURE SHALL BE PROPORTIONALLY RESET HIGHER UP TO A MAXIMUM LEAVING AIR TEMPERATURE OF 60F (ADJ.). SPECIFICALLY, THE SUPPLY AIR TEMPERATURE SHALL BE RESET HIGHER 1F FOR EVERY 2F DROP IN AMBIENT TEMPERATURE BELOW 57F. IN THE EVENT THAT THE SUPPLY AIR TEMPERATURE HAS BEEN ACTIVELY RESET AND TWO OR MORE ZONES ARE REPORTING A SPACE TEMPERATURE >2F ABOVE SETPOINT, THE SUPPLY AIR TEMPERATURE SHALL BE RESET 1F LOWER IN 10 MINUTE INTERVALS UNTIL EITHER THE ZONE TEMPERATURES ARE WITHIN 1F OF SETPOINT OR THE SUPPLY AIR TEMPERATURE HAS RETURNED TO 55F. THE RESET SCHEDULE, INTERVAL RESET POINTS AND TIME DELAYS SHALL ALL BE ADJUSTABLE.

**DEMAND VENTILATION CONTROL:** THE BAS SHALL CONTINUOUSLY MONITOR THE CO2 SENSOR. DURING OCCUPIED PERIODS AND WHEN ANY MEASURED CO2 LEVEL IS BELOW SETPOINT, THE BAS SHALL RESET THE OUTSIDE AIRFLOW SETPOINT LOWER EVERY 10 MINUTES UNTIL THE CO2 SETPOINT IS ACHIEVED OR MINIMUM FLOW IS REACHED (FIELD SET BY TAB CONTRACTOR). DURING OCCUPIED PERIODS AND WHEN CO2 LEVELS ARE ABOVE SETPOINT, THE BAS SHALL IMMEDIATELY RESET THE OUTSIDE AIR FLOW SETPOINT TO THE SCHEDULED VENTILATION AMOUNT. SEE AHU SCHEDULE FOR OUTSIDE AIRFLOW RATE REQUIREMENTS. INITIAL CO2 SETPOINT SHALL BE 900 PPM. MINIMUM AIRFLOW SHALL BE FIELD SET BY MEASURING BUILDING PRESSURE. MINIMUM FLOW SHALL BE REACHED WHEN A +0.05 IN.W.G. PRESSURE IS MEASURED BETWEEN THE BUILDING INTERIOR AND EXTERIOR WHILE ALL AHUS ARE ON, ALL EXHAUST FANS ARE ON, AND ALL BUILDING ENTRANCES ARE CLOSED.

**CHILLED WATER VALVE:** THE BAS SHALL MODULATE THE CHILLED WATER VALVE TO MAINTAIN A STEADY AND CONSISTENT 55F DISCHARGE AT THE DISCHARGE OF THE AIR HANDLING UNIT.

**OUTSIDE AIRFLOW CONTROL:** OUTSIDE AIRFLOW SHALL BE MONITORED AT THE ELECTRONIC OUTSIDE AIRFLOW MEASURING STATION. DURING OCCUPIED PERIODS, THE BAS SHALL MODULATE THE OUTSIDE AIR DAMPER TO MAINTAIN OUTSIDE AIRFLOW SETPOINT.

**ECONOMIZER MODE OPERATION:** ECONOMIZER MODE SHALL BE ENGAGED WHEN THE O/A TEMPERATURE IS BELOW 55F (ADJ.). THE FAN SHALL BE ENABLED AND FOLLOW THE SEQUENCE AS PREVIOUSLY DESCRIBED, THE O/A DAMPER SHALL FULLY OPEN AND THE CONTROLLER SHALL MODULATE THE O/A AND R/A DAMPER (WITHIN LIMITS OF THE EXISTING DUCTWORK CAPABILITIES) AND MODULATE THE CHILLED WATER VALVE AS NECESSARY TO MAINTAIN SPACE TEMPERATURE. UPON SENSING THE O/A TEMPERATURE RISE ABOVE 55F (ADJ.), THE UNIT SHALL RETURN TO NORMAL OPERATION. THE ECONOMIZER MODE SHALL BE DISENGAGED IF THE OUTSIDE AIR TEMPERATURE FALLS BELOW 40F (ADJ.).

**FREEZE PROTECTION:** IF ANY TEMPERATURE SENSOR INDICATES A TEMPERATURE BELOW 45F, THE BAS SHALL AUTOMATICALLY MODULATE THE HOT WATER PREHEAT VALVE TO MAINTAIN A STEADY AND CONSISTENT 45F DISCHARGE AT THE DISCHARGE OF THE PREHEAT COIL.

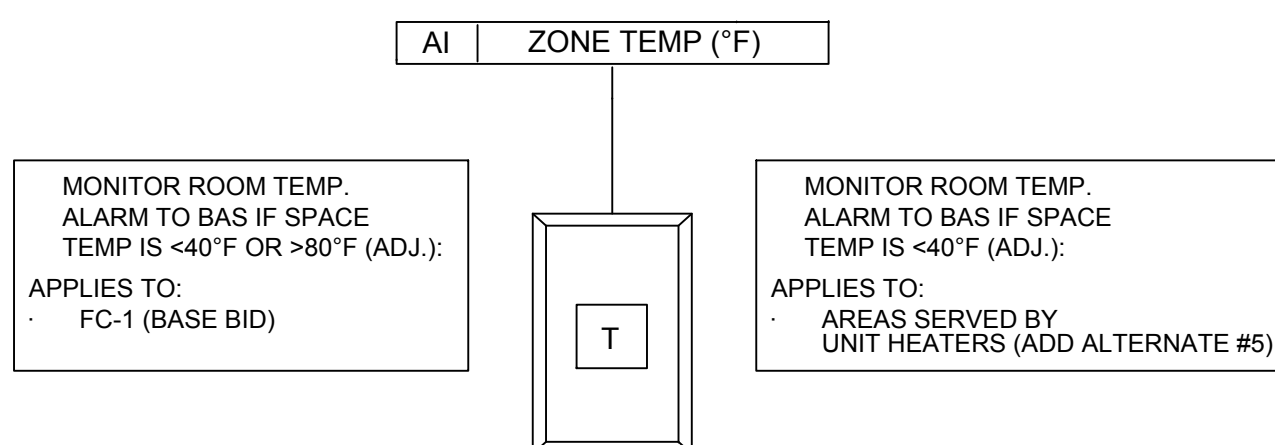
**DUCT STATIC HIGH LIMIT:** THE BAS SHALL MONITOR THE MANUAL RESET DUCT STATIC HIGH LIMIT. IF THE DUCT STATIC HIGH LIMIT SWITCH MAKES, THE VFD SHALL BE STOPPED AND REQUIRE RESET BY THE OPERATOR. INITIAL SETPOINT SHALL BE 3.5"WC.

**UNIT STOP:** ANYTIME THE UNIT IS COMMANDED TO SHUTDOWN THE OUTSIDE AIR DAMPER SHALL CLOSE, THE RETURN AIR DAMPER SHALL FULLY OPEN, THE CHILLED WATER VALVE SHALL CLOSE AND THE SUPPLY FAN SHALL BE OFF.

