CSI CONTRACTING, INC.

General Contractors / Construction Management / Design Build / Concrete Construction
1131 Dade Street, Quincy Florida 32351 / 2807 Remington Green Circle, Ste. 107, Tallahassee Florida 32308
Office: (850) 875-1471 / Fax: (850) 627-9673

Bid Package Revision #2

For All Bid Packages

Project: MSFM-022032060
R.A. Gray Building Design and Replace Boilers
Tallahassee, Florida

Issue Date: 01/17/25

This revision consists of 1 page, modifies and /or supplements the original bid packages and contract documents as detail.

Item No 1: New plans and specifications have been issued for this project. They are available in the Procore Bid Documents File Folder

Included Revised Documents:

1. New R.A. Gray Boiler Plans Dated 1.15.25
2. Combined Mech & Control Specifications

End of Bid Package Revision

RA Gray Building Design and Replace Boilers Specifications MSFM-02203260

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DIVISION 23 – MECHANICAL

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SECTION 230500 - COMMON WORK RESULTS FOR HVAC

PART 1 - GENERAL

1.1 Description

A. The requirements of this Section apply to all sections of Division 23

B. Definitions:
   1. Exposed: Piping, ductwork, and equipment exposed to view in finished rooms.
   2. Option or optional: Contractor's choice of an alternate material or method.

1.2 Quality Assurance

A. Mechanical, electrical and associated systems shall be safe, reliable, efficient, durable, easily and safely operable and maintainable, easily and safely accessible, and in compliance with applicable codes as specified. The systems shall be comprised of high quality institutional-class and industrial-class products of manufacturers that are experienced specialists in the required product lines. All construction firms and personnel shall be experienced and qualified specialists in industrial and institutional HVAC

B. Flow Rate Tolerance for HVAC Equipment: Section 23 05 93, TESTING, ADJUSTING, AND BALANCING FOR HVAC.

C. Equipment Vibration Tolerance:
   1. After HVAC air balance work is completed and permanent drive sheaves are in place, perform field mechanical balancing and adjustments required to meet the specified vibration tolerance.

D. Products Criteria:
   1. Standard Products: Material and equipment shall be the standard products of a manufacturer regularly engaged in the manufacture of the products for at least 3 years (or longer as specified elsewhere). The design, model and size of each item shall have been in satisfactory and efficient operation on at least three installations for approximately three years. However, digital electronics devices, software and systems such as controls, instruments, computer work station, shall be the current generation of technology and basic design that has a proven satisfactory service record of at least three years. See other specification sections for any exceptions and/or additional requirements.
   2. All items furnished shall be free from defects that would adversely affect the performance, maintainability and appearance of individual components and overall assembly.
   3. Conform to codes and standards as required by the specifications. Conform to local codes, if required by local authorities such as the natural gas supplier, if the local codes are more stringent than those specified. Refer any conflicts to the Resident Engineer.

4. Multiple Units: When two or more units of materials or equipment of the same type or class are required, these units shall be products of one manufacturer.
5. Assembled Units: Manufacturers of equipment assemblies, which use components made by others, assume complete responsibility for the final assembled product.
6. Nameplates: Nameplate bearing manufacturer's name or identifiable trademark shall be securely affixed in a conspicuous place on equipment, or name or trademark cast integrally with equipment, stamped or otherwise permanently marked on each item of equipment.
7. Asbestos products or equipment or materials containing asbestos shall not be used.

E. Equipment Service Organizations:
1. HVAC: Products and systems shall be supported by service organizations that maintain a complete inventory of repair parts and are located within 50 miles to the site.

F. HVAC Mechanical Systems Welding: Before any welding is performed, contractor shall submit a certificate certifying that welders comply with the following requirements:
1. Comply with provisions of ASME B31 series "Code for Pressure Piping".
2. Certify that each welder has passed American Welding Society (AWS) qualification tests for the welding processes involved, and that certification is current.

G. Execution (Installation, Construction) Quality:
1. Apply and install all items in accordance with manufacturer's written instructions. Refer conflicts between the manufacturer's instructions and the contract drawings and specifications to the Resident Engineer for resolution. Provide written hard copies or computer files of manufacturer’s installation instructions to the Resident Engineer at least two weeks prior to commencing installation of any item. Installation of the item will not be allowed to proceed until the recommendations are received. Failure to furnish these recommendations is a cause for rejection of the material.
2. Provide complete layout drawings required by Paragraph, SUBMITTALS. Do not commence construction work on any system until the layout drawings have been approved.

1.3 SECTION REQUIREMENTS

A. Submittals:
1. Contractor shall make all necessary field measurements and investigations to assure that the equipment and assemblies will meet contract requirements.
2. If equipment is submitted which differs in arrangement from that shown, provide drawings that show the rearrangement of all associated systems. Approval will be given only if all features of the equipment and associated systems, including accessibility, are equivalent to that required by the contract.
3. Prior to submitting shop drawings for approval, contractor shall certify in writing that manufacturers of all major items of equipment have each reviewed drawings and specifications, and have jointly coordinated and properly integrated their equipment and controls to provide a complete and efficient installation.
4. Layout Drawings:
a.

b. The drawings shall include plan views, elevations and sections of all systems and shall be on a scale of not less than 1:48 (1/4-inch equal to one foot). Clearly identify and dimension the proposed locations of the principal items of equipment. The drawings shall clearly show locations and adequate clearance for all equipment, piping, valves, control panels and other items. Show the access means for all items requiring access for operations and maintenance. Provide detailed layout drawings of all piping and duct systems.

5. In addition, for HVAC systems, provide details of the following:
6.
   a. Duct or equipment penetrations of floors, walls, ceilings, or roofs.
   b. Manufacturer's Literature and Data: Submit under the pertinent section rather than under this section.
   c. Submit electric motor data and variable speed drive data with the driven equipment.
   d. Equipment and materials identification.
   e. Fire-stopping materials.
   f. Wall, floor, and ceiling plates.
   g. HVAC Maintenance Data and Operating Instructions:
   h. Provide copies of approved HVAC equipment submittals to the Testing, Adjusting and Balancing Subcontractor.

1.4 DELIVERY, STORAGE AND HANDLING

A. Protection of Equipment:
   1. Equipment and material placed on the job site shall remain in the custody of the Contractor until phased acceptance, whether or not the Owner has reimbursed the Contractor for the equipment and material. The Contractor is solely responsible for the protection of such equipment and material against any damage.
   2. Place damaged equipment in first class, new operating condition; or, replace same as determined and directed by the Resident Engineer. Such repair or replacement shall be at no additional cost to the Owner.
   3. Protect interiors of new equipment and piping systems against entry of foreign matter. Clean both inside and outside before painting or placing equipment in operation.
   4. Existing equipment and piping being worked on by the Contractor shall be under the custody and responsibility of the Contractor and shall be protected as required for new work.

B. Cleanliness of Piping and Equipment Systems:
   1. Exercise care in storage and handling of equipment and piping material to be incorporated in the work. Remove debris arising from cutting, threading and welding of piping.
   2. Piping systems shall be flushed, blown or pigged as necessary to deliver clean systems.
   3. Clean interior of all tanks prior to delivery for beneficial use by the Owner.
   4. Contractor shall be fully responsible for all costs, damage, and delay arising from failure to provide clean systems.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Hangers and Supports for Plumbing Piping Equipment:
   1. Structural Performance: Hangers and supports shall withstand the effects of gravity loads and stresses within limits and under conditions indicated according to ASCE/SEI 7.
      a. Design supports for multiple pipes capable of supporting combined weight of supported systems, and system contents.
      b. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.
      c. Design seismic-restraint hangers and supports for piping and equipment and obtain approval from authorities having jurisdiction.

2.2 SLEEVES AND SLEEVE SEALS

A. Galvanized-Steel Pipe Sleeves: ASTM A 53, Type E, Grade B, Schedule 40, galvanized, plain ends.

B. Galvanized-Steel Sheet: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.

2.3 ESCUTCHEONS AND FLOOR PLATES

A. One-Piece, Cast-Brass Type: With polished, chrome-plated finish and setscrew fastener.

B. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with chrome-plated finish and spring-clip fasteners.

C. One-Piece, Stamped-Steel Type: With chrome-plated finish and spring-clip fasteners.

2.4 PRESSURE GAGES AND TEST PLUGS

A. Direct-Mounted, Metal-Case, Dial-Type Pressure Gages:
   1. Standard: ASME B40.100.
   2. Case: Sealed Solid-front, pressure relief Insert type type(s); cast aluminum or drawn steel; 4-1/2-inch nominal diameter.
   3. Movement: Mechanical, with link to pressure element and connection to pointer.
   4. Dial: Nonreflective aluminum with permanently etched scale markings graduated in psi.
   5. Pointer: Dark-colored metal.
   6. Window: Plastic.
   7. Ring: Metal.
   8. Accuracy: Grade A, plus or minus 1 percent of middle half of scale range.

B. Test Plug: Corrosion-resistant brass or stainless-steel body with two self-sealing rubber core inserts and gasketed and threaded cap, with extended stem for units to be installed in insulated piping. Minimum pressure and temperature rating of 500 psig at 200 deg F.

2.5 HANGERS AND SUPPORTS FOR HVAC

A. Carbon-Steel Pipe Hangers and Supports:
   1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
   2. Galvanized Metallic Coatings: Pregalvanized or hot dipped.
   3. Nonmetallic Coatings: Plastic coating, jacket, or liner.
   4. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
   5. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.

B. Fastener Systems:
   1. Verify suitability of fasteners in this article for use in lightweight concrete or concrete slabs less than 4 inches thick.
   2. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.
   3. Mechanical-Expansion Anchors: Insert-wedge-type, stainless-steel anchors, for use in hardened portland cement concrete; with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

C. Miscellaneous Materials:
   1. Structural Steel: ASTM A 36/A 36M, carbon-steel plates, shapes, and bars; black and galvanized.
   2. Grout: ASTM C 1107, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.
      a. Properties: Nonstaining, noncorrosive, and nongaseous.
      b. Design Mix: 5000-psi, 28-day compressive strength.

PART 3 - EXECUTION

3.1 GENERAL PIPING INSTALLATIONS

A. Install piping free of sags and bends.

B. Install fittings for changes in direction and branch connections.

C. Sleeves:
   1. Install sleeves for piping passing through penetrations in floors, partitions, roofs, and walls.
   2. Install sleeves in concrete floors, concrete roof slabs, and concrete walls as new slabs and walls are constructed.
      a. Using grout, seal the space outside of sleeves in slabs and walls without sleeve-seal system.
   3. Install stack-sleeve fittings in new slabs as slabs are constructed.

4. Exterior Wall, Pipe Penetrations: Mechanical sleeve seals installed in steel or cast-iron pipes for wall sleeves.
5. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Comply with requirements for firestopping specified in Section 078446 "Penetration Firestopping."

D. Escutcheons & Floor Plates:
1. Install escutcheons for piping penetrations of walls, ceilings, and finished floors.
2. Install escutcheons with ID to closely fit around pipe, tube, and insulation of piping and with OD that completely covers opening.
3. Install floor plates for piping penetrations of equipment-room floors.
4. Install floor plates with ID to closely fit around pipe, tube, and insulation of piping and with OD that completely covers opening.

E. Install unions at final connection to each piece of equipment.

F. Install dielectric unions and flanges to connect piping materials of dissimilar metals in gas piping.

G. Install dielectric coupling and nipple fittings to connect piping materials of dissimilar metals in water piping.

3.2 HANGERS AND SUPPORTS

A. Comply with MSS SP-69 and MSS SP-89. Install building attachments within concrete or to structural steel.

B. Install hangers and supports to allow controlled thermal and seismic movement of piping systems.

C. Install powder-actuated fasteners and mechanical-expansion anchors in concrete after concrete is cured. Do not use in lightweight concrete or in slabs less than 4 inches thick.

D. Load Distribution: Install hangers and supports so piping live and dead loading and stresses from movement will not be transmitted to connected equipment.

E. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Specification Sections, install the following types:
1. Adjustable Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated stationary pipes, NPS 1/2 to NPS 30.
2. Pipe Hangers (MSS Type 5): For suspension of pipes, NPS 1/2 to NPS 4, to allow off-center closure for hanger installation before pipe erection.
3. Adjustable Steel Band Hangers (MSS Type 7): For suspension of noninsulated stationary pipes, NPS 1/2 to NPS 8.
4. Adjustable Band Hangers (MSS Type 9): For suspension of noninsulated stationary pipes, NPS 1/2 to NPS 8.
5. Adjustable Swivel-Ring Band Hangers (MSS Type 10): For suspension of noninsulated stationary pipes, NPS 1/2 to NPS 2.

F. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Specification Sections, install the following types:
   1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers, NPS 3/4 to NPS 20.
   2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers, NPS 3/4 to NPS 20, if longer ends are required for riser clamps.

3.3 GENERAL EQUIPMENT INSTALLATIONS

A. Install equipment to allow maximum possible headroom unless specific mounting heights are not indicated.

B. Install equipment level and plumb, parallel and perpendicular to other building systems and components, unless otherwise indicated.

C. Install mechanical equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference to other installations. Extend grease fittings to accessible locations.

D. Install equipment to allow right of way for piping installed at required slope.

E. Mix and install grout for pump and other equipment base plates, and anchors. Place grout, completely filling equipment bases.

END OF SECTION 230500

SECTION 230513 - COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT

PART 1 - GENERAL

1.1 COORDINATION

A. Coordinate features of motors, installed units, and accessory devices to be compatible with the following:

1. Motor controllers.
2. Torque, speed, and horsepower requirements of the load.
3. Ratings and characteristics of supply circuit and required control sequence.
4. Ambient and environmental conditions of installation location.

PART 2 - PRODUCTS

2.1 GENERAL MOTOR REQUIREMENTS

A. Comply with requirements in this Section except when stricter requirements are specified in HVAC equipment schedules or Sections.

B. Comply with NEMA MG 1 unless otherwise indicated.

2.2 MOTOR CHARACTERISTICS

A. Duty: Continuous duty at ambient temperature of 40 deg C and at altitude of 3300 feet above sea level.

B. Capacity and Torque Characteristics: Sufficient to start, accelerate, and operate connected loads at designated speeds, at installed altitude and environment, with indicated operating sequence, and without exceeding nameplate ratings or considering service factor.

2.3 POLYPHASE MOTORS

A. Description: NEMA MG 1, Design B, medium induction motor.

B. Efficiency: Energy efficient, as defined in NEMA MG 1.

C. Service Factor: 1.15.

D. Multispeed Motors: Variable torque.

1. For motors with 2:1 speed ratio, consequent pole, single winding.

2. For motors with other than 2:1 speed ratio, separate winding for each speed.

E. Rotor: Random-wound, squirrel cage.

F. Bearings: Regreasable, shielded, antifriction ball bearings suitable for radial and thrust loading.

G. Temperature Rise: Match insulation rating.

H. Insulation: Class F

I. Code Letter Designation:

1. Motors 15 HP and Larger: NEMA starting Code F or Code G.
2. Motors Smaller than 15 HP: Manufacturer's standard starting characteristic.

J. Enclosure Material: Cast iron for motor frame sizes 324T and larger; rolled steel for motor frame sizes smaller than 324T.

2.4 POLYPHASE MOTORS WITH ADDITIONAL REQUIREMENTS

A. Motors Used with Reduced-Voltage and Multispeed Controllers: Match wiring connection requirements for controller with required motor leads. Provide terminals in motor terminal box, suited to control method.

B. Motors Used with Variable Frequency Controllers: Ratings, characteristics, and features coordinated with and approved by controller manufacturer.

1. Windings: Copper magnet wire with moisture-resistant insulation varnish, designed and tested to resist transient spikes, high frequencies, and short time rise pulses produced by pulse-width modulated inverters.
2. Energy- and Premium-Efficient Motors: Class B temperature rise; Class F insulation.
3. Inverter-Duty Motors: Class F temperature rise; Class H insulation.
4. Thermal Protection: Comply with NEMA MG 1 requirements for thermally protected motors.

2.5 SINGLE-PHASE MOTORS

A. Motors larger than 1/20 HP shall be one of the following, to suit starting torque and requirements of specific motor application:

1. Permanent-split capacitor.
2. Split phase.
3. Capacitor start, inductor run.
4. Capacitor start, capacitor run.

B. Multispeed Motors: Variable-torque, permanent-split-capacitor type.

C. Bearings: Prelubricated, antifriction ball bearings or sleeve bearings suitable for radial and thrust loading.

D. Motors 1/20 HP and Smaller: Shaded-pole type.

E. Thermal Protection: Internal protection to automatically open power supply circuit to motor when winding temperature exceeds a safe value calibrated to temperature rating of motor insulation. Thermal-protection device shall automatically reset when motor temperature returns to normal range.

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 230513

SECTION 230519 - METERS AND GAGES FOR HVAC PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Liquid-in-glass thermometers.
2. Thermowells.
3. Dial-type pressure gages.
4. Gage attachments.
5. Pitot-tube flowmeters.
6. Impeller-turbine, thermal-energy meters.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. Wiring Diagrams: For power, signal, and control wiring.

1.3 INFORMATIONAL SUBMITTALS

A. Product certificates.

1.4 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

PART 2 - PRODUCTS

2.1 BIMETALLIC-ACTUATED THERMOMETERS

A. Standard: ASME B40.200.

B. Case: Liquid-filled ,sealed type(s); stainless steel with 3-inch nominal diameter.

C. Dial: Nonreflective aluminum with permanently etched scale markings and scales in deg F and deg C.

D. Connector Type(s): Union joint, adjustable angle, rigid, back or rigid, bottom, with unified-inch screw threads.

E. Connector Size: 1/2 inch, with ASME B1.1 screw threads.

F. Stem: 0.25 or 0.375 inch in diameter; stainless steel.

G. Window: Plain glass.

H. Ring: Stainless steel.

I. Element: Bimetal coil.

J. Pointer: Dark-colored metal.

K. Accuracy: Plus or minus 1 percent of scale range.

2.2 LIQUID-IN-GLASS THERMOMETERS

A. Metal-Case, Industrial-Style, Liquid-in-Glass Thermometers:

1. Standard: ASME B40.200.
2. Case: Cast aluminum; 7-inch nominal size unless otherwise indicated.
3. Case Form: Adjustable angle, Back angle, or Straight unless otherwise indicated.
4. Tube: Glass with magnifying lens and blue organic liquid.
5. Tube Background: Nonreflective aluminum with permanently etched scale markings graduated in deg F and deg C.
6. Window: Glass.
7. Stem: Aluminum and of length to suit installation.

    a. Design for Air-Duct Installation: With ventilated shroud.
    b. Design for Thermowell Installation: Bare stem.

8. Connector: 1-1/4 inches, with ASME B1.1 screw threads.
9. Accuracy: Plus or minus 1 percent of scale range or one scale division, to a maximum of 1.5 percent of scale range.

2.3 THERMOWELLS

A. Thermowells:

1. Standard: ASME B40.200.
2. Description: Pressure-tight, socket-type fitting made for insertion into piping tee fitting.
3. Material for Use with Copper Tubing: CNR or CUNI.
4. Material for Use with Steel Piping: CRES or CSA.
5. Type: Stepped shank unless straight or tapered shank is indicated.
6. External Threads: NPS 1/2, NPS 3/4, or NPS 1, ASME B1.20.1 pipe threads.
7. Internal Threads: 1/2, 3/4, and 1 inch, with ASME B1.1 screw threads.
8. Bore: Diameter required to match thermometer bulb or stem.
9. Insertion Length: Length required to match thermometer bulb or stem.
10. Lagging Extension: Include on thermowells for insulated piping and tubing.

11. Bushings: For converting size of thermowell's internal screw thread to size of thermometer connection.

B. Heat-Transfer Medium: Mixture of graphite and glycerin.

2.4 PRESSURE GAGES

A. Direct-Mounted, Metal-Case, Dial-Type Pressure Gages:

1. Standard: ASME B40.100.
2. Case: Liquid-filled, Sealed Solid-front, pressure relief type(s); cast aluminum or drawn steel; 4-1/2-inch nominal diameter.
3. Pressure-Element Assembly: Bourdon tube unless otherwise indicated.
4. Pressure Connection: Brass, with NPS 1/4 or NPS 1/2, ASME B1.20.1 pipe threads and bottom-outlet type unless back-outlet type is indicated.
5. Movement: Mechanical, with link to pressure element and connection to pointer.
6. Dial: Nonreflective aluminum with permanently etched scale markings graduated in psi and kPa.
7. Pointer: Dark-colored metal.
8. Window: Glass.
9. Ring: Metal.
10. Accuracy: Grade A, plus or minus 1 percent of middle half of scale range.

2.5 GAGE ATTACHMENTS

A. Snubbers: ASME B40.100, brass; with NPS 1/4 or NPS 1/2, ASME B1.20.1 pipe threads and piston or porous-metal-type surge-dampening device. Include extension for use on insulated piping.

B. Siphons: Loop-shaped section of brass pipe with NPS 1/4 or NPS 1/2 pipe threads.

C. Valves: Brass ball, with NPS 1/4 or NPS 1/2, ASME B1.20.1 pipe threads.

2.6 FLOWMETERS

A. Pitot-Tube Flowmeters:

1. Description: Flowmeter with sensor and indicator.
2. Flow Range: Sensor and indicator shall cover operating range of equipment or system served.
3. Sensor: Insertion type; for inserting probe into piping and measuring flow directly in gallons per minute.

    a. Design: Differential-pressure-type measurement for water.
    b. Construction: Stainless-steel probe of length to span inside of pipe, with integral transmitter and direct-reading scale.
    c. Minimum Pressure Rating: 150 psig.

d. Minimum Temperature Rating: 250 deg F.

4. Indicator: Hand-held meter; either an integral part of sensor or a separate meter.
5. Integral Transformer: For low-voltage power connection.
6. Accuracy: Plus or minus 3 percent.
7. Display: Shows rate of flow, with register to indicate total volume in gallons.
8. Operating Instructions: Include complete instructions with each flowmeter.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install thermowells with socket extending one-third of pipe diameter and in vertical position in piping tees.

B. Install thermowells of sizes required to match thermometer connectors. Include bushings if required to match sizes.

C. Install thermowells with extension on insulated piping.

D. Fill thermowells with heat-transfer medium.

E. Install direct-mounted thermometers in thermowells and adjust vertical and tilted positions.

F. Install direct-mounted pressure gages in piping tees with pressure gage located on pipe at the most readable position.

G. Install valve and snubber in piping for each pressure gage for fluids (except steam).

H. Install valve and syphon fitting in piping for each pressure gage for steam.

I. Install flow indicators in piping systems in accessible positions for easy viewing.

J. Assemble and install connections, tubing, and accessories between flow-measuring elements and flowmeters according to manufacturer's written instructions.

K. Install flowmeter elements in accessible positions in piping systems.

L. Install differential-pressure-type flowmeter elements, with at least minimum straight lengths of pipe, upstream and downstream from element according to manufacturer's written instructions.

M. Install permanent indicators on walls or brackets in accessible and readable positions.

N. Install connection fittings in accessible locations for attachment to portable indicators.

3.2 CONNECTIONS

A. Install meters and gages adjacent to machines and equipment to allow service and maintenance of meters, gages, machines, and equipment.

B. Connect flowmeter-system elements to meters.

C. Connect flowmeter transmitters to meters.

D. Connect thermal-energy meter transmitters to meters.

3.3 ADJUSTING

A. After installation, calibrate meters according to manufacturer's written instructions.

B. Adjust faces of meters and gages to proper angle for best visibility.

3.4 THERMOMETER SCHEDULE

A. Thermometers at each hydronic boiler and chiller system shall be one of the following:

1. Liquid-filled, Sealed, bimetallic-actuated type.
2. Industrial-style, liquid-in-glass type.

B. Thermometer stems shall be of length to match thermowell insertion length.

3.5 THERMOMETER SCALE-RANGE SCHEDULE

A. Scale Range for Heating, Hot-Water Piping: 50 to 400 deg F and 0 to 200 deg C.

3.6 PRESSURE-GAGE SCHEDULE

A. Pressure gages at each hydronic system component shall be the following:

1. Liquid-filled, Sealed Solid-front, pressure-relief, direct or remote-mounted, metal case.

3.7 PRESSURE-GAGE SCALE-RANGE SCHEDULE

A. Scale Range for Heating, Hot-Water Piping: 0 to 300 psi and 0 to 2500 kPa.

3.8 FLOWMETER SCHEDULE

A. Flowmeters for Heating, Hot-Water Piping: Pitot-tube or Venturi type.

END OF SECTION 230519

SECTION 230523 - GENERAL-DUTY VALVES FOR HVAC PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Bronze ball valves.
   2. High-performance butterfly valves.
   3. Iron swing check valves with closure control.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of valve indicated.

1.3 PERFORMANCE REQUIREMENTS

A. Source Limitations for Valves: Obtain each type of valve from single source from single manufacturer.

B. ASME Compliance: ASME B16.10 and ASME B16.34 for ferrous valve dimensions and design criteria.

C. Valve Pressure and Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR VALVES

A. Valve Sizes: Same as upstream piping unless otherwise indicated.

B. Valve Actuator Types:

   1. Gear Actuator: For quarter-turn valves NPS 8 and larger.
   2. Handwheel: For valves other than quarter-turn types.
   3. Handlever: For quarter-turn valves NPS 6 and smaller.

C. Valves in Insulated Piping: With 2-inch stem extensions and the following features:
   1. Ball Valves: With extended operating handle of non-thermal-conductive material, and protective sleeve that allows operation of valve without breaking the vapor seal or disturbing insulation.
   2. Butterfly Valves: With extended neck.

D. Valve-End Connections:

1. Flanged: With flanges according to ASME B16.1 for cast-iron valves and with ANSI B16.24 for bronze valves.
2. Solder Joint: With sockets according to ASME B16.18.
3. Threaded: With threads according to ASME B1.20.1.

2.2 BRONZE BALL VALVES

A. Two-Piece, Full-Port, Bronze Ball Valves with Stainless-Steel Trim:

1. Description:

a. Standard: MSS SP-110.
b. SWP Rating: 150 psig.
c. CWP Rating: 600 psig.
d. Body Design: Two piece.
e. Body Material: Bronze.
f. Ends: Threaded.
g. Seats: PTFE or TFE.
h. Stem: Stainless steel.
i. Ball: Stainless steel, vented.
j. Port: Full.

2.3 HIGH-PERFORMANCE BUTTERFLY VALVES

A. Class 150, Single-Flange, High-Performance Butterfly Valves:

1. Description:

a. Standard: MSS SP-68.
b. CWP Rating: 285 psig at 100 deg F.
c. Body Design: Lug type; suitable for bidirectional dead-end service at rated pressure without use of downstream flange.
d. Body Material: Carbon steel, cast iron, ductile iron, or stainless steel.
e. Seat: Reinforced PTFE or metal.
f. Stem: Stainless steel; offset from seat plane.
g. Disc: Carbon steel.
h. Service: Bidirectional.

2.4 IRON SWING CHECK VALVES WITH CLOSURE CONTROL

A. Class 125, Iron Swing Check Valves with Lever- and Spring or Weight-Closure Control:

1. Description:

a. Standard: MSS SP-71, Type I.
b. NPS 2-1/2 to NPS 12, CWP Rating: 200 psig.
c. NPS 14 to NPS 24, CWP Rating: 150 psig.
d. Body Design: Clear or full waterway.

e. Body Material: ASTM A 126, gray iron with bolted bonnet.
f. Ends: Flanged.
g. Trim: Bronze.
h. Gasket: Asbestos free.
i. Closure Control: Factory-installed, exterior lever and spring or weight.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine valve interior for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks, used to prevent disc movement during shipping and handling.

B. Operate valves in positions from fully open to fully closed. Examine guides and seats made accessible by such operations.

C. Examine threads on valve and mating pipe for form and cleanliness.

D. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Verify that gasket is of proper size, that its material composition is suitable for service, and that it is free from defects and damage.

E. Do not attempt to repair defective valves; replace with new valves.

3.2 VALVE INSTALLATION

A. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.

B. Locate valves for easy access and provide separate support where necessary.

C. Install valves in horizontal piping with stem at or above center of pipe.

D. Install valves in position to allow full stem movement.

E. Install swing check valves for proper direction of flow and in horizontal position with hinge pin level.

F. Install three-valve bypass around each pressure-reducing valve using throttling-type valves

3.3 ADJUSTING

A. Adjust or replace valve packing after piping systems have been tested and put into service but before final adjusting and balancing. Replace valves if persistent leaking occurs.

3.4 GENERAL REQUIREMENTS FOR VALVE APPLICATIONS

A. If valve applications are not indicated, use the following:

1. Shutoff Service: Ball or butterfly valves.
2. Pump-Discharge Check Valves:
   a. NPS 2-1/2 and Larger: Iron swing check valves with lever and weight or with spring.

B. If valves with specified SWP classes or CWP ratings are not available, the same types of valves with higher SWP classes or CWP ratings may be substituted.

C. Select valves, except wafer types, with the following end connections:
1. For Steel Piping, NPS 2 and Smaller: Threaded ends.
2. For Steel Piping, NPS 2-1/2 to NPS 4: Flanged ends except where threaded valve-end option is indicated in valve schedules below.
3. For Steel Piping, NPS 5 and Larger: Flanged ends.

3.5 HEATING-WATER VALVE SCHEDULE

A. Pipe NPS 2 and Smaller:
1. Ball Valves: Two piece, full port, bronze with bronze or stainless-steel trim.

B. Pipe NPS 2-1/2 (DN 65) and Larger:
1. High-Performance Butterfly Valves: Class 150, single flange.

END OF SECTION 230523

SECTION 230548 - VIBRATION CONTROLS FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Isolation pads.
2. Isolation mounts.
3. Restrained elastomeric isolation mounts.
4. Freestanding and restrained spring isolators.
5. Elastomeric hangers.
6. Spring hangers with vertical-limit stops.
7. Pipe riser resilient supports.
8. Resilient pipe guides.
9. Restraining braces and cables.

1.2 PERFORMANCE REQUIREMENTS

1.3 ACTION SUBMITTALS

A. Product Data: For each product indicated.

B. Delegated-Design Submittal: For vibration isolation and seismic-restraint calculations and details indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

C. Welding certificates.

PART 2 - PRODUCTS

2.1 VIBRATION ISOLATORS

A. Pads: Arranged in single or multiple layers of sufficient stiffness for uniform loading over pad area, molded with a nonslip pattern and galvanized-steel baseplates, and factory cut to sizes that match requirements of supported equipment.

1. Resilient Material: Oil- and water-resistant neoprene rubber hermetically sealed compressed fiberglass.

B. Mounts: Double-deflection type, with molded, oil-resistant rubber, hermetically sealed compressed fiberglass, or neoprene isolator elements with factory-drilled, encapsulated

top plate for bolting to equipment and with baseplate for bolting to structure. Color-code or otherwise identify to indicate capacity range.

1. Materials: Cast-ductile-iron or welded steel housing containing two separate and opposing, oil-resistant rubber or neoprene elements that prevent central threaded element and attachment hardware from contacting the housing during normal operation.
2. Neoprene: Shock-absorbing materials compounded according to the standard for bridge-bearing neoprene as defined by AASHTO.

C. Restrained Mounts: All-directional mountings with seismic restraint.

1. Materials: Cast-ductile-iron or welded steel housing containing two separate and opposing, oil-resistant rubber or neoprene elements that prevent central threaded element and attachment hardware from contacting the housing during normal operation.
2. Neoprene: Shock-absorbing materials compounded according to the standard for bridge-bearing neoprene as defined by AASHTO.

D. Spring Isolators: Freestanding, laterally stable, open-spring isolators.

1. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
2. Minimum Additional Travel: 50 percent of the required deflection at rated load.
3. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
4. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
5. Baseplates: Factory drilled for bolting to structure and bonded to 1/4-inch- thick, rubber isolator pad attached to baseplate underside. Baseplates shall limit floor load to 500 psig.
6. Top Plate and Adjustment Bolt: Threaded top plate with adjustment bolt and cap screw to fasten and level equipment.

E. Restrained Spring Isolators: Freestanding, steel, open-spring isolators with seismic or limit-stop restraint.

1. Housing: Steel with resilient vertical-limit stops to prevent spring extension due to weight being removed; factory-drilled baseplate bonded to 1/4-inch-thick, neoprene or rubber isolator pad attached to baseplate underside; and adjustable equipment mounting and leveling bolt that acts as blocking during installation.
2. Restraint: Seismic or limit stop as required for equipment and authorities having jurisdiction.
3. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
4. Minimum Additional Travel: 50 percent of the required deflection at rated load.
5. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
6. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.

F. Housed Spring Mounts: Housed spring isolator with integral seismic snubbers.

1. Housing: Ductile-iron or steel housing to provide all-directional seismic restraint.
2. Base: Factory drilled for bolting to structure.
3. Snubbers: Vertically adjustable to allow a maximum of 1/4-inch travel up or down before contacting a resilient collar.

G. Elastomeric Hangers: Single or double-deflection type, fitted with molded, oil-resistant elastomeric isolator elements bonded to steel housings with threaded connections for hanger rods. Color-code or otherwise identify to indicate capacity range.

H. Spring Hangers: Combination coil-spring and elastomeric-insert hanger with spring and insert in compression.

1. Frame: Steel, fabricated for connection to threaded hanger rods and to allow for a maximum of 30 degrees of angular hanger-rod misalignment without binding or reducing isolation efficiency.
2. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
3. Minimum Additional Travel: 50 percent of the required deflection at rated load.
4. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
5. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
6. Elastomeric Element: Molded, oil-resistant rubber or neoprene. Steel-washer-reinforced cup to support spring and bushing projecting through bottom of frame.
7. Self-centering hanger rod cap to ensure concentricity between hanger rod and support spring coil.

I. Spring Hangers with Vertical-Limit Stop: Combination coil-spring and elastomeric-insert hanger with spring and insert in compression and with a vertical-limit stop.

1. Frame: Steel, fabricated for connection to threaded hanger rods and to allow for a maximum of 30 degrees of angular hanger-rod misalignment without binding or reducing isolation efficiency.
2. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
3. Minimum Additional Travel: 50 percent of the required deflection at rated load.
4. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
5. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
6. Elastomeric Element: Molded, oil-resistant rubber or neoprene.
7. Adjustable Vertical Stop: Steel washer with neoprene washer "up-stop" on lower threaded rod.
8. Self-centering hanger rod cap to ensure concentricity between hanger rod and support spring coil.

J. Pipe Riser Resilient Support: All-directional, acoustical pipe anchor consisting of 2 steel tubes separated by a minimum of 1/2-inch-thick neoprene. Include steel and neoprene vertical-limit stops arranged to prevent vertical travel in both directions. Design support for a maximum load on the isolation material of 500 psig and for equal resistance in all directions.

K. Resilient Pipe Guides: Telescopic arrangement of 2 steel tubes or post and sleeve arrangement separated by a minimum of 1/2-inch-thick neoprene. Where clearances are not readily visible, a factory-set guide height with a shear pin to allow vertical motion due to pipe expansion and contraction shall be fitted. Shear pin shall be removable and re-insertable to allow for selection of pipe movement. Guides shall be capable of motion to meet location requirements.

PART 3 - EXECUTION

3.1 VIBRATION-CONTROL DEVICE INSTALLATION

A. Equipment Restraints:

1. Install resilient bolt isolation washers on equipment anchor bolts where clearance between anchor and adjacent surface exceeds 0.125 inch.

B. Piping Restraints:

1. Comply with requirements in MSS SP-127.
2. Space lateral supports a maximum of 40 feet o.c., and longitudinal supports a maximum of 80 feet o.c.
3. Brace a change of direction longer than 12 feet.

C. Install cables so they do not bend across edges of adjacent equipment or building structure.

D. Install bushing assemblies for anchor bolts for floor-mounted equipment, arranged to provide resilient media between anchor bolt and mounting hole in concrete base.

E. Attachment to Structure: If specific attachment is not indicated, anchor bracing to structure at flanges of beams, at upper truss chords of bar joists, or at concrete members.

F. Drilled-in Anchors:

1. Identify position of reinforcing steel and other embedded items prior to drilling holes for anchors. Do not damage existing reinforcing or embedded items during coring or drilling. Notify the structural engineer if reinforcing steel or other embedded items are encountered during drilling. Locate and avoid prestressed tendons, electrical and telecommunications conduit, and gas lines.
2. Do not drill holes in concrete or masonry until concrete, mortar, or grout has achieved full design strength.
3. Wedge Anchors: Protect threads from damage during anchor installation. Heavy-duty sleeve anchors shall be installed with sleeve fully engaged in the structural element to which anchor is to be fastened.
4. Set anchors to manufacturer's recommended torque, using a torque wrench.
5. Install zinc-coated steel anchors for interior and stainless-steel anchors for exterior applications.

3.2 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Remove and replace malfunctioning units and retest as specified above.

C. Prepare test and inspection reports.

3.3 ADJUSTING

A. Adjust isolators after piping system is at operating weight.

B. Adjust limit stops on restrained spring isolators to mount equipment at normal operating height. After equipment installation is complete, adjust limit stops so they are out of contact during normal operation.

C. Adjust active height of spring isolators.

D. Adjust restraints to permit free movement of equipment within normal mode of operation.

END OF SECTION 230548

SECTION 230553 - IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Equipment labels.
2. Warning signs and labels.
3. Pipe labels.

1.2 ACTION SUBMITTAL

A. Product Data: For each type of product indicated.

PART 2 - PRODUCTS

2.1 EQUIPMENT LABELS

A. Metal Labels for Equipment:

1. Material and Thickness: anodized aluminum, 0.032-inch minimum thickness, and having predrilled or stamped holes for attachment hardware.
2. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
3. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
4. Fasteners: Stainless-steel rivets or self-tapping screws.
5. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

B. Label Content: Include equipment's Drawing designation or unique equipment number, Drawing numbers where equipment is indicated (plans, details, and schedules), plus the Specification Section number and title where equipment is specified.

C. Equipment Label Schedule: For each item of equipment to be labeled, on 8-1/2-by-11-inch bond paper. Tabulate equipment identification number and identify Drawing numbers where equipment is indicated (plans, details, and schedules), plus the Specification Section number and title where equipment is specified. Equipment schedule shall be included in operation and maintenance data.

2.2 WARNING SIGNS AND LABELS

A. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/16 inch thick, and having predrilled holes for attachment hardware.

B. Letter Color: Red

C. Background Color: White.

D. Maximum Temperature: Able to withstand temperatures up to 160 deg F.

E. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.

F. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.

G. Fasteners: Stainless-steel rivets or self-tapping screws.

H. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

I. Label Content: Include caution and warning information, plus emergency notification instructions.

2.3 PIPE LABELS

A. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction.

B. Pretensioned Pipe Labels: Precoiled, semirigid plastic formed to partially cover circumference of pipe and to attach to pipe without fasteners or adhesive.

C. Self-Adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.

D. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings, pipe size, and an arrow indicating flow direction.

1. Flow-Direction Arrows: Integral with piping system service lettering to accommodate both directions, or as separate unit on each pipe label to indicate flow direction.
2. Lettering Size: At least 1-1/2 inches high.

PART 3 - EXECUTION

3.1 PREPARATION

A. Clean piping and equipment surfaces of substances that could impair bond of identification devices, including dirt, oil, grease, release agents, and incompatible primers, paints, and encapsulants.

3.2 EQUIPMENT LABEL INSTALLATION

A. Install or permanently fasten labels on each major item of mechanical equipment.

B. Locate equipment labels where accessible and visible.

3.3 PIPE LABEL INSTALLATION

A. Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:

1. Near each valve and control device.
2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.
3. Near penetrations through walls, floors, ceilings, and inaccessible enclosures.
4. At access doors, manholes, and similar access points that permit view of concealed piping.
5. Near major equipment items and other points of origination and termination.
6. Spaced at maximum intervals of 50 feet along each run. Reduce intervals to 25 feet in areas of congested piping and equipment.
7. On piping above removable acoustical ceilings. Omit intermediately spaced labels.

END OF SECTION 230553

SECTION 230593 - TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Balancing Hydronic Piping Systems:

a. Constant-flow hydronic systems.

1.1 SECTION REQUIREMENTS

A. Submittals:

1. Certified TAB reports.
2. Documentation of work performed per ASHRAE 62.1, Section 7.2.2 - "Air Balancing."
3. Documentation of work performed per ASHRAE/IESNA 90.1, Section 6.7.2.3 - "System Balancing."