**ALARMS:** FAN FAILURE, LOW TEMPERATURE ALARM, DE-HUMIDIFICATION SEQUENCE ACTIVE, DUCT STATIC HIGH LIMIT, SMOKE DETECTOR IN ALARM, VFD IN ALARM, HIGH HUMIDITY, HIGH SUPPLY AIR TEMPERATURE, DIRTY FILTER.

**TEMPERATURE STATUS CONTROL DIAGRAM**

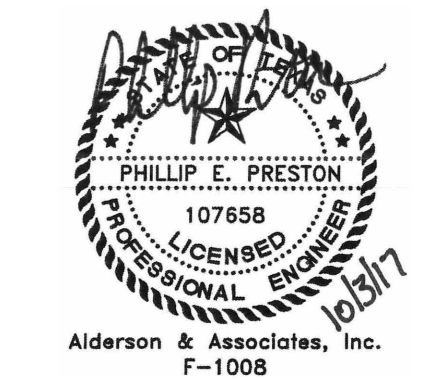
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REVISIONS:

ADDENDUM #3 1003/17

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MECHANICAL  
CONTROL  
DIAGRAMS

PROJECT: 16-091  
DRAWN: AN  
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DATE: 6/29/2017  
SHEET

**M3.3**



CONTROL SEQUENCE FOR CHILLED WATER SYSTEM:

**SYSTEM DESCRIPTION:** THE SYSTEM IS A CONSTANT VOLUME CHILLED WATER FLOW SYSTEM WITH THE FOLLOWING:

TWO WATER-COOLED, SCREW CHILLERS, WITH MOTORIZED CONDENSER AND CHILLED WATER ISOLATION VALVES.

TWO CONSTANT VOLUME CONDENSER WATER (LEAD/LAG) PUMPS.

TWO CONSTANT VOLUME CHILLED WATER (LEAD/LAG) PUMPS.

TWO COOLING TOWERS WITH CONNECTED SUMPS, CONSTANT SPEED FANS AND MOTORIZED ISOLATION VALVES.

CONDENSER WATER BY-PASS VALVE (ON ROOF).

CONTROL WILL BE SHARED BETWEEN THE CHILLER MANUFACTURER'S CONTROLS (CMC) AND THE BUILDING AUTOMATION SYSTEM (BAS).

**CMC - GENERAL:**

AFTER CHILLER IS ENABLED BY BAS, CMC STARTS SELECTED CHILLER'S LEAD AND LAG COMPRESSORS, AFTER CONDENSER WATER AND CHILLED WATER ISOLATION VALVES OPEN AND PUMPS ARE RUNNING.

CMC CONTROLS COMPRESSOR SEQUENCING BASED ON CMC'S INTERNAL ALGORITHMS AND CHILLERS' SUPPLY WATER TEMPERATURE.

CMC CONTROLS COOLING TOWER ISOLATION VALVES AND CONDENSER WATER BY-PASS VALVE IN SEQUENCE, PER CMC'S INTERNAL ALGORITHMS.

**BAS/CMC - SPECIFIC SEQUENCES:**

1. **GENERAL:** LEAD/LAG STATUS SHALL BE ROTATED BY BAS WEEKLY FOR CHILLERS, PUMPS AND COOLING TOWERS AT OFF-PEAK/UNOCCUPIED PERIOD. LEAD/LAG COMPRESSOR AND COOLING TOWER/FAN STATUS SHALL BE CONTROLLED BY CMC.

2. **STARTUP:**

a. BAS OPENS THE LEAD CHILLER'S 2-POSITION CONDENSER AND CHILLED WATER ISOLATION VALVES, VERIFY VALVES POSITION VIA END-SWITCH; ALARM BAS IF VALVES FAIL TO OPEN.

b. ON VALVES OPENING, BAS ENABLES THE LEAD CHILLER (VIA BACNET MS/TP TO CMC).

c. CMC SHALL OPEN LEAD COOLING TOWER ISOLATION VALVE (IN TOWER SUPPLY WATER) AND START TOWER FAN. CMC SHALL CONTROL TOWER FAN SPEED VIA FAN'S VFD VIA CMC'S INTERNAL ALGORITHM. BAS SHALL MONITOR/ALARM ISOLATION VALVE POSITION VIA END SWITCH, AND SHALL MONITOR FAN VFD SPEED. BAS SHALL SWITCH TO LAG CHILLER AND LAG TOWER OPERATION UPON FAILURE OF VALVE OR FAN. CMC TO PROVIDE BAS WITH COOLING TOWER ISOLATION VALVE OPEN COMMAND AND COOLING TOWER FAN VFD COMMAND VIA BACNET MS/TP FOR LAG UNIT OPERATION.

d. UPON CHILLER ENABLE COMMAND TO CMC THE BAS MONITORS PUMPS' STATUS VIA CURRENT SENSORS (ADJUSTED BY TAG CONTRACTOR TO "MAKE" AT MINIMUM FLOWS). CMC SHALL START CHILLER AND AFTER 30 SECONDS (ADJ.), BAS SHALL READ CHILLER STATUS FROM CMC. CMC TO NOTIFY BAS OF DISABLED CHILLER AND ALARM BAS IF LEAD CHILLER FAILS. BAS SHALL DISABLE/LOSE FAILED EQUIPMENT/VALVES AND OPEN LAG CHILLER'S VALVES, ENABLE LAG CHILLER AND ENABLE LAG PUMPS AS NECESSARY IN EVENT OF LEAD FAILURE.

e. CMC SHALL CONTROL CHILLER'S COMPRESSORS SPEED AND STAGING PER INTERNAL ALGORITHMS TO MAINTAIN SETPOINT READ FROM BAS.

f. BAS TO MONITOR CHILLER FLOW AT A DIFFERENTIAL PRESSURE (FLOW) SENSOR AT ENTERING WATER SIDE OF EACH CHILLER.

g. BAS SHALL ENABLE CONTROLS FOR AHU'S CONTROL VALVES. AFTER ADJUSTABLE INTERVAL (INITIALLY SET TO 5 MINUTES), ALLOW DIFFERENTIAL PRESSURE SENSOR (REMOTE, NEAR FURTHEST AHU) TO CONTROL CHILLED WATER PUMP SPEED FROM THE MINIMUM FLOW UP TO FULL DESIGN FLOW OF ONE CHILLER (NOMINALLY 280 GPM).

h. CMC SHALL STAGE/SEQUENCE CHILLER'S COMPRESSORS AND SPEEDS TO FOLLOW BUILDING LOAD, BASED ON CHILLED WATER RETURN TEMPERATURE AND INTERNAL ALGORITHMS.

i. CMC SHALL CONTROL CONDENSER WATER BYPASS VALVE VIA ITS INTERNAL ALGORITHMS TO MAINTAIN OPTIMAL CONDENSER WATER TEMPERATURE.

3. **ADDING A CHILLER:**

a. IF CHILLED WATER RETURN TEMPERATURE IS GREATER THAN THE CHILLED WATER RETURN SETPOINT, THE BAS SHALL GRADUALLY OPEN CHW AND CONDENSER WATER ISOLATION VALVES ON THE LAG CHILLER (AS ABOVE) AND ENABLE IT.

b. CMC SHALL SEQUENCE COMPRESSOR(S) AND CONTROL THE LEAD CHILLER (AND TOWERS/BYPASS) AS NEEDED TO MAINTAIN CHW SUPPLY TEMPERATURE SETPOINT PER INTERNAL ALGORITHMS.

4. **SUBTRACTING A CHILLER:**

a. AS BUILDING LOAD DECREASES AND THE RETURN WATER TEMPERATURE DROPS BELOW CHILLED WATER RETURN SETPOINT, THE LAG CHILLER SHALL BE DISABLED BY BAS, AND THE CHW LAG PUMP SHALL BE DISABLED. THE CONDENSER LAG PUMP SHALL BE DISABLED. AFTER A PUMP HAS BEEN DE-ENERGIZED, THE ASSOCIATED CHILLER ISOLATION VALVE SHALL CLOSE.

THE CMC SHALL THEN CONTROL THE COMPRESSOR(S) ON THE LEAD MACHINE AS REQUIRED TO MAINTAIN CHILLED WATER SUPPLY TEMPERATURE SETPOINT.

5. **CHILLER FREEZE PROTECTION:**

a. IN THE EVENT OF AN EVAPORATOR LOW TEMPERATURE ALARM, THE BAS SHALL ENABLE THE CHILLED WATER PUMP, OPEN THE CHILLED WATER ISOLATION VALVE, OPEN THE REMOTE CHILLED WATER BYPASS VALVE TO FULL OPEN POSITION.

b. IN THE EVENT OF A CONDENSER LOW TEMPERATURE ALARM, THE CMC SHALL OPEN THE COOLING TOWER ISOLATION VALVE, THE BAS SHALL ENABLE THE CONDENSER WATER PUMP.

c. IN THE EVENT OF A CONDENSER LOW TEMPERATURE ALARM, THE CMC SHALL OPEN THE COOLING TOWER ISOLATION VALVE, THE BAS SHALL ENABLE THE CONDENSER WATER PUMP.

6. **CHILLED WATER SUPPLY TEMPERATURE RESET:**

a. THE DESIGN CHILLED WATER SUPPLY TEMPERATURE SHALL BE RESET HIGHER 1F EVERY 10 MINUTES (ADJ.) TO A MAXIMUM TEMPERATURE OF 48F AS LONG AS THE CHILLED WATER FLOW RATE DOES NOT INCREASE.

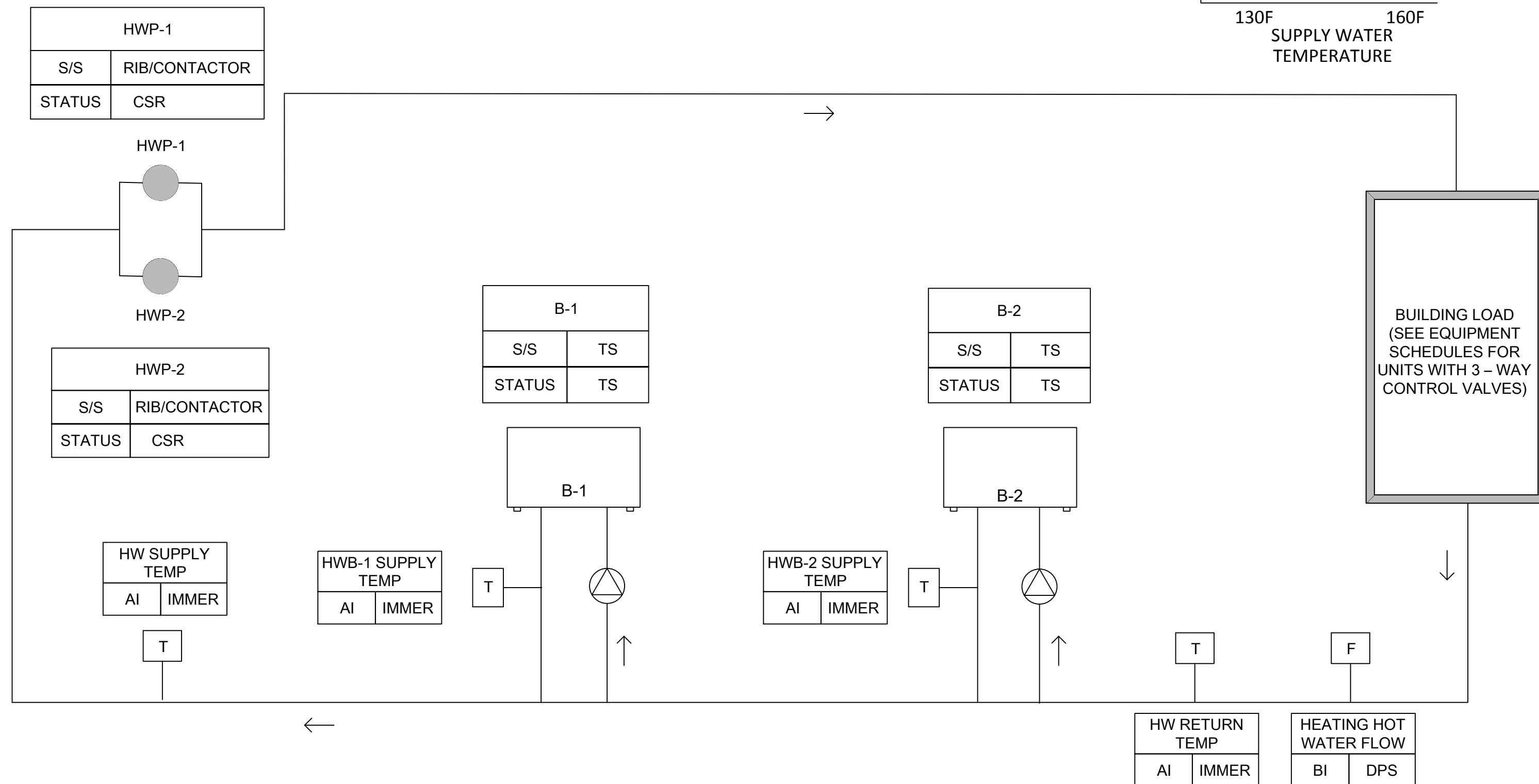
b. IN THE EVENT THAT THE CHILLED WATER FLOW RATE HAS INCREASED MORE THAN 10% ABOVE MINIMUM FLOW, THE CHILLED WATER SUPPLY TEMPERATURE SHALL BE RESET 1F LOWER EVERY 10 MINUTES UNTIL EITHER THE CHILLED WATER FLOW RATE IS REDUCED TO MINIMUM FLOW OR THE CHILLED WATER SUPPLY TEMPERATURE IS RESET TO THE DESIGN TEMPERATURE OF 42F.

c. THE RESET SCHEDULE AND INTERVAL RESET POINTS SHALL BE ADJUSTABLE.