B. TAB Firm Qualifications: AABC, NEBB or TABB certified.

C. TAB Report Forms: Standard TAB contractor's forms approved by Commissioning Authority.

D. Perform TAB after leakage and pressure tests on water distribution systems have been satisfactorily completed.

1.2 QUALITY ASSURANCE

A. TAB Contractor Qualifications: Engage a TAB entity certified by AABC, NEBB or TABB.

B. Review field data reports to validate accuracy of data and to prepare certified TAB reports.

C. TAB Report Forms: Use standard TAB contractor's forms approved by Commissioning Authority.

D. Instrumentation Type, Quantity, Accuracy, and Calibration: As described in ASHRAE 111, Section 5, "Instrumentation."

E. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 7.2.2 - "Air Balancing."

F. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1, Section 6.7.2.3 - "System Balancing."

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine the Contract Documents to become familiar with Project requirements and to discover conditions in systems' designs that may preclude proper TAB of systems and equipment.

B. Examine systems for installed balancing devices, such as test ports, gage cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers. Verify that locations of these balancing devices are accessible.

C. Examine the approved submittals for HVAC systems and equipment.

D. Examine equipment performance data including fan and pump curves.

1. Relate performance data to Project conditions and requirements, including system effects that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system.
2. Calculate system-effect factors to reduce performance ratings of HVAC equipment when installed under conditions different from the conditions used to rate equipment performance. To calculate system effects for air systems, use tables and charts found in AMCA 201, "Fans and Systems," or in SMACNA's "HVAC Systems - Duct Design." Compare results with the design data and installed conditions.

E. Examine system and equipment installations and verify that field quality-control testing, cleaning, and adjusting specified in individual Sections have been performed.

F. Examine test reports specified in individual system and equipment Sections.

G. Examine HVAC equipment and filters and verify that bearings are greased, belts are aligned and tight, and equipment with functioning controls is ready for operation.

H. Examine HVAC system equipment and verify that they are accessible and their controls are connected and functioning.

I. Examine strainers. Verify that startup screens are replaced by permanent screens with indicated perforations.

J. Examine three-way valves for proper installation for their intended function of diverting or mixing fluid flows.

K. Examine system pumps to ensure absence of entrained air in the suction piping.

L. Examine operating safety interlocks and controls on HVAC equipment.

M. Report deficiencies discovered before and during performance of TAB procedures. Observe and record system reactions to changes in conditions. Record default set points if different from indicated values.

3.2 PREPARATION

A. Complete system-readiness checks and prepare reports. Verify the following:

1. Permanent electrical-power wiring is complete.
2. Hydronic systems are filled, clean, and free of air.
3. Automatic temperature-control systems are operational.
4. Equipment access doors are securely closed.
5. Balance, smoke, and fire dampers are open.
6. Isolating and balancing valves are open and control valves are operational.
7. Windows and doors can be closed so indicated conditions for system operations can be met.

3.3 GENERAL PROCEDURES FOR TESTING AND BALANCING

A. Perform testing and balancing procedures on each system according to the procedures contained in NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems" and in this Section.

B. Cut insulation, ducts, pipes, and equipment cabinets for installation of test probes to the minimum extent necessary for TAB procedures.

1. After testing and balancing, patch probe holes in ducts with same material and thickness as used to construct ducts.
2. Install and join new insulation that matches removed materials. Restore insulation, coverings, vapor barrier, and finish according to Division 23 Section "HVAC Insulation."

C. Mark equipment and balancing devices, including damper-control positions, valve position indicators, fan-speed-control levers, and similar controls and devices, with paint or other suitable, permanent identification material to show final settings.

D. Take and report testing and balancing measurements in inch-pound (IP) units.

3.4 GENERAL PROCEDURES FOR HYDRONIC SYSTEMS

A. Prepare test reports with pertinent design data, and number in sequence starting at pump to end of system. Check the sum of branch-circuit flows against the approved pump flow rate. Correct variations that exceed plus or minus 5 percent.

B. Prepare schematic diagrams of systems' "as-built" piping layouts.

C. Prepare hydronic systems for testing and balancing according to the following, in addition to the general preparation procedures specified above:

1. Open all manual valves for maximum flow.
2. Check liquid level in expansion tank.
3. Check makeup water-station pressure gage for adequate pressure for highest vent.
4. Check flow-control valves for specified sequence of operation, and set at indicated flow.
5. Set differential-pressure control valves at the specified differential pressure. Do not set at fully closed position when pump is positive-displacement type unless several terminal valves are kept open.
6. Set system controls so automatic valves are wide open to heat exchangers.
7. Check pump-motor load. If motor is overloaded, throttle main flow-balancing device so motor nameplate rating is not exceeded.
8. Check air vents for a forceful liquid flow exiting from vents when manually operated.

3.5 TOLERANCES

A. Set HVAC system's air flow rates and water flow rates within the following tolerances:
1. Heating-Water Flow Rate: Plus or minus 10 percent.

3.6 REPORTING

A. Initial Construction-Phase Report: Based on examination of the Contract Documents as specified in "Examination" Article, prepare a report on the adequacy of design for systems' balancing devices. Recommend changes and additions to systems' balancing devices to facilitate proper performance measuring and balancing. Recommend changes and additions to HVAC systems and general construction to allow access for performance measuring and balancing devices.

B. Status Reports: Prepare progress reports to describe completed procedures, procedures in progress, and scheduled procedures. Include a list of deficiencies and problems found in systems being tested and balanced. Prepare a separate report for each system and each building floor for systems serving multiple floors.

3.7 FINAL REPORT

A. General: Prepare a certified written report; tabulate and divide the report into separate sections for tested systems and balanced systems.

1. Include a certification sheet at the front of the report's binder, signed and sealed by the certified testing and balancing engineer.
2. Include a list of instruments used for procedures, along with proof of calibration.

3.8 ADDITIONAL TESTS

A. Within 90 days of completing TAB, perform additional TAB to verify that balanced conditions are being maintained throughout and to correct unusual conditions.

B. Seasonal Periods: If initial TAB procedures were not performed during near-peak summer and winter conditions, perform additional TAB during near-peak summer and winter conditions.

END OF SECTION 230593

SECTION 230719 - HVAC PIPING INSULATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes insulating the following HVAC piping systems:

1. Heating hot-water piping, indoors.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

PART 2 - PRODUCTS

2.1 INSULATION MATERIALS

A. Products shall not contain asbestos, lead, mercury, or mercury compounds.

B. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.

C. Mineral-Fiber Blanket Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 1290, Type I.

D. Mineral-Fiber, Preformed Pipe Insulation:

1. Type I, 850 deg F Materials: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 547, Type I, Grade A, with factory-applied jacket. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

E. Mineral-Fiber, Pipe Insulation Wicking System: Preformed pipe insulation complying with ASTM C 547, Type I, Grade A, with absorbent cloth factory-applied to the entire inside surface of preformed pipe insulation and extended through the longitudinal joint to outside surface of insulation under insulation jacket. Factory apply a white, polymer, vapor-retarder jacket with self-sealing adhesive tape seam and evaporation holes running continuously along the longitudinal seam, exposing the absorbent cloth.

2.2 INSULATING CEMENTS

A. Mineral-Fiber, Hydraulic-Setting Insulating and Finishing Cement: Comply with ASTM C 449.

2.3 ADHESIVES

A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated unless otherwise indicated.

B. Cellular-Glass Adhesive: Two-component, thermosetting urethane adhesive containing no flammable solvents, with a service temperature range of minus 100 to plus 200 deg F.

1. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
2. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

C. Flexible Elastomeric and Polyolefin Adhesive: Comply with MIL-A-24179A, Type II, Class I.

1. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
2. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

D. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.

1. For indoor applications, adhesive shall have a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
2. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

E. ASJ Adhesive, and FSK and PVDC Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.

1. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
2. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

2.4 MASTICS

A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-PRF-19565C, Type II.

1. For indoor applications, use mastics that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

B. Vapor-Barrier Mastic: Water based; suitable for indoor use on below-ambient services.

1. Water-Vapor Permeance: ASTM E 96/E 96M, Procedure B, 0.013 perm at 43-mil dry film thickness.
2. Service Temperature Range: Minus 20 to plus 180 deg F.
3. Solids Content: ASTM D 1644, 58 percent by volume and 70 percent by weight.
4. Color: White.

C. Breather Mastic: Water based; suitable for indoor and outdoor use on above-ambient services.

1. Water-Vapor Permeance: ASTM F 1249, 1.8 perms at 0.0625-inch dry film thickness.
2. Service Temperature Range: Minus 20 to plus 180 deg F.
3. Solids Content: 60 percent by volume and 66 percent by weight.
4. Color: White.

2.5 SEALANTS

A. Joint Sealants:

1. Materials shall be compatible with insulation materials, jackets, and substrates.
2. Permanently flexible, elastomeric sealant.
3. Service Temperature Range: Minus 100 to plus 300 deg
4. Color: White or gray.
5. For indoor applications, sealants shall have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
6. Sealants shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

B. Metal Jacket Flashing Sealants:

1. Materials shall be compatible with insulation materials, jackets, and substrates.
2. Fire- and water-resistant, flexible, elastomeric sealant.
3. Service Temperature Range: Minus 40 to plus 250 deg F.
4. Color: Aluminum.
5. For indoor applications, sealants shall have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
6. Sealants shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

7. , acrylic-based adhesive covered by a removable protective strip.

2.6 FIELD-APPLIED FABRIC-REINFORCING MESH

A. Woven Polyester Fabric: Approximately 1 oz./sq. yd. with a thread count of 10 strands by 10 strands/sq. in, in a Leno weave, for pipe.

2.7 FIELD-APPLIED JACKETS

A. Field-applied jackets shall comply with ASTM C 921, Type I, unless otherwise indicated.

B. Aluminum Jacket: Comply with ASTM B 209, Alloy 3003, 3005, 3105, or 5005, Temper H-14.

1. Sheet and roll stock ready for shop or field sizing.
2. Finish and thickness are indicated in field-applied jacket schedules.
3. Moisture Barrier for Indoor Applications: 3-mil-thick, heat-bonded polyethylene and kraft paper.
4. Moisture Barrier for Outdoor Applications: 3-mil-thick, heat-bonded polyethylene and kraft paper.
5. Factory-Fabricated Fitting Covers:

    a. Same material, finish, and thickness as jacket.
    b. Preformed 2-piece or gore, 45- and 90-degree, short- and long-radius elbows.
    c. Tee covers.
    d. Flange and union covers.
    e. End caps.
    f. Beveled collars.
    g. Valve covers.
    h. Field fabricate fitting covers only if factory-fabricated fitting covers are not available.

2.8 TAPES

A. Aluminum-Foil Tape: Vapor-retarder tape with acrylic adhesive.

1. Width: 2 inches.
2. Thickness: 3.7 mils.
3. Adhesion: 100 ounces force/inch in width.
4. Elongation: 5 percent.
5. Tensile Strength: 34 lbf/inch in width.

2.9 SECUREMENTS

A. Aluminum Bands: ASTM B 209, Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch thick, 3/4 inch wide with wing seal or closed seal.

PART 3 - EXECUTION

3.1 PREPARATION

A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

B. Coordinate insulation installation with the trade installing heat tracing. Comply with requirements for heat tracing that apply to insulation.

C. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless-steel surfaces, use demineralized water.

3.2 GENERAL INSTALLATION REQUIREMENTS

A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of piping including fittings, valves, and specialties.

B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of pipe system as specified in insulation system schedules.

C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.

D. Install insulation with longitudinal seams at top and bottom of horizontal runs.

E. Install multiple layers of insulation with longitudinal and end seams staggered.

F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.

G. Keep insulation materials dry during application and finishing.

H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.

I. Install insulation with least number of joints practical.

J. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.

1. Install insulation continuously through hangers and around anchor attachments.
2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.

3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.

K. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.

L. Install insulation with factory-applied jackets as follows:

1. Draw jacket tight and smooth.
2. Cover circumferential joints with same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip.
3. Overlap jacket longitudinal seams. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge.

    a. For below ambient services, apply vapor-barrier mastic over staples.

4. Cover joints and seams with tape, according to insulation material manufacturer's written instructions, to maintain vapor seal.
5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints.

M. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.

N. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.

O. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.

P. For above-ambient services, do not install insulation to the following:

1. Vibration-control devices.
2. Testing agency labels and stamps.
3. Nameplates and data plates.
4. Manholes.
5. Handholes.
6. Cleanouts.

3.3 GENERAL PIPE INSULATION INSTALLATION

A. Requirements in this article generally apply to all insulation materials except where more specific requirements are specified in various pipe insulation material installation articles.

B. Insulation Installation on Fittings, Valves, Strainers, Flanges, and Unions:

1. Install insulation over fittings, valves, strainers, flanges, unions, and other specialties with continuous thermal and vapor-retarder integrity unless otherwise indicated.
2. Insulate pipe elbows using preformed fitting insulation or mitered fittings made from same material and density as adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.
3. Insulate tee fittings with preformed fitting insulation or sectional pipe insulation of same material and thickness as used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.
4. Insulate valves using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.
5. Insulate strainers using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Fill joints, seams, and irregular surfaces with insulating cement. Insulate strainers so strainer basket flange or plug can be easily removed and replaced without damaging the insulation and jacket. Provide a removable reusable insulation cover. For below-ambient services, provide a design that maintains vapor barrier.
6. Insulate flanges and unions using a section of oversized preformed pipe insulation. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker.
7. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below-ambient services and a breather mastic for above-ambient services. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.
8. For services not specified to receive a field-applied jacket except for flexible elastomeric and polyolefin, install fitted PVC cover over elbows, tees, strainers, valves, flanges, and unions. Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing using PVC tape.
9. Stencil or label the outside insulation jacket of each union with the word "union." Match size and color of pipe labels.

C. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.

D. Install removable insulation covers at locations indicated. Installation shall conform to the following:

1. Make removable flange and union insulation from sectional pipe insulation of same thickness as that on adjoining pipe. Install same insulation jacket as adjoining pipe insulation.
2. When flange and union covers are made from sectional pipe insulation, extend insulation from flanges or union long at least two times the insulation thickness over adjacent pipe insulation on each side of flange or union. Secure flange cover in place with stainless-steel or aluminum bands. Select band material compatible with insulation and jacket.
3. Construct removable valve insulation covers in same manner as for flanges, except divide the two-part section on the vertical center line of valve body.
4. When covers are made from block insulation, make two halves, each consisting of mitered blocks wired to stainless-steel fabric. Secure this wire frame, with its attached insulation, to flanges with tie wire. Extend insulation at least 2 inches over adjacent pipe insulation on each side of valve. Fill space between flange or union cover and pipe insulation with insulating cement. Finish cover assembly with insulating cement applied in two coats. After first coat is dry, apply and trowel second coat to a smooth finish.
5. Unless a PVC jacket is indicated in field-applied jacket schedules, finish exposed surfaces with a metal jacket.

3.4 INSTALLATION OF MINERAL-FIBER PREFORMED PIPE INSULATION

A. Insulation Installation on Straight Pipes and Tubes:

1. Secure each layer of preformed pipe insulation to pipe with wire or bands and tighten bands without deforming insulation materials.
2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
3. For insulation with factory-applied jackets on above-ambient surfaces, secure laps with outward-clinched staples at 6 inches o.c.
4. For insulation with factory-applied jackets on below-ambient surfaces, do not staple longitudinal tabs. Instead, secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.

B. Insulation Installation on Pipe Flanges:

1. Install preformed pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with mineral-fiber blanket insulation.
4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch, and seal joints with flashing sealant.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install preformed sections of same material as straight segments of pipe insulation when available.

2. When preformed insulation elbows and fittings are not available, install mitered sections of pipe insulation, to a thickness equal to adjoining pipe insulation. Secure insulation materials with wire or bands.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed sections of same material as straight segments of pipe insulation when available.
2. When preformed sections are not available, install mitered sections of pipe insulation to valve body.
3. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
4. Install insulation to flanges as specified for flange insulation application.

3.5 FIELD-APPLIED JACKET INSTALLATION

A. Where metal jackets are indicated, install with 2-inch overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof sealant recommended by insulation manufacturer. Secure jacket with stainless-steel bands 12 inches o.c. and at end joints.

3.6 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Tests and Inspections:

1. Inspect pipe, fittings, strainers, and valves, randomly selected by Architect, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to three locations of straight pipe, three locations of threaded fittings, three locations of welded fittings, two locations of threaded strainers, two locations of welded strainers, three locations of threaded valves, and three locations of flanged valves for each pipe service defined in the "Piping Insulation Schedule, General" Article.

C. All insulation applications will be considered defective Work if sample inspection reveals noncompliance with requirements.

3.7 PIPING INSULATION SCHEDULE, GENERAL

A. Acceptable preformed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range: heat hot water piping – 2-1/2” performed mineral fiber with aluminum jacketing.

B. Items Not Insulated: Unless otherwise indicated, do not install insulation on the following:

1. Drainage piping located in crawl spaces.

2. Underground piping.
3. Chrome-plated pipes and fittings unless there is a potential for personnel injury.

END OF SECTION 230719

SECTION 231123 - FACILITY NATURAL-GAS PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Pipes, tubes, and fittings.
2. Piping specialties.
3. Piping and tubing joining materials.
4. Valves.
5. Pressure regulators.

1.3 PERFORMANCE REQUIREMENTS

A. Minimum Operating-Pressure Ratings:

1. Piping and Valves: 100 psig minimum unless otherwise indicated.
2. Service Regulators: 65 psig minimum unless otherwise indicated.
3. Minimum Operating Pressure of Service Meter: 5 psig

B. Natural-Gas System Pressure within Buildings: More than 0.5 psig but not more than 2 psig

C. Natural-Gas System Pressures within Buildings: Two pressure ranges. Primary pressure is more than 0.5 psig (3.45 kPa) but not more than 2 psig (13.8 kPa), and is reduced to secondary pressure of 0.5 psig (3.45 kPa) or less.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: For facility natural-gas piping layout. Include plans, piping layout and elevations, sections, and details for fabrication of pipe anchors, hangers, supports for multiple pipes, alignment guides, expansion joints and loops, and attachments of the same to building structure. Detail location of anchors, alignment guides, and expansion joints and loops.
1. Detail mounting, supports, and valve arrangements for pressure regulator assembly.

1.5 CLOSEOUT SUBMITTALS

A. Operation and maintenance data: For motorized gas valves and pressure regulators to include in emergency, operation, and maintenance manuals.

1.6 QUALITY ASSURANCE

A. Steel Support Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

B. Pipe Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Handling Flammable Liquids: Remove and dispose of liquids from existing natural-gas piping according to requirements of authorities having jurisdiction.

B. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.

C. Store and handle pipes and tubes having factory-applied protective coatings to avoid damaging coating, and protect from direct sunlight.

1.8 PROJECT CONDITIONS

A. Perform site survey, research public utility records, and verify existing utility locations. Contact utility-locating service for area where Project is located.

B. Interruption of Existing Natural-Gas Service: Do not interrupt natural-gas service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide purging and startup of natural-gas supply according to requirements indicated:
   1. Notify Architect no fewer than two days in advance of proposed interruption of natural-gas service.

1.9 COORDINATION

A. Coordinate sizes and locations of concrete bases with actual equipment provided.

B. Coordinate requirements for access panels and doors for valves installed concealed behind finished surfaces. Comply with requirements in Division 08 Section "Access Doors and Frames."

PART 2 - PRODUCTS

2.1 PIPES, TUBES, AND FITTINGS

A. Steel Pipe: ASTM A 53/A 53M, black steel, Schedule 40, Type E or S, Grade B.

1. Malleable-Iron Threaded Fittings: ASME B16.3, Class 150, standard pattern.
2. Wrought-Steel Welding Fittings: ASTM A 234/A 234M for butt welding and socket welding.
3. Unions: ASME B16.39, Class 150, malleable iron with brass-to-iron seat, ground joint, and threaded ends.
4. Protective Coating for Underground Piping: Factory-applied, three-layer coating of epoxy, adhesive, and PE.

    a. Joint Cover Kits: Epoxy paint, adhesive, and heat-shrink PE sleeves.

B. Corrugated, Stainless-Steel Tubing: Comply with ANSI/IAS LC 1.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

    a. OmegaFlex, Inc.
    b. Parker Hannifin Corporation; Parflex Division.
    c. Titeflex.
    d. Tru-Flex Metal Hose Corp.

2. Tubing: ASTM A 240/A 240M, corrugated, Series 300 stainless steel.
3. Coating: PE with flame retardant.

    a. Surface-Burning Characteristics: As determined by testing identical products according to ASTM E 84 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

        1) Flame-Spread Index: 25 or less.
        2) Smoke-Developed Index: 50 or less.

4. Fittings: Copper-alloy mechanical fittings with ends made to fit and listed for use with corrugated stainless-steel tubing and capable of metal-to-metal seal without gaskets. Include brazing socket or threaded ends complying with ASME B1.20.1.
5. Striker Plates: Steel, designed to protect tubing from penetrations.
6. Manifolds: Malleable iron or steel with factory-applied protective coating. Threaded connections shall comply with ASME B1.20.1 for pipe inlet and corrugated tubing outlets.
7. Operating-Pressure Rating: 5 psig .

2.2 PIPING SPECIALTIES

A. Appliance Flexible Connectors:

1. Indoor, Fixed-Appliance Flexible Connectors: Comply with ANSI Z21.24.
2. Indoor, Movable-Appliance Flexible Connectors: Comply with ANSI Z21.69.
3. Corrugated stainless-steel tubing with polymer coating.
4. Operating-Pressure Rating: 0.5 psig.
5. End Fittings: Zinc-coated steel.
6. Threaded Ends: Comply with ASME B1.20.1.
7. Maximum Length: 72 inches .

B. Y-Pattern Strainers:

1. Body: ASTM A 126, Class B, cast iron with bolted cover and bottom drain connection.
2. End Connections: Threaded ends for NPS 2 and smaller.
3. Strainer Screen: 40-mesh startup strainer, and perforated stainless-steel basket with 50 percent free area.
4. CWP Rating: 125 psig .

2.3 JOINING MATERIALS

A. Joint Compound and Tape: Suitable for natural gas.

B. Welding Filler Metals: Comply with AWS D10.12/D10.12M for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

2.4 MANUAL GAS SHUTOFF VALVES

A. See "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles for where each valve type is applied in various services.

B. General Requirements for Metallic Valves, NPS 2 and Smaller: Comply with ASME B16.33.

1. CWP Rating: 125 psig
2. Threaded Ends: Comply with ASME B1.20.1.
3. Dryseal Threads on Flare Ends: Comply with ASME B1.20.3.
4. Tamperproof Feature: Locking feature for valves indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
5. Listing: Listed and labeled by an NRTL acceptable to authorities having jurisdiction for valves 1 inch and smaller.
6. Service Mark: Valves 1-1/4 inches to NPS 2 shall have initials "WOG" permanently marked on valve body.

C. General Requirements for Metallic Valves, NPS 2-1/2 and Larger: Comply with ASME B16.38.
   1. CWP Rating: 125 psig
   2. Flanged Ends: Comply with ASME B16.5 for steel flanges.
   3. Tamperproof Feature: Locking feature for valves indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
   4. Service Mark: Initials "WOG" shall be permanently marked on valve body.

D. Two-Piece, Full-Port, Bronze Ball Valves with Bronze Trim: MSS SP-110.

   1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

      a. BrassCraft Manufacturing Company; a Masco company.
      b. Conbraco Industries, Inc.; Apollo Div.
      c. Lyall, R. W. & Company, Inc.
      d. McDonald, A. Y. Mfg. Co.
      e. Perfection Corporation; a subsidiary of American Meter Company.

   2. Body: Bronze, complying with ASTM B 584.
   3. Ball: Chrome-plated bronze.
   4. Stem: Bronze; blowout proof.
   5. Seats: Reinforced TFE; blowout proof.
   6. Packing: Threaded-body packnut design with adjustable-stem packing.
   7. Ends: Threaded, flared, or socket as indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
   8. CWP Rating: 600 psig.
   9. Listing: Valves NPS 1 and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction.
   10. Service: Suitable for natural-gas service with "WOG" indicated on valve body.

E. Valve Boxes:

   1. Cast-iron, two-section box.
   2. Top section with cover with "GAS" lettering.
   3. Bottom section with base to fit over valve and barrel a minimum of 5 inches (125 mm) in diameter.
   4. Adjustable cast-iron extensions of length required for depth of bury.
   5. Include tee-handle, steel operating wrench with socket end fitting valve nut or flat head, and with stem of length required to operate valve.

2.5 PRESSURE REGULATORS

A. General Requirements:

1. Single stage and suitable for natural gas.
2. Steel jacket and corrosion-resistant components.
3. Elevation compensator.
4. End Connections: Threaded for regulators NPS 2 and smaller.

B. Line Pressure Regulators: Comply with ANSI Z21.80.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

    a. Actaris.
    b. American Meter Company.
    c. Eclipse Combustion, Inc.
    d. Fisher Control Valves and Regulators; Division of Emerson Process Management.
    e. Invensys.
    f. Maxitrol Company.
    g. Richards Industries; Jordan Valve Div.

2. Body and Diaphragm Case: Cast iron or die-cast aluminum.
3. Springs: Zinc-plated steel; interchangeable.
4. Diaphragm Plate: Zinc-plated steel.
5. Seat Disc: Nitrile rubber resistant to gas impurities, abrasion, and deformation at the valve port.
6. Orifice: Aluminum; interchangeable.
7. Seal Plug: Ultraviolet-stabilized, mineral-filled nylon.
8. Single-port, self-contained regulator with orifice no larger than required at maximum pressure inlet, and no pressure sensing piping external to the regulator.
9. Pressure regulator shall maintain discharge pressure setting downstream, and not exceed 150 percent of design discharge pressure at shutoff.
10. Overpressure Protection Device: Factory mounted on pressure regulator.
11. Atmospheric Vent: Factory- or field-installed, stainless-steel screen in opening if not connected to vent piping.
12. Maximum Inlet Pressure: 5 psig

C. Appliance Pressure Regulators: Comply with ANSI Z21.18.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following

    a. Canadian Meter Company Inc.
    b. Eaton Corporation; Controls Div.
    c. Harper Wyman Co.
    d. Maxitrol Company.
    e. SCP, Inc.

2. Body and Diaphragm Case: Die-cast aluminum.
3. Springs: Zinc-plated steel; interchangeable.
4. Diaphragm Plate: Zinc-plated steel.

5. Seat Disc: Nitrile rubber.
6. Seal Plug: Ultraviolet-stabilized, mineral-filled nylon.
7. Factory-Applied Finish: Minimum three-layer polyester and polyurethane paint finish.
8. Regulator may include vent limiting device, instead of vent connection, if approved by authorities having jurisdiction.
9. Maximum Inlet Pressure: 2 psig

2.6 DIELECTRIC UNIONS

A. Dielectric Unions:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following

    a. Capitol Manufacturing Company.
    b. Central Plastics Company.
    c. Hart Industries International, Inc.
    d. Jomar International Ltd.
    e. Matco-Norca, Inc.
    f. McDonald, A. Y. Mfg. Co.
    g. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
    h. Wilkins; a Zurn company.

2. Description:

    a. Standard: ASSE 1079.
    b. Pressure Rating: 125 psig minimum at 180 deg F
    c. End Connections: Solder-joint copper alloy and threaded ferrous.

2.7 LABELING AND IDENTIFYING

A. Detectable Warning Tape: Acid- and alkali-resistant, PE film warning tape manufactured for marking and identifying underground utilities, a minimum of 6 inches wide and 4 mils thick, continuously inscribed with a description of utility, with metallic core encased in a protective jacket for corrosion protection, detectable by metal detector when tape is buried up to 30 inches deep; colored yellow.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine roughing-in for natural-gas piping system to verify actual locations of piping connections before equipment installation.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Close equipment shutoff valves before turning off natural gas to premises or piping section.

B. Inspect natural-gas piping according to NFPA 54 and Florida Building Code - Fuel Gas to determine that natural-gas utilization devices are turned off in piping section affected.

C. Comply with NFPA 54 and Florida Building Code - Fuel Gas requirements for prevention of accidental ignition.

3.3 INDOOR PIPING INSTALLATION

A. Comply with NFPA 54 and Florida Building Code - Fuel Gas for installation and purging of natural-gas piping.

B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements are used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.

C. Arrange for pipe spaces, chases, slots, sleeves, and openings in building structure during progress of construction, to allow for mechanical installations.

D. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.

E. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

F. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

G. Locate valves for easy access.

H. Install natural-gas piping at uniform grade of 2 percent down toward drip and sediment traps.

I. Install piping free of sags and bends.

J. Install fittings for changes in direction and branch connections.

K. Verify final equipment locations for roughing-in.

L. Comply with requirements in Sections specifying gas-fired appliances and equipment for roughing-in requirements.

M. Drips and Sediment Traps: Install drips at points where condensate may collect, including service-meter outlets. Locate where accessible to permit cleaning and emptying. Do not install where condensate is subject to freezing.

1. Construct drips and sediment traps using tee fitting with bottom outlet plugged or capped. Use nipple a minimum length of 3 pipe diameters, but not less than 6 inches long and same size as connected pipe. Install with space below bottom of drip to remove plug or cap.

N. Extend relief vent connections for service regulators, line regulators, and overpressure protection devices to outdoors and terminate with weatherproof vent cap.

O. Conceal pipe installations in walls, pipe spaces, utility spaces, above ceilings, below grade or floors, and in floor channels unless indicated to be exposed to view.

P. Use eccentric reducer fittings to make reductions in pipe sizes. Install fittings with level side down.

Q. Connect branch piping from top or side of horizontal piping.

R. Install unions in pipes NPS 2 and smaller, adjacent to each valve, at final connection to each piece of equipment.

S. Do not use natural-gas piping as grounding electrode.

T. Install strainer on inlet of each line-pressure regulator and automatic or electrically operated valve.

U. Install pressure gage downstream from each line regulator. Pressure gages are specified in Division 22 Section "Meters and Gages for plumbing Piping."

V. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Division 22 Section "Sleeves and Sleeve Seals for plumbing Piping."

W. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Division 22 Section "Sleeves and Sleeve Seals for plumbing Piping."

X. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Division 22 Section "Escutcheons for plumbing Piping."

3.4 VALVE INSTALLATION

A. Install manual gas shutoff valve for each gas appliance ahead of corrugated stainless-steel tubing or copper connector.

B. Install underground valves with valve boxes.

C. Install regulators and overpressure protection devices with maintenance access space adequate for servicing and testing.

D. Install earthquake valves aboveground outside buildings according to listing.

E. Install anode for metallic valves in underground PE piping.

3.5 PIPING JOINT CONSTRUCTION

A. Ream ends of pipes and tubes and remove burrs.

B. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

C. Threaded Joints:

1. Thread pipe with tapered pipe threads complying with ASME B1.20.1.
2. Cut threads full and clean using sharp dies.
3. Ream threaded pipe ends to remove burrs and restore full inside diameter of pipe.
4. Apply appropriate tape or thread compound to external pipe threads unless dryseal threading is specified.
5. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

D. Welded Joints:

1. Construct joints according to AWS D10.12/D10.12M, using qualified processes and welding operators.
2. Bevel plain ends of steel pipe.
3. Patch factory-applied protective coating as recommended by manufacturer at field welds and where damage to coating occurs during construction.

E. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter.

F. Flared Joints: Cut tubing with roll cutting tool. Flare tube end with tool to result in flare dimensions complying with SAE J513. Tighten finger tight, then use wrench. Do not overtighten.

G. PE Piping Heat-Fusion Joints: Clean and dry joining surfaces by wiping with clean cloth or paper towels. Join according to ASTM D 2657.

1. Plain-End Pipe and Fittings: Use butt fusion.
2. Plain-End Pipe and Socket Fittings: Use socket fusion.

3.6 HANGER AND SUPPORT INSTALLATION

A. Comply with requirements for pipe hangers and supports specified in Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment."

B. Install hangers for horizontal steel piping with the following maximum spacing and minimum rod sizes:

1. NPS 1 and Smaller: Maximum span, 96 inches; minimum rod size, 3/8 inch .

2. NPS 1-1/4 : Maximum span, 108 inches ; minimum rod size, 3/8 inch.
3. NPS 1-1/2 and NPS 2: Maximum span, 108 inches; minimum rod size, 3/8 inch.

C. Install hangers for horizontal, corrugated stainless-steel tubing with the following maximum spacing and minimum rod sizes:

1. NPS 3/8: Maximum span, 48 inches; minimum rod size, 3/8 inch.
2. NPS 1/2: Maximum span, 72 inches; minimum rod size, 3/8 inch.
3. NPS 3/4 and Larger: Maximum span, 96 inches; minimum rod size, 3/8 inch.

3.7 CONNECTIONS

A. Connect to utility's gas main according to utility's procedures and requirements.

B. Install natural-gas piping electrically continuous, and bonded to gas appliance equipment grounding conductor of the circuit powering the appliance according to NFPA 70.

C. Install piping adjacent to appliances to allow service and maintenance of appliances.

D. Connect piping to appliances using manual gas shutoff valves and unions. Install valve within 72 inches of each gas-fired appliance and equipment. Install union between valve and appliances or equipment.

E. Sediment Traps: Install tee fitting with capped nipple in bottom to form drip, as close as practical to inlet of each appliance.

3.8 LABELING AND IDENTIFYING

A. Comply with requirements in Division 22 Section "Identification for Plumbing Piping and Equipment" for piping and valve identification.

B. Install detectable warning tape directly above gas piping, 12 inches below finished grade, except 6 inches below subgrade under pavements and slabs.

3.9 PAINTING

A. Comply with requirements in Division 09 painting Sections for painting interior and exterior natural-gas piping.

B. Paint exposed, exterior metal piping, valves, service regulators, service meters and meter bars, earthquake valves, and piping specialties, except components, with factory-applied paint or protective coating.

1. Alkyd System: MPI EXT 5.1D.

a. Prime Coat: Alkyd anticorrosive metal primer.
b. Intermediate Coat: Exterior alkyd enamel matching topcoat.
c. Topcoat: Exterior alkyd enamel flat.
d. Color: Yellow.

C. Paint exposed, interior metal piping, valves, service regulators, service meters and meter bars, earthquake valves, and piping specialties, except components, with factory-applied paint or protective coating.

1. Latex Over Alkyd Primer System: MPI INT 5.1Q.

a. Prime Coat: Alkyd anticorrosive metal primer.
b. Intermediate Coat: Interior latex matching topcoat.
c. Topcoat: Interior latex flat.
d. Color: Yellow.

D. Damage and Touchup: Repair marred and damaged factory-applied finishes with materials and by procedures to match original factory finish.

3.10 FIELD QUALITY CONTROL

A. Test, inspect, and purge natural gas according to NFPA 54 and Florida Building Code - Fuel Gas and authorities having jurisdiction.

B. Natural-gas piping will be considered defective if it does not pass tests and inspections.

C. Prepare test and inspection reports.

3.11 INDOOR PIPING SCHEDULE

A. Aboveground, branch piping NPS 1 and smaller shall be one of the following:

1. Corrugated stainless-steel tubing with mechanical fittings having socket or threaded ends to match adjacent piping.
2. Steel pipe with malleable-iron fittings and threaded joints.

B. Aboveground, distribution piping shall be one of the following:

1. Steel pipe with malleable-iron fittings and threaded joints.
2. Steel pipe with wrought-steel fittings and welded joints.

3.12 ABOVEGROUND MANUAL GAS SHUTOFF VALVE SCHEDULE

A. Valves for pipe sizes NPS 2 and smaller at service meter shall be one of the following:
1. Two-piece, full-port, bronze ball valves with bronze trim.
2. Bronze plug valve.

B. Valves for pipe sizes NPS 2-1/2 and larger at service meter shall be one of the following:

1. Two-piece, full-port, bronze ball valves with bronze trim.
2. Bronze plug valve.
3. Cast-iron, nonlubricated plug valve

C. Distribution piping valves for pipe sizes NPS 2 and smaller shall be one of the following:

1. Two-piece, full-port, bronze ball valves with bronze trim.
2. Bronze plug valve.

D. Distribution piping valves for pipe sizes NPS 2-1/2 and larger shall be one of the following:

1. Two-piece, full-port, bronze ball valves with bronze trim.
2. Bronze plug valve.
3. Cast-iron, nonlubricated plug valve

E. Valves in branch piping for single appliance shall be one of the following:
1. Two-piece, full-port, bronze ball valves with bronze trim.
2. Bronze plug valve.

END OF SECTION 231123

SECTION 232113 - HYDRONIC PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes pipe and fitting materials, joining methods, special-duty valves, and specialties for the following:

1. Hot-water heating piping.
2. Makeup-water piping.
3. Condensate-drain piping.
4. Blowdown-drain piping.
5. Air-vent piping.
6. Safety-valve-inlet and -outlet piping.

1.2 PERFORMANCE REQUIREMENTS

A. Hydronic piping components and installation shall be capable of withstanding the following minimum working pressure and temperature:

1. Hot-Water Heating Piping: 100 psig at 200 deg F.
2. Makeup-Water Piping: 80 psig at 150 deg F.
3. Condensate-Drain Piping: 180 deg F.
4. Blowdown-Drain Piping: 200 deg F.
5. Air-Vent Piping: 200 deg F.
6. Safety-Valve-Inlet and -Outlet Piping: Equal to the pressure of the piping system to which it is attached.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

1.4 INFORMATIONAL SUBMITTALS

A. Field quality-control test reports.

1.5 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

1.6 QUALITY ASSURANCE

A. ASME Compliance: Comply with ASME B31.9, "Building Services Piping," for materials, products, and installation. Safety valves and pressure vessels shall bear the appropriate ASME label. Fabricate and stamp air separators and expansion tanks to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.

PART 2 - PRODUCTS

2.1 COPPER TUBE AND FITTINGS

A. Drawn-Temper Copper Tubing: ASTM B 88, Type L.

B. Annealed-Temper Copper Tubing: ASTM B 88, Type K.

C. DWV Copper Tubing: ASTM B 306, Type DWV.

D. Wrought-Copper Fittings: ASME B16.22.

1. Grooved-End Copper Fittings: ASTM B 75, copper tube or ASTM B 584, bronze casting.
2. Grooved-End-Tube Couplings: Rigid pattern, unless otherwise indicated; gasketed fitting. Ductile-iron housing with keys matching pipe and fitting grooves, prelubricated EPDM gasket rated for minimum 230 deg F for use with housing, and steel bolts and nuts.

E. Wrought-Copper Unions: ASME B16.22.

2.2 STEEL PIPE AND FITTINGS

A. Steel Pipe: ASTM A 53/A 53M, black steel with plain ends; type, grade, and wall thickness as indicated in Part 3 "Piping Applications" Article.

B. Cast-Iron Threaded Fittings: ASME B16.4; Classes 125 and 250 as indicated in Part 3 "Piping Applications" Article.

C. Malleable-Iron Threaded Fittings: ASME B16.3, Classes 150 and 300 as indicated in Part 3 "Piping Applications" Article.

D. Malleable-Iron Unions: ASME B16.39; Classes 150, 250, and 300 as indicated in Part 3 "Piping Applications" Article.

E. Cast-Iron Pipe Flanges and Flanged Fittings: ASME B16.1, Classes 25, 125, and 250; raised ground face, and bolt holes spot faced as indicated in Part 3 "Piping Applications" Article.

F. Wrought Cast- and Forged-Steel Flanges and Flanged Fittings: ASME B16.5, including bolts, nuts, and gaskets of the following material group, end connections, and facings:

1. Material Group: 1.1.
2. End Connections: Butt welding.
3. Facings: Raised face.

G. Grooved Mechanical-Joint Fittings and Couplings:

1. Joint Fittings: ASTM A 536, Grade 65-45-12 ductile iron; ASTM A 47/A 47M, Grade 32510 malleable iron; ASTM A 53/A 53M, Type F, E, or S, Grade B fabricated steel; or ASTM A 106, Grade B steel fittings with grooves or shoulders constructed to accept grooved-end couplings; with nuts, bolts, locking pin, locking toggle, or lugs to secure grooved pipe and fittings.
2. Couplings: Ductile- or malleable-iron housing and synthetic rubber gasket of central cavity pressure-responsive design; with nuts, bolts, locking pin, locking toggle, or lugs to secure grooved pipe and fittings.

2.3 JOINING MATERIALS

A. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.

1. ASME B16.21, nonmetallic, flat, asbestos free, 1/8-inch maximum thickness unless thickness or specific material is indicated.

a. Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges.
b. Narrow-Face Type: For raised-face, Class 250, cast-iron and steel flanges.

B. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.

C. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.

D. Brazing Filler Metals: AWS A5.8, BCuP Series, copper-phosphorus alloys for joining copper with copper; or BAg-1, silver alloy for joining copper with bronze or steel.