REFRIGERANT MONITORING (EXISTING REFRIGERANT MONITORING SYSTEM):  
THE BAS SHALL ALARM UPON DETECTION OF REFRIGERANT (3 LEVELS).

ADD ALTERNATE #1  
CHILLER PLANT CONTROL DIAGRAM

1 NO SCALE



HEATING HOT WATER SYSTEM

THE HEATING HOT WATER SYSTEM CONSISTS OF TWO BOILERS, EACH WITH ITS OWN DEDICATED CIRCULATION PUMP, AND TWO HEATING HOT WATER PUMPS PIPED IN PARALLEL FOR LEAD/LAG OPERATION.

HEATING HOT WATER BOILER CIRCULATION PUMPS ARE ENABLED BY THE BOILER. THE BAS DOES NOT MONITOR THE CIRCULATION PUMPS.

WHEN A BOILER IS ENABLED, IT SHALL OPERATE ON ITS FACTORY CONTROLS TO ACHIEVE ITS HEATING WATER SETPOINT ADJUSTED BY THE OUTDOOR AIR RESET SCHEDULE.

THE HEATING HOT WATER SYSTEM SHALL OPERATE ANY TIME THE OUTSIDE AIR TEMPERATURE IS BELOW 60F UNLESS ANY AHU IS IN ZONE HUMIDITY CONTROL DEHUMIDIFICATION MODE. IF ANY AHU IS IN ZONE HUMIDITY CONTROL DEHUMIDIFICATION MODE THE HEATING HOT WATER SYSTEM SHALL BE ENABLED AND THE HEATING HOT WATER SYSTEM SUPPLY SETPOINT SHALL BE 150F.

RUNTIME EQUALIZATION

THE BAS SHALL AUTOMATICALLY ROTATE THE LEAD PIECE OF EQUIPMENT BASED ON A RUN-TIME EQUALIZATION ROUTINE EVERY 500 HOURS.

START UP

ANYTIME THERE IS A CALL FOR HEATING, THE BAS SHALL START THE LEAD HEATING HOT WATER PUMP AND AFTER THE FLOW SWITCH INDICATES FLOW THE BAS SHALL ENABLE THE LEAD HEATING HOT WATER BOILER.

ADD BOILER

THE BAS SHALL CONTINUOUSLY MONITOR THE HEATING HOT WATER SUPPLY TEMPERATURE. ANYTIME THE HEATING HOT WATER SUPPLY TEMPERATURE IS 5F LESS THAN THE HEATING HOT WATER SUPPLY SETPOINT FOR MORE THAN 10 MINUTES THE BAS SHALL ENABLE THE LAG HEATING HOT WATER PUMP AND LAG HEATING HOT WATER BOILER.

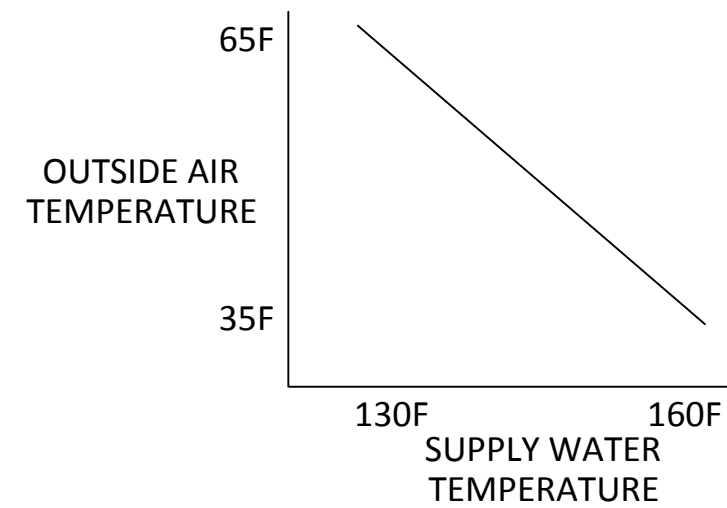
SUBTRACT BOILER

THE BAS SHALL MONITOR THE HEATING HOT WATER SYSTEM SUPPLY AND RETURN TEMPERATURE. THE BAS SHALL SUBTRACT A HEATING HOT WATER BOILER AND HEATING HOT WATER PUMP ANYTIME THERE IS A CALL FOR HEATING, MORE THAN 1 HEATING HOT WATER BOILER IS OPERATING, AND THE DIFFERENTIAL BETWEEN THE HEATING HOT WATER SUPPLY AND HEATING HOT WATER RETURN TEMPERATURE IS LESS THAN 5F FOR 15 MINUTES.

HEATING HOT WATER PUMPS

THE BAS SHALL ENABLE THE LEAD HEATING HOT PUMP WITH THE LEAD HEATING HOT WATER SYSTEM BOILER AND THE LAG HEATING HOT WATER PUMP AND LAG HEATING HOT WATER SYSTEM BOILER IN SERIES TO MAINTAIN THE HEATING HOT WATER SYSTEM SUPPLY HOT WATER SETPOINT.

OUTDOOR AIR RESET SCHEDULE



KEYED NOTES:

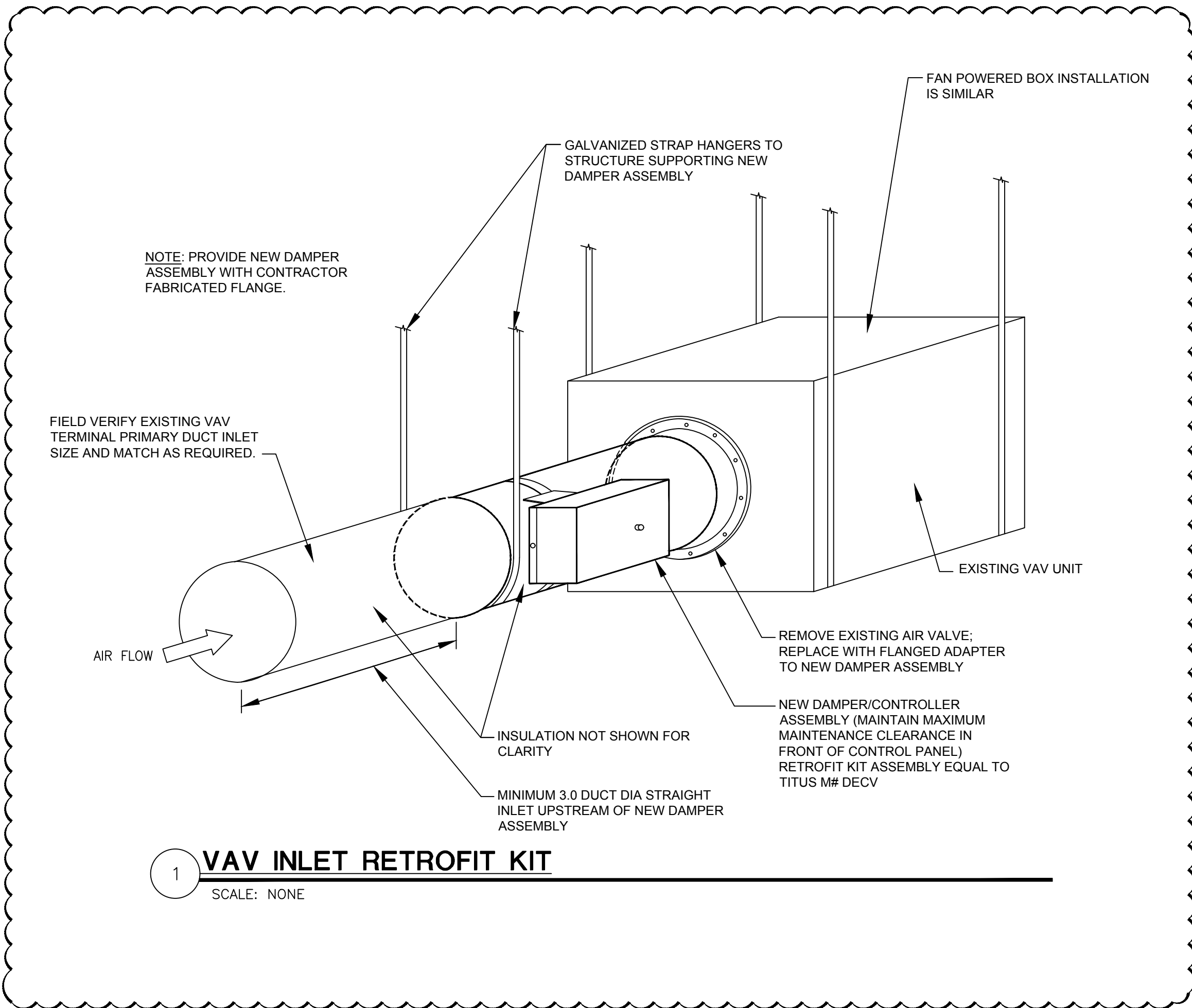
(APPLIES TO THIS SHEET) ○

1. REMOVE EXISTING MANUAL ISOLATION VALVE. PROVIDE AND INSTALL NEW 8" ACTUATED ISOLATION VALVE.
2. REMOVE EXISTING MANUAL ISOLATION VALVE. PROVIDE AND INSTALL NEW 6" ACTUATED ISOLATION VALVE.
3. EXISTING MOTORIZED ISOLATION VALVE TO REMAIN IN SERVICE. INTEGRATE VALVE INTO NEW BUILDING AUTOMATION SYSTEM.

ADD ALTERNATE #1  
BOILER CONTROL DIAGRAM

2 NO SCALE





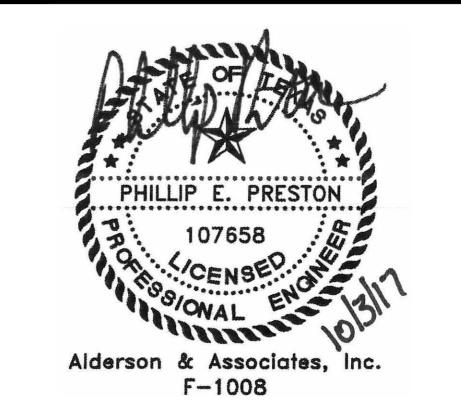
EXISTING AIR HANDLING UNIT SCHEDULE									
EQUIPMENT TAG	R/A DAMPER DUCT SIZE	O/A DAMPER DUCT SIZE	OA AFMS DUCT SIZE	CHILLED WATER COIL CONTROL VALVE			HOT WATER COIL CONTROL VALVE		
				TYPE	GPM	PIPE SIZE	TYPE	GPM	PIPE SIZE
AHU-1	100" x 30"	100" x 30"	100" x 30"	2-WAY	FIELD VERIFY	3"	-	-	-
AHU-2	115" x 28"	115" x 28"	115" x 28"	2-WAY	FIELD VERIFY	2"	-	-	-
AHU-3	108"x26"	60" x 20"	60" x 20"	2-WAY	80	1-1/2"	2-WAY	7.40	1-1/2"
AHU-4	112" x 42"	112" x 42"	112" x 42"	2-WAY	156	3"	2-WAY	38.00	2"
AHU-5	108" x 26"	108" x 26"	108" x 26"	2-WAY	92	3"	2-WAY	24.00	1"
AHU-6	110" x 26"	110" x 26"	110" x 26"	2-WAY	96	3"	-	-	-
AHU-7	110" x 26"	110" x 26"	110" x 26"	2-WAY	86	3"	-	-	-

- NOTES:
1. PROVIDE NEW RA DAMPER, DAMPER ACTUATOR AND CONTROLS. DUCT SIZE IS APPROXIMATE AND SHALL BE FIELD VERIFIED PRIOR TO ORDERING DAMPER.
  2. PROVIDE NEW OA DAMPER, DAMPER ACTUATOR AND CONTROLS. DUCT SIZE IS APPROXIMATE AND SHALL BE FIELD VERIFIED PRIOR TO ORDERING DAMPER.
  3. INSTALL NEW DAMPER (S) IN EXISTING AHU DAMPER HOUSING/DUCTWORK AS APPLICABLE. REINSULATE DUCT TO MATCH EXISTING AFTER DAMPER INSTALLATION.
  4. PROVIDE NEW AFMS IN EXISTING OA DUCTWORK. COORDINATE LOCATION WITH OA DAMPER AND EXISTING DUCT FITTINGS TO MAINTAIN MANUFACTURER'S RECOMMENDED MINIMUM DISTANCES FROM DAMPERS AND DUCT FITTINGS. REINSULATE DUCT TO MATCH EXISTING AFTER AFMS INSTALLATION.
  5. COIL GPM AND PIPE SIZE ARE FROM AVAILABLE AS-BUILT DRAWINGS. FIELD VERIFY ALL EXISTING VALVE SIZES PRIOR TO ORDERING NEW VALVES.
  6. RE-INSULATE PIPING TO MATCH EXISTING AFTER VALVE INSTALLATION.
  7. WORK SHALL BE INCLUDED IN BASE BID OR ADD ALTERNATES AS APPLICABLE FOR EACH AHU.

VARIABLE FREQUENCY DRIVE SCHEDULE						
EQUIPMENT TAG	VOLTS/PHASE	MOTOR HP	DRIVE INPUT FUSE RATING (AMPS)	MANUFACTURER	MODEL #	NOTES
AHU-1			EXISTING TO REMAIN			
AHU-2	460/3	15.0	30	ABB	ACH550	ALL
AHU-3	460/3	5.0	15	ABB	ACH550	ALL
AHU-4	460/3	15.0	30	ABB	ACH550	ALL
AHU-5	460/3	15.0	30	ABB	ACH550	ALL
AHU-6	460/3	25.0	60	ABB	ACH550	1,4,5,6
AHU-7	460/3	20.0	60	ABB	ACH550	ALL
RF-1	460/3	1.5	15	ABB	ACH550	ALL
RF-2	460/3	5.0	15	ABB	ACH550	ALL

- NOTES:
1. REFER TO SPEC SECTION 23 05 14 FOR ADDITIONAL REQUIREMENTS.
  2. REPLACE EXISTING FAN MOTOR WITH NEW MOTOR RATED FOR INVERTER DUTY. PROVIDE WITH SHAFT GROUNDING RING.
  3. FIELD VERIFY SIZE OF EXISTING MOTOR.
  4. PROVIDE WITH 3-CONTACTOR BY-PASS.
  5. WORK SHALL BE INCLUDED IN BASE BID OR ADD ALTERNATES AS APPLICABLE FOR EACH AHU.
  6. PROVIDE SHAFT GROUNDING RING.

REVISIONS:	
ADDENDUM #3	1003/17
THESE DRAWINGS, ACCOMPANYING SPECIFICATIONS AND ANY ADDENDUMS, AMENDMENTS, OR ADDITIONS OF THE ENGINEER'S SERVICE FOR THE PROJECT, SHALL BE THE PROPERTY OF THE ENGINEER. NO PART OF THESE DRAWINGS OR SPECIFICATIONS SHALL BE REPRODUCED OR TRANSMITTED IN ANY FORM OR BY ANY MEANS, ELECTRONIC OR MECHANICAL, INCLUDING PHOTOCOPYING, RECORDING, OR BY ANY INFORMATION STORAGE AND RETRIEVAL SYSTEM, WITHOUT THE WRITTEN PERMISSION OF THE ENGINEER. NO PART OF THESE DRAWINGS OR SPECIFICATIONS SHALL BE USED FOR ANY OTHER PROJECT WITHOUT THE WRITTEN PERMISSION OF THE ENGINEER. NO PART OF THESE DRAWINGS OR SPECIFICATIONS SHALL BE USED FOR ANY OTHER PROJECT WITHOUT THE WRITTEN PERMISSION OF THE ENGINEER.	



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F-1008  
PROJECT # 16091

CITY OF SAN ANTONIO  
**FRANK D. WING MUNICIPAL COURT BUILDING**  
HVAC CONTROLS UPGRADE  
401 S. FRIO STREET, SAN ANTONIO, TX 78207

MECHANICAL SCHEDULES & DETAILS	
PROJECT:	16-091
DRAWN:	AAI
CHECKED:	PEP
DATE:	6/29/2017
SHEET	
M4.1	





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F-1008

PROJECT # 10091

**CITY OF SAN ANTONIO**  
**FRANK D. WING MUNICIPAL COURT BUILDING**  
**HVAC CONTROLS UPGRADE**  
**401 S. FRIO STREET, SAN ANTONIO, TX 78207**

MECHANICAL POWER -  
FIRST FLOOR -  
NEW WORK

PROJECT: 16-091  
DRAWN: AN  
CHECKED: PEP  
DATE: 6/29/2017  
SHEET

E1.1

**GENERAL POWER NOTES:** (APPLIES TO ALL ELECTRICAL SHEETS)

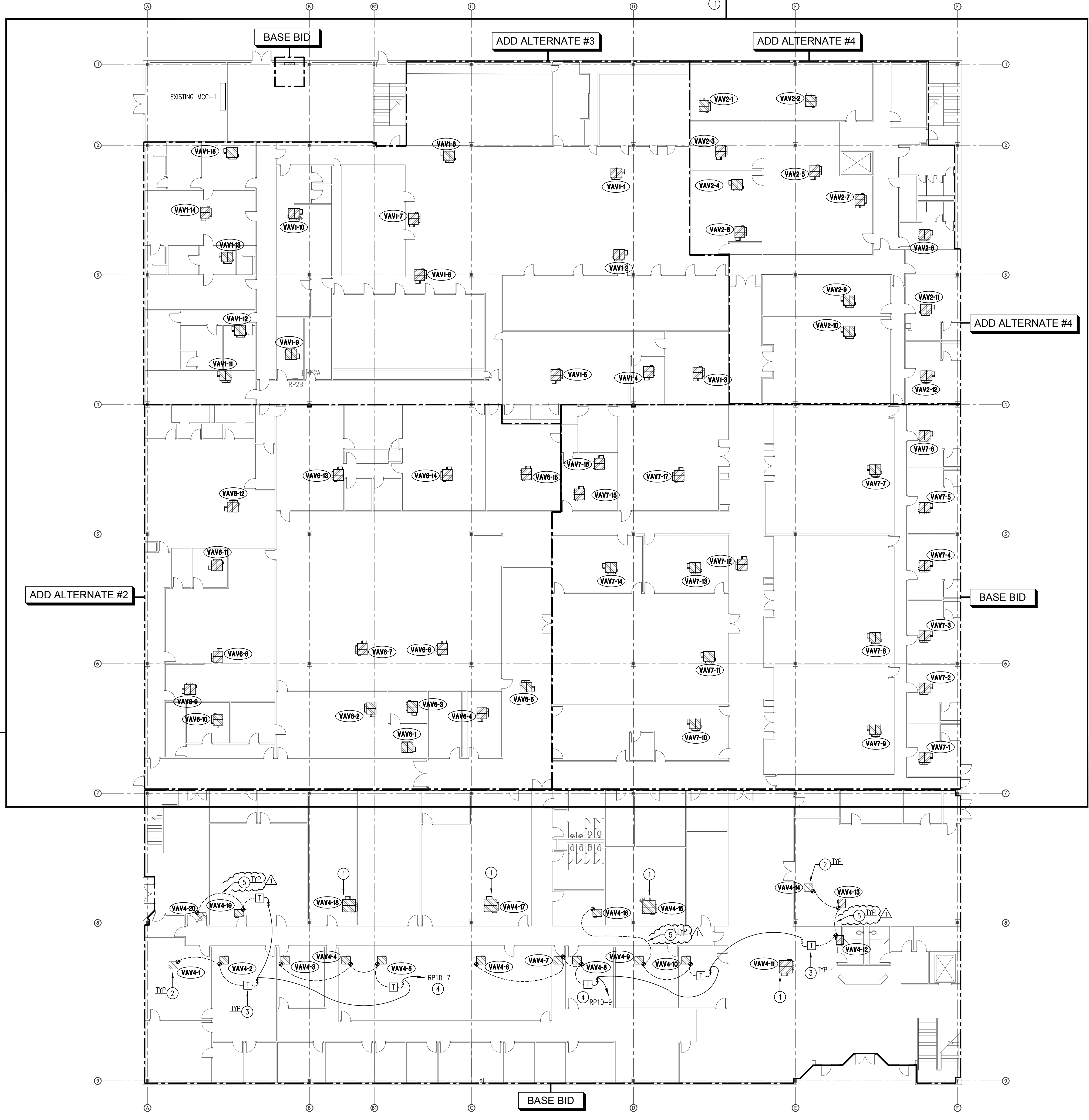
- ALL WORK TO BE COMPLETED IN ACCORDANCE WITH THE NATIONAL ELECTRIC CODE AND AUTHORITIES HAVING JURISDICTION.
- SINGLE HOME RUNS ARE SHOWN FOR CIRCUIT IDENTIFICATION ONLY. CONTRACTOR MAY GROUP A MAXIMUM OF THREE (3) BRANCH CIRCUITS PER HOMERUN RACEWAY, UNLESS NOTED OTHERWISE. TYPICAL FOR ALL ELECTRICAL FLOOR PLANS.
- MULTI-WIRED (SHARED NEUTRAL) BRANCH CIRCUITS SHALL NOT BE INSTALLED. ALL 120V- & 277V- VOLT BRANCH CIRCUITS SHALL HAVE A DEDICATED INDIVIDUAL NEUTRAL CONDUCTOR.
- ALL HOMERUNS AND RUNS BETWEEN JUNCTION BOXES TO BE A MINIMUM OF 3/4" CONDUIT WITH #10 WIRE. NO MORE THAN THREE (3) CIRCUITS PER HOMERUN. ALL WIRING SHALL HAVE A SEPARATE INSULATED GREEN GROUNDING CONDUCTOR. #10 CONDUCTORS SHALL EXTEND FROM OCCP TO A JUNCTION BOX IN THE AREA OF THE OUTLETS OR UTILIZATION EQUIPMENT. DROPS TO INDIVIDUAL 20A SWITCHES AND RECEPTACLES MAY BE #12 THIN COPPER.
- PROVIDE U.L. LISTED FIRE STOP SYSTEMS AT ALL PENETRATIONS THROUGH WALLS.
- ELECTRICAL CONTRACTOR SHALL COORDINATE THE INSTALLATION OF ELECTRICAL WORK ABOVE THE CEILING TO PROVIDE THE GREATEST POSSIBLE CLEARANCE FOR PLUMBING AND MECHANICAL EQUIPMENT BOTH CURRENT AND FUTURE. CONDUITS SHALL BE KEPT TIGHT TO STRUCTURE OR ROUTED THROUGH STRUCTURAL TRUSSES WHEREVER POSSIBLE.
- ALL FEEDER AND BRANCH CIRCUIT WIRING SHALL BE COPPER.
- ALL JUNCTION BOX COVERS WILL BE MARKED USING "SHARPIE" OR "MARKSALOT" INDICATING THE PANEL AND CIRCUIT #'S CONTAINED WITHIN THE JUNCTION BOX.
- ALL SWITCH AND RECEPTACLE COVER PLATES WILL BE MARKED TO INDICATE PANEL AND CIRCUIT #'S USING APPROVED LABEL MAKER.
- IN ALL CASES VOLTAGE DROP TO LAST OUTLET MUST NOT EXCEED 3%.
- FLEXIBLE METAL CONDUIT (FMC) CAN BE USED ONLY FOR FINAL CONNECTIONS TO LIGHT FIXTURES. RUNS LONGER THAN 6' WILL NOT BE ALLOWED.
- LIQUIDTIGHT FLEXIBLE CONDUIT (LFMC) SHALL BE USED FOR CONNECTIONS TO EQUIPMENT AND MOTORS.
- ALL DATA CONDUITS, SLEEVES AND STUBS SHALL BE TERMINATED WITH PLASTIC BUSHINGS.
- COORDINATE LOCATION OF ALL DISCONNECT SWITCHES TO ENSURE THAT ALL NEC MINIMUM WORKING CLEARANCES ARE MAINTAINED.
- REFER TO BRANCH CIRCUIT SCHEDULES FOR CONDUCTOR SIZING. CIRCUITS FEEDING COMPUTERS SHALL CONSIST OF THE FOLLOWING:
  - (1) CURRENT CARRYING CONDUCTOR
  - (1) NEUTRAL CONDUCTOR
  - (1) INSULATED GND. CONDUCTOR
  - (1) INSULATED ISOLATED GND. CONDUCTOR
- PROVIDE CEILING ACCESS DOORS TO GAIN ACCESS TO EQUIPMENT ABOVE HARD CEILINGS.