E. Gasket Material: Thickness, material, and type suitable for fluid to be handled and working temperatures and pressures.

2.4 DIELECTRIC FITTINGS

A. General Requirements: Assembly of copper alloy and ferrous materials with separating nonconductive insulating material. Include end connections compatible with pipes to be joined.

B. Dielectric Unions:

a. Standard: ASSE 1079.
b. Pressure Rating: 125 psig minimum at 180 deg.
c. End Connections: Solder-joint copper alloy and threaded ferrous.

2.5 VALVES

A. Gate, Check, Ball, and Butterfly Valves: Comply with requirements specified in Division 23 Section "General-Duty Valves for HVAC Piping."

B. Bronze, Calibrated-Orifice, Balancing Valves:

1. Body: Bronze, ball or plug type with calibrated orifice or venturi.
2. Ball: Brass or stainless steel.
3. Plug: Resin.
4. Seat: PTFE.
5. End Connections: Threaded or socket.
6. Pressure Gage Connections: Integral seals for portable differential pressure meter.
7. Handle Style: Lever, with memory stop to retain set position.
8. CWP Rating: Minimum 125 psig.
9. Maximum Operating Temperature: 250 deg F.

C. Cast-Iron or Steel, Calibrated-Orifice, Balancing Valves:

1. Body: Cast-iron or steel body, ball, plug, or globe pattern with calibrated orifice or venturi.
2. Ball: Brass or stainless steel.
3. Stem Seals: EPDM O-rings.
4. Disc: Glass and carbon-filled PTFE.
5. Seat: PTFE.
6. End Connections: Flanged or grooved.
7. Pressure Gage Connections: Integral seals for portable differential pressure meter.
8. Handle Style: Lever, with memory stop to retain set position.
9. CWP Rating: Minimum 125 psig.
10. Maximum Operating Temperature: 250 deg F.

D. Diaphragm-Operated, Pressure-Reducing Valves:

1. Body: Bronze or brass.
2. Disc: Glass and carbon-filled PTFE.
3. Seat: Brass.
4. Stem Seals: EPDM O-rings.
5. Diaphragm: EPT.
6. Low inlet-pressure check valve.
7. Inlet Strainer: removable without system shutdown.
8. Valve Seat and Stem: Noncorrosive.
9. Valve Size, Capacity, and Operating Pressure: Selected to suit system in which installed, with operating pressure and capacity factory set and field adjustable.

E. Diaphragm-Operated Safety Valves:

1. Body: Bronze or brass.
2. Disc: Glass and carbon-filled PTFE.
3. Seat: Brass.

4. Stem Seals: EPDM O-rings.
5. Diaphragm: EPT.
6. Wetted, Internal Work Parts: Brass and rubber.
7. Inlet Strainer: removable without system shutdown.
8. Valve Seat and Stem: Noncorrosive.
9. Valve Size, Capacity, and Operating Pressure: Comply with ASME Boiler and Pressure Vessel Code: Section IV, and selected to suit system in which installed, with operating pressure and capacity factory set and field adjustable.

F. Automatic Flow-Control Valves:

1. Body: Brass or ferrous metal.
2. Piston and Spring Assembly: Stainless steel, tamper proof, self cleaning, and removable.
3. Combination Assemblies: Include bonze or brass-alloy ball valve.
4. Identification Tag: Marked with zone identification, valve number, and flow rate.
5. Size: Same as pipe in which installed.
6. Performance: Maintain constant flow, plus or minus 5 percent over system pressure fluctuations.
7. Minimum CWP Rating: 175 psig.
8. Maximum Operating Temperature: 250 deg F.

2.6 AIR CONTROL DEVICES

A. Manual Air Vents:

1. Body: Bronze.
2. Internal Parts: Nonferrous.
3. Operator: Screwdriver or thumbscrew.
4. Inlet Connection: NPS 1/2.
5. Discharge Connection: NPS 1/8.
6. CWP Rating: 150 psig.
7. Maximum Operating Temperature: 225 deg.

B. Expansion Tanks:

1. Tank: Welded steel, rated for 125-psig working pressure and 375 deg F maximum operating temperature, with taps in bottom of tank for tank fitting and taps in end of tank for gage glass. Tanks shall be factory tested with taps fabricated and labeled according to ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.
2. Air-Control Tank Fitting: Cast-iron body, copper-plated tube, brass vent tube plug, and stainless-steel ball check, 100-gal. unit only; sized for compression-tank diameter. Provide tank fittings for 125-psig working pressure and 250 deg F maximum operating temperature.
3. Tank Drain Fitting: Brass body, nonferrous internal parts; 125-psig working pressure and 240 deg F maximum operating temperature; constructed to admit air to compression tank, drain water, and close off system.
4. Gage Glass: Full height with dual manual shutoff valves, 3/4-inch-diameter gage glass, and slotted-metal glass guard.

C. In-Line Air Separators:

1. Tank: One-piece cast iron with an integral weir constructed to decelerate system flow to maximize air separation.
2. Maximum Working Pressure: Up to 175 psig.
3. Maximum Operating Temperature: Up to 300 deg F.

2.7 CHEMICAL TREATMENT

A. Bypass Chemical Feeder: Welded steel construction; 125-psig working pressure; 5-gal. capacity; with fill funnel and inlet, outlet, and drain valves.

1. Chemicals: Specially formulated, based on analysis of makeup water, to prevent accumulation of scale and corrosion in piping and connected equipment.

B. Ethylene and Propylene Glycol: Industrial grade with corrosion inhibitors and environmental-stabilizer additives for mixing with water in systems indicated to contain antifreeze or glycol solutions.

2.8 HYDRONIC PIPING SPECIALTIES

A. Y-Pattern Strainers:

1. Body: ASTM A 126, Class B, cast iron with bolted cover and bottom drain connection.
2. End Connections: Threaded ends for NPS 2 and smaller; flanged ends for NPS 2-1/2 and larger.
3. Strainer Screen: 40-mesh startup strainer, and perforated stainless-steel basket with 50 percent free area.
4. CWP Rating: 125 psig.

B. Stainless-Steel Bellow, Flexible Connectors:

1. Body: Stainless-steel bellows with woven, flexible, bronze, wire-reinforcing protective jacket.
2. End Connections: Threaded or flanged to match equipment connected.
3. Performance: Capable of 3/4-inch misalignment.
4. CWP Rating: 150 psig.
5. Maximum Operating Temperature: 250 deg F.

C. Expansion fittings are specified in Division 23 Section "Expansion Fittings and Loops for HVAC Piping."

PART 3 - EXECUTION

3.1 PIPING APPLICATIONS

A. Hot-water heating piping, aboveground, NPS 2 and smaller, shall be any of the following:

1. Schedule 40 steel pipe; Class 125/250, cast-iron fittings; cast-iron flanges and flange fittings; and threaded joints.

B. Hot-water heating piping, aboveground, NPS 2-1/2 and larger, shall be any of the following:

1. Schedule 40 steel pipe, wrought-steel fittings and wrought-cast or forged-steel flanges and flange fittings, and welded and flanged joints.

C. Makeup-water piping installed aboveground shall be the following:

1. Type L, drawn-temper copper tubing, wrought-copper fittings, and soldered joints.

D. Condensate-Drain Piping: Type M, drawn-temper copper tubing, wrought-copper fittings, and soldered joints or Schedule 40 PVC plastic pipe and fittings and solvent-welded joints.

E. Blowdown-Drain Piping: Same materials and joining methods as for piping specified for the service in which blowdown drain is installed.

F. Air-Vent Piping:

1. Inlet: Same as service where installed with metal-to-plastic transition fittings for plastic piping systems according to the piping manufacturer's written instructions.
2. Outlet: Type K, annealed-temper copper tubing with soldered or flared joints.

G. Safety-Valve-Inlet and -Outlet Piping for Hot-Water Piping: Same materials and joining methods as for piping specified for the service in which safety valve is installed with metal-to-plastic transition fittings for plastic piping systems according to the piping manufacturer's written instructions.

3.2 PIPING INSTALLATIONS

A. Install piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas.

B. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

C. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

D. Install piping to permit valve servicing.

E. Install piping at indicated slopes.

F. Install piping free of sags and bends.

G. Install fittings for changes in direction and branch connections.

H. Install piping to allow application of insulation.

I. Select system components with pressure rating equal to or greater than system operating pressure.

J. Install groups of pipes parallel to each other, spaced to permit applying insulation and servicing of valves.

K. Install drains, consisting of a tee fitting, NPS 3/4 ball valve, and short NPS 3/4 threaded nipple with cap, at low points in piping system mains and elsewhere as required for system drainage.

L. Install piping at a uniform grade of 0.2 percent upward in direction of flow.

M. Reduce pipe sizes using eccentric reducer fitting installed with level side up.

N. Install branch connections to mains using tee fittings in main pipe, with the branch connected to the bottom of the main pipe. For up-feed risers, connect the branch to the top of the main pipe.

O. Install unions and flanges in piping, at final connections of equipment, and elsewhere as indicated.

P. Install strainers on inlet side of each control valve, pressure-reducing valve, solenoid valve, in-line pump, and elsewhere as indicated. Install NPS 3/4 nipple and ball valve in blowdown connection of strainers NPS 2 and larger. Match size of strainer blowoff connection for strainers smaller than NPS 2.

Q. Install flexible connectors at inlet and discharge connections to pumps (except in-line pumps) and other vibration-producing equipment.

R. Remove stems, seats, and packing of valves and accessible internal parts at piping specialties before soldering or brazing.

3.3 PIPE JOINT CONSTRUCTION

A. Join pipe and fittings according to the following requirements and Division 23 Sections specifying piping systems.

B. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

C. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

D. Soldered Joints: Apply ASTM B 813, water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using lead-free solder alloy complying with ASTM B 32.

E. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter, using copper-phosphorus brazing filler metal complying with AWS A5.8.

F. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:

1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

G. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.

3.4 HYDRONIC SPECIALTIES INSTALLATION

A. Install manual air vents at high points in piping, at heat-transfer coils, and elsewhere as required for system air venting.

B. Install piping from boiler air outlet, air separator, or air purger to expansion tank with a 2 percent upward slope toward tank.

C. Install in-line air separators in pump suction. Install drain valve on air separators NPS 2 and larger.

D. Install bypass chemical feeders in each hydronic system where indicated, in upright position with top of funnel not more than 48 inches above the floor. Install feeder in minimum NPS 3/4 bypass line, from main with full-size, full-port, ball valve in the main between bypass connections. Install NPS 3/4 pipe from chemical feeder drain, to nearest equipment drain and include a full-size, full-port, ball valve.

E. Install expansion tanks above the air separator. Install tank fitting in tank bottom and charge tank. Use manual vent for initial fill to establish proper water level in tank.

1. Install tank fittings that are shipped loose.
2. Support tank from floor or structure above with sufficient strength to carry weight of tank, piping connections, fittings, plus tank full of water. Do not overload building components and structural members.

3.5 CHEMICAL TREATMENT

A. Fill system with fresh water and add liquid alkaline compound with emulsifying agents and detergents to remove grease and petroleum products from piping. Circulate solution for a minimum of 24 hours, drain, clean strainer screens, and refill with fresh water.

B. Add initial chemical treatment and maintain water quality in ranges noted above for the first year of operation.

C. Fill systems indicated to have antifreeze or glycol solutions

END OF SECTION 232113

SECTION 232123 - HYDRONIC PUMPS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Close-coupled, in-line centrifugal pumps.
2. Close-coupled, end-suction centrifugal pumps.

1.2 SUBMITTALS

1. Product Data. For each type of pump including certified pump-performance curves, furnished specialties, motor horsepower and electrical characteristics.
2. Operation and maintenance data.

PART 2 - PRODUCTS

2.1 CLOSE-COUPLED, IN-LINE CENTRIFUGAL PUMPS

A. Description: Factory-assembled and -tested, centrifugal, overhung-impeller, close-coupled, in-line pump as defined in HI 1.1-1.2 and HI 1.3; designed for installation with pump and motor shafts mounted horizontally or vertically.

B. Pump Construction:

1. Casing: Radially split, cast iron, with threaded gage tappings at inlet and outlet, replaceable bronze wear rings, and threaded companion-flange connections.
2. Impeller: ASTM B 584, cast bronze; statically and dynamically balanced, keyed to shaft, and secured with a locking cap screw. For constant-speed pumps, trim impeller to match specified performance.
3. Pump Shaft: Steel, with copper-alloy shaft sleeve
4. Seal: Mechanical seal consisting of carbon rotating ring against a ceramic seat held by a stainless-steel spring, and Buna-N bellows and gasket. Include water slinger on shaft between motor and seal.

C. Motor: Single speed and rigidly mounted to pump casing.

1. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.2 CLOSE-COUPLED, END-SUCTION CENTRIFUGAL PUMPS

A. Description: Factory-assembled and -tested, centrifugal, overhung-impeller, close-coupled, end-suction pump as defined in HI 1.1-1.2 and HI 1.3; designed for installation with pump and motor shafts mounted horizontally.

B. Pump Construction:

1. Casing: Radially split, cast iron, with replaceable bronze wear rings, drain plug at bottom and air vent at top of volute, threaded gage tappings at inlet and outlet, and threaded companion-flange connections.
2. Impeller: ASTM B 584, cast bronze; statically and dynamically balanced, keyed to shaft, and secured with a locking cap screw. For constant-speed pumps, trim impeller to match specified performance.
3. Pump Shaft: Steel, with copper-alloy shaft sleeve.
4. Mechanical Seal: Carbon rotating ring against a ceramic seat held by a stainless-steel spring, and Buna-N bellows and gasket. Include water slinger on shaft between motor and seal.

C. Motor: Single speed and rigidly mounted to pump casing with integral pump support.

1. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.3 PUMP SPECIALTY FITTINGS

A. Suction Diffuser:

1. Angle pattern.
2. 300-psig pressure rating, cast-iron body and end cap, pump-inlet fitting.
3. Bronze startup and bronze or stainless-steel permanent strainers.
4. Bronze or stainless-steel straightening vanes.
5. Drain plug.
6. Factory-fabricated support.

B. Triple-Duty Valve:

1. Angle or straight pattern.
2. 300-psig pressure rating, cast-iron body, pump-discharge fitting.
3. Drain plug and bronze-fitted shutoff, balancing, and check valve features.
4. Brass gage ports with integral check valve and orifice for flow measurement.

PART 3 - EXECUTION

3.1 PUMP INSTALLATION

A. Comply with HI 1.4.

B. Install pumps to provide access for periodic maintenance including removing motors, impellers, couplings, and accessories.

C. Independently support pumps and piping so weight of piping is not supported by pumps and weight of pumps is not supported by piping.

D. Equipment Mounting: Install base-mounted pumps on cast-in-place concrete equipment bases.

E. Install electrical connections for power, controls, and devices.

F. Suspend in-line pumps independent from piping. Use continuous-thread hanger rods and vibration isolation hangers. Fabricate brackets or supports as required for pumps

3.2 ALIGNMENT

A. Comply with requirements in Hydronics Institute standards for alignment of pump and motor shaft. Add shims to the motor feet and bolt motor to base frame. Do not use grout between motor feet and base frame.

B. Comply with pump and coupling manufacturers' written instructions.

C. After alignment is correct, tighten foundation bolts evenly but not too firmly. Completely fill baseplate with nonshrink, nonmetallic grout while metal blocks and shims or wedges are in place. After grout has cured, fully tighten foundation bolts.

3.3 CONNECTIONS

A. Where installing piping adjacent to pump, allow space for service and maintenance.

B. Connect piping to pumps. Install valves that are same size as piping connected to pumps.

C. Install suction and discharge pipe sizes equal to or greater than diameter of pump nozzles.

D. Install flexible connectors on suction and discharge sides of base-mounted pumps between pump casing and valves.

E. Install pressure gages on pump suction and discharge or at integral pressure-gage tapping, or install single gage with multiple-input selector valve.

F. Install shutoff valve and strainer on suction side of pumps.

G. Install check valve and gate or ball valve on each condensate pump unit discharge.

END OF SECTION 232123

SECTION 232500 - HVAC WATER TREATMENT

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following HVAC water-treatment systems:

1. Bypass chemical-feed equipment and controls.
2. HVAC water-treatment chemicals.

1.2 PERFORMANCE REQUIREMENTS

A. Water quality for HVAC systems shall minimize corrosion, scale buildup, and biological growth for optimum efficiency of HVAC equipment without creating a hazard to operating personnel or the environment.

B. Base HVAC water treatment on quality of water available at Project site, HVAC system equipment material characteristics and functional performance characteristics, operating personnel capabilities, and requirements and guidelines of authorities having jurisdiction.

C. Closed hydronic systems, including hot-water heating and chilled water, shall have the following water qualities:

1. pH: Maintain a value within 9.0 to 10.5.
2. "P" Alkalinity: Maintain a value within 100 to 500 ppm.
3. Boron: Maintain a value within 100 to 200 ppm.
4. Chemical Oxygen Demand: Maintain a maximum value of 100 ppm.
5. Soluble Copper: Maintain a maximum value of 0.20 ppm.
6. TDS: Maintain a maximum value of 10 ppm.
7. Ammonia: Maintain a maximum value of 20 ppm.
8. Free Caustic Alkalinity: Maintain a maximum value of 20 ppm.
9. Microbiological Limits:

    a. Total Aerobic Plate Count: Maintain a maximum value of 1000 organisms/ml.
    b. Total Anaerobic Plate Count: Maintain a maximum value of 100 organisms/ml.
    c. Nitrate Reducers: Maintain a maximum value of 100 organisms/ml.
    d. Sulfate Reducers: Maintain a maximum value of 0 organisms/ml.
    e. Iron Bacteria: Maintain a maximum value of 0 organisms/ml.

D. Open hydronic systems, including condenser water, shall have the following water qualities:

1. pH: Maintain a value within 8.0 to 9.1.
2. "P" Alkalinity: Maintain a maximum value of 100 ppm.

3. Chemical Oxygen Demand: Maintain a maximum value of 100 ppm.
4. Soluble Copper: Maintain a maximum value of 0.20 ppm.
5. TDS: Maintain a maximum value of 10 ppm.
6. Ammonia: Maintain a maximum value of 20 ppm.
7. Free "OH" Alkalinity: Maintain a maximum value of 0 ppm.
8. Microbiological Limits:

    a. Total Aerobic Plate Count: Maintain a maximum value of 10,000 organisms/ml.
    b. Total Anaerobic Plate Count: Maintain a maximum value of 1000 organisms/ml.
    c. Nitrate Reducers: Maintain a maximum value of 100 organisms/ml.
    d. Sulfate Reducers: Maintain a maximum value of 0 organisms/ml.
    e. Iron Bacteria: Maintain a maximum value of 0 organisms/ml.

9. Polymer Testable: Maintain a minimum value within 10 to 40.

E. Passivation for Galvanized Steel: For the first 60 days of operation.

1. pH: Maintain a value within 7 to 8.
2. Calcium Carbonate Hardness: Maintain a value within 100 to 300 ppm.
3. Calcium Carbonate Alkalinity: Maintain a value within 100 to 300 ppm.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

1.4 QUALITY ASSURANCE

A. HVAC Water-Treatment Service Provider Qualifications: An experienced HVAC water-treatment service provider capable of analyzing water qualities, installing water-treatment equipment, and applying water treatment as specified in this Section.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

PART 2 - PRODUCTS

2.1 MANUAL CHEMICAL-FEED EQUIPMENT

A. Bypass Feeders: Steel, with corrosion-resistant exterior coating, minimum 3-1/2-inch fill opening in the top, and NPS 3/4 bottom inlet and top side outlet. Quarter turn or threaded fill cap with gasket seal and diaphragm to lock the top on the feeder when exposed to system pressure in the vessel.

1. Capacity: 5 gal.

2. Minimum Working Pressure: 125 psig.

2.2 CHEMICALS

A. Chemicals shall be as recommended by water-treatment system manufacturer that are compatible with piping system components and connected equipment, and that can attain water quality specified in Part 1 "Performance Requirements" Article.

B. Water Softener Chemicals:

1. Mineral: High-capacity, sulfonated-polystyrene ion-exchange resin that is stable over entire pH range with good resistance to bead fracture from attrition or shock. Resin exchange capacity minimum 30,000 grains/cu. ft. of calcium carbonate of resin when regenerated with 15 lb of salt.
2. Salt for Brine Tanks: High-purity sodium chloride, free of dirt and foreign material. Rock and granulated forms are not acceptable.

PART 3 - EXECUTION

3.1 WATER ANALYSIS

A. Perform an analysis of supply water to determine quality of water available at Project site.

3.2 INSTALLATION

A. Install chemical application equipment on concrete bases, level and plumb. Maintain manufacturer's recommended clearances. Arrange units so controls and devices that require servicing are accessible. Anchor chemical tanks and floor-mounting accessories to substrate.

B. Install water testing equipment on wall near water chemical application equipment.

C. Install interconnecting control wiring for chemical treatment controls and sensors.

D. Mount sensors and injectors in piping circuits.

E. Bypass Feeders: Install in closed hydronic systems, including hot-water heating and chilled water and equipped with the following:

1. Install bypass feeder in a bypass circuit around circulating pumps, unless otherwise indicated on Drawings.
2. Install water meter in makeup water supply.
3. Install test-coupon assembly in bypass circuit around circulating pumps, unless otherwise indicated on Drawings.
4. Install a gate or full-port ball isolation valves on inlet, outlet, and drain below feeder inlet.

5. Install a swing check on inlet after the isolation valve.

3.3 CONNECTIONS

A. Install piping adjacent to equipment to allow service and maintenance.

B. Install shutoff valves on HVAC water-treatment equipment inlet and outlet.

3.4 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections. Report results in writing.

B. Perform tests and inspections and prepare test reports.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

C. Remove and replace malfunctioning units and retest as specified above.

D. At eight-week intervals following Substantial Completion, perform separate water analyses on hydronic systems to show that automatic chemical-feed systems are maintaining water quality within performance requirements specified in this Section. Submit written reports of water analysis advising Owner of changes necessary to adhere to Part 1 "Performance Requirements" Article.

E. Comply with ASTM D 3370 and with the following standards:

1. Silica: ASTM D 859.
2. Acidity and Alkalinity: ASTM D 1067.
3. Iron: ASTM D 1068.
4. Water Hardness: ASTM D 1126.

3.5 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain HVAC water-treatment systems and equipment.

END OF SECTION 232500

SECTION 235100 - BREECHINGS, CHIMNEYS, AND STACKS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:
   1. Listed double-wall vents.

1.2 ACTION SUBMITTALS

A. Product Data: For the following:
   1. Type B vents.

PART 2 - PRODUCTS

2.1 LISTED TYPE B VENTS

A. Description: Double-wall metal vents tested according to UL 441 and rated for 480 deg F continuously for Type B; with neutral or negative flue pressure complying with NFPA 211.

B. Construction: Inner shell and outer jacket separated by at least a 1/4-inch airspace.

C. Inner Shell: ASTM B 209-Type 1100 aluminum, ASTM B 209-Type 3003 aluminum, ASTM B 209-Type 3105 aluminum, or ASTM A 666-Type 430 stainless steel.

D. Outer Jacket: Galvanized or Aluminized steel.

E. Accessories: Tees, elbows, increasers, draft-hood connectors, terminations, storm collars, support assemblies, thimbles, firestop spacers, and fasteners; fabricated from similar materials and designs as vent-pipe straight sections; all listed for same assembly.

PART 3 - EXECUTION

3.1 APPLICATION

A. Listed Type B Vents: Vents for certified gas appliances.

3.2 INSTALLATION OF LISTED VENTS AND CHIMNEYS

A. Locate to comply with minimum clearances from combustibles and minimum termination heights according to product listing or NFPA 211, whichever is most stringent.

B. Seal between sections of positive-pressure vents according to manufacturer's written installation instructions, using sealants recommended by manufacturer.

C. Support vents at intervals recommended by manufacturer to support weight of vents and all accessories, without exceeding appliance loading.

D. Slope breechings down in direction of appliance, with condensate drain connection at lowest point piped to nearest drain.

E. Lap joints in direction of flow.

F. After completing system installation, including outlet fittings and devices, inspect exposed finish. Remove burrs, dirt, and construction debris and repair damaged finishes.

G. Clean breechings internally, during and after installation, to remove dust and debris. Clean external surfaces to remove welding slag and mill film. Grind welds smooth and apply touchup finish to match factory or shop finish.

H. Provide temporary closures at ends of breechings, chimneys, and stacks that are not completed or connected to equipment.

END OF SECTION 235100

SECTION 25 0100

GENERAL REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. This section provides the general administrative and procedural requirements that apply to projects involving Building Automation Systems (BAS) regardless of size or scope, whether performed by the prime contractor or subcontractor.

1. Definitions
2. General Responsibilities
3. Request for Information
4. Submittals
5. Permits and fees
6. Codes, standards, and specifications
7. Field quality control
8. Closeout documents
9. Site examination
10. Quality Assurance
11. Work hours
12. Work restrictions
13. Delivery, storage, and handling
14. Control devices for installation by others
15. Protecting existing finishes, carpets, and furnishings
16. Cleaning
17. Commissioning
18. Warranty
19. Training

B. DMS is dedicated to establishing an open system that facilitates the seamless integration of products from diverse suppliers into a cohesive BAS system. This approach ensures competitive and flexible procurement supporting system expansion, maintenance, and servicing. DMS retains the right to utilize specific products across its portfolio to limit the number of service tools required to maintain the system.

1. The BAS shall comprise a network of interoperable, stand-alone, IP-based Direct Digital Controls (DDC), a computer system, graphical user interface software, and network devices.

C. The BAS shall utilize Direct Digital Controls (DDC) to provide full control and visibility of heating, ventilation, and air conditioning equipment, interior and exterior lighting, Computer Room Air Conditioners (CRACs) and variable frequency drives (VFDs).

D. The BAS shall provide visibility of equipment status and alarms for electrical and miscellaneous equipment such as generators, fuel tank monitors, utility meters, automatic transfer switches, and uninterruptable power supplies.

E. The BAS server software shall be Windows based, communicate over Ethernet using TCP/IP, and be compatible with a virtual operating environment. The database shall be compatible with relational database management systems (RDBMS) like Microsoft SQL Server, MySQL, PostgreSQL, Oracle. Access to the system, either locally in each building, or remotely from a central site or sites, shall be accomplished through standard Web browsers, via the Internet and/or local area network.

F. DMS is utilizing the Tridium Niagara platform hosted in an on-premises virtual environment. The BAS design shall adhere to the Tridium Niagara Framework, encompassing controllers, programming, graphics, schedules, trends, alarms, and points in compliance with Niagara framework standards. Equipment will interface with or be integrated to the existing DMS Tridium Niagara Supervisor.

G. DMS' ability to service and maintain equipment shall be at the forefront of the designs. Exceptions to the DMS Integrated Automation Standards shall be documented and approved in writing by the DMS Project Manager and the DMS Chief of Building Systems.

H. Engineers may modify this section to meet the unique requirements of the Project. If an Engineer chooses to supplement or replace information in this section, the new information will meet the intent of the data it replaces.

1.2 DEFINITIONS

A.	BACnet	American Society of Heating, Refrigeration and Air Conditioning Engineers building automation and control networking protocol.
B.	BAS	A Building Automation System is the use of automation hardware and software to automatically monitor and control building systems, such as Heating, Ventilation & Air Conditioning (HVAC), lighting, and access control.
C.	BBMD	A BACnet Broadcast Management Device is used to manage and distribute BACnet messages across a network and from one subnet to another.
D.	Controller	Intelligent, stand-alone, programmable Direct Digital Control device used in an BAS to control building equipment and systems.
E.	Furnish	To supply and deliver to the project site, ready to be install.
F.	Integration	Connection of disparate systems to a common platform using communication protocols.
G.	Install	To place in position for service or use.
H.	IP Address	Internet Protocol (IP) node address.

I.	MAC Address	Media Access Control (MAC) address is a unique identifier assigned to a network interface controller for use as a network address.
J.	Niagara Framework	Software platform developed by Tridium to integrate and control diverse systems, equipment, devices, and components real-time via local network or internet regardless of manufacturer or protocol.
K.	NICS	The Niagara Information and Conformance Statement is a licensing model that provides manufacturers with the ability to define the various levels and types of Niagara interoperability their products will support.
L.	PICS	The Protocol Implementation Conformance Statement describes the BACnet capabilities of a particular BACnet implementation. These statements are relevant for developers in the testing and certification of a product. The PICS document is created by the manufacturer to identify the BACnet functionality in a product.
M.	PID	A proportional–integral–derivative is a control loop mechanism employing feedback that is widely used in industrial control systems and a variety of other applications requiring continuously modulated control.
N.	Protocol	An agreed-upon format for transmitting data between two devices.
O.	Provide	To furnish and install, complete, ready for use.

1.3 GENERAL RESPONSIBILITIES

A. The Controls Contractor shall

1. Provide a complete, fully functional BAS, including labor, materials, equipment, and software.

2. Notify the DMS Project Manager of design errors and omissions that interfere with or prevent the Contractor from providing a complete, fully functional BAS. The DMS Project Manager will notify the Engineer of Record and DMS Chief of Building Systems.

3. Provide:

(a) Submittals.

(b) Installation of:

(1) Controllers.

(2) Control devices.

(3) Control panel enclosures.

(4) Control wiring.

(5) Power wiring.

(6) Uninterruptable Power Supply (UPS).

(7) Ethernet cables.

(8) Connection of controller to the network.

(9) Niagara integration drivers.

(10) Software Maintenance Agreements.

(c) Software to program or calibrate BAS equipment.

(d) Latest version of controller software/firmware.

(e) Database configuration to include equipment programming, sequences of operation, proportional–integral–derivative loop control, point names, alarms, trends, schedules, and reports.

(f) Graphical user interface.

(g) Startup.

(h) Test and validation of fully functional BAS.

(i) As built documentation.

(j) System warranty.

4. Promptly notify the DMS Project Manager of obstacles or issues that may hinder completion of the project.

5. Participate in an Integration Planning Session to finalize details for the following:

(a) Equipment, systems, and sub-systems to be integrated to the DMS Niagara Supervisor.

(b) Communications protocols to be utilized.

(c) Controller installation locations.

(d) Tier 2 Application Controller connections (daisy-chained or direct to switch).

(e) Niagara drivers for integration of legacy devices.

(f) Graphics generation.

(g) Point naming.

(h) Alarm configuration and management.

(i) Control sequences and deviations from DMS Standard Control Drawings.

(j) AHU modes of operation.

(k) DMS network access requirements.

(l) Final integration of site to the DMS Niagara Supervisor.

6. Conduct a site survey to gather information about the existing building systems, equipment, and infrastructure to be upgraded, replaced, interfaced, and integrated.

7. Coordinate with the DMS BAS Subject Matter Expert to view existing building automation system. Additionally, view site on the Tridium Niagara BAS.

8. Execute project requirements on the construction documents in accordance with the DMS Integrated Automation Standards.

9. Notify the DMS Project Manager if there is a conflict between the construction documents and DMS Integration Automation Standards. The DMS Project Manager will notify the Engineer of Record and DMS Chief of Building Systems.

10. Provide overall management and coordination responsibility for executing the DMS Integrated Automation Standards to deliver a fully functional BAS.

    (a) Coordinate work with other trades and subcontractors to prevent unnecessary delays.

    (b) Coordinate installation schedules, final installation locations, factory mounting, and connections required for equipment provided by others.

    (c) Promptly report issues with work performed by others to the DMS Project Manager.

1.4 REQUEST FOR INFORMATION.

A. Submit Request for Information (RFI) to clarify construction drawings, specifications, or contract requirements to the Engineer. Questions and responses must be documented in writing. The Engineer will not issue verbal directions. Verbal interpretations, clarifications, and conversations are non-binding without proper documentation.

B. Submit RFI using the Engineer's preferred form, template, or method.

C. RFI must be received by Engineer 10 or more calendar days prior to bid opening. RFI received 9 or less calendar days prior to bid opening will not be honored.

D. RFI will include:

1. Clearly articulated questions, one at a time. Multi-part questions will be submitted as separate, individual questions.

2. Each question will reference drawing, specification, or contract page number, section, and/or paragraph number.

3. Proposed solution:

    (a) Attach sketch or drawing, if applicable.

    (b) Attach specific verbiage, if applicable.

4. Contact information of person submitting RFI.

E. RFI answers are for clarification only and do not authorize additional work or change orders.

F. An amendment to the construction drawings or contract will be issued to officially authorize a change or additional work.

1.5 SUBMITTALS

A. Shop Drawings

1. General.

(a) Submit one copy of shop drawings to the Engineer of Record and one copy to the DMS Chief of Building Systems. The DMS Chief of Building Systems will reviews submittals. The Engineer of Record will review and approve submittals.

(b) Allow 15 days for submittal review. Allow additional time if coordination with subsequent submittals is required. No extension to contract time will be authorized due to lengthy submittal review including resubmittals.

2. Shop drawings shall include complete system design information.

(a) General.

(1) Include cover with project name, project number, location, owner, Engineer, Contractor, and issue date.

(2) Include a drawing index sheet listing each drawing number and title.

(3) Drawing size: 11" x 17."

(b) Equipment lists (bill of materials) of all proposed devices and equipment.

(c) Floor Level Communications Riser Diagram:

(1) Room number where each product is located.

(2) Product identification.

(3) Equipment controlled.

(4) Type of communications cabling.

(5) Connection point to DMS network for each product.

(6) Communications protocol used.

(7) For BACnet specific designs:

(i) BACnet routers.

(ii) Subnets.

(iii) Device instance numbers.

(iv) Devices configured for BBMD.

(d) Control Panel Enclosure Schematic:

(1) Physical layout for each enclosure.

(2) Panel dimensions.

(3) Interior layout showing the components, cabling, and wiring raceways.

(4) Point of connection for each product and connection type.

(5) Power requirements:

(i) Control Power source.

(ii) Power supply: Volts, phase, hertz, amperes.

(iii) Ground connection.

(iv) Transformers.

(6) UPS.

(e) Communication Wiring:

(1) Control signal wiring diagram between products. Identify:

(i) Product.

(ii) Cable type.

(iii) Communication link.

(iv) Bus connections.

(f) Input/Output (I/O) Wiring:

(1) Point-to-point wiring diagram from each product to sensors and equipment. Identify:

(i) Product.

(ii) Sensor and equipment.

(iii) Type of I/O.

(iv) I/O power requirements.

(g) Safety Interlocks:

(1) Wiring schematic from each motor to interlocks, switches, and relays.

(2) Identify:

(i) Equipment.

(ii) Interlock, switch, relay.

(iii) Wiring colors.

(h) Points List:

(1) Include the following for each piece of equipment, as applicable:

(i) Point type.

(ii) Point name.

(iii) Facets.

(iv) Default value.

(v) Cable tag.

(vi) Trend type and interval.

(vii) Alarm and alarm setpoint.

(i) Valve, damper, well and tap schedules showing:

(1) Manufacturer and product number.

(2) Size.

(3) Configuration.

(4) Capacity.

(5) Location.

(j) Control Sequence:

(1) Diagram showing interrelationship between inputs, outputs, PID functions, and user adjustable set points.

(2) Plain language written sequence of operations for each piece of equipment.

(k) Identification:

(1) List of names used on nameplates and labels for the following

(i) Valves and dampers.

(ii) Wires, cables, and tubing.

(iii) Control panel enclosure.

(iv) Controllers.

(2) Type of identification:

(i) Plastic nameplate.

(ii) Heat shrink tubing.

(iii) Self-laminating wrap-on label.

(3) Installation method for plastic nameplates

B. Product Data

1. Include the following for each product included in the submittal:

(a) Manufacturer and product number.

(b) Product description.

(c) Dimensions.

(d) Product specification sheet:

(1) Product specification sheet must clearly show compliance with construction drawings and specifications

(2) When manufacturer's product specification sheet applies to a product series rather than a specific product model, clearly indicate and highlight only applicable information

(e) Operating range and accuracy over range.

(f) Electrical power requirements including voltage.

(g) Input/Outputs.

(h) Control signal.

(i) Regulatory or Protection.

(j) Ambient operating environment including temperature and humidity.

(k) For actuators and positioners, product data sheets shall contain:

(1) Shaft type.

(2) Maximum design parameters (temperature, pressure, velocity).

(3) Performance data for full range of actuator stroke.

(4) Torgue capacities.

(l) For air and gas measurement:

(1) Include recommended probe quantities to meet specified accuracy.

(2) Identify locations where measurement accuracy may be negatively affected and demonstrate solution to maintain specified accuracy.

(m) BACnet Protocol Implementation Conformance Statement (PICS) for each BACnet controller or gateway.

(n) Niagara Compatibility Statement (NiCS) for each controller running the Niagara Framework.

(o) LonWorks profiles and Modbus registry lists.

(p) Software utilized to configure and program each controller.

C. Controls Contractors Qualifications

1. The Controls Contractor shall identify the employees assigned to the project with primary responsibility for the roles listed below. Depending on project size, the same employee may fill all three roles.

(a) Project manager

(b) Installer

(c) Programmer

2. Employees assigned to the project shall meet the minimum requirements below:

(a) Niagara 4 certification; provide copy of certificate.

(b) 3 years of documented project experience working with products utilizing the Tridium Niagara framework. The projects submitted for proof shall be of similar size and complexity as the DMS project being bid.

(c) Demonstrate product expertise through completion of at least one project using the controllers specified in the submittals.

1.6 PERMIT FEES

A. Obtain and pay all fees for permits, connection charges, impact fees, and inspections.

1.7 CODES, STANDARDS AND SPECIFICATIONS

A. Work and materials must comply with applicable codes, standards, specifications, statutes, ordinances, and regulations of governmental authorities having jurisdiction. See Section C-13 of General Terms and Conditions for further guidance.

1.	ADA	Americans with Disabilities Act.
2.	ASME	American Society of Mechanical Engineers.
3.	ANSI	American National Standards Institute.
4.	ASHRAE	American Society for Heating, Refrigeration, Air-Conditioning Engineers.
5.	ASTM	American Society for Testing and Materials.
6.	AWWA	American Water Works Association.
7.	BICSI	Building Industry Consulting Services International.
8.	EIA	Electronic Industries Association.
9.	FCC	Federal Communications Commission.
10.	CEA	Insulated Cable Engineers Association.
11.	IEEE	Institute of Electrical & Electronics Engineers.
12.	ISO	International Organization for Standards.
13.	NEC	National Electrical Code.
14.	NECA	National Electrical Contractors Association.
15.	NEMA	National Electrical Manufacturers Association.
16.	NETA	National Electrical Testing Association.
17.	NFPA	National Fire Protection Codes.
18.	NIST	National Institute of Standards & Technology.
19.	OSHA	Occupational Safety and Health Administration.
20.	TIA	Telecommunications Industries Association.
21.	UL	Underwriters Laboratories, Inc.

B. Utilize the Request for Information process to resolve, in writing, code violations discovered in contract documents with the Engineer prior to bidding.

C. After award of the contract, the Contractor shall include labor, materials, services, apparatus, and drawings required to comply with applicable codes, laws, ordinances, rules, and regulations at no additional cost to DMS.

D. Where there is conflict between the Contract Documents and the applicable Codes, the Codes shall govern, except where the requirements of the Contract Documents are more stringent.

1.8 FIELD QUALITY CONTROL

A. Testing

1. Lead the coordination effort to conduct a plugfest for the purpose of testing the interoperability of controllers in submittals, protocols, and drivers, including those for legacy devices to be integrated to the BAS.

(a) Provide 10 days' notice to schedule plugfest with Engineer of Record, DMS Project Manager, DMS Chief of Building Systems, and DMS BAS subject matter expert.

(b) Document test results to include work-arounds coordinated with and approved by the Engineer of Record and DMS Project Manager.

1.9 CLOSE-OUT DOCUMENTS

A. Document field condition updates or changes to shop drawings and publish revised documents labeled As-Builts to include:

1. Communications riser.
2. Control panel enclosures.
3. Communications wiring.
4. I/O wiring.
5. Safety interlocks.
6. Points lists.
7. Valve, damper, tap and well schedules.
8. Control sequences.
9. BACnet information:

(a) Spreadsheet with the following information listed for each newly installed BACnet controller or gateway.

(1) IP Address.

(2) MAC Address.

(3) Device instance number.

(4) BACnet Port.

(5) Devices configured for BBMD.

(6) BACnet router and subnet.

B. Operation Manuals:

1. Include a table of contents.
2. Tab manual based on specification chapters or sections.
3. Network architecture and communications concepts/diagrams.
4. Uploading and downloading software to the field hardware.
5. Finely detailed descriptions of all software programs.
6. Complete set of software engineering manuals.
7. Complete system design and engineering manual same as used by manufactures personnel.
8. Application Programming.
9. CD of configuration tools used in project.
10. Operator instructions or User Manual.
11. Calibration and/or verification sheets.
12. Certificates issued by authorities having jurisdiction to the Engineer.