**KEYED NOTES:** (APPLIES TO THIS SHEET) ○

- EXISTING PARALLEL FAN POWERED TERMINAL UNIT & ASSOCIATED ELECTRICAL POWER TO REMAIN. NO ELECTRICAL CONTRACTOR SCOPE OF WORK WITH INDICATED EQUIPMENT.
- EXISTING SINGLE DUCT TERMINAL UNIT TO REMAIN, WITH 24V AC POWER ADDED FOR NEW DDC CONTROLS.
- PROVIDE TRANSFORMER TO PROVIDE POWER TO THE VAV CONTROLS. TRANSFORMER SHALL BE EDWARDS CATALOG # 88-250A, 250VA, 120V-24VAC. PROVIDE 120V DISCONNECT SWITCH AT EACH TRANSFORMER. FIELD VERIFY NAMEPLATE VA REQUIREMENTS FOR EQUIPMENT SUPPLIES, AND PROVIDE SUFFICIENT QUANTITY OF TRANSFORMERS FOR EACH CIRCUIT SHOWN. 24VAC WIRING SHALL BE BY CONTROLS CONTRACTOR. REFER TO MECHANICAL SHEETS FOR ADDITIONAL INFORMATION.
- PROVIDE (2) #10 AWG CU, #10 GROUND, 3/4" CONDUIT FOR INDICATED CIRCUIT.
- PROVIDE CONDUIT FOR ALL 24V AC POWER TO INDIVIDUAL HVAC TERMINAL UNITS FROM LOW VOLTAGE TRANSFORMERS. COORDINATE INSTALLATION WITH MECHANICAL EQUIPMENT & OTHER TRADES.

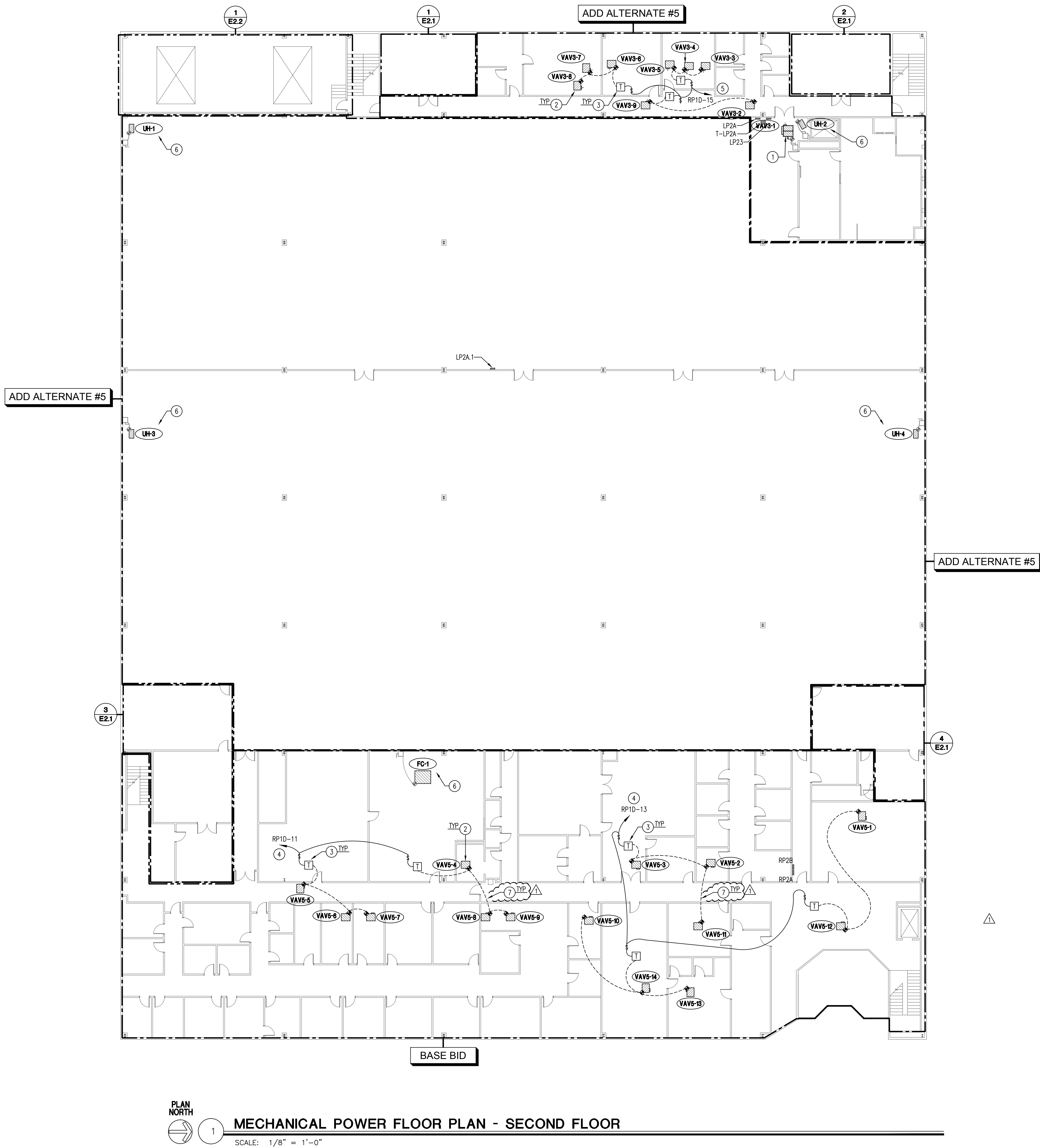
NO ELECTRICAL CONTRACTOR SCOPE OF WORK THIS AREA  
EXISTING ELECTRICAL POWER TO MECH EQUIP TO REMAIN

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PLAN NORTH  
**MECHANICAL POWER FLOOR PLAN - FIRST FLOOR**  
SCALE: 1/8" = 1'-0"





GENERAL  
POWER NOTES:

- (APPLIES TO ALL ELECTRICAL SHEETS)
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    - (1) INSULATED ISOLATED GND. CONDUCTOR
  - PROVIDE CEILING ACCESS DOORS TO GAIN ACCESS TO EQUIPMENT ABOVE HARD CEILINGS.

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  - PROVIDE TRANSFORMER TO PROVIDE POWER TO THE VAV CONTROLS. TRANSFORMER SHALL BE EDWARDS CATALOG # 28-250A, 250VA, 120V-24VAC. PROVIDE 120V DISCONNECT SWITCH AT EACH TRANSFORMER. FIELD VERIFY NAMEPLATE VA REQUIREMENTS FOR EQUIPMENT SUPPLIED, AND PROVIDE SUFFICIENT QUANTITY OF TRANSFORMERS FOR EACH CIRCUIT SHOWN. 24VAC WIRING SHALL BE BY CONTROLS CONTRACTOR. REFER TO MECHANICAL SHEETS FOR ADDITIONAL INFORMATION.
  - PROVIDE (2) #10 AWG CU, #10 GROUND, 3/4" CONDUIT FOR INDICATED CIRCUIT.
  - PROVIDE 20A, 1-POLE CIRCUIT BREAKER IN EXISTING AVAILABLE SPACE IN EXISTING PANELBOARD "LP2A". PROVIDE (2) #12 AWG CU, #12 GROUND, 3/4" CONDUIT.
  - EXISTING MECHANICAL EQUIPMENT TO REMAIN. NO ELECTRICAL CONTRACTOR SCOPE OF WORK WITH INDICATED EQUIPMENT.
  - PROVIDE CONDUIT FOR ALL 24V AC POWER TO INDIVIDUAL HVAC TERMINAL UNITS FROM LOW VOLTAGE TRANSFORMERS. COORDINATE INSTALLATION WITH MECHANICAL EQUIPMENT & OTHER TRADES.

REVISIONS:

ADDENDUM #3	10/03/17

THESE DRAWINGS, ACCOMPANYING SPECIFICATIONS AND ANY OTHER DOCUMENTS HEREAFTER PROVIDED BY THE ENGINEER'S OFFICE SHALL BE THE SOLE BASIS FOR THE CONTRACTOR'S OBLIGATION TO COMPLY WITH THE REQUIREMENTS OF THE PROJECT. THE CONTRACTOR SHALL BE RESPONSIBLE FOR OBTAINING ALL NECESSARY PERMITS AND FOR VERIFYING THE ACCURACY OF ALL INFORMATION PROVIDED BY OTHERS. THE CONTRACTOR SHALL BE RESPONSIBLE FOR OBTAINING ALL NECESSARY PERMITS AND FOR VERIFYING THE ACCURACY OF ALL INFORMATION PROVIDED BY OTHERS. THE CONTRACTOR SHALL BE RESPONSIBLE FOR OBTAINING ALL NECESSARY PERMITS AND FOR VERIFYING THE ACCURACY OF ALL INFORMATION PROVIDED BY OTHERS.

100875  
LON M. CULBERTSON  
Professional Engineer  
10/03/2017

Alderson & Associates, Inc.  
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PROJECT # 16091

CITY OF SAN ANTONIO

FRANK D. WING MUNICIPAL COURT BUILDING

HVAC CONTROLS UPGRADE

401 S. FRIO STREET, SAN ANTONIO, TX 78207

MECHANICAL POWER -  
SECOND FLOOR -  
NEW WORK

PROJECT: 16-091  
DRAWN: AN  
CHECKED: PEP  
DATE: 6/29/2017  
SHEET

E1.2



# ACKNOWLEDGEMENT FORM

RECEIPT OF ADDENDUM NUMBER(S) 3 IS HEREBY ACKNOWLEDGED BY THE UNDERSIGNED REGARDING THE SOLICITATION OF THE CONSTRUCTION OF **FRANK WING HVAC SYSTEM AND CONTROLS UPGRADE – PROJECT NO. 35-00069**, FOR WHICH BIDS ARE SCHEDULED TO BE OPENED ON **TUESDAY, OCTOBER 10, 2017 AT 2:00 P.M.**

THIS ACKNOWLEDGEMENT FORM MUST BE SIGNED AND RETURNED WITH CONTRACTOR’S BID PACKAGE.

Company Name: \_\_\_\_\_

Address: \_\_\_\_\_

City/State/Zip Code: \_\_\_\_\_

Date: \_\_\_\_\_

\_\_\_\_\_

Signature

\_\_\_\_\_

Print Name/Title