C. Project Maintenance Manuals:

1. Include a table of contents.
2. One copy on CD.
3. Organize by manual by specification section number.
4. Index sheet listing contents in alphabetical order.
5. Include the following:
   (a) Installation instructions.
   (b) Manufacturer's operating and maintenance instructions (not product submittals).
   (c) Factory and field-test records, including calibration and factory setup.
   (d) Printout of application control programs (typical).
   (e) Snapshot printout of each system installed.
   (f) Signed checklist of each system.
   (g) Factory training schedule and course description catalog.
   (h) Archived backup of software, drawings, and record documents.
   (i) Installation Contractor and service representative information.
   (j) Licensing and warranty information.

1.10 SITE EXAMINATION

A. Inspect site to verify new parts, materials, and equipment can be installed in accordance with the construction drawings and specifications.

1. Report conflicts to the Engineer.

B. Prior to start of work, check for modifications, relocations, or adjustments necessary to complete work or to avoid interference with other trades.

C. Promptly report inadequate or unacceptable conditions to the Engineer immediately.

D. See contract General Terms and Conditions for more information regarding examination of worksite.

1.11 QUALITY ASSURANCE

A. General:

1. It is the intent of the construction drawings and specifications to obtain a complete, operable, and satisfactory installation.

2. Materials shall be properly labeled and/or identified and be in full compliance with the contract documents.

3. Work shall comply with applicable Codes and Standards.

4. Manufacturer's model names and numbers used in these specifications are subject to change per manufacturer's action. Contractor shall verify them with manufacturer's representative before ordering product or equipment.

5. Beta testing of software, equipment, control strategies, and sequences of operation is prohibited.

B. Furnish new, unused equipment, components, accessories, and installation hardware free from defects, and currently in production. Provide components and equipment of a given type product from the same manufacturer throughout project.

C. BACnet products shall be BTL compliant.

D. Provide Underwriters Laboratories (UL) listed equipment, when required by code or construction documents.

E. Digital equipment furnished under this contract shall have been tested and will comply with limits of Class A computing device pursuant to Subpart J of Part 15 of FCC Rules.

F. Maintain NEC workspace clearances.

G. Install controllers in appropriate enclosure and in an accessible location.

H. Install systems and controllers in a neat, workmanlike manner, and in accordance with manufacturer's recommendations.

I. Continually monitor field installation for code compliance and quality workmanship.

J. Remove and re-install equipment or controllers where installation is deemed of poor quality by Engineer of Record or DMS staff.

K. Provide software and firmware updates prior to substantial completion.

L. Comply with all health and safety regulations.

M. Include automatic restart logic for loss of power, safeties, and fire alarm shutdown.

1.12 WORK HOURS

A. DMS and tenants may occupy facility during construction operations.

B. Facility business hours are 8 a.m. to 5 p.m., Monday through Friday, unless otherwise indicated.

C. Project work may be performed during business hours with the proper dust, noise, odor, and vibration avoidance.

D. Coordinate with the DMS facilities manager to perform work after hours.

E. Perform work so as not to interfere with DMS and tenant's day-to-day operations.

F. Coordinate with DMS to minimize conflicts with facility occupants. Notify DMS facilities manager not less than 72 hours in advance of activities that will affect DMS and tenant operations.

1.13 WORK RESTRICTIONS

A. Public Spaces. Comply with limitations on use of public streets, right-of-way, easement, and other requirements of authorities having jurisdiction.

B. Site Access. Do not block entrances serving premises, driveways, reserved parking, loading areas, and walkways.

C. Facility Access. Do not close or obstruct walkways, stairways, corridors, or occupied spaces without permission from DMS facilities manager and approval of authority having jurisdiction.

D. Tools and Materials Storage. Tools and materials may be stored overnight. Coordinate with DMS facilities manager for long term secure storage.

E. Water. Drinking water is available from fountains within the facility.

F. Restrooms. Restrooms are available in the facility.

G. Electricity. Electrical outlets are available in mechanical spaces. Coordinate with DMS facilities manager prior to using equipment with a large amperage draw.

H. Utility Interruptions:

1. Coordinate operations that require electrical, water, and heating, ventilation, and air conditioning service outages with DMS facilities manager. Outages must occur outside of business hours and not impact DMS or the tenant's ability to accomplish their core mission.

   (a) Notify DMS not less than 72 hours in advance of proposed utility interruptions.

   (b) Obtain DMS' written permission before proceeding with utility interruptions.

2. Unscheduled utility interruptions at project site by Contractor or sub-contractor employees are top priority and shall be expeditiously resolved by Contractor.

(a) Contractor shall provide temporary utility services at project site within 24 hours of unscheduled utility interruptions if primary utility service is not restored.

(b) Contractor shall bear the cost of resolving unscheduled utility interruptions and the cost of temporary utility services at project site.

I. Dust, Noise, Odor, and Vibration Avoidance. Coordinate operations that may result in high levels of noise, dust, odors, and vibration with DMS facilities manager.

1. Notify DMS not less than 72 hours in advance of proposed disruptive operations.

2. Obtain DMS' written permission before proceeding with disruptive operations.

J. Nonsmoking Building. Smoking is not permitted within the building or within 25 feet (8 m) of entrances or outdoor-air intakes.

K. Smokeless Tobacco. Use of smokeless tobacco products on project site is prohibited.

L. Controlled Substances/Illegal Drugs. Use of controlled substances and illegal drugs on project site is prohibited.

1.14 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle products, material, and supplies using means and methods that will prevent damage, deterioration, and loss, including theft and vandalism, and in accordance with manufacturer's recommendations.

B. Inspect products on delivery to determine compliance with the Contract Documents and to determine that products are undamaged and properly protected.

C. Coordinate with DMS facilities manager for secure, overnight storage of tools, materials, and supplies.

D. Protect stored products, material, and supplies from weather.

E. Material and equipment showing signs of exposure prior to installation due to improper handling or storage shall be replaced at Contractor's expense. See Storage and Work Areas in General Terms and Conditions for further guidance.

1.15 CONTROL DEVICES FOR INSTALLATION BY OTHERS

A. Deliver the control devices specified in the Construction Documents to the appropriate trade, and applicable.

1. Automatic control valves.

2. Pipe-mounted flow meters.

3. Pipe-mounted sensors, switches, and transmitters.

4. Motorized damper actuators when not integral to the controller or applicable.

5. Flow and pressure sensors, transmitters, and transducers when not integral to the controller or as applicable.

6. Unit-mounted temperature sensors when applicable.

7. Unit-mounted relays when applicable.

1.16 PROTECT EXISTING FINISHES, CARPETS, AND FURNISHING

A. Protect existing finishes, carpet, casework, furnishing, and other building components against damage and soiling throughout construction activities. Contractor shall be responsible for replacing damaged material or restoring damaged materials to DMS's satisfaction.

B. When permitted by DMS or tenant, items may be removed to a suitable, protected storage location during construction and cleaned and reinstalled in their original locations after construction operations are complete.

C. When permitted by DMS or tenant, furniture may be relocated during construction and reinstalled in their original locations after construction operations are complete.

D. Means and methods for protection are the responsibility of the Contractor. Utilize plywood, polyethylene sheeting, dust cloths, and other means.

1.17 CLEANING

A. Clean construction debris and byproducts from project site daily. Properly dispose of debris and byproducts.

B. Clean debris from equipment, control panels, security panels, fire panel enclosures, junction boxes, and pull boxes.

C. Arrange wire neatly with surplus length cut off prior to installation of covers.

D. Thoroughly clean equipment of stains, dirt, and dust. Remove temporary labels not used for instruction or operation.

E. See contract General Terms and Conditions section C-10 for additional guidance regarding cleaning.

1.18 COMMISSIONING

A. Controls Contractor shall complete pre-functional checks before the BAS is submitted for commissioning.

B. Absent guidance provided by Engineer of Record, complete and document the following pre-functional checks:

1. Verify devices and instruments:

(a) Are the correct device or instrument for the application and provided in accordance with the Construction Documents.

(b) Have power, are connected to the appropriate source, and wiring is complete.

(c) Are correctly installed for location, orientation, direction, and operating clearances.

(d) Are labeled in accordance with the Construction Documents.

(e) Have configurable switches set properly.

2. Verify controls dampers and valves are:

(a) Installed correctly for flow direction and have proper clearance for full operation.

(b) Properly sealed and actuator linkage is secure.

(c) Not leaking or leaking by.

3. Calibrate instruments not factory calibrated according to manufacturer's recommended procedures.

4. Stroke and adjust control dampers and valves according to manufacturer's recommended procedures.

5. Calibrate switches to make or break at set points indicated on Construction Documents.

6. Test control loops to verify stable and accurate operation.

C. Schedule owner GUI acceptance testing to occur during commissioning. Require verification of user tasks including:

1. Graphics navigation

2. Trend data collection and presentation

3. Alarm handling, acknowledgement, and routing

4. Time schedule editing

5. Application parameter adjustment

6. Manual control

7. Report execution

8. Automatic backups

9. Web Client access

D. The Controls Contractor is responsible for correcting issues that are not in compliance with the Construction Documents and DMS Integrated Automation Standards. The Controls Contractor is responsible for correcting performance issues and assisting with re-testing at no additional charge.

1.19 WARRANTY

A. Submit warranty documentation upon completion of project and acceptance by Engineer and DMS.

1. Warranty start date shall be the calendar day after substantial completion.

2. Warranty period shall be one year unless otherwise noted.

B. During the warranty period, provide labor and materials to make good faults, imperfections, or performance issues that may arise due to defects or omissions in materials or workmanship without expense to DMS.

1. Corrective software modifications made during the warranty period shall be updated on user documentation and archived software disks.

C. Manufacturer's disclaimers and limitations on product warranties do not relieve Contractor of obligations under requirements of contract documents.

D. DMS reserves the right to make emergency repairs to keep equipment in operation without voiding Contractor's Guarantee Bond nor relieving the Contractor of responsibilities during the warranty period.

1.20 TRAINING

A. Prepare and provide services of qualified instructors to instruct DMS personnel to adjust, operate, and maintain newly installed controllers and equipment.

1. Training shall occur upon substantial completion of work and at a time designated by DMS representative.

2. Provide a high-resolution digital video recording of each training session to DMS.

3. Provide physical copies of training aids (e.g. PowerPoint) to DMS.

B. Include up to four hours of classroom instruction and up to four hours of field demonstration in one or more repeatable training sessions. Provide separate agendas for each type of training.

C. Classroom instruction include at a minimum:

1. Detailed review of as-built documentation and conditions.

2. In depth discussion of theory and sequence of operations.

3. Walk-through of new graphics, alarms, trends, and histories in the Tridium Niagara 4 Supervisor.

D. Field instruction include at a minimum:

1. Demonstration of operation.

2. Demonstration of safeties and interlocks.

3. Troubleshooting process to identify and correct commonly observed system issues.

PART 2 - GENERAL

2.1 PROJECT MANAGEMENT SOFTWARE

A. Use CX Alloy or similar project management software to document project status and findings.

B. Provide access to Engineer, DMS project manager, and others at Engineer or DMS project manager request.

PART 3 - GENERAL

3.1 GENERAL

A. Furnish information to DMS that is necessary to adjust, move, or relocate existing utility structures, lines, services, or other utility appurtenances located in or affected by construction. Coordinate with authorities having jurisdiction.

B. Before the existing equipment or system is shut down for disconnecting or tie-ins, coordinate with Engineer and DMS regarding acceptable dates and times for this Work to be performed. Work shall be performed at the time best suited for DMS, which typically is either on

weekends, holidays, or after normal working hours. Services shall be restored the same day unless prior arrangements are made. Overtime or premium costs associated with this Work shall be included in the Contractor's bid.

C. Structural Elements: Do not cut structural elements without written approval from Engineer. Notify Engineer of locations and details of proposed structural cutting and await directions from Engineer before proceeding.

D. Where "rated" walls, floor, roofs and ceilings are penetrated or cut to install equipment, materials, and controllers, the Contractor shall provide and install all materials required to reestablish the rating of the wall, floor, roof, or ceiling to the satisfaction of the authority having jurisdiction.

E. Select equipment to operate with minimum dust, noise, odor, and vibration. If objectionable dust, noise, odor, or vibration is produced or transmitted to or through the building structure by equipment, piping, ducts, or other parts of work, rectify conditions without cost to DMS.

3.2 COMMISSIONING

A. Participate in the commissioning process.

B. Refer to Commissioning requirements in paragraph 1.17 and the construction documents.

3.3 INSTALLATION

A. Lead the effort to interface and integrate equipment and building systems specified in the Construction Documents in accordance with the DMS Integrated Automation Standards.

B. Install materials and equipment in a professional manner. The Engineer may direct replacement of items which, in the Engineer's opinion, do not present a professional appearance or do not allow adequate space for maintenance. Replace or reinstall items at the expense of the Contractor.

C. General: Locate the Work and components of the Work accurately, in correct alignment and elevation.

1. Make vertical work plumb and make horizontal work level.

2. Where space is limited, install components to maximize space available for maintenance and ease of removal for replacement.

3. Conceal wiring in finished areas unless otherwise indicated.

D. Comply with manufacturer's written instructions and recommendations for installing products and applications.

E. Submit Device Connection Application to DMS Project Manager to request IP addresses.

1. DMS Project Manager can provide electronic copy of Device Connection Application.

2. Submit application as soon as controller or gateway MAC addresses are available to prevent delays.

F. Install equipment, piping, and wiring or raceway horizontally, vertically, and parallel to walls wherever possible.

G. Provide sufficient slack, flexible connections, and isolation to allow for equipment vibration.

H. Verify elevations and measurements prior to installation of materials.

I. Beginning installation means Contractor accepts existing conditions.

J. Provide temporary service, routing of service, or other temporary requirements to minimize downtime of service.

K. Equipment and wiring shall be selected and installed for conditions in which it will be required to perform (i.e., general purpose, weatherproof, rain-tight, explosion proof, dust tight, or other special type.)

L. Arrange for necessary openings in building to allow for admittance of apparatus.

M. Install equipment with ample space allowed for removal, repair, or changes to equipment. Provide ready accessibility to equipment and wiring without moving other equipment, which is to be installed or which is already in place.

N. Coordinate systems to minimize the need for access doors.

O. Coordinate final locations, sizes, and rough-in dimensions for access doors.

P. Verify door swings for proper clearance before installing.

Q. Perform work in a safe and competent manner and use industry accepted installation procedures required for the work.

3.4 WARRANTY

A. Manufacturer's Warranty: Manufacturer and Installer warrants controllers free from defects within specified warranty period.

1. Warranties include, but are not limited to, the following:

(a) Recalibration of sensors.

(b) Tuning of Proportional Interval Derivative (PID) control loops.

(c) Labor and materials.

(d) Update of operator workstation software, project specific software, graphics, database, and firmware.

2. Failures shall be adjusted, repaired, or replaced at no additional cost or reduction in service to Owner.

3. Install updates to software, graphics, database, or firmware only after receiving Owner's written authorization.

4. Warranty service shall occur during normal business hours by qualified factory trained technician(s) and commence within 24 hours of Owner's verbal or written warranty service request, 24 hours a day, 365 days a year, including holidays and weekends.

END OF SECTION

SECTION 25 0500

CABLES, PATHWAYS, AND IDENTIFICATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes requirements for:

1. Communication, signal, and power cables.

2. Requirements for pathways to include:

(a) Conduit and fittings.

(b) Outlet boxes.

(c) Pull and junction boxes.

(d) Sleeves.

3. Labeling requirements for control panels, instrumentation, control valves, wire, cable, and tubing.

1.2 DEFINITIONS

A.	AMCA	Air Movement and Controls Association is an accredited resource for leading companies in the air movement industry.
B.	Continuous Pathway	Permanent and uninterrupted support and protection for cabling such as conduit, cable trays, and ladder racks.
C.	Duct	A tube or passageway in a building or machine for air, liquid, cables, etc. For example, HVAC duct in a building is typically square metal and round flexible tube above the ceiling used to move air throughout the building.
D.	Furnish	To supply and deliver to the project site, ready to be install.
E.	HVAC	Heating, Ventilation, and Air Conditioning is broadly described as the equipment used to heat or cool a building.
F.	Noise	Unwanted electrical or electromagnetic energy often caused by equipment producing rapid or large amplitude changes in voltage or current and frequently the result of poor wiring practices.
G.	Non-Continuous Pathway	Permanent and intermittent support and protection for cabling such Pathway J-Hooks, beam clamps, flange clips, and U-hooks.
H.	Pathway	Support and protection system for wires and cabling.
I.	Provide	To furnish and install, complete, ready for use.
J.	PVC	Polyvinyl Chloride is a man-made polymer solid and one of the world’s most utilized plastics.

K.	Signal Wire	Wire used to transmit an electrical signal such as voltage, amps, or resistance.
L.	Sleeve	Protects wires against damage or abrasion in wall, floor, and ceiling penetrations.
M.	Wiring Duct	Pathway for wire management inside of panels.
N.	Wiring Trough	Wiring enclosure used to manage wiring outside of panels.

1.3 SYSTEM DESCRIPTION

A. Conductors and Cables

1. Final connectors to control device.
2. Communication cables for integrated systems.
3. Signal cables for Integrated Automated systems.
4. Power cables for Integrated Automated systems.
5. Final terminations of conductors and cables not specifically shown but required for systems operation.

B. Pathways

1. Approved pathways include:
    a. Conduit as specified in Division 26 specifications.
    b. Cable tray as specified in Division 27 specifications.
2. Where specifically allowed or specified, pathway system includes hangers, bridle rings, j-hooks and other supports for cabling not required to be in conduit.

C. Identification

1. Includes labels for the following:
    a. control panels
    b. instrumentation including control valves
    c. Control room instruments
    d. Panel instruments
    e. Wire, cable, and tubing

1.4 SUBMITTALS

A. Sample tags and installation methods.

B. Refer to section 25 0100 for additional requirements.

1.5 QUALITY ASSURANCE

A. Cabling

1. Ground and Bond according to manufacturer's recommendations. Refer to Division 26 of the DMS Design and Construction Guidelines for grounding and bonding requirements.
2. Splicing of communication and instrumentation cables is prohibited.
3. Kinked cable is prohibited and must be replaced.
4. Cable will be free of tension at both ends. In cases where cable must bear stress, provide strain relief to spread stress over longer length of cable.
5. Adhere to recommended minimum distances to reduce effects of Electronic Magnetic Interference (EMI).
6. Separate cables supporting BAS from other building systems such as fire and access control.
7. Install cables parallel and perpendicular to building walls. Coordinate space requirements with other trades.
8. Wires and cabling being replaced will be removed in their entirety. Wires and cabling shall not be abandoned in place.

B. Pathways

1. BAS cabling must be in approved pathways. See Division 26 of the DMS Design and Construction Guidelines.
2. Exposed cabling above dropped ceilings shall be plenum rated and securely supported in an approved pathway.
   (a) Wire and cabling shall not lay on top of any ceiling or insulation materials, duct work, lighting fixtures, plumbing, or piping.
3. Low voltage cabling shall be in an enclosed pathway for exposed areas, inaccessible spaces such as wall and hard ceilings, and in mechanical and electrical spaces.
4. Pathways shall not be installed on the floor, or in any manner, that obstructs access to spaces, walkways, and equipment.
5. Pathways shall be supported to avoid movement and vibration.
6. Where conduit is not required, space J-Hooks or equivalent product, and cable supports every 4 feet, or in accordance with the manufacturer's specifications.

C. Identification

1. Add a tag or label to the following:
   (a) Instrumentation.
   (b) Control panel enclosure.
   (c) Valves and dampers.
2. Wire, cabling, and tubing.

(a) Where major devices are above the ceiling, provide identification on ceiling grid to assist in locating device.

(b) Tags shall be machine generated and easily readable.

(c) Tags shall be appropriate for the environment installed.

(d) Use of permanent markers, pencils, ink pens, or paint for labeling is prohibited.

3. Refer to section 25 0100 for more information.

1.6 WARRANTY

A. Refer to section 25 0100.

PART 2 - PRODUCTS

2.1 CABLING

A. Floor Level (RS-485) Communication Cable

1. Cabling Requirements: Beldon 3106A or equivalent

(a)	Min Size	22 American Wire Gauge (AWG), Stranded Tinned Copper with Foil Sheild
(b)	Min Number of Conductors	1 Twisted-Pair with Drain conductor
(c)	Jacket	PVC
(d)	Jacket color	Orange

B. Instrumentation Signal Cable

1. Cabling Requirements:

(a)	Min Size	18 AWG stranded (except vendor specific instrument)
(b)	Min Number of Conductors	2 – 4 (application specific)
(c)	Jacket	PVC
(d)	Jacket Color	Blue
(e)	Sheild	Per manufacturer recommendation

C. Power Wire (50 VOLTS OR LESS)

1. Cabling Requirements:

(a)	Min Size	18 AWG stranded
(b)	Number of Conductors	2
(c)	Jacket	PVC
(d)	Jacket Color	Grey

D. Power Wire (GREATER THAN 50 VOLTS)

1. Refer to DMS Design and Construction Guidelines Division 26.

E. Kellems Strain Relief Grips

1. Manufacturer: Hubbell Wiring Device or equivalent

2. Size Kellems thread adapters and grips based on circular mil size of cable.

2.2 IDENTIFICATION

A. Instrument

1. Construction:

(a) 1/16-inch-thick laminated phenolic plastic tag, white with black core.

(b) Nominal size of 1in high by 1 to 4 in wide.

(c) Stamped in ¼ inch high block characters.

2. Self-adhesive identification is not acceptable where conditions will allow for permanent mounting.

B. Control Panel Enclosure

1. Construction:

(a) 1/16-inch thick laminated phenolic plastic tag, white with black core.

(b) Nominal size of 2 in. by 4 in.

(c) Stamped 1-inch-high block letters.

2. Self-adhesive identification is not acceptable where conditions will allow for permanent mounting.

C. Valve and Damper

1. Construction:

(a) 1/16-inch thick laminated phenolic plastic tag, white with black core or minimum 0.032" thick, polished brass or 316 stainless steel.

(b) Nominal size of 2 in by 4in.

(c) Stamped 1inch high block letters.

2. Hanging type only, self adhesive is not acceptable for permanent mounting.

D. Wire, Cable, and Tubing

1. Heat Shrink Tubes:

(a) Manufacturer: Rhino, Brady Bradysleeve, or equivalent.

(b) Minimum size of ¾ in (19mm).

(c) Heat shrink labels shall be used on wire, cable, and tubing except for vendor specific cables which may not be cut.

2. Self Laminating Wrap-On Labels:

(a) Manufacturer: Rhino, Brady WML series, or equivalent.

(b) Minimum size of ¾ in (19mm).

(c) Self-laminating, wrap-on labels shall be used only on wire and cable which cannot be cut, and on tubing.

E. Conduit

1. Conduit and junction box covers containing data communication cabling shall be identified using blue, Direct to Metal latex paint.

PART 3 - EXECUTION

3.1 GENERAL

A. Verify routing, pathways, and termination locations prior to rough in.

B. Coordinate utility interruptions and operations that may result in high levels of noise, dust, odor, and vibration in accordance with Section 25 0100.

C. Coordinate floor, wall, and ceiling penetrations with appropriate trades. Penetrations shall maintain the designed rating of the wall, floor, and ceiling after conduit and cabling has been installed or removed.

D. Utilize approved identification names from submittals.

E. Schedule and coordinate work with DMS and applicable trades.

F. Provide supplementary or miscellaneous materials, equipment, and labor necessary to implement a fully functional BAS irrespective of whether it is identified within this standard or the construction documents.

G. Install materials and products in a neat, workmanlike manner, and in accordance with manufacturer's recommendations.

H. Confirm work and materials comply with applicable codes, standards, specifications, statutes, ordinances, and regulations of governmental authorities having jurisdiction.

I. Adhere to the following minimum distances to reduce effects of EMI:

1. Five (5) inches from power lines of 2 kilo volt ampere (kVA).

2. Eighteen (18) inches from high voltage lighting (including fluorescent).

3. Thirty-nine (39) inches from power lines of 5kVA or greater.

4. Thirty-nine (39) inches from transformers and motors.

3.2 CABLING

A. Floor Level (RS-485) Communication Cable

1. Provide cable in approved pathways.

2. Provide final terminations.

3. Provide appropriate shielding to eliminate equipment noise from Variable Frequency Drive (VFD) and other equipment.

4. Verify cable shield or coupled bonding conductor for end-to-end continuity.

5. Provide additional shielding and grounding per applicable manufacturer's recommendations and/or job site conditions.

B. Instrumentation Signal Cable

1. Provide cable in approved pathways.

2. Provide final terminations.

3. Provide appropriate shielding to eliminate equipment noise from VFD's and other equipment.

4. Provide isolated instrument grounding system as per manufacturer's recommendations.

5. Terminate instrument cables at terminal blocks or terminal strips in enclosures.

C. Power Wire (50 volts or less)

1. Unless otherwise specified or noted, provide final power connections including conduit, wire, and/or control panel disconnect switches to control devices from appropriate electrical j-box.

2. Provide power cables for instrumentation and devices.

3. Provide wire in approved pathways.

D. Power Wire (Greater than 50 volts))

1. Provide final power cables and connections for instrumentation and devices.

2. Provide wire in approved pathways.

3.3 PATHWAYS

A. Provide pathways for work within this division.

1. Provide continuous enclosed conduit pathway in mechanical spaces, electrical spaces, and any areas not specifically allowed to be non-continuous pathways.

(a) Cat 6 cable between the data RJ-45 jack and the control panel enclosure shall be in a continuous enclosed conduit pathway.

2. Provide non-continuous pathway systems from wall sensor conduit stub to associated controller.

3. Provide non-continuous pathway system from controllers to horizontal connection points.

4. Provide non-continuous pathway system for air terminal reheat valves and discharge air sensors.

5. Provide continuous enclosed conduit pathway systems for Smoke Control System.

B. Provide penetrations for pathways

C. Provide conduit and electrical junction boxes sized based on the circular mil size of cable in the conduit or box.

1. Minimum conduit size is ¾ inch unless otherwise noted.

2. Maximum length of flexible conduit is 3 feet.

D. Protection

1. Provide firestopping for penetrations through walls, floors, and ceilings.

2. Provide sleeves for penetrations. Coordinate sleeve selection and application with DMS Design and Construction Guidelines Division 26.

3. Do not cut, remove, or pierce general or mechanical insulation, fire rated walls, ceilings, or steelwork without prior permission and instruction from the DMS Project Manager.

4. Provide conduit to protect pneumatic tubing outside of panels.

3.4 IDENTIFICATION

A. Instrument

1. Provide instrumentation tags.

2. Mark each instrument with hardware and software name.

(a) Instrument hardware name shall be according to symbols and tag numbers used on Control Drawings.

(b) Instrument software name shall be according to database generated point name. Coordinate name with section 25 1200.

3. Size tag to accommodate hardware and software name.

4. Affix tag directly to instrument or permanently mount tag to housing.

5. Fastening Methods for indoor applications:

(a) Self-adhesive or double-side adhesive tape.

(b) Epoxy Cement as required.

6. Fastening Methods for weather exposed or other conditions where self-adhesive is impractical:

(a) Field tags: Use Round head, No. 0 x 3/16", Type U, metallic drive screw, (0.075 diameter, blunt), size 51 (0.067") drill, stainless steel or chromium plated. Cadmium plated screws are not allowed. Similar screw may be substituted.

(b) Panel face: Use Phillips panhead, No. 2-56 x 5/16", Type T, self-tapping sheet metal screw (0.086 diameter., blunt, notched), size 48 (0.076") drill, stainless steel or chromium plated. Cadmium plated screws are not allowed. Similar screw may be substituted.

B. Control Panel Enclosure

1. Provide control panel face mounted device tags.

2. Mark each device with device number from construction documents and equipment controlled.

C. Valve and Damper Identification

1. Provide valve and damper tags for controlled equipment.

2. Valve and damper tags number shall be per contract documents and owner's standard.

D. Wire, Cable, and Tubing Identification

1. Provide cable sheaths labeling on both ends approximately 6 inches from the termination in case the cable becomes separated from its termination.

2. Provide a complete documented cable record for Integrated Automation systems.

3. Label Coverage area cables at each end:

(a) Label terminating end with distribution location identification serving terminal device.

(b) Label distribution end with terminal device destination.

4. Label instrumentation cable and tubing at each end:

(a) Label terminating end with panel device tag.

(b) Label distribution end with instrument device tag.

E. Conduit Identification

1. Provide blue, Direct to Metal latex paint to mark conduit and junction box covers containing data communication cabling.

2. Provide a degreaser such as ethanol to clean the surface before applying paint.

3. Use a brush to paint a 1 to 2 inch stripe encircling conduit

(a) within 6 inches of wall, floor, and ceiling penetrations.

(b) every 10 feet of conduit.

4. Use brush to paint junction box covers.

5. Use of spray paint is prohibited.

3.5 FIRE STOPPING

A. Seal wall, floor, and ceiling penetrations with a 2-hour fire stop assembly.

B. Us EZ Path fire stopping in communications pathways for ease of moves, add, and changes.

C. Verify fire stopping penetrations conform to the recommended practices listed in UL 1479 or ASTM E.

END OF SECTION

SECTION 25 1100

NETWORK

PART 1 - GENERAL

1.1 SUMMARY

A. This section describes the physical interconnection of controllers with the network, outlines the network architecture, and specifies essential equipment such as Ethernet switches, BACnet routers, and BACnet gateways.

1.2 DEFINITIONS

A.	Access Switch	Facilitates connection of end use devices to the network
B.	BACnet	American Society of Heating, Refrigeration and Air Conditioning Engineers building automation and control networking protocol.
C.	BBMD	A BACnet Broadcast Management Device is used to manage and distribute BACnet messages across a network and from one subnet to another.
D.	Controller	Intelligent, stand-alone, programmable Direct Digital Control device used in a BAS to control building equipment and systems.
E.	Core Switch	High capacity switch in the backbone of a network serving as the gateway to Local Area Network (LAN) access and centralizes multiple aggregation devices to the core.
F.	Data RJ-45 Jack	Wall mounted Ethernet jack for local area network.
G.	EIA	US Energy Information Administration (EIA) standard defining the electrical characteristics of drivers and receivers used in serial communications systems.
H.	Furnish	To supply and deliver to the project site, ready to be install.
I.	Gateway	Provides bi-directional translation of data and information between BACnet devices and devices communicating via a proprietary protocol.
J.	Install	To place in position for service or use.
K.	MS/TP	A token passing protocol, Master Slave/Token Passing uses a signal called a token to authorize devices on the network to communicate. It is mainly used for communications between field devices and a controller or router.
L.	Niagara Framework	Software platform developed by Tridium to integrate and control diverse systems, equipment, devices, and components real-time via local network or internet regardless of manufacturer or protocol.
M.	Protocol	An agreed-upon format for transmitting data between two devices.

N.	Provide	To furnish and install, complete, ready for use.
O.	Supervisor	The Niagara Supervisor serves real-time graphical information to standard web-browser clients and performs essential functions such as analytics, centralized data logging/trending, archiving to external databases, alarming, dashboarding, system navigation, master scheduling, database management, and integration with other enterprise software applications.
P.	Web Server	Oversees distribution of global data, sharing of information between controllers, provides remote access to the building, and hosts graphical displays for standard web browser. The web server is typically a JACE.

1.3 SYSTEM DESCRIPTION

A. General

1. Designed to support integration of equipment and systems specified in the Construction Documents.

2. Utilizes standard Ethernet communications over copper and fiber optic communication media. Wireless communication is prohibited.

3. Operates at a minimum speed of 10/100 Mb/sec.

B. NETWORK ACCESS

1. Access Requirements

(a) Contractors are required to have a completed and favorably adjudicated Level II criminal records check on file prior to network access.

(b) Contractors are required to complete Security Awareness training within 30 days of hire date.

(c) Contractors are required to acknowledge and sign a security compliance statement.

2. Local Access

(a) Controls Contractor shall use their portable workstation directly connected to a controller.

(b) Controls Contractor also has the option of using a DMS workstation.

(1) Request DMS logon credentials through DMS Project Manager to the DMS Office of Information Technology. DMS Project Manager will submit an IT ticket.

3. Remote Access

(a) Access to the BAS from outside the DMS network may be granted in extraordinary circumstances. Request access through the DMS Project Manager to the DMS Office of Information Technology.

(b) Access to controllers on the DMS network via a third-party wireless or cellular solution is strictly forbidden.

4. Access to the Niagara Supervisor

    (a) Request logon credentials through the DMS Project Manager to the DMS Building Operations Center.

    (b) Access to the Tridium Niagara Supervisor must be pre-coordinated with the DMS Project Manager a minimum of 72 hours in advance. Access is supervised by the system administrator.

C. Network Infrastructure

1. DMS will provide the Wide Area Network (WAN) between facilities and the Niagara Supervisor.

2. DMS will provide the Local Area Network (LAN) with data RJ-45 jacks strategically distributed throughout the facility in mechanical spaces and communications closets for connection of systems and equipment via Ethernet.

3. Data RJ45 jacks in mechanical spaces will be located inside 10 x 10 x 4" metal junction boxes.

D. Topology

1. Building Controllers will connect to the DMS provided LAN via Ethernet.

2. Application Controllers shall connect to the LAN via one of two methods specified on the Construction Documents. See Diagram 1 for an example.

    (a) Daisy chain topology to connect multiple Application Controllers running the Niagara Framework to one Building Controller via Ethernet.

    (b) EIA-485 based daisy chain topology to connect multiple BACnet Slave Controllers to either a BACnet Router or a BACnet Building Controller via twisted pair serial connection.

E. Network Equipment

1. Ethernet Switches

    (a) Core and Access switches will be provided by DMS or purchased through the project. The DMS Office of Information Technology shall configure network switches.

        (1) Additional Ethernet switches, routers, or hubs are prohibited.

        (2) Middleware and third-party communications devices are prohibited.

2. Gateway

    (a) A Java Application Control Engine will be used as a gateway to:

        (1) Translate communication between the native Niagara protocols including Fox, BACnet, Modbus, and LonWorks.

        (2) Translate communication between legacy proprietary protocols and the native Niagara protocols.

(3) Interface with enterprise platforms through use of RESTful APIs or Message Queuing Telemetry Transport.

3. BACnet Router

(a) Shall support routing between BACnet/IP, BACnet Ethernet, and BACnet MS/TP.

(b) Router shall function as a web server for commissioning and troubleshooting, function as a BACnet Broadcast Management Device (BBMD), provide foreign device registration, and allow firmware upgrades to be performed remotely.

F. Protocols

1. The native Niagara protocols, including Fox, BACnet, Modbus, and LonWorks, are the approved communication standards. If the Controls Contractor deem it necessary to utilize a different protocol, consult with the DMS Chief of Building Systems or the DMS BAS Subject Matter Expert for authorization.

2. FOXS protocol is the preferred communications standard when utilizing controllers operating on the Niagara framework.

3. When BACnet is utilized, BACnet Secure Connect (BACnet/SC) is preferred. BACnet/IP or BACnet MS/TP may also be used.

G. Legacy Controller Integration

1. Existing Siemens Terminal Equipment Controllers (TECs) may not be replaced during HVAC or BAS modernization projects.

(a) In such instances, a Siemens APOGEE 600 TEC Driver shall be used in a JACE to enable visibility and control of TEC points.

(b) This is a proven integration method successfully executed in other DMS projects.

H. Equipment Integration

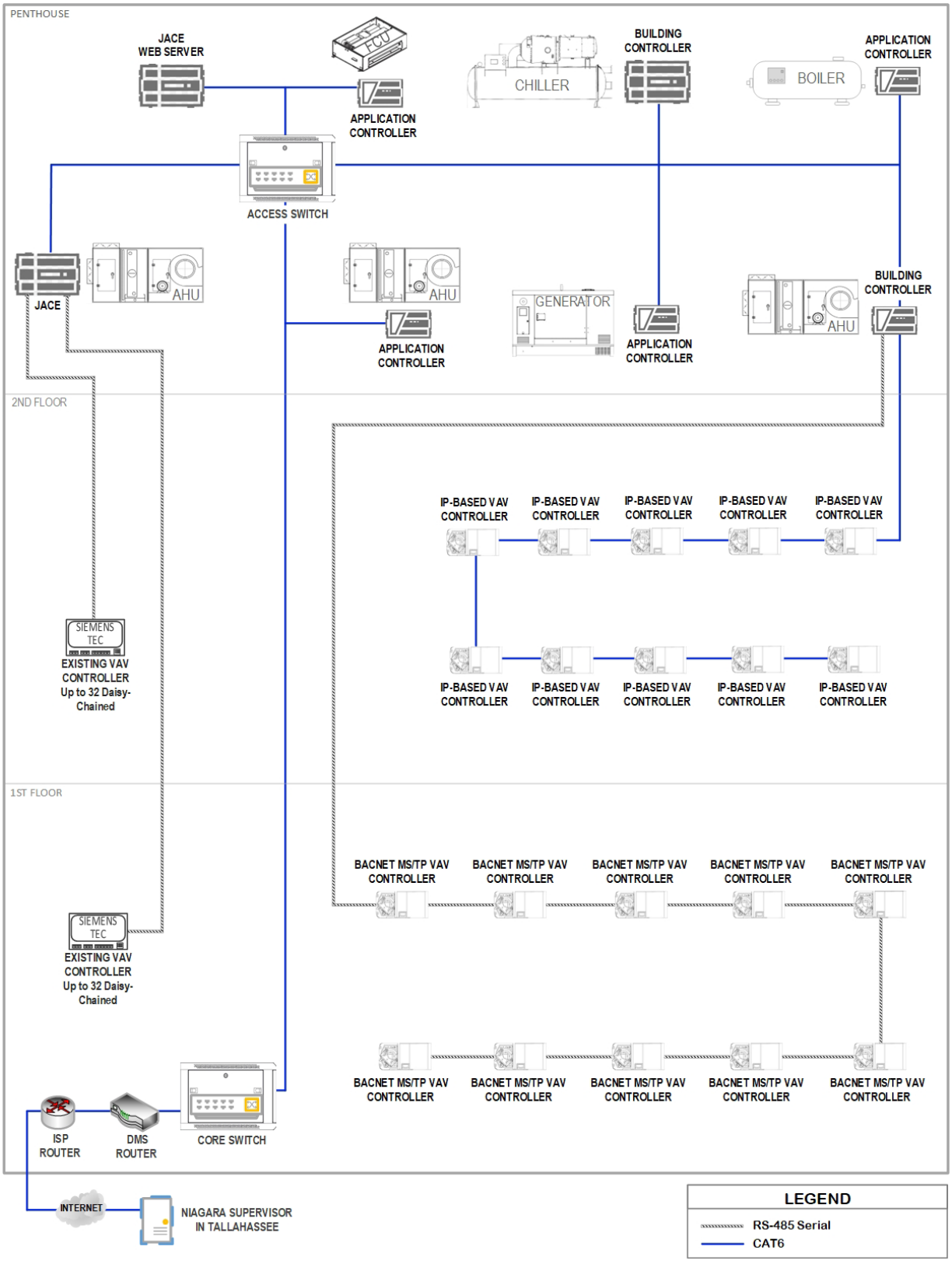
1. Chillers, boilers, generators, and packaged systems such as VFDs, CRACs, ATS, and UPS can be ordered with factory installed communication interfaces. These interfaces will streamline integration of equipment into the BAS.

2. BACnet offers integration via BACnet/IP or MS/TP. When BACnet is used, BACnet/IP is preferred communications method.

3. Modbus and LonWorks protocols may be used when integration via BACnet is not possible.

4. Modbus offers integration via the network (Modbus/TCP) or direct connection (Modbus RTU). When Modbus is utilized, Modbus/TCP is the preferred communications method.

Diagram 1. Example BAS Network Topology.



1.4 SUBMITTALS

A. Refer to section 25 0100.

1.5 QUALITY ASSURANCE

A. Single Socket Layer (SSL) requirements

1. Communications between controllers and the Niagara Supervisor shall be secured using SSL encryption and utilize the following ports:

(a) Browser HTTPS 443

(b) Niagara Station FOXS 4911

(c) Niagara Platform TLSv1 5011

2. BACnet Networks must be installed to BACnet Network industry standards with attention to the number of devices, routers, and overall length, point, and trend count to assure proper polling of devices and points. Points and devices must update correctly and not go into a fault, stale, or offline.

3. Refer to section 25 0100 for additional requirements.

1.6 WARRANTY

A. Refer to section 25 0100.

PART 2 - PRODUCTS

2.1 GENERAL NETWORK REQUIREMENTS

A. Ethernet; IEEE standard 802.3.

B. Cable; 100 Base-T, Unshielded Twisted Pair (UTP)-8 wire, category 6, plenum rated, maximum length 300 feet.

C. BACnet MS/TP; EIA-485 shielded twisted pair, maximum length 4,000 feet.

2.2 ETHERNET SWITCHES

A. Ruckus ICX switches in 8-port through 48-port configurations.

B. Substitutions for Ruckus switches shall be approved in writing by the DMS Office of Information Technology.

2.3 BACNET ROUTER

A. Sized to support the number of BBMD entries specified in the Construction Documents.

B. Hardware minimum requirements:

1. 10/100 Mbps Ethernet with auto-negotiation.

2. Optically isolated MS/TP port.

3. MS/TP baud rates range from 9600 to 115200 bits per second (bps).

4. Support for up to 32 full-load EIA-485 devices sharing the same MS/TP network.

2.4 BACNET GATEWAY

A. Shall translate communication protocols specified in the Construction Documents.

B. Sized to read/write the required number of BACnet objects, Modbus registers, and LonWorks network variables.

C. Provide the ability to map data to and from existing devices in full compliance with ASHRAE BACnet standards.

1. Map device inputs as BACnet BI and AI objects

2. Map device outputs as BACnet BO and AO objects

3. Map value parameters as BACnet AV and BV objects

4. Map multiple state parameters as BACnet MSI, MSO and MSV objects.

D. Support enhanced BACnet MS/TP schemes for BACnet compliant traffic.

E. Provide ability to use the following BACnet functions:

1. Schedules.

2. Trend log.

3. Alarms.

4. Support priority array for BACnet object types.

F. Hardware minimum requirements:

1. 10/100 Mbps Ethernet.

2. Hardened MS/TP port.

3. MS/TP baud rates range from 9600 to 115200 bps.

4. EIA-485 serial port.

PART 3 - EXECUTION

3.1 GENERAL

A. Schedule and coordinate work with DMS and applicable trades.

B. Provide supplementary or miscellaneous materials, equipment, and labor necessary to implement a fully functional BAS irrespective of whether it is identified within this specification and/or construction documents.

C. Install materials and products in a neat, workmanlike manner, and in accordance with manufacturer's recommendations.

D. Confirm work and materials comply with applicable codes, standards, specifications, statutes, ordinances, and regulations of governmental authorities having jurisdiction

E. Promptly notify the DMS Project Manager and Construction Manager of conflicts between the construction documents and DMS Integrated Automation Standards.

F. Provide temporary wired LAN connections via network switches to keep pace with construction schedule if permanent data RJ-45 jacks provided by DMS are not available. Postponing controls work due to networking delays is not acceptable. Temporary LAN connections shall be removed when permanent DMS provided LAN connections are available.

3.2 INSTALLATION

A. Provide network cabling between controllers, Ethernet switches, BACnet routers and gateways, as applicable. Refer to Section 25 0500 for cable and pathway requirements.

B. Provide wiring, cabling, connectors, jumpers, terminals, and other hardware for complete system.

A. Install Ethernet switches furnished as part of the project.

1. Mount in the wall-mounted equipment rack designated on the Construction Documents.

2. Make connection to the rack mounted power distribution unit.

3. Make connections between switch and Ethernet patch panel.

C. BACnet Installations

1. MS/TP Network

(a) Provide BACnet router to facilitate communication between a MS/TP network and LAN.

(b) Limit the number of daisy-chained devices connected to a router on the MS/TP network to 32. Repeaters will not be used to extend the length of MS/TP networks.

(c) Install BACnet router as the end node on an MS/TP network.

(1) Connect cable shield to ground at the router. Establish router as the single grounding point on a MS/TP network.

(d) Install termination resistors across the receiver sized for end point (network) biasing at both ends of the MS/TP network.

(e) Connect the ground reference wire of devices with isolated power on a MS/TP network together through a common third wire.

(f) Tie the common third wire of isolated and non-isolated devices to the earth ground using a current limiting resistor.

4. Provide gateway as specified in construction documents.

END OF SECTION

SECTION 25 1200

DATABASE CONFIGURATION

PART 1 - GENERAL

1.1 SUMMARY

A. This section includes requirements for point naming, scheduling, alarms, trends, and reports.

1.2 DEFINITIONS

A.	Archive	To store data.
B.	Controller	Intelligent, stand-alone, programmable Direct Digital Control device used in a BAS to control building equipment and systems.
C.	Furnish	To supply and deliver to the project site, ready to be install.
D.	Install	To place in position for service or use.
E.	JACE	A Java Application Control Engine is a supervisory controller in the Tridium Niagara Framework which provides drivers to integrate devices using different communications protocols from multiple manufactures . A JACE may also host the web user interface.
F.	Provide	To furnish and install, complete, ready for use.
G.	Trend	Record data for a specified time intervals.

1.3 SYSTEM DESCRIPTION

A. Database structures that define the configuration, operation, and control of equipment connected to the BAS.

B. Include hardware points, setpoints, and integrated points identified on the Control Drawings for monitoring and control by the BAS.

C. Graphical user interface that allows users to monitor system status, adjust settings, view trends, and respond to alarms.

D. User ability to modify set points, alarm limits, tuning parameters, scheduling, and trends through interaction with graphics.

E. User ability to view, control, and perform related BAS functions through the Niagara Supervisor, operator workstation, or a web server.

1.4 GENERAL REQUIREMENTS

A. Refer to the DMS Points List for the following:

1. Point names

2. Facets

3. Command priority

4. Trend type
5. Alarm Type
6. Alarm class
7. Alarm high and low limits
8. Alarm delay

B. Point Names

1. The DMS BAS Subject Matter Expert or DMS Chief of Building Systems will provide names not listed on the DMS Points List.

C. Alarms

1. General

(a) Alarm handling shall always be active to ensure that alarms are processed even if an operator is not currently signed on to the DDC system.

(b) Full point name shall be included in alarm message; refer to “Point Naming” in this specification section.

(c) Alarm threshold, limit, and time delay values to be user-adjustable

(d) End-users shall be able to define additional alarms for any point in the system.

(e) Provide timed (scheduled) routing of alarms by building name and class, object, group, or node.

(f) Provide alarm generation from binary object “runtime” and event counts for equipment maintenance. The user shall be able to reset runtime or event count value with appropriate password control.

(g) Control equipment and network failures shall be treated as alarms and annunciated.

(h) Niagara B-formatting shall be utilized for alarms.

(i) On each Alarm Extension, the Alarm Source Name shall be correctly B-Formatted to automatically prepend the Point Display Name with Device Name, or Station Name if alarm extension resides in Supervisor, and the Point Name.

(j) Boolean Alarm extensions on analog (Numeric) values are not acceptable.

2. The Alarm Console will be the recipient for alarms.

3. Alarms will be configured in two categories: Standard and Critical.

(a) Standard alarms include:

(1) Points reaching a high or low limit.

(2) When feedback does not equal command.

(3) JACE Ping command failure notification.

(b) Critical alarms include:

(1) Chilled water, hot water, and AHU supply temperatures not meeting set point.

4. Configure alarms to include the following:
   (a) Point Name and Description
   (b) Alarm differentials (automatically adjust with setpoints)
   (c) Units
   (d) Coordinate settings (limits or state) with DMS
   (e) Instrument tag
   (f) Priority
   (g) Message
5. State-based alarming
   (a) Provide state-based alarms to prevent alarms during specific equipment states.
      (1) Interlock equipment status and/or modes to lock out associated alarms during shutdowns.
      (2) Interlock acknowledgement to lock out associated alarm for limited adjustable time.
   (b) Alarms shall be inhibited for a specified time after a change in occupancy or for AHUs that are off.
   (c) VAV box alarms shall be inhibited while the AHU serving those boxes is non-functional.
6. Provide alarms suppression, to minimize nuisance alarms resulting from higher level alarms.
   (a) Hot water and chilled water alarms master to AHU temperatures.
   (b) AHU alarms master to associated Air Terminal Unit (ATU) and room temperatures.
   (c) Fire alarms master to associated HVAC equipment.
7. Alarms will be filtered and routed based on user log in.
8. Communication Alarms
   (a) Provide Niagara Station Health Alarms if a Niagara station is offline longer than 5 minutes. Time will be user adjustable.
   (b) Provide alarm when communication to a controller is lost for 10 minutes. Time will be user adjustable.
      (1) Prepend Alarm and To Normal text with B-Formatting to add building name and station name.

D. Reports

1. Standard reports shall be provided.

2. Operator shall be able to define database data into recurring, customizable reports.

3. Operator shall be able to define a custom trend log report for I/O points in the database.

E. History Trending

1. Trend extensions shall be added and configured for hardware points and calculated software points that change automatically by way of program logic.

2. Full point name shall be included in trend name.

3. Each trend shall include interval, start, and stop time.

4. Operator shall be able to define a custom trend log for any I/O point in the database.

5. Trend data shall be stored on a local controller, within storage limits, then uploaded to the Niagara Supervisor.

6. Historical trends shall be stored for 2 years. It is understood that Change of Value (COV) trend storage will need to be estimated; configure at least 7,000 COV records.

1.5 SUBMITTALS

A. Refer to section 25 0100.

1.6 QUALITY ASSURANCE

A. Point Naming

1. Only alphanumeric (A-Z, a-z, 0-9) and underscore(_) characters are allowed.

2. Spaces, hyphens, and other symbols, (&, %, $, #) are prohibited.

3. The first character in the name must be a letter.

4. Name must be unique for every component in the same parent component.

5. Naming is case sensitive. For example, zone1 and Zone1 are unique names. Abbreviations are the preferred method of naming components.

6. Component names shall not use leading zeros. For example, AHU1 is acceptable; AHU01 is not acceptable.

7. Improper, or “escaped” names, shall not be used.

B. Tenant agency names shall not be used in Point Names or Folder Names.

C. Sequence of operation

1. Equipment operating sequence for HVAC equipment shall be based on the DMS Standard Control Drawings.

D. Scheduling

1. Schedule function shall include capability to:

(a) Schedule each point or group of points in the system individually.

(b) Create a separate schedule for each day of the week.

(c) Define a schedule up to a year in advance.

(d) Schedule start, stop, optimal start and optimal stop.

(e) Specify exception schedule on any day of the year.

(f) Repeat holiday schedule on a specific date each year.

(g) Define length and reoccurrence of the schedule.

E. Refer to section 25 0100 for additional requirements.

1.7 WARRANTY

A. Refer to section 25 0100.

PART 2 - PRODUCTS

2.1 Existing Tridium Niagara Supervisor with unlimited device license.

PART 3 - EXECUTION

3.1 GENERAL

A. Controls Contractor shall

1. Create, configure, and program database to include:

(a) Data collection.

(b) Global control strategies.

(c) Scheduling.

(d) Permanent trending.

(e) Alarm generation and management.

(f) Web page development.

(g) Reports.

2. Coordinate database configuration with DMS during the Integration Planning Session prior to database generation.

3. Schedule and coordinate work with DMS and applicable trades.

4. Provide supplementary or miscellaneous materials, equipment, and labor necessary to implement a fully functional BAS irrespective of whether it is identified within this specification and/or construction documents.

5. Confirm work and materials comply with applicable codes, standards, specifications, statutes, ordinances, and regulations of governmental authorities having jurisdiction.

6. Map points from equipment and systems identified on the Construction Documents. Point configuration shall include the ability to read and display the value of a property

from any mapped object including available and supported optional properties, and proprietary extensions.

7. Normalize mapped data points for ease of data management and readability.

8. Timestamp data points.

9. Archive alarms, trends, events, and transactions for 2 years.

3.2 NAMING CONVENTIONS

A. Point Naming

1. Specific points names are published on the DMS Points List available on the DMS website.

2. Create new point names in accordance with this document and Attachment 1, the DMS Naming Convention.

B. Folder Structure

1. Create folder structure in accordance with the following:

(a) Root Folder. This is the top-level folder in the Niagara station that contains all other folders.

(b) Building Folder. Under the root folder, create a folder dedicated to the building.

(c) Location Folder. Within the building folder, create subfolders representing floors or areas to organize devices and points according to their physical location within the building.

(d) Equipment Folder. Inside the appropriate floor folder, create subfolders dedicated to specific types of equipment or systems.

(e) Points Folder. Inside the appropriate equipment or system folder, create subfolders that contain the individual points that are monitored and controlled.

C. Global Strategies

1. Repeat actual names of Boolean, Numeric, Enumerated, and String points throughout the system to take advantage of batch commands.

(a) For example, numerous Zone Temperature points should populate the system under the uniform name "Zone Tmp". These replicated points will be housed within distinct, uniquely titled folders. The actual point name will be dynamically derived from the structure of the folder names, automatically extracted as required by the Building Automation System (BAS).

(b) When a point alarms and is issued to the alarm log, the complete point name extracted from the folder structure shall be incorporated into the alarm message. This ensures absolute clarity regarding which specific "Zone Tmp" among all "Zone Tmp" within the system has encountered an alarm condition.

3.3 ALARMS

A. Configure alarms identified on the DMS Points Lists.

B. Configure state-based alarms as follows to prevent alarms during specific equipment states.

1. Interlock equipment status and/or modes to lock out associated alarms during shutdowns.

2. Interlock acknowledgement to lock out associated alarm for limited adjustable time.

C. Configure alarm suppression in accordance with Table 1 to minimize nuisance alarms resulting from higher level alarms.

1. Hot water and chilled water alarms master to AHU temperatures.

2. AHU alarms master to associated ATU and room temperatures.

3. Fire alarms master to associated HVAC equipment.

Table 1. Associated Equipment Alarm Suppression

System	Alarm Inputs	Temp Alarms	AHU Temp Alarm High	AHU Temp Alarm Low	Zone Temp Alarm High	Zone Temp Alarm Low	Zone Flow Alarm Low
Fire Alarm	General Alarm	X					
Schedules	Unoccupied	X	X	X	X	X	X
Chiller System	Status Off (Alarm or Normal)		X		X		
Chiller System	Supply Temperature - High		X		X		
Chiller System	Differential Pressure - Low		X		X		
HHW System	Status Off (Alarm or Normal)			X		X	
HHW System	Supply Temperature - Low			X		X	
HHW System	Differential Pressure - Low			X		X	
AHU	Status Off (Alarm or Normal)		X	X	X	X	X
AHU	Supply Temperature - High		X		X		
AHU	Differential Pressure - Low		X	X	X	X	X
Building CHW Pumps	Status Off (Alarm)		X		X		X
Building CHW Pumps	Differential Pressure - Low		X		X		X
Building HHW Pumps	Status Off (Alarm)		X		X		X
Building HHW Pumps	Differential Pressure - Low			X		X	

D. Route and filter alarms based on user log in.

3.4 TRENDS

A. Create trends identified on the DMS Points List.

B. Trend analog points at 15-minute intervals.

C. Trend digital points on change of value or state.

D. Normalize trend data for common reporting and archiving

3.5 SCHEDULES

A. Input initial schedules coordinated with and approved by DMS.

B. Use the facet ranges listed below for enumerated schedules:

1. Occupied = 1

2. Unoccupied = 2

3.6 REPORTS

A. Configure the standard reported listed below:

1. I/O points in manual override state with live status and values
2. Current alarms
3. Disabled I/O points

3.7 PROGRAMMING

A. Program equipment operating sequence for HVAC equipment based on the control drawings in the Construction Documents.

3.8 BACNET

A. Utilize the BACnet command priority in Table 2 for device objects with a property that can be commanded.

1. Writeable points that are intended for override only will have the SET action flag hidden.
2. Writable points will have their Emergency Override and Emergency Auto action flags hidden.
3. Writable points will have a facet to limit the maximum override time to eight (8) hours.
4. Points that are trended will have the points' hyperlink property set to the corresponding trend.

Table 2. BACnet Command Priority Array

Priority Level	Application	Priority Level	Application
1	Manual-Life Safety	9	Programming
2	Automatic-Life Safety	10	Schedule
3	Not Used	11	Load Shedding
4	Not Used	12	Not Used
5	Critical Equipment Control	13	Not Used
6	Minimum On/Off	14	Not Used
7	Not Used	15	Not Used
8	Manual Operator	16	Not Used

END OF SECTION

SECTION 25 1300

CONTROLLERS

PART 1 - GENERAL

1.1 SUMMARY

A. This section provides requirements for controller selection, installation, and start-up.

1.2 DEFINITIONS

A.	Advanced Application Controller	General purpose controller that can be programmed or configured to control a wide variety of equipment or systems. Typically used to control a chiller, air handler, or boiler. May coordinate the activities of Application Specific Controllers.
B.	Application Specific Controller	Designed with built-in control logic to handle a narrow, pre-defined set of tasks. Also known as a unitary or terminal equipment controller, primarily used to control a single fan coil unit or variable air volume box.
C.	BACnet	American Society of Heating, Refrigeration and Air Conditioning Engineers building automation and control networking protocol.
D.	BAS	An integrated automation system is the use of automation hardware and software to automatically monitor and control building systems, such as Heating, Ventilation & Air Conditioning (HVAC), lighting and access control.
E.	BBMD	A BACnet Broadcast Management Device is used to manage and distribute BACnet messages across a network and from one subnet to another.
F.	Building Controller	Manages data flow between application controllers and server or user interface. Enables integration between legacy controllers, building subsystems, and other smart building technologies using various protocols. Also known as network or supervisory controller, a building controller is typically a Java Application Control Engine.
G.	Controller	Intelligent, stand-alone, programmable Direct Digital Control device used in a BAS to control building equipment and systems.
H.	Dry-Type Contact	Contact closure without an electrical output (switch).
I.	Furnish	To supply and deliver to the project site, ready to be install.
J.	Integration	Connection of disparate systems to a common platform using communication protocols.
K.	Install	To place in position for service or use.
L.	IP Address	Internet Protocol (IP) node address.

M.	JACE	A Java Application Control Engine is a supervisory controller in the Tridium Niagara Framework which provides drivers to integrate devices from multiple manufactures. A JACE may also host the web user interface.
N.	MAC Address	Media Access Control (MAC) address is a unique identifier assigned to a network interface controller for use as a network address.
O.	Niagara Framework	Software platform developed by Tridium to integrate and control diverse systems, equipment, devices, and components real-time via local network or internet regardless of manufacturer or protocol.
P.	NICS	The Niagara Information and Conformance Statement is a licensing model that provides manufacturers with the ability to define the various levels and types of Niagara interoperability their products will support.
Q.	Ohm	Unit of electric measure.
R.	PICS	The Protocol Implementation Conformance Statement describes the BACnet capabilities of a particular BACnet implementation. These statements are relevant for developers in the testing and certification of a product. The PICS document is created by the manufacturer to identify the BACnet functionality in a product.
S.	Protocol	An agreed-upon format for transmitting data between two devices.
T.	Provide	To furnish and install, complete, ready for use.
U.	Stand-Alone	To operate or control without the need for higher level communications.
V.	Supervisor	The Niagara Supervisor serves real-time graphical information to standard web-browser clients and performs essential functions such as analytics, centralized data logging/trending, archiving to external databases, alarming, dashboarding, system navigation, master scheduling, database management, and integration with other enterprise software applications.
W.	Web Server	Oversees distribution of global data, sharing of information between controllers, provides remote access to the building, and hosts graphical displays for standard web browser. The web server is typically a JACE.

1.1 SYSTEM DESCRIPTION

A. Microprocessor based, field programmable controllers to:

1. Integrate systems specified.
2. Accept communication from existing enterprise server for the following:
   (a) Commands

(b) Overrides

(c) Schedules

(d) Interlocks

(e) Adjustments

3. Perform standalone facility wide control strategies and sequences.

4. Allow unlimited number of clients to use a common Web browser to view HTML graphics.

(a) Real-time values displayed on a Web page shall update automatically without requiring a manual “refresh” of the Web page.

1.2 SUBMITTALS

A. Refer to section 25 0100.

1.3 QUALITY ASSURANCE

A. Comply with ISO 9000 Model for Quality Assurance in Production, Installation, and Servicing.

B. Documented history of compatibility by design for a minimum of 2 years.

1. Future compatibility shall be supported for no less than 7 years.

2. Products available on the market for over a decade will undergo thorough verification to ensure they are not approaching or at the end of their lifecycle. Use of products approaching their end of lifecycle is prohibited.

C. Comply with the ANSI/ASHRAE Standard 135-2016.

D. Comply with the BACnet Interoperability Building Block standardized functional profiles defined in ASHRAE Standard 135 Annex K.

E. Comply with applicable International Electrotechnical Commission standards:

1. 61000 series for immunity to conducted and radiated electromagnetic disturbances.

2. 60703 series for safety and reliability requirements.

F. Comply with applicable Underwriters Laboratory standards for environmental conditions and behavior during power and communication interruptions:

1. UL 508A: Industrial Control Panels

2. UL 61010-1: Safety Requirements for Electrical Equipment for Measurement, Control, and Laboratory Use

3. UL 864: Control Units and Accessories for Fire Alarm Systems

4. UL 916: Energy Management Equipment

G. Refer to section 25 0100 for additional requirements.

1.4 WARRANTY

A. Include:

1. Update controllers to the latest software revision during the warranty period.

2. Provide 5-year software maintenance agreement.

B. Refer to section 25 0100 for additional requirements.

PART 2 - PRODUCTS

2.1 CONTROLLERS

A. Controllers shall be fully compatible with the Tridium Niagara Framework.

B. Controllers shall employ a Niagara module Java ARchive (JAR) file to enable programming by the standard Niagara Workbench without the need for a specific Niagara brand license.

1. Workbench is the preferred service tool.

2. A wizard may be used to perform initial controller setup.

C. Controllers shall not require the installation of brand-specific or third-party software, utilities, or applications for programming purposes.

D. Controllers shall demonstrate full interoperability to facilitate seamless "plug and play" replacement by manufacturer meeting the requirements of the DMS Integrated Automation Standards.

E. Controllers shall be readily available for purchase on the open market or through a minimum of three suppliers within the state of Florida.

F. Java Application Control Engine (JACE)

1. When utilized, a Java Application Control Engine (JACE) shall be provided with no connectivity restrictions regardless of brand. The NiCS for station and tool shall be:

Station Compatibility IN	**ALL** or *
Station Compatibility OUT	**ALL** or *
Tool Compatibility IN	**ALL** or *
Tool Compatibility OUT	**ALL** or *

2.2 GENERAL CONTROLLER REQUIREMENTS

A. Controller shall be capable of enterprise communication using Ethernet TCP/IP.

B. Controller shall utilize native Niagara protocols such as Fox, BACnet, Modbus, and LonWorks.

C. Controllers shall be true peer-to-peer communications devices. Controllers requiring polling by a host to pass data shall not be acceptable.

D. Controllers running the Niagara Framework shall have a Niagara Compatibility Statement (NiCS) indicating they are fully compliant.

E. BACnet controllers will be listed by the BACnet Testing Laboratory with a Protocol Implementation Conformance Statement (PiCS) indicating they are fully compliant.

F. Controllers shall fully support plug and play functionality with features such as:

1. Automatic device detection

2. Self-configuration

3. Seamless integration to the Niagara Supervisor

4. Use of native Niagara protocols

5. Programmable by the standard Niagara Workbench

G. Each controller shall be capable of complete operation as an independent standalone unit.

H. Controllers will be capable of updating operating parameters and receiving firmware updates remotely over the network.

I. Controllers shall control a single piece of equipment, such as a chiller, boiler, air handling unit, Variable Air Volume box, etc., to prevent one failed controller from taking multiple pieces of equipment offline.

J. Controllers shall be capable of communication with all other controllers on the same network and able to communicate globally across all networks through dynamic routing and switching.

K. Controllers shall be equipped with a service communication port for connection to a portable operator's workstation.

L. Wiring and cable connection shall be made to be field removable such as modular terminal strip or termination cards connected by ribbon cable.

M. Controller shall maintain BIOS and programming information in the event of power loss for a minimum of 72 hours.

N. Controllers shall be configured to use stored default values to ensure fail-safe operation. Default values shall be used upon failure of a connected input instrument or loss of communication of a global point value.

O. Controllers shall have sufficient I/O capacity to perform and manage specific sequences and include all points listed in the Construction Documents.

P. DMS shall be named the license holder of all BAS software utilized during the project.

2.3 BUILDING CONTROLLER

A. The primary function for DMS purposes is to allow access and control building systems through a web-based interface.

B. General Requirements

(a) Network management functions.

(b) Data logging.

(c) Calendar functions.

(d) Scheduling.

(e) Alarm monitoring and routing.

(f) Trending.

(g) Time synchronization.

(h) Standalone facility wide execution of control strategies and sequences.

C. Standard features:

1. Support standard Web browser access via the Intranet/Internet.

2. Ability to store trends, alarms, and events for up to 72 hours

3. Ability to archive data remotely to a server on the network.

4. Ability to automatically backup its database at a user-defined interval.

5. Hardware

(a) Programmable and expandable IO.

(b) Isolated RS-485 serial port connection.

(c) 10/100 Mbps Ethernet port.

(d) Real-time clock.

(e) Firmware upgradable over-the-network.

(f) 24-VAC supply.

2.4 ADVANCED APPLICATION CONTROLLER

A. Primary function is control and optimization of major building mechanical systems such as:

1. Chilled water systems.

2. Hot water systems.

3. Air handling systems.

4. Electrical systems.

5. Lighting systems.

6. Metering applications.

B. General Requirements

1. Network management functions.

2. Data logging.

3. Calendar functions.

4. Scheduling.

5. Alarm monitoring and routing.
6. Trending.
7. Time synchronization.
8. Standalone facility wide execution of control strategies and sequences.

C. Standard features:

1. Execution of custom, job-specific processes defined by the user, to automatically perform calculations and special control routines.
2. Support standard Web browser access via the Intranet/Internet.
3. Ability to archive data remotely to a server on the network.
4. Ability to automatically backup its database at a user-defined interval.
5. Hardware
   (a) Programmable and expandable IO.
   (b) Isolated RS-485 serial port connection.
   (c) 10/100 Mbps Ethernet port.
   (d) Real-time clock.
   (e) Firmware upgradable over-the-network.
   (f) 24-VAC supply.
6. Programmable features
   (a) Time-of-day scheduling.
   (b) Calendar-based scheduling.
   (c) Holiday scheduling.
   (d) Temporary schedule overrides.
   (e) Start-Stop Time Optimization.
   (f) Automatic Daylight Savings Time Switch-over.
   (g) Night setback control.
   (h) Enthalpy switch-over (economizer).
   (i) Peak demand limiting.

2.5 APPLICATION SPECIFIC CONTROLLER

A. Primary function is to monitor and control a single piece of terminal equipment such as:

1. Variable Air Volume (VAV) units
2. Laboratory Controllers

3. Fan Coil Units
4. Unit Ventilators
5. Lighting Panels
6. Pumps
7. Supply and Exhaust Fans
8. Remote Dampers
9. Computer Room Air Conditioning
10. Heat Exchangers
11. Variable Frequency Drives
12. Generators
13. Fuel Tank Monitors
14. Automatic Transfer Switches
15. Uninterruptable Power Supplies
16. Other miscellaneous equipment

B. Standard Features:

1. Stand-alone Proportional Integral Derivative (PID) control.
2. Ability to execute predefined control sequences in project documents.
3. Indefinite storage of setpoints, flow limits, and occupancy schedules in non-volatile memory.

C. Hardware:

1. Capable of IO expansion.
2. Isolated RS-485 serial port.
3. 10/100 Mbps Ethernet port.
4. MS/TP baud rate of 76.8 Kbps or higher on BACnet controller.
5. Selectable biasing resistance on BACnet compliant controller.
6. Real-time clock.
7. IO Compatibility
   (a) 0-10 or 0-12 VDC.
   (b) 4-20 milliamps.
   (c) 0-1000 ohm resistive, or Type-3 10K ohm thermistor.

(d) Dry-type contacts (no grounds or no voltage) of either normally open (NO) or normally closed (NC) configuration.

D. Programmable features.

1. Calendar functions.

2. Scheduling.

3. Trending.

4. Alarm monitoring and routing.

5. Time synchronization.

6. Application specific and custom control algorithms.

E. Application Specific Controllers supporting a VAV box shall:

1. Contain built-in air flow transducer for Pressure Independent VAV operations, when required. If the transducer is not integral to the controller, the controller/transducer assembly shall be factory tested and approved for the intended use.

2. Contain an integral direct coupled electronic actuator. If the actuator is not integral to the controllers, the controller/actuator assembly shall be factory tested and approved for the intended use.

3. The actuator shall provide a minimum of 35 in-lb of torque.

4. The assembly shall mount directly to the damper operating shaft with a universal V-Bolt clamp assembly.

5. The actuator shall not require limit switches, and shall be electronically protected against overload.

6. When reaching the damper or actuator end position, the actuator shall automatically stop.

7. The actuator shall be capable to be manually disengaged via a clutch.

8. The position of the actuator shall be indicated by a visual pointer.

9. The assembly shall have an anti-rotational bracket.

2.6 CONTROLLERS UTILIZING BACNET PROTOCOL

A. A PICS shall be provided by the manufacturer for BACnet devices and shall include information described in ASHRAE Standard 135 Annex A to include protocol revision, software revision, and firmware revision.

B. The PICS shall identify the level of support for the following:

1. Conformance class.

2. Standard and non-standard application services that can be initiated and/or executed.

3. Interoperability building blocks compatibility to include:

(a) Data sharing.

(b) Device and network management.

(c) Scheduling.

(d) Alarm and event management.

(e) Trending.

4. Any restrictions to the range of values available for standard and proprietary object types.

5. Data link layer options, both real and virtual.

6. Networking option.

C. Data in BACnet devices shall be accessible through standard Web browsers without requiring proprietary interface or configuration programs.

D. Proprietary services and objects are prohibited unless a detailed description in BACnet-standard format is provided for each service and object on the construction documents.

2.7 WEB SERVER

A. Each site shall have a JACE configured as a web server. The JACE shall be a zero node controller with no physical I/O points.

B. The Web Server shall provide the same view of graphics, schedules, logs, etc., as is provided by the Niagara Supervisor.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

A. Return controllers removed from use to the DMS Project manager for proper disposal.

B. Schedule and coordinate work with DMS and applicable trades.

C. Provide supplementary or miscellaneous materials, equipment, and labor necessary to implement a fully functional Building Automation System (BAS) irrespective of whether it is identified within this specification and/or construction documents.

D. Install materials and products in a neat, workmanlike manner, and in accordance with manufacturer's recommendations.

E. Confirm work and materials comply with applicable codes, standards, specifications, statutes, ordinances, and regulations of governmental authorities having jurisdiction.

F. Promptly notify the DMS Project Manager of conflicts between the Construction Documents and the DMS Integrated Automation Standards.

G. Provide controller and point expansion modules sized for point count to accommodate project design.

H. Provide wiring, cabling, connectors, jumpers, terminals, and other hardware for a complete system.

I. Coordinate power requirements with Mechanical Specifications and DMS Design and Construction Guidelines.

J. Provide static, transient, short circuit, and surge protection on inputs and outputs. Communication lines to be protected against electrostatic transients and induced magnetic interference. Bus-connected devices will be AC coupled or equivalent so that any single device failure will not disrupt or halt bus communication.

K. Protect products from ground fault by providing suitable grounding. Install grounding wires as shown in the manufacturer's instructions.

L. Refer to section 25 1100 for networking requirements.

M. Install controller with the latest version of applicable software.

N. Mount in accordance with Section 25 1400.

1. Install controllers according to manufacturer's requirements.

(a) Provide 3" minimum space between controllers and other devices on enclosure back panel.

(b) Provide 6" of space between front of controller and enclosure door.

(c) Controller or control devices shall not be mounted on the top, bottom, side, or outside of an enclosure.

O. All devices shall be configured to utilize static IP addresses.

3.2 CONTROLLER ADDRESSING

A. IP Addresses

1. Request IP addresses on the DMS Device Connection Application available from the DMS Project Manager.

(a) All applicable sections of the form must be filled out.

(b) IP address will not be assigned without the device MAC address.

B. BACnet Addresses

1. Request Device Instance Numbers through the DMS Project Manager to the DMS BAS Subject Matter Expert or DMS Chief of Building Systems.

3.3 JACE INSTALLATION

A. Utilize primary Ethernet port to connect controller to data RJ45 jack specified on the construction documents.

B. Provide DMS with controller login credentials.

1. Change factory platform default credentials to:

(a) New username: *DMSAdmin*

(b) New password: *DMS123*

C. Runtime Profiles

1. Enable Runtime profiles to support the following,

(a) Web client browser access (UX).

(b) Brower Web Workbench (WB).

D. Station Installation

1. Install station template provided by DMS:

(a) Station name shall be the abbreviated building name designated in Section 25 1200 Attachment 1 – DMS Naming Conventions, or as specified by DMS.

(b) Enable AUTO-START for the station to start every time the controller is rebooted.

(c) Copy files in the station directory and its subdirectories.

E. Engine Watchdog Policy

1. Set timeout to 15 minutes.

2. Enable Restart on Failure and Auto-Start.

F. Additional Defaults

1. Port and security defaults shall remain unchanged.

3.4 IP-BASED APPLICATION CONTROLLER INSTALLATION

A. Utilize primary Ethernet port to connect controller to data RJ45 jack, network switch, or Building Controller as specified on the Construction Documents.

B. When daisy chaining controllers is specified on the Construction Documents:

1. Utilize the secondary Ethernet port to daisy chain application controllers.

2. Limit the number of application specific controllers in daisy chain configuration to 32, or the maximum number supported by the specific controller brand, whichever is less.

3.5 BACNET INSTALLATIONS

A. Set UDP port number for BACnet controllers to 47808.

B. Configure controllers utilizing BACnet protocol for static BBMD.

C. MS/TP Installations

1. Configure controllers on a MS/TP network to utilize the same baud rate.

2. Configure BACnet instance numbers. Instance numbers will utilize the vendor BACnet ID as the first digit(s).

3. If a router is present, use MAC 0 for the router’s MS/TP address.

4. Reserve MAC addresses 1-4 for service tools on a technician’s laptop.

5. Begin numbering controllers at MAC address 5 and number consecutively until each controller is assigned a MAC address.

D. Connect to 3rd party equipment per Construction Documents.

END OF SECTION

SECTION 25 1400

CONTROL PANEL ENCLOSURES

PART 1 - GENERAL

1.1 SUMMARY

A. This section describes requirements for control panel enclosure, wiring duct, wiring trough, AC power outlet, and Uninterruptable Power Supply (UPS).

1.2 DEFINITIONS

A.	Controller	Intelligent, stand-alone, programmable Direct Digital Control device used in a BAS to control building equipment and systems.
B.	Furnish	To supply and deliver to the project site, ready to be install.
C.	Install	To place in position for service or use.
D.	Provide	To furnish and install, complete, ready for use.
E.	Wiring Duct	Pathway for wire management inside of panels.
F.	Wiring Trough	Wiring enclosure used to manage wiring outside of panels.

1.3 SYSTEM DESCRIPTION

A. Control panel enclosures are used to protect controllers.

B. Control panel enclosure general requirements.

1. Locate enclosures adjacent to and independent of equipment served.
   (a) Provide a minimum of 3 ft clearance in front of door.
   (b) Provide sufficient clearances to allow full door swing and full access to internal components.
   (c) Remote mounted panels are acceptable where accessibility will be significantly improved.
2. Products mounted within the enclosure will be on a removable internal panel/backplane.
3. Wire, cable, and tubing located inside enclosure will be routed within a raceway.
4. Provide instrument and equipment tag numbers included on submittal documents.
5. Provide terminal strips for total controller input/output (I/O) count plus 20% spare capacity with analog and discrete spare capacity calculated separately.

1.4 SUBMITTALS

A. Refer to section 25 0100.

1.5 QUALITY ASSURANCE

A. Refer to section 25 0100.

1.6 WARRANTY

A. Refer to section 25 0100.

PART 2 - PRODUCTS

2.1 ENCLOSURES

A. Manufacturer: Hoffman, Hammond Manufacturing or approved equal.

B. Construction:

1. Minimum 14-gauge steel
2. Hinged door
3. Removable internal panel/backplane
4. ANSI 61 external powder paint finish
5. Cylinder locks and 2 master keys for panels less than 8 foot above finished floor
6. Include print pockets on the inside of enclosure doors
7. Miscellaneous steel components, e.g. standoffs, shall be 12-gauge minimum rolled steel

C. Provide National Electrical Manufactures Association (NEMA) type 1 enclosures for dry indoor locations.

D. The minimum size for enclosure fastening anchors shall be 9/16" for floor anchors and 3/8" bolt for wall anchors. Increase anchor sizes as required for heavy enclosures.

E. Provide NEMA type 4 control panel enclosures in outdoor locations

F. Dimensions:

1. Size enclosure internal dimensions to include at least 25 percent spare area on the panel's backplane.

2.2 WIRING DUCT

A. Manufacturers: Panduit, Tyton, or approved alternate.

B. Construction:

1. Slotted plastic or vinyl (PVC)
2. Grey or white
3. Snap-on covers

2.3 WIRING TROUGH

A. Manufacturer: Hoffman, Hammond Manufacturing or approved equal.

B. Construction:

1. Minimum 14-gauge steel
2. Unpainted galvanized finish

3. Flat cover

2.4 DC POWER SUPPLIES

A. Transformers for use with digital controllers, actuators.

1. Input Power: 120VAC to 480VAC

2. Output Power: 24VAC

3. Minimum capacity 40VA

2.5 UNINTERRUPTIBLE POWER SUPPLY (UPS)

A. UPS units shall provide continuous, regulated output power without using their batteries during brown-out, surge, and spike conditions.

B. Load served shall not exceed 75 percent of UPS rated capacity, including power factor of connected load.

1. Larger-capacity units shall be provided for systems with larger connected loads.

2. UPS shall provide at least 5 minutes of battery power.

C. Performance:

1. Input Voltage: Single phase, 120- or 230-V ac, compatible with field power source.

2. Load Power Factor Range (Crest Factor): 0.65 to 1.0.

3. Output Voltage: 101- to 132-V ac, while input voltage varies between 89 and 152-V ac.

4. On Battery Output Voltage: Sine wave.

5. Inverter overload capacity shall be minimum 150 percent for 30 seconds.

6. Recharge time shall be a maximum of six hours to 90 percent capacity after full discharge to cutoff.

7. Surge Voltage Withstand Capacity: IEEE C62.41, Categories A and B; 6 kV/200 and 500 A; 100-kHz ringwave.

D. UPS shall be automatic during fault or overload conditions.

E. Unit with integral line-interactive, power condition topology to eliminate power contaminants.

F. Include front panel with power switch and visual indication of power, battery, fault, and temperature.

G. Unit shall include an audible alarm of faults and front panel silence feature.

H. Unit with four NEMA WD 1, NEMA WD 6 Configuration 5-15R receptacles.

I. UPS shall include dry contacts (digital output points) for low battery condition and battery-on (primary utility power failure) and connect the points to the DDC system.

J. Batteries shall be sealed lead-acid type and be maintenance free. Battery replacement shall be front accessible by user without dropping load.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

A. Provide control panel enclosures except those furnished by equipment manufacturers for factory mounted controls.

B. Provide wiring duct, wiring trough, AC power supplies, and UPS.

C. Schedule and coordinate work with DMS and applicable trades.

D. Provide supplementary or miscellaneous materials, equipment, and labor necessary to implement a fully functional BAS irrespective of whether it is identified within this specification and/or construction documents.

E. Install materials and products in a neat, workmanlike manner, and in accordance with manufacturer's recommendations.

F. Confirm work and materials comply with applicable codes, standards, specifications, statutes, ordinances, and regulations of governmental authorities having jurisdiction.

G. Promptly notify the DMS Project Manager (PM) of conflicts between the Construction Documents and DMS Integrated Automation Standards.

H. Install enclosures in locations shown on Construction Documents.

1. Mount top of panels 5-foot above floor.

2. Provide a minimum of 3 ft clearance in front of door.

3. Provide sufficient clearances to allow full door swing and full access to internal components.

I. Install 20-amp GFCI duplex receptacle with toggle style switch to disconnect power.

1. Mount receptacle inside enclosure, space permitting, or within 4 inches of enclosure.

2. Wire receptacle on the hot side of the enclosure disconnect switch.

J. Route and terminate wiring parallel and at right angles within panels.

K. Terminate field cable and wire using heavy-duty terminal blocks. Install a maximum of two wires on each terminal side.

L. Locate terminal strips either horizontally in upper half of back panel or vertically. Space wire-ways and terminal strips 3" apart.

M. Separate 24 Volts Direct Current and 120 Volts Alternating Current (VAC) terminal strips, wire, cable, and devices by 6" minimum space.

N. Comply with section 25 0500 for cables and pathways.

O. Label enclosures with respective unique ID numbers in accordance with section 25 0500.

3.2 FLOOR MOUNTED ENCLOSURES:

A. Unless otherwise specified, install floor mounted control panel enclosures on four 4" concrete equipment pad with grout as required.

B. Install two (2) anchors for each four (4) feet of equipment length or minimum of four (4) anchors. Decrease anchor spacing for heavy panels as required. Bolt equipment to pad using cap screws and washers.

C. Complete necessary grouting after equipment is installed and leveled. Grouting material shall be Owner approved cement grout; mixed and placed in accordance with manufacturer's recommendations. Remove leveling shims and wedges after grout has hardened. Re-grout Shim and wedge areas after shims or wedges are removed.

3.3 WALL MOUNTED ENCLOSURE:

A. Provide two anchors for every four (4) feet of outside perimeter for wall mounted panels; minimum number of anchors shall be 4. Decrease anchor spacing for heavy panels as required.

B. Provide clear space around enclosure for:

1. Installation of pathways.

2. Pulling wire and cabling.

3. Dressing out wiring and cabling.

C. Align panels and sub-panels in vertical and horizontal alignment, where possible.

3.4 LIFTING LUGS:

A. Remove lifting lugs after enclosures are set and use short, full-thread, hex-head machine screws to fill lug holes.

3.5 INSTRUMENT MOUNTING:

A. Ensure connections can be easily made and ample room exists for servicing each item. Every component in and on enclosures shall be able to be removed individually without affecting other components and without the need to move other components.

B. Install devices prior to terminating wire or tubing.

C. Rigidly attach instruments with properly sized stainless-steel screws or bolts so they may be removed.

D. Provide gaskets for instruments penetrating enclosure exterior and seal in accordance with NEMA standards. Entire enclosure shall meet NEMA standard after installation of required devices.

3.6 KNOCKOUTS:

A. Flame cutting or arc-cutting is not permitted.

B. Cutouts shall be smooth and without irregularity from desired shape.

C. Provide rubber grommets in cutouts to protect wiring and tubing.

3.7 PNEUMATIC TUBING

A. Do not splice tubing within panel. Use bulkhead bars for circuit extensions.

B. Mount tubing so that tubing run(s) do not interfere with removal of components.

C. Terminate interior pneumatic components to bulkhead bars. Terminate incoming tubing to these bulkheads.

D. Install tubing along vertical or horizontal runs to present neat appearance. Angled runs are not allowed.

E. Label pneumatic tubing.

3.8 WIRING DUCT

A. Install wiring duct along vertical or horizontal runs to present neat appearance.

B. Permanently fasten wire duct into sub-panels using 10/32 screws.

C. Support lower sidewall on horizontal runs of plastic wiring duct with bracing to avoid sagging.

D. Install wiring between devices and terminal blocks in wiring duct except for dressing out to make terminations.

E. Wiring duct fill shall not exceed 40% of wiring duct volume.

F. Provide labels on wiring duct designating AC and DC wiring.

3.9 WIRING TROUGH

A. Provide wiring trough above or parallel to control panel enclosures.

B. Route wiring through wire trough to minimize wire tension and allow re-routing of wire when necessary.

3.10 ELECTRICAL POWER CONNECTIONS

A. Connect electrical power to controllers requiring connections.

B. Electrical power design not specified in the Construction Documents is the responsibility of the Controls Contractor.

3.11 DC POWER SUPPLIES

A. Provide transformer with a means of disconnect.

B. Locate transformer in upper left or upper right side of enclosure to minimize 120V power wiring inside enclosure.

3.12 UPS

A. Provide UPS specified in this section.

B. Install UPS inside the enclosure, or adjacent to the enclosure if there is insufficient room.

C. Connect the UPS to condition the incoming power on the line side of enclosure devices.

END OF SECTION

SECTION 25 1500

GRAPHICS

PART 1 - GENERAL

1.1 SUMMARY

A. This section provides requirements for graphic generation and the end user interface within the Building Automation System (BAS).

1.2 DEFINITIONS

A.	Provide	To furnish and install, complete, ready for use.
B.	Web Server	Oversees distribution of global data, sharing of information between controllers, provides remote access to the building, and hosts graphical displays for standard web browser.

1.3 SYSTEM DESCRIPTION

A. Each building in the BAS will have the following graphics:

1. Home page
2. Legend page
3. Floor plans
4. Dashboard
5. Communications riser

B. Each building will have graphics for the equipment listed below, as applicable:

1. Chilled water system
2. Heating hot water system
3. Air Handling Units (AHU)
4. Terminal equipment
5. Exhaust systems
6. Lighting systems
7. Generators
8. Fuel tank monitoring systems

C. Coordinate additional graphics requirements with DMS Chief of Building Systems and DMS BAS Subject Matter Expert.

D. Graphics will have consistent use of colors, units, symbols, and descriptions. Include the following:

1. Text description
2. Calculated and shared points

3. Integrated points

4. Associated points, including dynamic input values, output values, set points, gains, time schedules.

5. System schematic or picture

6. Alarm fields

E. Floor Plans

1. Coordinate with as-built drawings to include

(a) Room name and numbers

(b) Column numbers

2. Identify

(a) Heating, Ventilation, and Air Conditioning (HVAC) zones by AHU

(b) HVAC rooms served by singe space sensor

3. Allow penetration to associated system graphic

F. Additional floor plan requirements include

1. Automated Temperature Controls system

2. Fire dampers controlled by BAS

3. Color coded temperature zones

4. Color coded alarms

G. Dashboards will include the following data, if available:

1. Local weather

2. Facility cost per hour

3. Facility alarms

4. Facility utility usage

H. Dynamic Risers:

1. System service and status

2. Hardware service and status

I. Summaries:

1. Alarms

2. Overrides

3. Transactions

4. Air Handling Units

5. Terminal Units

6. Exhaust

J. Provide organized hierarchy

1. Provide penetration from home page down to instrument level using mouse point and click feature.

2. Provide penetration from instrument level back up to home page level using mouse point and click feature.

3. Provide links from sub-systems to main systems:

(a) Air terminal shall have a link to associated AHU.

(b) AHU shall have a link to cooling, heating, exhaust, energy recovery.

(c) Labs shall have a link to supply and exhaust systems.

(d) Floor plan will have link to terminal equipment such as variable air volume boxes.

4. Provide links to the following:

(a) Vendor controls as-builts

(b) Equipment schedules

(c) Mechanical plans

5. Organize system data that:

(a) Input and output points on graphics are relative to actual field locations.

(b) Locate control loop setpoints close to controlled loop variable.

(c) Locate commanded points close to feedback.

(d) Locate global information in upper left corner of the page.

6. Measured Units

(a) Unless indicated otherwise on the construction documents, point values shall be displayed with one decimal place.

7. All valve and damper positions shall be denoted as percent OPEN.

(a) The damper icon blades will dynamically adjust to open or close based on actual damper position.

8. Vendor names and logos are not permitted on graphics.

1.4 SUBMITTALS

A. Refer to section 25 0100.

1.5 QUALITY ASSURANCE

A. Graphics

1. Only graphics templates supplied by DMS in a Niagara Station File are allowed.

2. Site graphics will be built in a JAVA Application Control Engine designated as the site Web Server.

3. Site graphics will be replicated on the Niagara Supervisor.

B. Refer to section 25 0100 for additional requirements.

1.6 WARRANTY

A. Refer to section 25 0100.

PART 2 - PRODUCTS

2.1 Tridium Niagara.

PART 3 - EXECUTION

3.1 GENERAL

A. Modify each applicable template provided by DMS in the Niagara station file by type, piece, and configuration of equipment to be integrated to the BAS.

1. Create site graphics in a JACE designated as the Web Server.

2. Replicate site graphics in the JACE on the Niagara Supervisor.

B. Modify standardized header on each graphic page to include the following information:

1. The current outside air temperature, outside relative humidity, date, and time information at top right corner of the page.

2. Navigational links to applicable sub-system graphics, previous page, and home page in the top left corner of the page.

3. Building name, page name or equipment tag, and equipment location by room number or room name at top middle of page.

C. Display control points on equipment graphics shown in as-built control drawings.

D. Display setpoints of analog inputs on the equipment graphic.

E. Display equipment status as ON or OFF.

F. Configure equipment icons to act as a link to the corresponding page of integrated points.

G. Configure font background to turn yellow upon loss of communication.

H. Configure font background to turn red and the text will blink when input values are outside their respective setpoints to indicate an alarm condition.

I. Configure setpoints and settings to be overridden by users.

J. Create a Table List on the left-hand side of each equipment graphic to display pertinent sensor input and set points.

K. Fans (Applicable to fans)

1. Fan status will be visually represented with dynamic spinning of the fan wheel when the fan is ON. The fan wheel will remain static when the fan is OFF.

2. An alarm point shall be added to indicate alarm condition when fan is commanded ON but registers an OFF condition.

3. Lead-lag fan timer will be automatically updated as fan rotation occurs.

4. Fan operating kW will be displayed.

5. Where fan is controlled by VFD, provide fan VFD speed command, 0 – 100 percent. If the VFD can exceed 60 Hertz (Hz) during normal operation, 100% will correspond to the maximum speed the VFD can achieve.

6. Fan status will be derived from the output power reading.

L. Pumps (Applicable to pumps)

1. Pump status will be visually represented by dynamically spinning the impeller wheel when the pump is ON. The impeller wheel will remain static when the pump is off.

2. An alarm point shall be added to indicate alarm condition when pump is commanded ON but registers an OFF condition.

3. Pump operating kW will be displayed.

4. Where pump is controlled by VFD, provide pump VFD speed command, 0 – 100 percent. If the VFD can exceed 60 Hertz (Hz) during normal operation, 100% will correspond to the maximum speed the VFD can achieve.

5. Lead-lag pump timer will be automatically updated as pump rotation occurs.

6. Pump status will be derived from the output power reading.

3.2 INDIVIDUAL PAGES

A. Home Page

1. A picture of the building will appear in the left-hand corner of the page. The picture will not act as an active link.

2. Under the building picture, provide links to the following:

(a) Chilled water system

(b) Heating hot water system

(c) Air handling units

(d) Floor plans

(e) Terminal equipment

(f) Exhaust systems

(g) Lighting systems

(h) Generator

(i) Fuel tank monitoring system

(j) Legend

(k) Dashboard

(l) Communications riser

B. Legend Page

1. Provide detailed explanation of color changes for alarms and temperature color coding on floor plans.

C. Dashboard

1. Provide an overview of the building's energy consumption and its pressurization status.

2. Provide near-real time calculations for the dynamic points below, if available:

(a) Chilled water consumption (kBtu/hr)

(b) Steam consumption (lbs/hour)

(c) Electric consumption (kWh)

(d) Total building energy cost ($/sq. ft.)

(e) Outside and return air enthalpy

3. Provide calculations for totalization points including:

(a) Runtime Hours on major equipment

(b) Monthly Energy Cost

(c) Yearly Energy Cost

4. Provide an alarm bell as a visual indicator and an active link. The bell will display one of two colors; green or red. A green color signifies that building systems are operating normally, while a red color indicates that certain systems within the building are in alarm mode. Provide users the option to customize activation of the red color for the alarm bell, allowing it to trigger only in the presence of high-priority alarms. Additionally, provide a direct link to the alarm management page.

5. Provide a building pressurization indicator to illustrate the building's pressure relative to the outdoors. The indicator bar will be segmented into green and red areas, where green signifies positive building pressure and red indicates negative pressure. The current

building pressure will be displayed beneath the bar sourced from the building's differential pressure sensor. In cases where multiple sensors serve the building, the displayed building pressure will reflect the worst-case scenario for differential pressure.

6. Provide energy consumption gauges with indicator arrows to present real-time energy usage for each measured utility. Scale and resolution of gauges will adjust to correspond with peak design conditions. Energy consumption will be displayed beneath the gauges. The gauge indicator arrows will mirror the value displayed beneath the gauge.

D. Floor Plans

1. The floor plan will accurately represent the as-built layout of rooms in the building.

2. Each floor plan page will include:

(a) Header information detailed in paragraph 3.1.

(b) Room numbers and thermostat placement.

(c) Demarcation lines to indicate areas or zones served by each AHU.

(d) Dynamically changing alarm condition within its boundaries by changing from a green to red background color.

(e) Links to other floors in the bottom left-hand corner of the page.

3. Floor plans in large facilities may be divided into sections as needed to facilitate visualization of room numbers and sensor placement.

(a) Upon selecting a link to a particular floor, the entire floor plan page will be displayed with a dotted line indicating section boundaries.

(b) Label the sections based on either cardinal direction (North, South, East, West) or ordinal directions (Northeast, Southeast, Northwest, and Southwest).

(c) Each label will act as a link to the corresponding floor plan section.

4. Each thermostat icon will act as a link to the corresponding air terminal unit page.

5. Lab Systems

(a) Lab system floor plan page shall depict location of relevant components:

(1) Fume hoods

(2) Air flow control valves

(3) Supply fans

(4) Exhaust fans

(5) Thermostats

(b) Air change rate information shall be calculated based on the room’s volume and the direction of airflow. Positive rooms shall use total supply and negative rooms shall use total exhaust.

(c) The following data points will be in the table list for each lab:

(1) Supply air volume

(2) Total exhaust

(3) Room pressure differential. An alarm point shall be added to indicate a negative pressure alarm when room pressure differential is negative.

(4) Zone temperature

(5) Heating setpoint

(6) Cooling setpoint

(7) Fume hood sash position

(d) All pertinent sensor inputs will be displayed on the graphic.

(e) Provide dynamic representation of equipment statuses, where applicable.

E. Air Handling Units

1. AHU page will include header information detailed in paragraph 3.1.

2. AHU page shall depict location relevant components:

(a) Fans

(b) Dampers

(c) Coils

(d) Valves

(e) VFDs

(f) Filter

(g) Sensors

3. The following additional information will be included as applicable:

(a) Cooling and economizer mode setpoints

(b) Mode of Operation including dehumidification mode, economizer mode

(c) Economizer run time (reset per day)

(d) Average Air Terminal Unit (ATU) damper position served by AHU

(e) ATU driving AHU's Static Pressure Reset Setpoint

(f) Total airflow CFM derived by adding airflows associated with ATUs served by AHU

4. All pertinent sensor inputs will be displayed on the graphic.

5. Provide dynamic representation of equipment statuses, where applicable.

6. Filter status will be displayed as CLEAN or DIRTY. An alarm point shall be added to indicate alarm when the filter is dirty.

7. An alarm point shall be added to the Outside Air temperature to indicate low temperature alarm when temperature is below a user defined threshold.

8. An alarm point shall be added to the Static Pressure to indicate high pressure alarm when pressure is above a user defined threshold.

9. An alarm point shall be added to indicate a smoke alarm.

10. UV lights status shall be displayed as ON or OFF.

F. Air Terminal Units

1. Air terminal unit page will include header information detailed in paragraph 3.1.

2. ATU page shall depict location of relevant components:

   (a) Fan

   (b) Damper

   (c) Coil

   (d) Valve

   (e) VFD

   (f) Sensors

3. The following information will be included in the Table List:

   (a) Fan status

   (b) Zone temperature

   (c) Heating and cooling setpoints

   (d) Supply airflow minimum and maximum setpoints

   (e) Damper command

4. All pertinent sensor inputs will be displayed on the graphic.

5. Provide dynamic representation of equipment statuses, where applicable.

6. Provide links to associated as-built reference information at the bottom of the page.

7. Pages depicting laboratory air terminal equipment will include air flow control valves with their respective tags displayed on their icon per as-built drawings.

G. Exhaust System

1. Exhaust system page will include header information detailed in paragraph 3.1.

2. Exhaust system page will include relevant components:

   (a) Fans

   (b) Dampers

   (c) Sensors

3. The following additional information will be included as applicable:
    (a) Average ATU position served by Exhaust Fan (EF) system
    (b) ATU driving EF's Static Pressure Reset Setpoint
    (c) Total airflow CFM derived by adding airflows associated with ATUs served by EF
4. All pertinent sensor inputs will be displayed on the graphic.
5. Provide dynamic representation of equipment statuses, where applicable.
6. An alarm point shall be added to Static Pressure to indicate low pressure alarm when pressure is below a user defined threshold.

H. Chilled Water System

1. Chilled water system page will include header information detailed in paragraph 3.1.
2. Chilled water system page will include relevant components:
    (a) Chillers
    (b) Primary/secondary loops
    (c) Condenser water loop
    (d) Pumps
    (e) Valves
    (f) Cooling towers
    (g) Cooling tower fans
    (h) VFD
    (i) Sensors
3. The following information will be included in the Table List:
    (a) Outside air temperature
    (b) Plant differential pressure
    (c) System enable
    (d) Set points
4. All pertinent sensor inputs will be displayed on the graphic.
5. Provide dynamic representation of equipment statuses, where applicable.
6. Each chiller icon will act as a link to the corresponding page of internal chiller control points.

I. Condenser Water System

1. The condenser water system page will include header information detailed in paragraph 3.1.

2. The condenser water system page will include relevant components:
    (a) Condenser water loop
    (b) Cooling towers
    (c) Cooling tower fans
    (d) Pumps
    (e) Valves
3. The following information will be included in the table list:
    (a) Outdoor air temperature wet bulb
    (b) Pump status
    (c) Fan speed
    (d) Leaving water temperature
    (e) Entering water temperature
    (f) Set points
4. All pertinent sensor inputs will be displayed on the graphic.
5. Provide dynamic representation of equipment statuses, where applicable.

J. Heating Hot Water System
1. Hot water system page will include header information detailed in paragraph 3.1.
2. Hot water system graphic will include relevant components:
    (a) Boilers
    (b) Primary/secondary pumps
    (c) Valves
    (d) Heat exchangers
    (e) Sensors
3. Provide dynamic representation of equipment statuses, where applicable.

K. Variable Frequency Drive
1. The VFD page will include header information detailed in paragraph 3.1.
2. All available analog and binary inputs will be shown with appropriate names and units.
3. Fan or pump status will be derived from the output power reading.

END OF SECTION

SECTION 25 3501

ACTUATORS, SWITCHES AND RELAYS

PART 1 - GENERAL

1.1 SUMMARY

A. Section provides requirements for actuators, positioners, switches, and relays.

1.2 DEFINITIONS

A.	Controller	Intelligent, stand-alone, programmable Direct Digital Control device used in a BAS to control building equipment and systems.
B.	Furnish	To supply and deliver to the project site, ready to be install.
C.	Install	To place in position for service or use.
D.	Provide	To furnish and install, complete, ready for use.

1.3 GENERAL RESPONSIBILITIES

A. Controls Contractor shall

1. Provide control valve actuators, damper actuators, positioners, low limit switches, pressure switches, current switches, position switches, level switches, flow switches, and control relays.

2. Schedule and coordinate work with DMS and applicable trades.

3. Provide supplementary or miscellaneous materials, equipment, and labor necessary to implement a fully functional IAS irrespective of whether it is identified within this specification and/or construction documents.

4. Install materials and products in a neat, workmanlike manner, and in accordance with manufacturer's recommendations.

5. Confirm work and materials comply with applicable codes, standards, specifications, statutes, ordinances, and regulations of governmental authorities having jurisdiction.

1.4 SYSTEM DESCRIPTION

A. Control valve actuators, damper actuators, positioners, low limit switches, pressure switches, current switches, position switches, level switches, flow switches, and control relays used for the control of Heating, Ventilation, and Air Conditioning systems.

B. Include components not specifically indicated or specified, but necessary to make the system function within the intent of the specification and in accordance with control sequences located on contract documents.

C. Unless otherwise specified, functionality of interlocks and safeties shall be operational in hand, auto, or bypass for Variable Frequency Drives (VFDs).

1.5 SUBMITTALS

A. Refer to section 25 0100.

1.6 QUALITY ASSURANCE

A. Refer to section 25 0100.

1.7 WARRANTY

A. Refer to section 25 0100.

PART 2 - PRODUCTS

2.1 GENERAL

A. Electrical devices, switches, and relays shall be UL listed and of type meeting current and voltage characteristics of project.

B. Manufacturer will be International Organization for Standards (ISO) 9000 certified.

C. Ratings of normally open and normally closed contacts shall be adequate for applied load (minimum 5 amps at 240 Volts) unless otherwise specified.

D. Mount adjustable or resettable instruments for easy access without the need for a ladder, flashlight.

E. Install actuators, switches, and relays in accordance with manufactures recommendations.

2.2 ANALOG ELECTRONIC ACTUATORS

A. Manufacturers: Belimo, Honeywell, Johnson Controls, Siemens Building Technologies or approved equal.

B. Modulating actuator input signals shall be, 0-5 Voltage Direct Current (VDC), 2-10VDC, or 0-10VDC. Floating or pulsing signals are not allowed.

C. Provide spring return feature for fail open or closed positions as required by control sequence or control drawings.

D. Provide actuator with a conduit fitting.

E. Non-spring return actuators and spring return actuators with more than 60lbs torque, shall have an external manual gear release to allow manual positioning of the damper when the actuator is not powered.

F. Provide local service switch for large valves powered by 120 Volts Alternating Current (VAC).

G. Spring return not required for terminal equipment.

H. Provide analog feedback as required by control sequence or control drawings.

2.3 DISCRETE TWO-POSITION ELECTRIC ACTUATORS

A. Manufacturers: Belimo, Honeywell, Johnson Controls, Siemens Building Technologies or approved equal.

B. Provide spring return feature for fail open or closed positions as required by control sequence or control drawings.

C. Non-spring return actuators and spring return actuators with more than 60lbs torque, shall have an external manual gear release to allow manual positioning of the damper when the actuator is not powered.

D. Provide local service switch for large valves powered independent of control signal or powered by 120VAC.

E. Provide discrete feedback as required by control sequence or control drawings.

2.4 PNEUMATIC ACTUATORS

A. Pneumatic Diaphragm with Spring Return

1. Actuators shall be selected to match maximum diaphragm air pressure, fail position, stroke, shut-off pressure, temperature, torque, required for intended service. Unless otherwise scheduled, diaphragm air pressure shall be sufficient to provide 100 percent valve shut-off at least equal to pump shut-off head or 125 percent of rated flow head for water systems, or full rated pressure for steam systems.

2. Select spring ranges to match intended service. If valves or dampers are sequenced, spring ranges shall not overlap.

3. Provide spring return feature for fail open or closed positions, as required by control sequence, for outside, return, or exhaust dampers, heating and cooling coils on major air handling units, humidifiers, heat exchangers, and flow control for chillers, cooling towers, and boilers.

2.5 LOW LIMIT TEMPERATURE SWITCHES

A. Manufacturers: Siemens, Johnson Controls/Penn or equal

B. Electric 2-position type with temperature sensing element and manual reset.

C. Capable of opening circuit if1-foot length of sensing element is subject to temperature below setting.

D. Include auxiliary contact for alarm condition reporting to the building automation system.

E. Minimum Requirements:

1. Set Point Range: 35 Deg F to 45 Deg F.

2. Switch differential: .12 Deg F

3. Contact Type: SPST-NC

4. Ratings:

(a) 16 amps @ 120VAC,

(b) 9.2amps @ 208VAC

(c) 8 amps @ 240VAC

(d) 125VA @ 24 277VAC (Pilot Duty)

2.6 DRY PRESSURE SWITCHES

A. Manufacturers: Cleveland, Allen Bradley, Ashcroft, Dwyer, Honeywell, Johnson Controls/Penn, Siemens Building Technologies, Invensys, SOR, or United Electric. Or approved equal.

B. Field adjustable set point, differential pressure type.

C. Manual Reset.

D. Minimum Requirements:

1. Set Point Range: 1.25 inches w.c to 12.0 inches w.c.

2. Switch differential: .06 inches min to 0.8 inches max

3. Contact Type: SPST-NC

4. Ratings:

(a) 15 amps @ 125, 250 or 277VAC

(b) .5 Volt-Ampere (VA) @ 24VAC

(c) ¼ Horsepower (HP) @ 125VAC

(d) ½ HP @ 250VAC

E. UL approved for application.

F. Include auxiliary contact for alarm condition reporting to the control system.

2.7 CONTROL RELAYS

A. Non-enclosed relays

1. Manufacturers: IDEC, Potter Brumfield, Square D, or Allen Bradley.

2. Equal to IDEC type RH2B-U, miniature 8 blade pilot relay with DPDT silver cadmium oxide contacts rated at 10 Amps (A), 30VDC, or 120VAC. Coil shall match control circuit characteristics.

3. Rectangular base socket mount with blade type plug-in terminals and polycarbonate dust cover.

4. Provide DIN rail mountable (Snap type) mounting sockets equal to IDEC SH2B-05.

5. Include manual override

B. Enclosed Relay (Relay-in-a-Box):

1. Manufacturers: Veris Industries, Kele & Associates, Functional devices, Inc. or approved equal.

2. 1 or 2 SPDT relays in NEMA 1 or better enclosure. Coil shall be selected for control circuit characteristics.

3. Contacts rated at 10A, 28VDC or 120VAC. Conduit nipple is 1/2 inches National Pipe Thread. Maximum coil current burden 50 milliamps.

4. LED status indication.

5. Include Hand-Off-Auto (HOA) switch

2.8 CURRENT SWITCHES

A. Manufacturers: Veris Industries, N-K Technologies, Absolute Process Instruments, Kele & Associates, R-K Electronics or approved equal.

B. Induction type sensors clamped over single- phase conductor of AC electrical power and shall be solid-state sensors with adjustable threshold, visual indication and normally open contacts. Each current switch shall be selected for proper operating range of current.

2.9 POSITION SWITCHES (END SWITCHES)

A. Manufacturers: Allen Bradley, Johnson Controls/Penn, Honeywell, Ruskin, Greystone Energy Systems, NAMCO, Kele & Associates, Omron or Westlock.

B. SPDT contacts rated for application.

C. Provide damper brackets and connecting rods for connecting position switch actuation levers to damper blades or jackshafts.

D. Mercury type position switches are not allowed.

2.10 THERMAL DISPERSION FLOW SWITCHES:

A. Manufacturers: Fluid Components, Inc., Delta M, Dwyer or Magnetrol.

B. Units shall use thermal dispersion sensors to detect flow from heated reference elements whenever flow is above threshold setpoint. Setpoint shall be adjustable between 20 and 80 percent flow. Select units for proper installation orientation.

1. Maximum Response Time: 1 minute

2. Maximum Temperature: 200 Deg F

3. Repeatability: ± 1 percent

4. Pressure Rating: 300 pounds per square inch (psi) for chilled water

(a) 150 psi for other applications

2.11 LEVEL SWITCHES:

A. Manufacturers: Drexelbrook, Magnetrol, Endress and Hauser or Dwyer.

B. Radio Frequency (RF) type continuous level probe with multiple adjustable setpoints and Single Pole Double Throw (SPDT) snap action contacts to meet intended use. Probe shall have shielding to reject buildup of conductive, sticky, or viscous material. Probe length shall match vessel dimensions to measure within 6 inches of bottom.

C. Provide probe brace every 4 ft if probe length exceeds 6 ft, and not installed in stilling well.

1. Supply Voltage: 120VAC/60 Hertz

2. Fail Safe: Low Level output on instrument failure

3. Ambient Temperature Limits: -40 to 160 Deg F

4. Minimum Enclosure Rating: NEMA 4

5. Transmitter Mounting: Remote

6. Performance:

   (a) Accuracy: ± 2 percent nominal

   (b) Linearity: ± 1 percent nominal

   (c) Repeatability: ± 1 percent nominal

   (d) Response Time: 20 milliseconds

   (e) Ambient Temperature Effect: 2 percent per 100 Deg F max.

   (f) Voltage Variation Effect: ± 0.2 percent maximum per 10V change

PART 3 - EXECUTION

3.1 ANALOG ELECTRONIC ACTUATORS

A. Provide actuator for dampers and valves with sufficient capacity to operate under conditions.

B. Select actuators to provide tight shut-off against maximum system temperatures and pressure encountered.

C. Each actuator shall be full-modulating as specified and shall be provided with spring-return for fail open or fail closed position for, heating or cooling protection on power interruption.

D. Fail steam valves serving pressure rated heat exchangers or converters closed unless otherwise shown.

E. Valve and damper operating speeds shall be selected or adjusted so that actuators will remain in step with controllers without hunting, regardless of load variations. Actuators acting in sequence with other actuators shall have adjustment of control sequence as required by operating characteristics of system.

F. Provide proper linkage and brackets for mounting and attaching actuators to devices. Design mounting and/or support to provide no more than 5 percent hysteresis in either direction (actual movement of valve stem or damper shaft versus ideal movement) due to deflection of actuator mounting.

G. Coordinate the factory installation of control valve actuators and operators where possible.

H. Mount actuators and operators outside the airstreams.

3.2 DISCRETE TWO POSITION ELECTRIC ACTUATORS

A. Provide actuators for dampers and valves with sufficient capacity to operate under conditions.

B. Select actuators to provide tight shut-off against maximum system temperatures and pressure encountered.

C. Each actuator shall be two-position as specified and shall be provided with spring-return for fail open or fail closed position for, heating or cooling isolation or protection on power interruption.

D. Valve and damper operating speeds shall be selected or adjusted so that actuators will remain in step with controllers without hunting, regardless of load variations. Actuators acting in sequence with other actuators shall have adjustment of control sequence as required by operating characteristics of system.

E. Provide proper linkage and brackets for mounting and attaching actuators to devices. Design mounting and/or support to provide no more than 5 percent hysteresis in either direction (actual movement of valve stem or damper shaft versus ideal movement) due to deflection of actuator mounting.

3.3 PNEUMATIC ACTUATORS

A. Provide actuators for Air Handlers, Exhaust Fans, Hydronic systems, and steam systems.

B. Provide actuator for each automatic damper or valve with sufficient capacity to operate damper or valve under conditions.

C. Select actuators to provide tight shut-off against maximum system temperatures and pressure encountered.

D. Each actuator shall be full-modulating, or two-position type as required or specified, and shall be provided with spring-return for fail open or fail closed position for fire, freeze, occupant safety, equipment protection, heating or cooling protection on power interruption as.

E. Valve and damper operating speeds shall be selected or adjusted so that actuators will remain in step with controllers without hunting, regardless of load variations. Actuators acting in sequence with other actuators shall have adjustment of control sequence by operating characteristics of system.

F. Provide proper linkage and brackets for mounting and attaching actuators to devices. Design mounting and/or support to provide no more than 5 percent hysteresis in either direction (actual movement of valve stem or damper shaft versus ideal movement) due to deflection of actuator mounting.

G. Coordinate the factory installation of control valve actuators and operators.

H. Mount actuators and operators outside the airstreams of unit.

3.4 LOW LIMIT TEMPERATURE SWITCHES

A. Provide low limit temperature switches where indicated on drawings to accomplish sequences.

B. Unless otherwise indicated, install sensing element on upstream face of cooling coil where cooling coil is provided, or at downstream side of heating coils where no cooling coil is provided.

C. Size element or add additional elements to cover no less than one lineal foot per square foot of coil surface areas.

D. Unless otherwise indicated, adjust temperature switch setpoint to 38 Deg F.

E. Distribute sensing element across entire area of medium being sensed.

F. Install controls at accessible location with suitable mounting brackets and element duct collars where required.

3.5 DRY PRESSURE SWITCHES

A. Provide pressure switches where indicated on drawings to accomplish sequences.

B. Unless otherwise indicated, adjust high static pressure switch to .5 inches w.c less than equipment of duct static ratings.

3.6 WET PRESSURE SWITCHES

A. Provide pressure switches where indicated on drawings to accomplish sequences.

B. Select switches for accuracy, ranges (20 to 80 percent of operating range) and dead band to match process conditions, electrical requirements and to implement intended functions.

3.7 CONTROL RELAYS

A. Provide control relays where indicated on drawings to accomplish sequences.

B. Provide DIN mounted relays in control panels.

C. Provide Rib in a Box type relays for field control devices and chillers, air handling units, pumps, and VFD's.

1. Mount relay for easy accessibility.

2. Mount relay for easy visual accessibility.

3.8 CURRENT SWITCH

A. Provide current switches where indicated on drawings to accomplish sequences.

B. Locate in starter or VFD or in an appropriate adjacent enclosure.

3.9 POSITION SWITCHES (END SWITCHES)

A. Provide end switches where indicated on drawings to accomplish sequences.

3.10 THERMAL DISPERSION FLOW SWITCHES:

A. Provide dispersion flow switches where indicated on drawings to accomplish sequences.

3.11 LEVEL SWITCHES:

A. Provide level switches where indicated on drawings to accomplish sequences.

END OF SECTION

SECTION 25 3502

AIR, GAS, AND WATER MEASUREMENT

PART 1 - GENERAL

1.1 SUMMARY

A. This section provides requirements for sensors, transmitters, and instrumentation for measurement of air, water, and gas.

1.2 DEFINITIONS

A.	Controller	Intelligent, stand-alone, programmable Direct Digital Control device used in a BAS to control building equipment and systems.
B.	Furnish	To supply and deliver to the project site, ready to be install.
C.	Install	To place in position for service or use.
D.	Provide	To furnish and install, complete, ready for use.

1.3 GENERAL RESPONSIBILITIES

A. Controls Contractor shall

1. Provide sensors, transmitters, and instrumentation for measurement of air, water, and gas.
2. Schedule and coordinate work with DMS and applicable trades.
3. Provide supplementary or miscellaneous materials, equipment, and labor necessary to implement a fully functional IAS irrespective of whether it is identified within this specification and/or construction documents.
4. Install materials and products in a neat, workmanlike manner, and in accordance with manufacturer's recommendations.
5. Confirm work and materials comply with applicable codes, standards, specifications, statutes, ordinances, and regulations of governmental authorities having jurisdiction.

1.4 SYSTEM DESCRIPTION

A. Air flow, static pressure, differential pressure, water system pressure and water flow measurement for the control of Heating, Ventilation, and Air Conditioning systems.

B. Provide supplementary or miscellaneous items, products, and labor incidental to or necessary for a complete and operable installation.

C. Wiring shall be done in accordance with local and national codes.

D. Coordinate installation activities of instrumentation, immersion wells, pressure tapping, shut-off valves, flow switches, level switches, flow meters, air flow stations and other items. Installation activities include:

1. Power requirements
2. Panel locations

3. Commissioning
4. Test and Balance
5. Equipment start-up
6. User access

E. Install control devices in appropriate enclosure and in accessible location.

F. Provide shielding per manufacturer's recommendation.

G. Provide junction box or conduit to protect wiring.

H. Provide access doors where removal of instrument is not possible for maintenance.

1.5 SUBMITTALS

A. Refer to section 25 0100.

1.6 QUALITY ASSURANCE

A. Refer to section 25 0100.

1.7 WARRANTY

A. Refer to section 25 0100.

PART 2 - PRODUCTS

2.1 AVERAGING TEMPERATURE SENSORS

A. Platinum Resistance Temperature Detector (RTD) type, with the following minimum performance

1. Accuracy: ± 1.0 percent at 32 Deg F (Class B)
2. Operating Range: -50 to 170 Deg F and 0 to 99 percent Relative Humidity (RH)
3. Conformance: DIN-IEC 751

2.2 SINGLE POINT TEMPERATURE SENSORS

A. Platinum RTD type with the following minimum performance

1. Accuracy: ± 0.1 percent at 32 Deg F (Class B)
2. Operating Range: -50 to 170 Deg F and 0 to 99 percent RH
3. Conformance: DIN-IEC 751

B. Thermistors type, with the following minimum performance

1. 5-yr guarantee device will maintain its accuracy within tolerance of ± 0.36 Deg F between 32 Deg F and 150 Deg F, and 0.5 Deg F between -20 Deg F and 212 Deg F.
2. Accuracy: ± 0.1 percent at 32 Deg F (Class B).
3. Operating Range: -50 to 170 Deg F and 0 to 99 percent RH.

2.3 SINGLE POINT AIR TERMINAL TEMPERATURE SENSORS

A. Thermistor or RTD type with the following minimum performance

1. Accuracy: ± 1.0 Deg F at 70 Deg F (Class B).

2. Operating Range: -50 to 170 Deg F and 0 to 99 percent RH

2.4 RTD TEMPERATURE SENSOR/TRANSMITTERS:

A. Manufacturers: Rosemount, Burns, Minco Products, Weed or Pyromation or Equal.

B. Transmitters shall provide 2 wires, 4-20 Milliampere (mA) current output signal proportional to specified temperature span of transmitter and compatible with controller and equipment served.

1. These shall be 1000 platinum RTD type temperature instruments for process immersion or air duct mounting.

2. Operating Temperature: -20 to +180 Deg F.

3. Power Supply Voltage: -13 to 35 Volts Direct Current (VDC) unregulated.

4. Accuracy or Output Error: 0.1 percent of span of sensor and transmitter combination.

5. Temperature Coefficient: 0.00385 O/O Deg C.

6. Thermowells: By same manufacturer as Sensor/Transmitter or approved alternate.

C. Provide local temperature indicator with LCD digital readout.

2.5 SENSOR WELLS

A. Compatible with sensor and application.

B. Include thermal compound.

2.6 SPACE TEMPERATURE SENSORS

A. Adjustable setpoint, with programmable minimum/maximum setpoints (default to disable).

B. Pushbutton override for temporary occupancy default to disable.

C. Compatible with the intended service such as Variable Air Volume (VAV), VAV Reheat, Dual-duct, unoccupied setback, and associated controlled devices such as air terminal controller, damper, valve.

D. RTD type with the following minimum performance:

1. Accuracy: ± 0.1 percent at 32 Deg F (Class B)

2. Temperature Operating Range: -50 to 500 Deg F

3. Humidity Operating Range: 0 to 99 percent RH

E. Thermistors will be acceptable in lieu of RTD provided device will maintain its accuracy within tolerance of ± 0.36 Deg F between 32 Deg F and 150 Deg F, and 0.5 Deg F between -20 Deg F and 212 Deg F.

2.7 SPACE HUMIDITY SENSORS/TRANSMITTERS

A. Manufactures: Viasala, General Easter, Automation Components, or Equal.

B. Space humidity sensors shall be wall mount type to match room thermostats and/or temperature sensors.

C. Sensing element shall be resistive bulk polymer, or thin film capacitive type. Sensor/transmitter shall have the following minimum performance:

1. Accuracy: ± 2 percent RH at 25 Deg C over range of 20-95 percent RH including hysteresis, linearity, and repeatability

2. Temperature Effect: Less than 0.06 percent per Deg F at baseline of 68 Deg F

3. Sensitivity: 0.1 percent RH

4. Repeatability: 0.5 percent RH

5. Hysteresis: Less than 1 percent

6. Long Term Stability: Less than 1 percent RH drift per year.

7. Adjustment: ± 20 percent RH zero, non-interactive, ± 10 percent RH span, non-interactive.

8. Operating Range: 0-99 percent RH, non-condensing, sensor -95 percent RH, non-condensing, electronics.

9. Output: 0-10VDC 0-100 percent linear, proportional.

10. Power: 12-36 VDC or 24 Volts Alternating Current (VAC).

2.8 DUCT MOUNTED HUMIDITY SENSORS/TRANSMITTERS

A. Manufactures: Viasala, General Easter, Automation Components, or Equal.

B. Probe type, temperature compensated, resistive bulk polymer or thin film capacitive type.

C. Sensor/transmitter shall have the following minimum performance.

1. Accuracy: ± 2 percent RH at 25 Deg C over 20-95 percent RH including hysteresis linearity and repeatability.

2. Temperature Effect: Less than 0.06 percent per Deg F at baseline of 68 Deg F.

3. Sensitivity: 0.1 percent RH

4. Repeatability: 0.5 percent RH

5. Hysteresis: Less than 1 percent.

6. Long Term Stability: Less than 1 percent drift per year.

7. Adjustment: ± 20 percent RH zero, non-interactive,
± 10 percent RH span, non-interactive.

8. Operating Range: 0-99 percent RH, non-condensing, sensor,
0-95 percent RH, non-condensing, electronics.

9. Output: 0-10VDC 0-100 percent linear, proportional.

10. Power: 12-36VDC or 24VAC

2.9 VIBRATION SENSOR

A. Performance Requirements:

1. Power: 12VDC – 36VDC loop power

2. Output: 4-20mA

3. Frequency Range: 2-1000 Hertz

4. Accuracy: +/- 5 percent

B. Enclosure shall be NEMA rated for application.

2.10 DUCT MOUNTED AIR FLOW MEASURING STATION

A. Manufacturers: Tek-Air, Ebtron, or Equal

1. Transmitter and/or systems, which require periodic calibration to maintain accuracy specified, shall not be acceptable.

2. Minimum Requirements:

a) Accuracy: ± 2.0 percent of Reading

b) Span: Less than twice maximum flow.

c) Temperature Range: -20 Deg F to 140 Deg F.

d) Humidity Range: 10-95 percent RH (non-condensing)

e) Power: 24VAC

f) Output Signal: 4-20 mA or 0-10VDC

B. Velocity measured by each sensor shall be linearized, summed, averaged, and an output signal proportional to air-flow rate (cfm) or velocity (fpm) by transmitter electronics.

2.11 INLET FAN MOUNTED AIR FLOW MEASURING STATION

A. Transmitter and/or systems, which require periodic calibration to maintain accuracy specified, shall not be acceptable.

B. Requirements:

1. Accuracy: ± 3.0 percent of Reading

2. Span: Less than twice maximum flow

3. Temperature Range: -20 Deg F to 140 Deg F.

4. Humidity Range: 10-95 percent RH (non-condensing)

5. Power: 12-30VDC or 24VAC

6. Output Signal: 0-5VDC, 2-10VDC or 0-10VDC

C. Velocity measured by each sensor shall be linearized, summed, averaged, and an output signal proportional to air-flow rate (cfm) or velocity (fpm) by transmitter electronics.

2.12 DIFFERENTIAL PRESSURE TRANSMITTERS

A. Manufacturers: GE Modus, Setra, Ashcroft XLDP, or approved equal.

B. Sensors shall convert velocity pressure differential or static duct pressure relative to sensor location into electronic signal.

C. Unit shall be capable of transmitting linear signal proportional to differential (total minus static or static minus ambient) pressure input signals with the following minimum performance and application criteria:

1. Span: Less than twice maximum reading.
2. Accuracy: ± 1.0 percent of span or ± 1.0 percent of full scale
3. Dead Band: Less than 0.5 percent of output
4. Hysteresis: Within 0.5 percent of span or within 0.5 percent of full scale
5. Linearity: Within 1.0 percent of span or within 0.5 percent of full scale
6. Repeatability: Within 0.5 percent of output
7. Response: Less than 1 second for full span input
8. Output Signal: 0-5VDC, 2-10VDC or 0-10VDC

2.13 CO2 SENSORS

A. Manufacturers: Veris, Telaire, Vaisala, or approved equal.

B. Units shall have following minimum characteristics:

1. Range: 0-2000 parts per mission (ppm)
2. Power Supply: 15-30 VDC/VAC
3. Output: 0-5VDC, 2-10VDC or 0-10VDC
4. Operating Temperature: 0 – 120 Deg F
5. Operating Humidity: 0 to 90 percent RH non-condensing
6. Accuracy: 5.0 percent or 30ppm

2.14 CO SENSORS

A. Manufacturers: Veris, Telaire, Vaisala, or approved equal.

B. Units shall have following minimum characteristics:

1. Range: 0-2000ppm
2. Power Supply: 15-30 VDC/VAC
3. Output: 0-10VDC

4. Operating Temperature: 40 – 100 Deg F

5. Operating Humidity: 0 to 85 percent RH non-condensing

2.15 LIQUID DIFFERENTIAL PRESSURE TRANSMITTER

A. Manufacturers: Ashcroft, BAPI, Setra, Veris or approved equal.

B. Pressure sensor and integral transmitter. Select instrument for intended usage (differential pressure, gauge pressure, level), range, maximum pressure/temperature. Enclosure to be NEMA 4.

C. Include LCD display.

D. Differential pressure transmitters shall have 3-valve manifold for servicing.

E. Performance:

1. Power: 12 - 30VDC or 24VAC

2. Output: 0-5VDC, 2-10VDC or 0-10VDC

3. Accuracy (PSIG): + 1 percent of full scale

4. Stability: + 0.25 percent per year

5. Hysteresis: $\pm$ 0.05 percent of calibrated span

F. Operating Range: -140 Deg F to 130 Deg F

G. Over Pressure: 2 times maximum operating pressure whichever is greater.

H. Accuracy: ± 1 percent of full scale

I. Zero adjust pushbutton.

2.16 PRESSURE TRANSMITTERS

A. Manufacturers: Setra, Ashcroft, Dwyer or approved equal

B. Include pressure sensor and integral transmitter. Transmitters shall use capacitance sensing element.

C. Performance

1. Power: 12 - 30VDC or 24VAC

2. Output: 0-5 VDC, 2-10VDC or 0-10VDC

3. Accuracy (PSIG): + 0.5 percent of calibrated span

4. Stability: $\pm$ 0.25 percent per year

2.17 WATER FLOW TRANSMITTER

A. Manufacturers: Onicon, Badger, Neptune or approved equal

B. Type: Electromagnetic insertion

C. Include flow meter and transmitter.

D. Include certificate of calibration

E. Direction of flow indication (for bi-direction flow meters)

F. Performance

1. Output: 0-5VDC, 2-10VDC or 0-10VDC

2. Accuracy: ± 1 percent of rate from 2-20ft/s

2.18 BTU SUB-METER

A. Manufacturer: Onicon (System 10), or approved equal

B. Include flow meter and remote transmitter with NIST Traceable Calibration with Certifications.

C. Include BACnet communications card to integrate to building automation systems.

D. Minimum Performance

1. Output: 0-5 VDC, 2-10VDC or 0-10VDC

2. Temperature Accuracy: + .15 percent from 32-200 Deg F.

3. Water Flow Accuracy: ± 1.0 percent of reading.

PART 3 - EXECUTION

3.1 AVERAGING TEMPERATURE SENSORS

A. Provide flexible averaging element for air ducts where prone to temperature stratification or where ducts are larger than 9 square feet.

B. Provide rigid averaging probe for air ducts smaller than 9 square feet.

C. Provide multiple averaging type sensors for sufficient duct or coil coverage. For coils, at minimum provide appropriate number of sensors for 1 linear foot of sensing for every 1 sq. ft of coil.

3.2 SINGLE POINT TEMPERATURE SENSORS

A. Provide single point duct mounted probes where ducts are too small for averaging elements.

B. Mount in center of air flow or where most accurate reading will result.

C. Install as far from fan as possible, but within mechanical space.

3.3 SINGLE POINT AIR TERMINAL TEMPERATURE SENSORS

A. Provide single point duct mounted sensors at air terminal coils or fan coil units

3.4 SPACE TEMPERATURE SENSORS

A. Provide space thermostats/sensors where indicated, to perform specified control sequences, to meet job site conditions.

B. Coordinate mounting height prior to installation. Unless otherwise noted, mount sensors at 48inches above finished floor.

C. Recess mounting box unless otherwise indicated or required by the building construction materials.

D. Unless otherwise noted provide at minimum, ½ inch conduit from room sensors to corresponding controller.

E. Mounted space thermostats/sensors, located on exterior walls, on thermally insulated sub-base.

F. Relocate space thermostats/sensors if required due to draft, interferences with cabinets, chalkboards, or improper sensing.

3.5 SINGLE POINT AIR TERMINAL TEMPERATURE SENSORS

A. Provide sensors where indicated, to perform specified control sequences, to meet job site conditions. At minimum, provide at discharge of fan coil units and terminal reheat.

3.6 SPACE HUMIDITY SENSORS/TRANSMITTERS

A. Provide space thermostats/sensors where indicated, to perform specified control sequences, to meet job site conditions.

B. Mount sensors at 48 inches above finished floor.

C. Recess mounting box unless otherwise indicated or required by the building construction materials.

3.7 SENSOR WELLS

A. Furnish wells for installation.

B. Coordinate with Division 23 Specifications for location placement.

1. Wells mounted in pipe 3 inches and larger may be installed in horizontal or vertical lines if element is always in the flow, (for condensate and other gravity return lines, install in bottom of pipe).

2. Wells mounted in pipe 2-1/2 inches and smaller shall be installed at elbow tee fittings with well pointed upstream. Minimum of 2 inches pipe size for elbow tee installation.

3.8 DUCT MOUNTED HUMIDITY SENSORS/TRANSMITTERS

A. Provide duct humidity sensors and transmitters where indicated, and to perform specified control sequences, to meet job site conditions.

3.9 VIBRATION SENSOR

A. Provide vibration transmitter for well pumps, and motors and equipment where shown.

B. Coordinate installation/mounting requirements with motor and equipment manufacture.

3.10 DUCT MOUNTED AIR FLOW MEASURING STATION

A. Furnish and coordinate the installation of Air Flow Measuring Stations according to contract documents and control sequences.

B. Include manufacturer’s recommended number of probes for the proper traverse of the air duct and required mounting hardware.

C. Provide transmitter as part of air flow sensor and shall include integral diagnostics with on-line zeroing and sensor operation verification.

D. Provide cabling required for connection to probe assemblies and transmitter electronics.

3.11 INLET FAN MOUNTED AIR FLOW MEASURING STATION

A. Provide Inlet Fan Mounted Air Flow Measuring Stations (where not provided by Division 23) on Supply and Return Fans and according to contract documents and control sequences.

B. Include manufacturer's recommended number of probes for the proper traverse of the air duct and required mounting hardware.

C. Provide transmitter (where not provided by Division 23) as part of air flow sensor and shall include integral diagnostics with on-line zeroing and sensor operation verification.

D. Provide cabling required for connection to probe assemblies and transmitter electronics.

E. Coordinate signal requirements and monitor air flow stations provided.

3.12 DIFFERENTIAL PRESSURE TRANSMITTERS

A. Provide Differential Pressure Transmitters according to contract documents or to accomplish sequences.

B. Locate static pressure transmitters and transducers in control panel where possible.

C. Select instrument for intended usage range, maximum pressure/temperature.

D. For indicating type instruments, locate indicating element with 6 ft of floor with readout easily visible from floor level.

3.13 CO2 SENSORS

A. Provide CO2 sensors according to contract documents and control sequences.

3.14 CO SENSORS

A. Provide CO sensors according to contract documents or to accomplish sequences.

3.15 DIFFERENTIAL PRESSURE TRANSMITTER

A. Provide differential pressure transmitter for building [chilled water/hot water] differential pressure.

B. Differential pressure transmitters used for flow measurement shall be sized to the flow-sensing device. Transmitter range shall be selected for mid-range values while operating under normal operating range.

C. Differential pressure transmitters shall be supplied with tee fittings and shut-off valves in the high and low sensing pick-up lines. Test ports shall be included for 3rd party verification.

D. Differential pressure transmitter shall include a separate pressure gage scaled to indicate normal operating range of device. This pressure gage shall be installed in parallel with sensing lines.

E. The transmitters shall be installed in an accessible location whenever possible.

3.16 PRESSURE TRANSMITTER

A. Furnish differential pressure transmitters as shown in construction documents or to implement sequences.

1. Span flow transmitter for 130 percent of design pressure.

B. Transmitter shall be mounted in accessible location and in mechanical rooms shall be installed 4ft to 5ft above floor level. Include isolation valve for servicing at transmitter location.

3.17 WATER FLOW TRANSMITTER

A. Furnish Flow Transmitter for Water Systems.

1. Span flow meter for 130 percent of design flow.

B. Remote Transmitter shall be mounted in accessible location and in mechanical rooms shall be installed 4ft to 5ft above floor level.

3.18 BTU SUB-METER

A. Furnish BTU Sub-Meter for chilled water and heating hot water systems.

1. Span flow meter for 130 percent of design flow.

B. Display shall be mounted in accessible location and in mechanical rooms shall be installed 4ft to 5ft above floor level.

END OF SECTION

SECTION 25 3503

CONTROL VALVES AND DAMPERS

PART **1 -** GENERAL

1.1 SUMMARY

A. Section provides requirements for valves and dampers as shown in Contract Documents, except where provided by equipment manufacturer.

1.2 DEFINITIONS

A.	AMCA	Air Movement and Controls Association is an accredited resource for leading companies in the air movement industry.
B.	Duct	A tube or passageway in a building or machine for air, liquid, cables, For example, HVAC duct in a building is typically square metal and round flexible tube above the ceiling used to move air throughout the building.
C.	Furnish	To supply and deliver to the project site, ready to be install.
D.	HVAC	Heating, Ventilation, and Air Conditioning is broadly described as the equipment used to heat or cool a building.
E.	Install	To place in position for service or use.
F.	Provide	To furnish and install, complete, ready for use.

1.3 GENERAL RESPONSIBILITIES

A. Controls Contractor shall:

1. Provide water control valves, two-position control valves, standard control dampers, exhaust fan shut-off dampers, outside air dampers, smoke dampers, and combination fire and smoke dampers.
2. Schedule and coordinate work with DMS and applicable trades.
3. Provide supplementary or miscellaneous materials, equipment, and labor necessary to implement a fully functional IAS irrespective of whether it is identified within this specification and/or construction documents.
4. Install materials and products in a neat, workmanlike manner, and in accordance with manufacturer's recommendations.
5. Confirm work and materials comply with applicable codes, standards, specifications, statutes, ordinances, and regulations of governmental authorities having jurisdiction.

1.4 SYSTEM DESCRIPTION

A. General.

1. Water control valves, two-position control valves, standard control dampers, exhaust fan shut-off dampers, outside air dampers, smoke dampers, and combination fire and smoke dampers used in Heating, Ventilation, and Air Conditioning systems.

2. Include components not specifically indicated or specified, but necessary to make the system function within the intent of the specification and in accordance with control sequences located on contract documents.

3. Obtain adequate system information necessary for sizing.

4. Tag valves and dampers appropriately. (Refer to 25 0553)

B. Control Dampers

1. High performance low leakage Class I control dampers suitable for Heating, Ventilation, and Air Conditioning (HVAC) applications such as control or isolation of outside, exhaust, or supply air and other non-smoke or fire rated applications.

2. Underwriters Laboratories (UL) listed under standard 873 for Temperature-Indicating and Regulating Equipment.

3. Meet certified leakage rates and pressure drop ratings in accordance with Air Movement and Control Association (AMCA). Leakage ratings shall be based on AMCA Standard 500, and dampers shall bear AMCA Air Leakage Seals.

4. Base sizing calculations on actual characteristics of ductwork system being installed.

5. Size dampers as close as possible to duct size, but in no case is damper size to be less than duct size.

6. Size opposed blade dampers shall for minimum of 10 percent of duct system pressure drop.

7. Size parallel blade dampers for minimum of 30 percent of duct system pressure drop.

8. Calculate actual duct pressure drops for each duct section containing modulating damper using latest version of American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE) Handbook of Fundamentals.

9. Two position dampers to be sized as close as possible to duct size, but in no case is damper size to be less than duct area.

10. Select dampers to meet their intended service with respect to maximum approach velocities and maximum pressure differential.

11. Damper materials shall meet intended service for which they are installed (galvanized steel, aluminum, 304 or 316 stainless steel, unless otherwise noted).

12. Dampers shall be tested, rated, and labeled in accordance with the latest UL requirements.

C. Control Valves

1. HVAC control valve types shall be from the same manufacture.

2. UL listed under standard 873 for Temperature-Indicating and Regulating Equipment.

3. Factory fabricated, of type, body material, and pressure class based on maximum pressure and temperature rating of piping system, unless otherwise indicated.

D. Water Valves

1. Pressure independent control valves shall be factory calibrated and tested.

2. Valve body ratings indicated in Part 2 are minimum required. Valves selected shall be designed to withstand maximum pressure and temperature encountered in the systems, for proper control and without cavitation.

3. Calculations for sizing modulating valves shall be based on actual characteristics of equipment and system being installed. Valve calculations shall include information such as pump head or available pressure; branch piping circuit losses including pipe, fittings, valves, and coils; flow rates; and pressure losses of other in-line devices.

E. Smoke Dampers

1. Calculations for sizing dampers shall be based on actual characteristics of ductwork system being installed. Opposed blade dampers shall be sized for minimum of 10% of duct system pressure drop. Meet certified leakage rates and pressure drop ratings in accordance with AMCA. Leakage ratings shall be based on AMCA Standard 500, and dampers shall bear AMCA Air Leakage Seals.

2. Base sizing calculations on actual characteristics of ductwork system being installed.

3. Size dampers as close as possible to duct size, but in no case is damper size to be less than duct size.

4. Size opposed blade dampers shall for minimum of 10 percent of duct system pressure drop.

5. Size parallel blade dampers for minimum of 30 percent of duct system pressure drop.

6. Calculate actual duct pressure drops for each duct section containing modulating damper using latest version of ASHRAE Handbook of Fundamentals.

(a) Two position dampers to be sized as close as possible to duct size, but in no case is damper size to be less than duct area.

(b) Select dampers to meet their intended service with respect to maximum approach velocities and maximum pressure differential.

(c) Damper materials shall meet intended service for which they are installed (galvanized steel, aluminum, 304 or 316 stainless steel).

(d) Dampers shall be tested, rated, and labeled in accordance with the latest UL requirements.

1.5 SUBMITTALS

A. Refer to section 25 0100.

1.6 QUALITY ASSURANCE

A. Refer to section 25 0100.

1.7 WARRANTY

A. Refer to section 25 0100.

PART 2 - PRODUCTS

2.1 WATER CONTROL VALVES (3’ OR SMALLER):

A. Valves shall be pressure independent.

B. Actuator stem shall be removable/replaceable without removing valve from line.

C. Control flow from 0 to 100 percent

D. Include pressure/temperature ports

E. Minimum Characteristics:

1. Valve Body: Brass
2. Max Operating Temperature: 212 degrees Fahrenheit
3. Close off Pressure: 90 Pressure per Square Inch (PSI)
4. Accuracy: Plus or minus 5 percent
5. Rated Pressure: 150 PSI

2.2 WATER CONTROL VALVES (LARGER THAN 3”):

A. Valves shall be pressure independent.

B. Control flow from 0 to 100 percent.

C. Include pressure/temperature ports.

D. Minimum Characteristics

1. Valve Body: Iron, Bronze, or Steel
2. Max Operating Temperature: 240 degrees Fahrenheit
3. Close off Pressure: 90 PSI
4. Rated Pressure: 150 PSI
5. Accuracy: Plus or minus 5 percent

2.3 TWO POSITION CONTROL VALVES

A. Meet ANSI Class 150 rating design.

B. Provide bubble-tight shut off with pressures in either direction to 275 psi suitable for 150 psi steam.

C. External disc position indication.

D. Valve neck extensions with sufficient length to allow for insulation.

E. Provide threaded lug type valves for equipment isolation, permitting removal of downstream piping without removing valve. Dead end pressure rating of lug type valves shall be 275 psi.

F. Characteristics:

1. Valve Body: Carbon or Cast steel, Cast Iron
2. Valve Type: Butterfly
3. Max Operating Temperature: 250 degrees Fahrenheit (minimum)
4. Min Rated Pressure: 150 PSI
5. Shaft: Stainless steel
6. Disc: Stainless steel
7. Seat: Reinforced PTFE
8. Packing: Graphite

2.4 STANDARD CONTROL DAMPERS

A. Manufacturers: Ruskin, Tamco, Johnson Controls, Siemens, Honeywell or approved equal.

B. Opposed or parallel blades for modulating dampers and opposed blade only for 2 position dampers.

C. Blade linkage hardware shall have corrosion-resistant finish.

D. Requirements:

1. Frame: 16 ga galvanized steel or 14 ga extruded aluminum hat-shaped channel.
2. Blades: 16 ga galvanized steel or 14 ga aluminum airfoil shaped
3. Max Blade Width: 8 inches
4. Bearings: Molded synthetic, nylon, bronze, or ball
5. Max Leakage: Less than 3 cfm per square foot at 1 inch of static pressure.
6. Temp. Range: -minus 40 to 250 Deg F.
7. Diff. Pressure: 6.0 Inches of Water Column (INWG)
8. Approach Velocity: 6000 feet per minute (fpm)

2.5 EXHAUST FAN SHUT-OFF DAMPERS:

A. Manufacturers: Swartwout 902, Ruskin CDR92 or approved equal.

B. 304 stainless steel constructions, flanged connection, grease lubricated ball bearings, continuous shaft with seal, suitable for maximum temperature 250 deg F, approach velocity 6000 fpm, and differential pressure of 13" Water Gauge (WG).

C. Furnish dampers with neoprene blade seals.

2.7 OUTSIDE AIR DAMPERS:

A. Manufacturers: Ruskin, Tamco, Johnson Controls, Siemens, Honeywell, or approved equal.

B. Opposed or parallel blades for modulating dampers and opposed blade only for 2 position dampers.

C. Requirements:

1. Frame: Extruded aluminum.
2. Blades: Extruded aluminum
3. Linkage: Corrosion resistant and concealed.
4. Max Blade Width: 8 inches.
5. Max Leakage: Leakage Class 1A at 1 in. WG.
6. Temp. Range: -40 to 250 Deg F.

2.8 SMOKE DAMPERS

A. Manufacturers: Air Balance, Johnson Controls, Ruskin, Greenheck, NCA Manufacturing, Cesco or Prefco.

B. Requirements:

1. Leakage rated under UL 555S; less than 4 cubic feet per minute (cfm) per square foot at 1 inch of static pressure and 8 cfm at 4 inches static pressure at temperature category 250°F.
2. Maximum blade width of 8 inches.
3. Minimum 16-gauge galvanized steel or aluminum airfoil shaped blades.
4. Stainless Steel or bronze bearings.
5. Dampers and seals shall be suitable for maximum system temperature, pressure differential and approach velocity, but not less than temperature category 250 deg F, pressure differential of 4" WG, and approach velocity of 2000 fpm.

C. Actuator mounting assemblies shall be outside airstreams.

D. Include damper position switch linked directly to damper blade to provide capability of remotely indicating damper blade open position and closed position.

E. Dampers shall fully open in 15 seconds or less and fully close in not more than 15 seconds and not less than 5 seconds when activated.

F. Electric actuators shall be 120-volt non-stall type unless otherwise stated and shall be rated for energized hold open position period of 6 months or more.

G. Allow reset from fire alarm control panel.

2.9 COMBINATION FIRE AND SMOKE DAMPERS

A. Manufacturers: Ruskin, Air Balance, Prefco, Greenheck, Nailor, Cesco, equal to Ruskin FSD-60.

B. Requirements:

1. Meet requirements of NFPA 90A.
2. 1-1/2 or 3 hr rated as shown on drawings.

3. Maximum blade width of 6 inches.

4. Minimum 14-gauge galvanized steel or aluminum airfoil shaped blades.

5. Leakage rated at no higher than leakage Class I; 4 cfm/ft^2 at 1inch WG and 8 cfm/ft^2 at 4 inches WG) under UL 555/555S at temperature category 350°F, and compatible with system static pressures.

6. Rated pressures to 4 inches WG and velocities to 3000 fpm.

C. Operators shall be electric, factory installed outside of air stream, linked to dampers for fail closed operation, and be UL listed and labeled for the application.

D. Include damper position switch linked directly to damper blade to provide capability of remotely indicating damper blade open position and closed position.

E. Operators to be capable of closing damper at pressures encountered in system. Electric operators shall be rated for energized hold open position period of 6 months or more.

F. Dampers shall fully open in 15 seconds or less and fully close in not more than 15 seconds and not less than 5 seconds when activated.

G. Firestat

1. Dampers shall be furnished with UL classified firestat, functioning to close dampers when duct temperatures exceed 165 deg. F while allowing reset capability from fire alarm system or building automation system.

2. Include damper position switch linked directly to damper blade to provide capability of remotely indicating damper blade position. Firestat and position indicator switches to be capable of interfacing electrically with building fire alarm system or automation system.

3. Firestats shall be equipped with high limit temperature sensors meeting requirements of NFPA 92A by returning damper to fire protection mode when temperature reaches 350°F.

H. Furnish EP switches where pneumatic operators are used.

I. Submit UL installation details showing mounting method and duct connection method.

2.10 FACTORY MOUNTED ACTUATORS

A. Pneumatic Diaphragm with Spring Return:

1. Provide spring return feature for fail closed positions.

B. Discrete Two-Position Electric:

1. Provide spring return feature for fail open or closed positions as required by control sequence.

PART 3 - EXECUTION

3.1 WATER CONTROL VALVES (3 INCHES OR SMALLER):

A. Furnish pressure independent control valves for terminal units.

B. Factory mount actuator.

C. Select valves to provide tight shut-off against maximum system temperatures and pressure encountered.

3.2 WATER CONTROL VALVES (LARGER THAN 3 INCHES):

A. Furnish pressure independent control valves for larger equipment.

B. Factory mount actuator where possible.

C. Shut-off against maximum system temperatures and pressure encountered.

D. Select valve components to withstand maximum pressure and temperature encountered in system.

3.3 TWO POSITION CONTROL VALVES (2 Inches and Larger)

A. Furnish two position control valves for equipment isolation.

B. Factory mount actuator.

C. Select valves to provide tight shut-off against maximum system temperatures and pressure encountered.

D. Size valve to full pipe size for shut off applications.

3.4 STANDARD CONTROL DAMPERS

A. Furnish control dampers as shown on drawings or as required to perform control sequences specified, except those furnished with other equipment.

B. Coordinate delivery, storage, and installation with Division 23 Specifications.

C. Mount blade linkage hardware to be readily accessible for maintenance.

D. Mount actuator to achieve fail safe condition as shown on drawings or as needed to accomplish sequences.

3.5 EXHAUST FAN SHUT-OFF DAMPERS

A. Furnish exhaust dampers as shown on drawings or as required to perform control sequences, or isolation as specified, except those furnished with other equipment.

B. Coordinate delivery, storage, and installation with Division 23 Specifications.

C. Mount actuator to fail damper to the closed position, unless otherwise shown.

3.6 OUTSIDE AIR DAMPERS

A. Furnish outside air dampers as shown on drawings or as required to perform control sequences, or isolation as specified, except those furnished with other equipment.

B. Provide cover or enclosures to protect actuators from weather.

C. Coordinate delivery, storage, and installation with Division 23 Specification.

3.7 SMOKE DAMPERS

A. Furnish smoke dampers as shown on drawings or as required to perform control sequences specified.

B. Furnish factory mounted actuator mounted outside airstream.

C. Coordinate delivery, storage, and installation.

D. Coordinate final power requirements and locations

3.8 COMBINATION FIRE AND SMOKE DAMPERS

A. Furnish combination fire/smoke dampers as shown on drawings or as required to perform control sequences specified.

B. Furnish factory mounted actuator mounted outside airstream.

C. Coordinate delivery, storage, and installation.

D. Coordinate final power requirements and locations.

3.9 FACTORY MOUNTED ACTUATORS

A. Select actuators to provide tight shut-off against maximum system temperatures and pressure encountered.

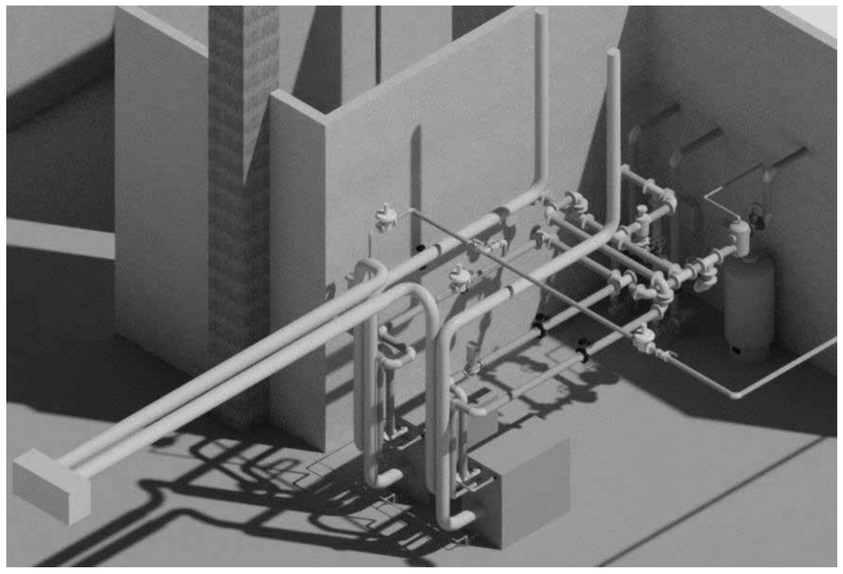
B. Configure smoke dampers serving pressure rated heat exchangers or converters to fail closed unless otherwise shown.

END OF SECTION

RA GRAY BUILDING
DESIGN AND REPLACE BOILERS

PROJECT NUMBER: MSFM-02203260

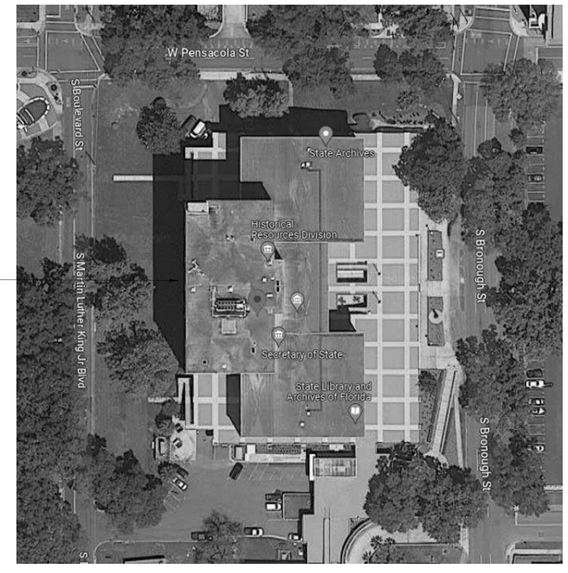
500 S. BRONOUGH ST.
TALLAHASSEE, FL 32399



SHEET INDEX	
SHEET NUMBER	SHEET NAME
E001	ELECTRICAL LEGEND & NOTES
E101	ELECTRICAL PLAN
M001	GENERAL NOTES LEGENDS, SHEET INDEX, SCHEDULES - MECH
M101	MECHANICAL PHASE 1 PLAN
M102	MECHANICAL PHASE 2 PLAN
M501	MECHANICAL DETAILS
M701	MECHANICAL CONTROLS

PROJECT LOCATION

NORTH



FSM Engineering
150 John Knox Road
Tallahassee, FL, 32303
p.850.222.5683
FL CA 28968

ROBERT E GELHARDT II LICENSEE NO. 77568 STATE OF FLORIDA PROFESSIONAL ENGINEER

Robert Gelhardt II, PE FL 77568

RA GRAY BUILDING, DESIGN AND REPLACE BOILERS
100% CONSTRUCTION DOCUMENT

500 S. BRONOUGH STREET
TALLAHASSEE, FL 32399

REVISION

No.	Date	Description
1	2025-1-15	CODE UPDATES
-	-	-
-	-	-
-	-	-
-	-	-
-	-	-
-	-	-
-	-	-

DRAWN BY:	KRW
CHECKED BY:	REGII
APPROVED BY:	REGII

PROJECT: 22067
DATE: 01/15/2025

COVER SHEET

C000

SYMBOLS

ROUND DUCT
D=INSIDE DIAMETER DIMENSION

SQUARE TO ROUND

DEMOLITION HATCH INDICATION

EQUIPMENT, PIPE, DUCT, FITTINGS, ETC TO BE DEMOLISHED WILL BE INDICATED SPECIFICALLY OR BY DIAGONAL HATCH MARKING.

DEMOLITION KEYNOTE

KEYNOTE

CONNECT TO EXISTING AT THIS POINT

DEMOLISH BACK TO THIS POINT

END SUCTION PUMP

AIR/DIRT SEPARATOR

CHEMICAL SHOT FEEDER

EXPANSION TANK

PIPE CONTINUES UP

PIPE CONTINUES DOWN

THERMOMETER

PRESSURE GAUGE

MOTORIZED 3-WAY CONTROL VALVE

MOTORIZED 2-WAY CONTROL VALVE

BUTTERFLY ISOLATION/SHUT-OFF VALVE

GATE ISOLATION/SHUT-OFF VALVE

BALL ISOLATION/SHUT-OFF VALVE

PLUG ISOLATION/SHUT-OFF VALVE

PRESSURE REDUCING VALVE

PRESSURE RELIEF VALVE

UNION

FLEXIBLE CONNECTION

CHECK VALVE

STRAINER

RE-CIRCULATION PUMP

ABBREVIATION

ALL MAY NOT APPLY

ADS	AIR/DIRT SEPARATOR
B	BOILER
BP	BOILER PUMP
BRP	BOILER RE-CIRCULATION PUMP
BTU	BRITISH THERMAL UNIT
CD	CONDENSATE
CKV	CHECK VALVE
CV	CONTROL VALVE
ΔP	DIFFERENCE IN PRESSURE
ΔT	DIFFERENCE IN TEMPERATURE
DEG. F	DEGREES FAHRENHEIT
DDC	DISTRIBUTED DIGITAL CONTROLS
DN	DOWN
EWT	ENTERING WATER TEMPERATURE
EX	EXISTING
GPM	GALLONS PER MINUTE
HHWS	HEATING HOT WATER SUPPLY
HHWR	HEATING HOT WATER RETURN
In W.C.	INCHES OF WATER COLUMN
IV	ISOLATION VALVE
LWT	LEAVING WATER TEMPERATURE
MBH	1,000 BTUS PER HOUR
MFG.	MANUFACTURER
OA	OUTSIDE AIR
PG	PRESSURE GAUGE
RA	RETURN AIR
RND	ROUND
RPM	REVOLUTIONS PER MINUTE
STR	STRAINER
THM	THERMOMETER
TSP	TOTAL STATIC PRESSURE
UNO	UNLESS NOTED OTHERWISE
V/PZ	VOLT/PHASE
VFD	VARIABLE FREQUENCY DRIVE
VSD	VARIABLE SPEED DRIVE
XT	EXPANSION TANK

CODE REFERENCE

THE LATEST EDITIONS OF THE ESTABLISHED STANDARDS OF THE FOLLOWING ORGANIZATIONS, AND INDIVIDUAL STANDARDS NAMED SHALL BE FOLLOWED THE SAME AS IF THEY WERE FULLY WRITTEN HEREIN AND CONSTITUTE A PART OF THE SPECIFICATION REQUIREMENTS EXCEPT WHERE OTHERWISE SPECIFIED:

FBC, BUILDING	FLORIDA BUILDING CODE 8TH EDITION
FBC, MECHANICAL	FLORIDA BUILDING CODE 8TH EDITION
FBC, EXISTING BUILDING	FLORIDA BUILDING CODE 8TH EDITION
FBC, FUEL GAS	FLORIDA BUILDING CODE 8TH EDITION
FBC, ENERGY CONSERVATION	FLORIDA BUILDING CODE 8TH EDITION
FFPC	FLORIDA FIRE PREVENTION CODE, 2020 7TH EDITION
NFPA 13	STANDARD FOR THE INSTALLATION OF FIRE SPRINKLER SYSTEMS
NFPA 51B	STANDARD FOR FIRE PREVENTION DURING WELDING, CUTTING AND OTHER HOT WORK
NFPA 54	NATIONAL FUEL GAS CODE
NFPA 90A	STANDARD FOR THE INSTALLATION OF AIR CONDITIONING AND VENTILATION SYSTEMS
NFPA 90B	STANDARD FOR THE INSTALLATION OF WARM AIR HEATING AND AIR CONDITIONING SYSTEMS
NFPA 101	LIFE SAFETY CODE
NFPA 101A	GUIDE ON ALTERNATIVE APPROACHES TO LIFE SAFETY
NFPA 101B	CODE FOR MEANS OF EGRESS FOR BUILDINGS AND STRUCTURES
NFPA 900	BUILDING ENERGY CODE
ASTM	AMERICAN SOCIETY FOR TESTING AND MATERIALS
ANSI	AMERICAN NATIONAL STANDARDS INSTITUTE
ASME	AMERICAN SOCIETY OF MECHANICAL ENGINEERS
ADA	AMERICAN WITH DISABILITIES ACT
UL	UNDERWRITERS LABORATORIES

THESE CODE AND STANDARDS SHALL BE CONSIDERED A MINIMUM REQUIREMENT. THE CONTRACTOR SHALL NOT RELIEVED FROM PROVIDING HIGHER GRADE MATERIALS, PRODUCTS AND WORKMANSHIP WHICH MAY BE SPECIFIED WITHIN THESE DOCUMENTS

ENERGY SYSTEMS - GENERAL

1. PROVIDE A TEST AND BALANCE OF THE SYSTEM IN COMPLIANCE WITH FBC-EC SECTION 408.2.2 IN ACCORDANCE WITH THE LATEST NEBB, ASHRAE, OR EQUIVALENT GUIDELINES FOR SUCH WORK. TAB CONTRACTORS SHALL BE PRE APPROVED BY THE ENGINEER OF RECORD.
2. PROVIDE OWNER A COMPLETE SET OF OPERATIONS AND MAINTENANCE MANUALS FOR ALL EQUIPMENT WITHIN 90 DAYS OF SYSTEM ACCEPTANCE.
3. HVAC EQUIPMENT EFFICIENCY MUST BE VERIFIED PER TABLES C403.2.3(1-11) UNDER FBC CHAPTER 4, C403.2.3.
4. DRAWINGS, MANUALS, SYSTEM BALANCING REPORTS, AND A FINAL COMMISSIONING REPORT SHALL BE PROVIDED TO THE BUILDING OWNER WITHIN 90 DAYS OF THE RECEIPT OF THE CERTIFICATE OF OCCUPANCY.
5. A COMMISSIONING PLAN SHALL BE DEVELOPED BY A REGISTERED DESIGN PROFESSIONAL OR APPROVED AGENCY IN ACCORDANCE WITH FBC CHAPTER 4, C408.2.1.
6. HVAC EQUIPMENT SHALL UNDERGO FUNCTIONAL PERFORMANCE TESTING AS SPECIFIED UNDER FBC CHAPTER 4, SECTIONS C408.2.3.1-3. THIS INCLUDES ALL CONTROL SYSTEMS. TESTING SHALL SHOW EFFECTIVE OPERATION IN ACCORDANCE WITH ALL APPROVED PLANS AND SPECIFICATIONS.
7. ALL PIPING SERVING AS PART OF A HEATING OR COOLING SYSTEM SHALL BE THERMALLY INSULATED IN ACCORDANCE WITH FBC CHAPTER 4, TABLE C403.2.10. WHERE PIPING IS INSTALLED IN OR UNDER A SLAB, VERIFICATION MAY NEED TO OCCUR DURING FOUNDATION INSPECTION.
8. AUTOMATIC START CONTROLS SHALL BE PROVIDED FOR EACH HVAC SYSTEM. THE CONTROLS SHALL BE CAPABLE OF AUTOMATICALLY ADJUSTING THE DAILY START TIME OF THE HVAC SYSTEM IN ORDER TO BRING EACH SPACE THE DESIRED OCCUPIED TEMPERATURE IMMEDIATELY PRIOR TO SCHEDULED OCCUPANCY.
9. HVAC WATER-HEATING CONTROL SYSTEMS SHALL BE TESTED TO DOCUMENT THAT CONTROL DEVICES, COMPONENTS, EQUIPMENT, AND SYSTEMS ARE CALIBRATED AND ADJUSTED AND OPERATE IN ACCORDANCE WITH APPROVED PLANS AND SPECIFICATIONS. SEQUENCES OF OPERATION SHALL BE FUNCTIONALLY TESTED TO DOCUMENT THEY OPERATE IN ACCORDANCE WITH APPROVED PLANS AND SPECIFICATIONS.
10. HVAC PERFORMANCE EFFICIENCY SHALL BE CONSISTENT WITH WHAT IS SHOWN IN THE APPROVED PLANS.

ENERGY SYSTEMS - HYDRONIC SYSTEMS

1. THREE-PIPE HYDRONIC SYSTEMS ARE NOT PERMITTED TO USE A COMMON RETURN FOR BOTH HOT WATER AND CHILLED WATER.
2. TWO-PIPE HYDRONIC SYSTEMS THAT USE A COMMON DISTRIBUTION SYSTEM TO SUPPLY HEATED WATER SHALL BE DESIGNED WITH OPERATION CONTROLS, CHANGEOVER DEADBAND, AND TEMPERATURE CONTROLS IN ACCORDANCE WITH FBC CHAPTER 4, C403.4.3.2.
3. HYDRONIC SYSTEMS 300,000 BTU/H OR GREATER IN DESIGN OUTPUT CAPACITY SHALL INCLUDE CONTROLS WHICH HAVE THE CAPABILITY TO AUTOMATICALLY RESET SUPPLY-WATER TEMPERATURE AND REDUCE SYSTEM PUMP FLOW IN ACCORDANCE WITH FBC CHAPTER 4, C403.4.3.4.
4. BOILER PLANTS WITH MULTIPLE BOILERS SHALL HAVE THE CAPABILITY TO AUTOMATICALLY REDUCE FLOW THROUGH THE PLANT WHEN A BOILER IS SHUT DOWN.

HYDRONIC PIPING

1. ALL HYDRONIC PIPING SHALL BE WELDED STEEL, 2-1/2" TO 6" FLANGED AND ½" TO 2" THREADED.
2. ALL HYDRONIC PIPING SHALL BE INSULATED. INTERIOR WITH 1-1/2"MINIMUM. EXTERIOR 2" MINIMUM, CLOSED CELL INSULATION. ALL PIPING SHALL BE ALUMINUM JACKETED, SEALED AS RECOMMENDED BY THE MANUFACTURER, SECURED WITH STAINLESS STEEL BANDS 12" O.C.
3. PIPE SHALL BE HUNG WITH CLEVIS OR UNISTRUT PRODUCTS WITH THREADED RODS IN COMPLIANCE WITH FBC-M SECTION 305.
4. PIPE PENETRATIONS THROUGH FIRE RATED ASSEMBLIES SHALL BE SEALED WITH FIRE CAULKING EQUAL TO METACAULK: UL-CAJ2134, UL-WL2135

HVAC GENERAL NOTES

1. ONLY NEW EQUIPMENT SHALL BE PROVIDED UNLESS INDICATED AS EXISTING TO REMAIN.
2. ALL CONNECTIONS TO EQUIPMENT SHALL BE MADE WITH FLEXIBLE REGIONS FOR VIBRATION ISOLATION.
3. ALL EQUIPMENT SHALL BE LABELED SO THAT USERS CAN IDENTIFY EACH PIECE OF EQUIPMENT. LABELS SHALL BE CONSISTENT WITH EQUIPMENT TAGS THAT ARE LISTED IN THE SCHEDULES WITHIN THESE DOCUMENTS.
4. ALL EQUIPMENT SHALL BE INSTALLED PER MANUFACTURERS WRITTEN INSTRUCTIONS AND RECOMMENDATIONS.
5. INSTALL DUCTWORK AND PIPING AS HIGH AS POSSIBLE ABOVE CEILING.
6. COORDINATE THE INSTALLATION OF DUCTWORK AND PIPING WITH ELECTRICAL EQUIPMENT SO THAT THE REQUIRED CODE CLEARANCES TO ELECTRICAL EQUIPMENT IS MAINTAINED.
7. DUCTWORK AND PIPING INSTALLATIONS SHALL ALLOW FOR EQUIPMENT RECOMMENDED MAINTENANCE CLEARANCES. CONVENIENT ACCESS FOR REMOVAL OF FILTERS SHALL BE MAINTAINED.
8. ENSURE ALL EQUIPMENT HAS BEEN CLEANED AT THE END OF THE PROJECT.
9. DO NOT LOCATE AIR INTAKES CLOSER THAN 10 FEET FROM ANY VENT OR EXHAUST OUTLETS. ROUTE TOILET EXHAUST TO LOCATION SHOWN ON PLANS. WALL CAPS SHALL BE ALUMINUM CONSTRUCTION WITH BACKDRAFT DAMPER, BIRD AND INSECT SCREENS.

DESIGN CRITERIA

BUILDING TYPE	GROUP B, BUSINESS
CLIMATE ZONE	2A, LEON COUNTY, FLORIDA
OUTDOOR DESIGN CONDITIONS (SUMMER)	95 DEG Fdb, 77 DEG Fwb
OUTDOOR DESIGN CONDITIONS (WINTER)	20 DEG Fdb
INTERIOR DESIGN CONDITIONS	75 DEG F COOLING, 72 DEG F HEATING

SUBMITTAL REQUIREMENTS

1. USE OF AN APPROVAL STAMP ON SUBMITTAL DOCUMENTS CERTIFIES THAT THE CONTRACTOR HAS COMPLIED WITH THE CONTRACT DOCUMENT REQUIREMENTS.
2. THE CONTRACTOR SHALL NOT BE RELIEVED OF RESPONSIBILITY FOR DEVIATIONS FROM REQUIREMENTS OF THE CONTRACT DOCUMENTS BY THE ARCHITECT/ENGINEERS APPROVAL OF SHOP DRAWINGS, PRODUCT DATA, SAMPLES, OR SIMILAR SUBMITTAL ITEMS UNLESS THE CONTRACTOR HAS SPECIFICALLY INFORMED THE ARCHITECT/ENGINEER IN WRITING OF SUCH DEVIATION AT THE TIME OF SUBMITTAL AND THE ARCHITECT/ENGINEER HAS GIVEN WRITTEN APPROVAL TO THE SPECIFIC DEVIATION. THE CONTRACTOR SHALL NOT BE RELIEVED OF RESPONSIBILITY FOR ERRORS OR OMISSIONS IN SHOP DRAWINGS, PRODUCT DATA, SAMPLES, OR SIMILAR SUBMITTAL ITEMS BY THE ARCHITECT/ENGINEERS APPROVAL THEREOF.
3. CONTRACTOR SHALL SUPPLY TO THE ARCHITECT SUBMITTALS ON THE FOLLOWING WHERE APPLICABLE (ALL MAY NOT APPLY):
   - 3.1. HVAC EQUIPMENT (BOILERS, PUMPS AND ACCESSORIES)
     - 3.1.1. INCLUDING PERFORMANCE DATA AT LISTED ENTERING CONDITIONS
   - 3.2. DUCTWORK MATERIALS AND CONSTRUCTION METHODS
   - 3.3. DUCT FITTINGS
   - 3.4. INSULATION MATERIALS
   - 3.5. DUCT ACCESSORIES AND SPECIALITIES
   - 3.6. PIPING
   - 3.7. CONTROLS
   - 3.8. ROOF EQUIPMENT AND MOUNTING

COMMISSIONING

1. BUILDING MECHANICAL SYSTEMS SHALL BE COMMISSIONED IN ACCORDANCE WITH THE FLORIDA BUILDING CODE, ENERGY CONSERVATION, SECTION C408 "SYSTEM COMMISSIONING".
2. A COMMISSIONING PLAN SHALL BE DEVELOPED BY AN APPROVED COMMISSIONING AUTHORITY (REGISTERED DESIGN PROFESSIONAL OR AGENCY) AND SHALL INCLUDE THE FOLLOWING ITEMS: (1) A NARRATIVE DESCRIPTION OF THE ACTIVITIES THAT WILL BE ACCOMPLISHED DURING EACH PHASE OF COMMISSIONING, INCLUDING THE PERSONNEL INTENDED TO ACCOMPLISH EACH OF THE ACTIVITIES; (2) A LISTING OF THE SPECIFIC EQUIPMENT, APPLIANCES OR SYSTEMS TO BE TESTING AND A DESCRIPTION OF THE TESTS TO BE PERFORMED; (3) FUNCTIONS TO BE TESTED, INCLUDING BUT NOT LIMITED TO, CALIBRATIONS AND CONTROLS; CONDITIONS UNDER WHICH THE TEST WILL BE PERFORMED, INCLUDING BUT NOT LIMITED TO, AFFIRMING WINTER AND SUMMER DESIGN CONDITIONS AND FULL OUTSIDE AIR CONDITIONS; (5) MEASURABLE CRITERIA FOR PERFORMANCE.
3. PRIOR TO THE FINAL MECHANICAL INSPECTION, THE COMMISSIONING AUTHORITY SHALL PROVIDE EVIDENCE OF MECHANICAL SYSTEMS COMMISSIONING AND COMPLETION. PROVIDE A COMPLETED PRELIMINARY REPORT OF COMMISSIONING TEST PROCEDURES AND RESULTS TO THE OWNER, CERTIFIED BY COMMISSIONING AUTHORITY. THE REPORT SHALL BE IDENTIFIED AS "PRELIMINARY COMMISSIONING REPORT" AND SHALL IDENTIFY: (1) ITEMIZATION OF DEFICIENCIES FOUND DURING TESTING THAT HAVE NOT BEEN CORRECTED AT THE TIME OF THE REPORT PREPARATION; (2) DEFERRED TESTS THAT CANNOT BE PERFORMED.
4. PROVIDE FINAL COMMISSIONING REPORT TO OWNER WITHIN 90 DAYS OF CERTIFICATE OF OCCUPANCY. THE REPORT SHALL BE IDENTIFIED AS "FINAL COMMISSIONING REPORT" AND SHALL INCLUDE: (1) RESULTS OF FUNCTIONAL PERFORMANCE TESTS; (2) DISPOSITION OF DEFICIENCIES FOUND DURING TESTING, INCLUDING DETAILS OF CORRECTIVE MEASURES USED OR PROPOSED; (3) FUNCTIONAL PERFORMANCE TEST ACCEPTANCE, PROVIDE FOR REPEATABILITY. EXCEPTION: DEFERRED TESTS WHICH CANNOT BE PERFORMED AT THE TIME OF REPORT PREPARATION FOR CLIMATIC CONDITIONS.
5. THE ENGINEER OF RECORD SHALL BE RESPONSIBLE FOR PROVIDING THE SERVICES OF AN APPROVED COMMISSIONING AUTHORITY.
6. THE GENERAL CONTRACTOR OR CONSTRUCTION MANAGER SHALL ASSIGN REPRESENTATIVES WITH EXPERTISE AND AUTHORITY TO ACT ON ITS BEHALF AND SHALL SCHEDULE THEM TO PARTICIPATE IN AND PERFORM COMMISSIONING PROCESS ACTIVITIES.
7. CONTRACTORS SHALL PERFORM COMMISSIONING FUNCTIONAL PERFORMANCE TESTS AT THE DIRECTION OF THE COMMISSIONING AUTHORITY. A REPRESENTATIVE FROM THE MECHANICAL CONTRACTOR AND CONTROLS CONTRACTOR WILL BE REQUIRED TO BE ONSITE FOR THE ENTIRE DURATION OF FUNCTIONAL PERFORMANCE TESTING. INCLUDE ADDITIONAL SITE VISITS FROM EQUIPMENT MANUFACTURERS IF NECESSARY TO DEMONSTRATE THE OPERATION OF THE EQUIPMENT AND/OR SYSTEMS, THEIR INTEGRATION WITH THE BAS, AND PERFORM THE REQUIREMENTS OF THE FUNCTIONAL PERFORMANCE TESTS.

GENERAL NOTES

1. THE ENGINEER SHALL NOT BE HELD RESPONSIBLE FOR ANY MISUSE AND/OR MISREPRESENTATION OF THIS SET OF DOCUMENTS.
2. THE CONTRACTOR ASSUMES RESPONSIBILITY FOR THE USE OF THE CONTRACT DOCUMENTS. THE CONTRACTOR SHALL MAKE THEMSELVES AWARE OF PROJECT CONDITIONS AND OWNER REQUIREMENTS PRIOR TO PROCUREMENT OF EQUIPMENT AND SERVICES. CHANGES IN PROJECT COST WILL NOT BE GRANTED DUE TO FIELD CONFLICTS AND OR PROJECT CONDITIONS.
3. THIS SET OF DRAWINGS AND SPECIFICATIONS SHALL NOT BE CONSIDERED A SET OF CONSTRUCTION DOCUMENTS UNLESS A SIGNATURE AND DATE ARE AFFIXED TO THE DRAWINGS AND SPECIFICATIONS BY THE ENGINEER OF RESPONSIBLE CHARGE OF THE GIVEN DISCIPLINE. PRINTED COPIES OF THIS DOCUMENT ARE NOT CONSIDERED SIGNED AND SEALED UNLESS EMBOSSED AND THE SHA AUTHENTICATION CODE MUST BE VERIFIED ON ELECTRONIC COPIES.
4. CONFLICTS BETWEEN THIS SET OF DRAWINGS AND THE CONTRACT SPECIFICATIONS SHALL BE RESOLVED BY THE ENGINEER OF RECORD. THE CONTRACTOR DOES NOT HAVE THE AUTHORITY TO INTERPRET CONFLICTS AND RESOLVE ISSUES WITHOUT WRITTEN DIRECTION FROM THE ENGINEER OF RECORD.
5. ANY CONFLICTS IN THE FIELD OR WITHIN THESE DOCUMENTS SHALL BE RECORDED AND PROVIDED TO THE ENGINEER OF RECORD ON THE CONTRACTOR'S STANDARD LETTERHEAD. WRITTEN DIRECTION RESOLVING CONFLICT WILL BE ISSUED BY THE ENGINEER OF RECORD.
6. PRIOR TO INSTALLATION, COORDINATE AND ADJUST THE FINAL LOCATION OF ALL WALL MOUNTED DEVICES AND EQUIPMENT WITH ALL CASEWORK, SHELVING OR OTHER WALL MOUNTED FURNISHINGS.
7. PLANS ARE DIAGRAMMATIC IN NATURE AND INTENDED TO SHOW THE GENERAL SCOPE OF THE WORK TO BE PERFORMED. REFER TO ARCHITECTURAL AND STRUCTURAL DRAWINGS FOR ALL DIMENSIONS.
8. DUE TO THE SMALL SCALE OF THE DRAWINGS, AND TO UNFORESEEN JOB CONDITIONS, ALL REQUIRED OFFSETS, TRANSITIONS AND FITTINGS MAY NOT BE SHOWN BUT SHALL BE PROVIDED AT NO ADDITIONAL COST.
9. THE CONTRACTOR SHALL COORDINATE WITH OTHER TRADES AND EXISTING EQUIPMENT TO ENSURE THE EQUIPMENT SPECIFIED WILL WORK FOR THE SPACES PROVIDED. FINAL DIMENSIONS OF SYSTEMS SHOWN ON THESE PLANS SHALL BE COORDINATED IN THE FIELD. THE CONTRACTOR SHALL ASSUME RESPONSIBILITY FOR PROVIDING OFFSETS AND TRANSITIONS TO FIT IN SPACES PROVIDED AND AT NO COST TO THE OWNER.
10. THE CONTRACTOR IS RESPONSIBLE FOR ANY SPECIAL REQUIREMENTS INVOLVED IN INSTALLING EQUIPMENT IN THE BUILDING. DISMANTLING AND REASSEMBLING OF ANY EQUIPMENT SHALL BE DONE AS REQUIRED TO BRING INTO THE BUILDING AND EQUIPMENT ROOMS.
11. ALL WORK PERFORMED AS PART OF THIS PROJECT SHALL BE PERFORMED BY EXPERIENCED TRADESMEN WHO ARE TRAINED, EXPERIENCED, AND SKILLED IN THE TASKS INCIDENTAL TO THE PROJECT.
12. ALL WORK SHALL COMPLY WITH APPLICABLE OSHA AND EPS REGULATIONS AND GUIDELINES.
13. THE CONTRACTOR PERFORMING WORK ON THIS PROJECT WILL BE RESPONSIBLE FOR REGULARLY CLEANING THE WORK AREA OF ANY DEBRIS ASSOCIATED WITH THE WORK BEING PERFORMED. THE SITE SHALL BE CLEAN OF ALL CONSTRUCTION DEBRIS AT THE COMPLETION OF THE JOB, BEFORE FINAL PAYMENT IS MADE.
14. REASONABLE PRECAUTIONS SHALL BE MADE FOR SAFETY AND HEALTH INCLUDING BUT NOT LIMITED TO WARNING SIGNS, SAFETY PRECAUTIONS, AND BARRICADES FOR PEDESTRIANS.
15. COORDINATE ALL DEMOLITION, CLEANING, AND CONSTRUCTION WORK. CONTRACTOR SHALL PROVIDE OWNER A FULL CONSTRUCTION SCHEDULE.
16. CONTRACTOR SHALL BE HELD TO PROVIDED SCHEDULE. THEY SHALL BE RESPONSIBLE FOR PROVIDING SUFFICIENT MANPOWER AND EQUIPMENT TO COMPLETE THE WORK IN THE TIME INDICATED.
17. THE CONTRACTOR IS RESPONSIBLE FOR THE PROTECTION AND SECURITY OF ALL EQUIPMENT AND MATERIALS. THE LOCATION OF STORAGE SHALL BE RESTRICTED SPECIFICALLY TO THE AREA ALLOTTED BY THE OWNER.
18. ALL ITEMS INSTALLED UNDER THE SCOPE OF THIS PROJECT SHALL BE NEW, CLEAN, AND FREE OF DEFECTS.
19. IF DRAWING CHANGES ARE NEEDED FOR INSPECTION DUE TO FIELD CHANGES MADE BY THE CONTRACTOR WITHOUT PRIOR APPROVAL OF THE ENGINEER AND AGREED UPON TERMS, THEN THE CONTRACTOR SHALL PAY HOURLY RATES TO THE ENGINEER OF RECORD FOR MAKING NECESSARY CHANGES.
20. SUPPORTS, HANGERS, WIRING, AND PIPING SHALL BE INSTALLED IN A NEAT FASHION AND IN AN ORDERLY APPEARANCE.
21. ALL ROOF EQUIPMENT SHALL BE SECURED TO STRUCTURE TO RESIST A 130 MPH WIND LOAD.
22. PROTECT THE ROOF FROM DAMAGE WHENEVER ANY WORK ON THE ROOF IS REQUIRED.
23. CONTRACTOR SHALL MAINTAIN THE INTEGRITY OF ALL PARTITIONS LABELED WITH A SPECIAL LISTING ON THE ARCHITECTURAL PLANS. THIS INCLUDES FIRE, SMOKE ACOUSTICAL AND OTHER UL WALL OR CEILING ASSEMBLIES.
24. STRUCTURAL PENETRATIONS INCLUDING BUT NOT LIMITED TO WALL, FLOOR, OR BEAM SHALL BE APPROVED BY THE STRUCTURAL ENGINEER. ALL BEAM SLEEVES AND REINFORCING APPROVED BY STRUCTURAL ENGINEER SHALL BE FURNISHED AND INSTALLED BY THE CONTRACTOR.
25. CONTRACTOR SHALL GUARANTEE THE WORK AND MATERIALS FOR PERIOD OF ONE YEAR FROM THE DATE OF FINAL ACCEPTANCE. THIS GUARANTEE SHALL BE IN ADDITION TO THE WARRANTIES PROVIDED BY THE MATERIAL SUPPLIES AND MANUFACTURERS.
26. VALUE ENGINEERING OR CHANGES TO PLANS MUST BE APPROVED BY THE ENGINEER OF RECORD AND RESUBMITTED THROUGH THE BUILDING DEPARTMENT PRIOR TO BEING INSTALLED.

BOILER SCHEDULE

TAG	BLR1 & BLR2
MANUFACTURER	PATTERSON KELLY
MODEL NUMBER	STORM - ST-2000
GAS INPUT (MBH)	2000
HEATING OUTPUT(MBH)	1940
MIN GAS INPUT PRESSURE ("W.C)	3.5
MAX GAS INPUT PRESSURE ("W.C)	14
EFFICIENCY (%)	97%
ENTERING TEMP (F)	140
LEAVING TEMP (F)	160
MAX FLOW (GPM)	170
MIN FLOW (GPM)	54
WEIGHT (LBS)	1305
ELECTRICAL (V/PH)	208/1
OPERATING CURRENT (AMPS)	20
MINIMUM CIRCUIT CAPACITY	20

NOTES

1. BOILER INSTALLATION SHALL COMPLY WITH THE INTERNATIONAL BUILDING CODE-MECHANICAL AND THE BOILER SAFETY ACT (F.S. 554) AND ALL REFERENCED STANDARDS ASSOCIATED WITH THESE SECTIONS OF LAW.
2. PROVIDE BOILER CONTROLLER FROM MANUFACTURER. (BACNET COMPATIBLE)
3. PROVIDE WITH A PRESSURE RELIEF VALVE/PRESSURE-TEMPERATURE GAUGE
4. PROVIDE TURNDOWN RATIO OF 10:1
5. PROVIDE STAINLESS STEEL HX
6. PROVIDE 10 YEAR PARTS AND LABOR WARRANTY (OR MAXIMUM AVAILABLE)

PUMP SCHEDULE

MARK	PP-1&PP-2	BP-1&BP-2
MANUFACTURER	TACO	TACO
MODEL	3007D	SCI3007D-A-4P-PD
TYPE	INLINE	CCES
SERVICE	BOILER PRIMARY HHW	BUILDING HHW
FLUID TEMP	160	160
FLUID SERVICE	WATER	WATER
LOCATION	RA GRAY BUILDING MECHANICAL ROOM	RA GRAY BUILDING MECHANICAL ROOM
WEIGHT (LBS)	220	220
FLOW (GPM)	170	289
MINIMUM FLOW (GPM)	54	30
TOTAL DYNAMIC HEAD (FT)	35	40
MAXIMUM SPEED (RPM)	1760	1760
MINIMUM EFFICIENCY (%)	88	65
MAX BREAK HORSEPOWER (BHP)	1.9	3.51
NAMEPLATE HORSEPOWER (HP)	3	5
ELECTRICAL (V/PH/HZ)	460/3	460/3
ESTIMATED AMP DRAW	5.3	6.9

NOTES:

1. PROVIDE FACTORY MOUNTED VFD, SELF SENSING WITH INSTALLED DP SENSOR IN THE PIPING SYSTEM. THE VFD SHOULD NOT CONTAIN A BYPASS.
2. PUMPS INSTALLED MUST BE BACNET COMPATIBLE.

EXPANSION TANK SCHEDULE

TAG	XT
MANUFACTURER	TACO
MODEL NUMBER	CW600
MAX WORKING PRESSURE (PSI)	125
APPROX WEIGHT (LBS)	620
MAX VOLUME	158
DIAMETER INCHES	30
HEIGHT INCHES	74

MECHANICAL SHEET INDEX

FSM Engineering
150 John Knox Road
Tallahassee, FL, 32303
p.850.222.5683
FL CA 28968

ROBERT E GELHARDT II LICENSEE NO. 77568 STATE OF FLORIDA PROFESSIONAL ENGINEER

Robert Gelhardt II, PE FL 77568

DESIGN AND REPLACE

RA GRAY BUILDING, BOILERS

100% CONSTRUCTION DOCUMENT

500 S. BRONOUGH STREET
TALLAHASSEE, FL 32399

REVISION

No.	Date	Description
1	2025-1-15	CODE UPDATES
-	-	-
-	-	-
-	-	-
-	-	-
-	-	-
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-	-	-
-	-	-

DRAWN BY: REGII
CHECKED BY: REGII
APPROVED BY: REGII

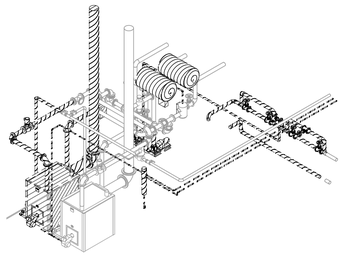
PROJECT: 22067
DATE: 01/15/2025

GENERAL NOTES LEGENDS, SHEET INDEX, SCHEDULES - MECH

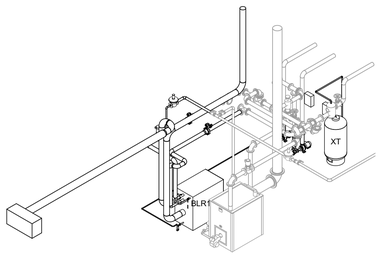
M001

DEMOLITION KEYED NOTES

1	DEMOLISH EXISTING BOILER, POWER, SUPPORTS, CONTROLS, AND OTHER APPURTENANCES AS NECESSARY FOR COMPLETE REMOVAL.
2	DEMOLISH THE EXISTING HOT WATER RETURN PIPING BACK TO THE APPROXIMATE LIMITS INDICATED OR AS NEEDED TO PIPE IN THE NEW TEMPORARY BOILER.
3	DEMOLISH EXISTING GAS PIPING BACK TO JUST BEFORE THE BTU METER. OR AS NEEDED FOR PROPER INSTALLATION OF NEW TEMPORARY BOILER.
4	DEMOLISH EXISTING HOT WATER SUPPLY PIPING BACK TO LIMITS INDICATED OR NEDED FOR PROPER INSTALLATION OF NEW TEMPORARY BOILER.
5	DEMOLISH EXISTING PIPING BACK TO WALL AND CAP AIR AND WATER TIGHT.
6	DEMOLISH EXISTING ABANDONED FUEL OIL PIPING AND ACCESSORIES BACK TO AN APPORPRIATE LOCATION OUTSIDE OF THIS MECHANICAL ROOM. CAP AND ABANDON REMAINING PIPING.
7	DEMOLISH MIDDLE TOP SECTION OF THE SHEET METAL COVER OF THE EXISTING LOUVER TO ALLOW FOR INSTALLATION OF COMBUSTION AIR INTAKE PLENUM IN RENO PHASE. COORDINATE EXACT SIZE ON SITE.
8	DEMOLISH EXISTING FLUE THRU ROOF, NEW FLUE WILL BE INSTALLED IN NEXT PHASE.
9	EXISTING BOILER EMERGENCY SHUTOFF SWITCH SHALL REMAIN.



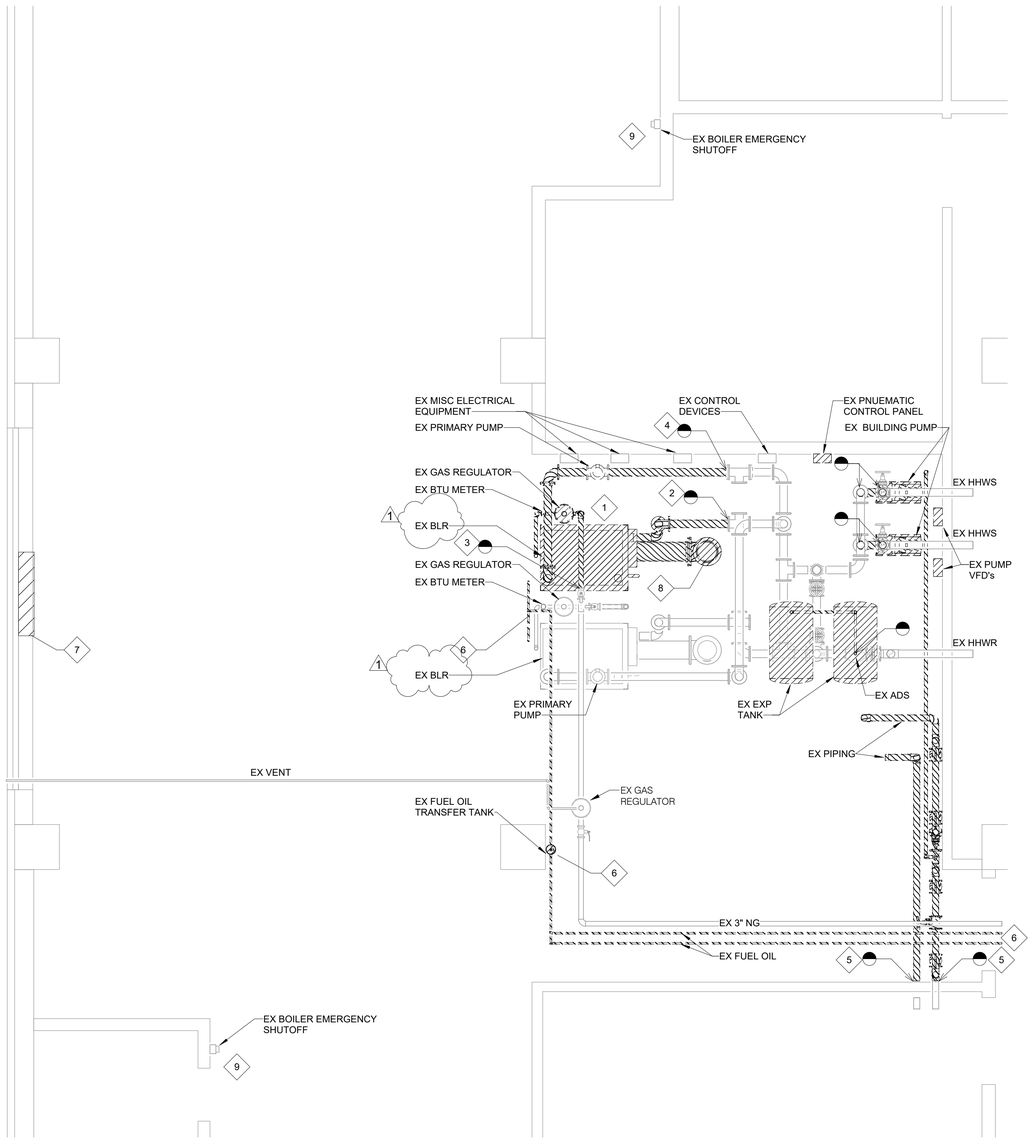
3 M101 **PHASE 1 DEMO ISOMETRIC**
No Scale



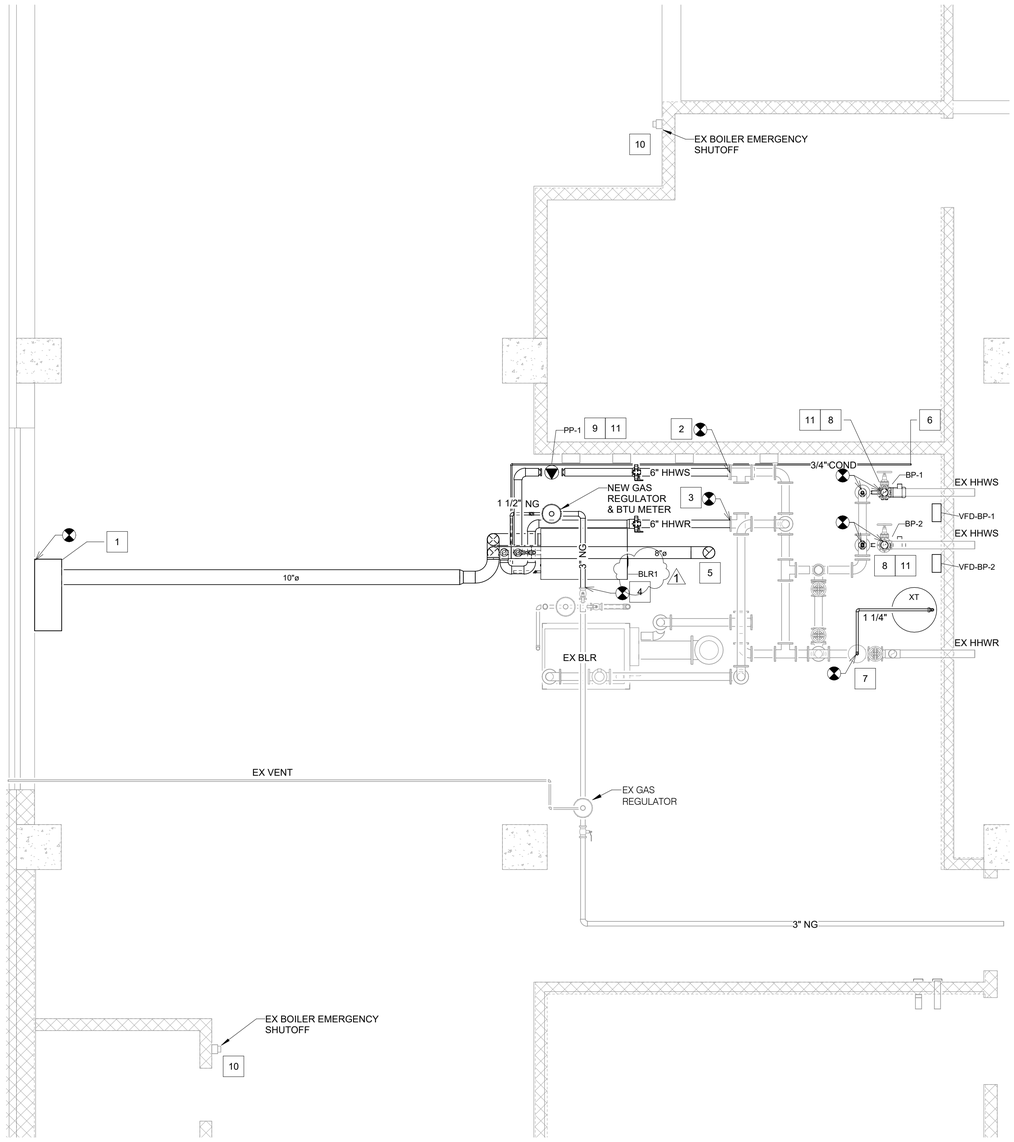
4 M101 **PHASE 1 RENO ISOMETRIC**
No Scale

RENOVATION KEYED NOTES

1	INSTALL NEW COMBUSTION AIR PLENUM ON BACK OF EXISTING LOUVER SECTION. SEAL AIR AND WATER TIGHT, PROVIDE BIRD SCREEN.
2	CONNECT NEW SUPPLY PIPING TO EXISTING SUPPLY CONNECTION IN THIS APPROXIMATE LOCATION. TRANSITION AS NECESSARY.
3	CONNECT NEW RETURN PIPING TO EXISTING RETURN CONNECTION IN THIS APPROXIMATE LOCATION. TRANSITION AS NECESSARY.
4	CONNECT NEW NATURAL GAS PIPING TO EXISTING GAS PIPING IN THIS APPROXIMATE LOCATION. TRANSITION AS NECESSARY. PROVIDE NEW BTU METER TO TIE INTO EX BAS. PROVIDE NEW REGULATOR OF PROPER TYPE.
5	ROUTE NEW FLUE DUCT THROUGH THE ROOF AND FLASH AND SEAL ANY PART OF THE OPENING NOT NEEDED DUE TO THE REDUCED SIZE OF THE DUCT. PROVIDE RAIN CAP AS RECOMMENDED BY MANUFACTURER.
6	ROUTE CONDENSATE FROM BOILER TO FLOOR DRAIN IN THIS APPROXIMATE LOCAITON. SECURE AND PROTECT FROM DAMAGE AND TERMINATE WITH OPEN AIR GAP.
7	INSTALL NEW BLADDER TYPE EXPANSION TANK AND CONNECT INTO EXISTING AIR DIRT SEPERATOR IN THIS APPROXIMATE LOCATION.
8	INSTALL NEW BUILDING PUMPS, VFD'S AND ACCESSORIES AS DETAILED IN THIS APPROXIMATE LOCATION.
9	INSTALL NEW PRIMARY BOILER PUMP, VFD AND ACCESSORIES AS DETAILED IN THIS APPROXIMATE LOCATION.
10	TIE EXISTING BOILER SHUT OFF TO BOTH BOILERS THROUGH THIS PHASE. MOUNT RED ENGRAVED BOILER E-STOP LABEL ON WALL. FONT SHALL BE LARGE ENOUGH TO BE READABLE FROM ACROSS THE ROOM.
11	PROVIDE NEW FLEXIBLE PUMP CONNECTIONS. TYPICAL FOR ALL NEW PUMPS.



1 M101 **PHASE 1 DEMOLITION PLAN - MECHANICAL**
Scale: 1/4" = 1'-0"



2 M101 **PHASE 1 RENOVATION PLAN - MECHANICAL**
Scale: 1/4" = 1'-0"

FSM Engineering
150 John Knox Road
Tallahassee, FL, 32303
p.850.222.5683
FL CA 28968

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DRAWN BY:	REGII
CHECKED BY:	REGII
APPROVED BY:	REGII

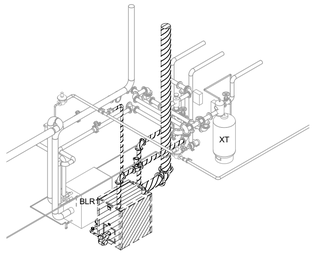
PROJECT: 22067
DATE: 01/15/2025

MECHANICAL PHASE 1 PLAN

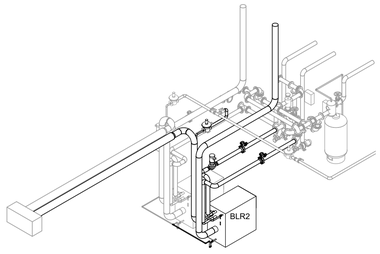
M101

DEMOLITION KEYED NOTES

1	DEMOLISH EXISTING BOILER, POWER, SUPPORTS, CONTROLS, AND OTHER APPURTENANCES AS NECESSARY FOR COMPLETE REMOVAL.
2	DEMOLISH THE EXISTING HOT WATER RETURN PIPING BACK TO THE APPROXIMATE LIMITS INDICATED OR AS NEEDED TO PIPE IN THE NEW TEMPORARY BOILER.
3	DEMOLISH EXISTING GAS PIPING BACK TO JUST BEFORE THE BTU METER. OR AS NEEDED FOR PROPER INSTALLATION OF NEW TEMPORARY BOILER.
4	DEMOLISH EXISTING HOT WATER SUPPLY PIPING BACK TO LIMITS INDICATED OR NEDED FOR PROPER INSTALLATION OF NEW TEMPORARY BOILER.
5	DEMOLISH EXISTING FLUE THRU ROOF, NEW FLUE WILL BE INSTALLED IN NEXT PHASE.
6	EXISTING BOILER EMERGENCY SHUTOFF SWITCH SHALL REMAIN.



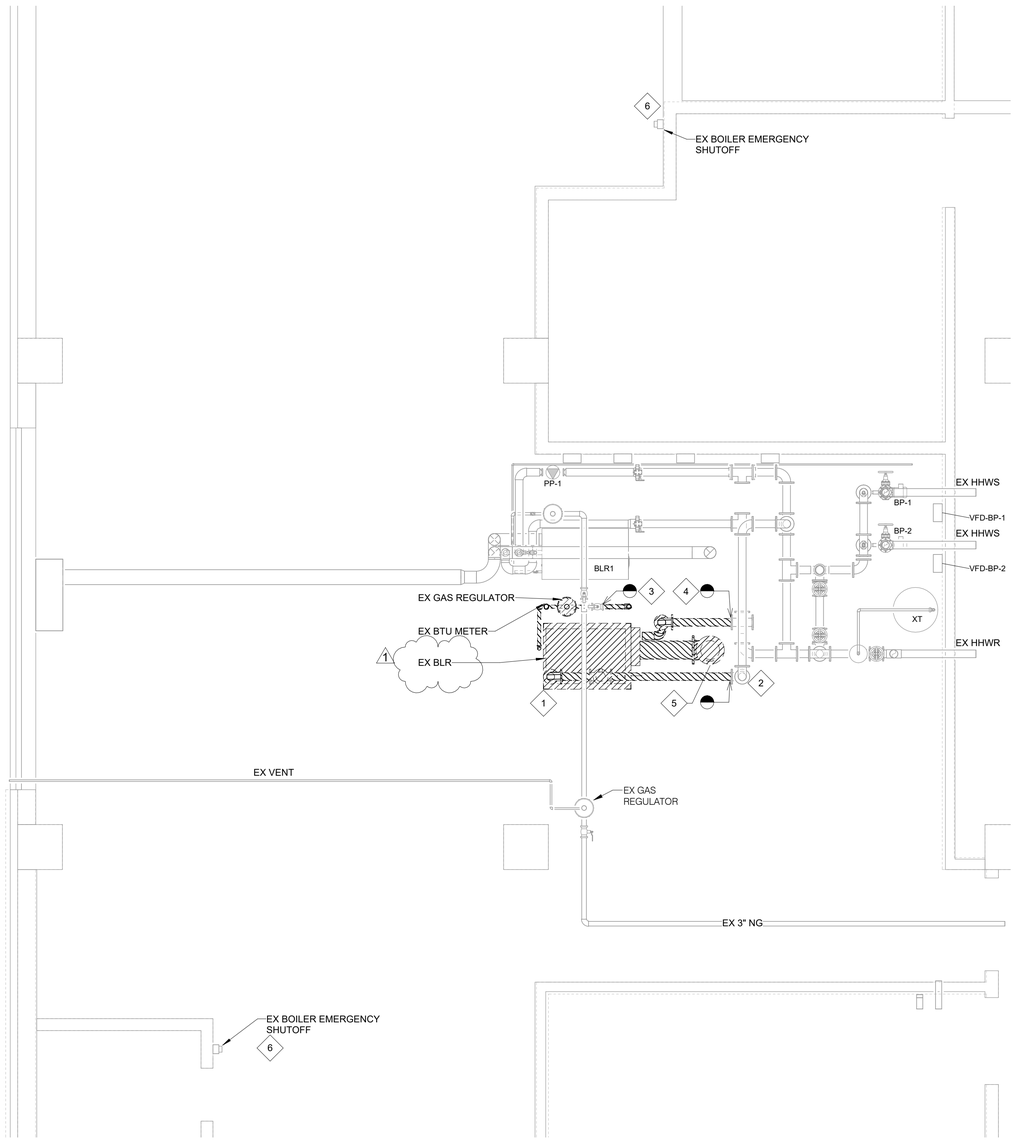
3 M102 **PHASE 2 DEMO ISOMETRIC**
Scale:



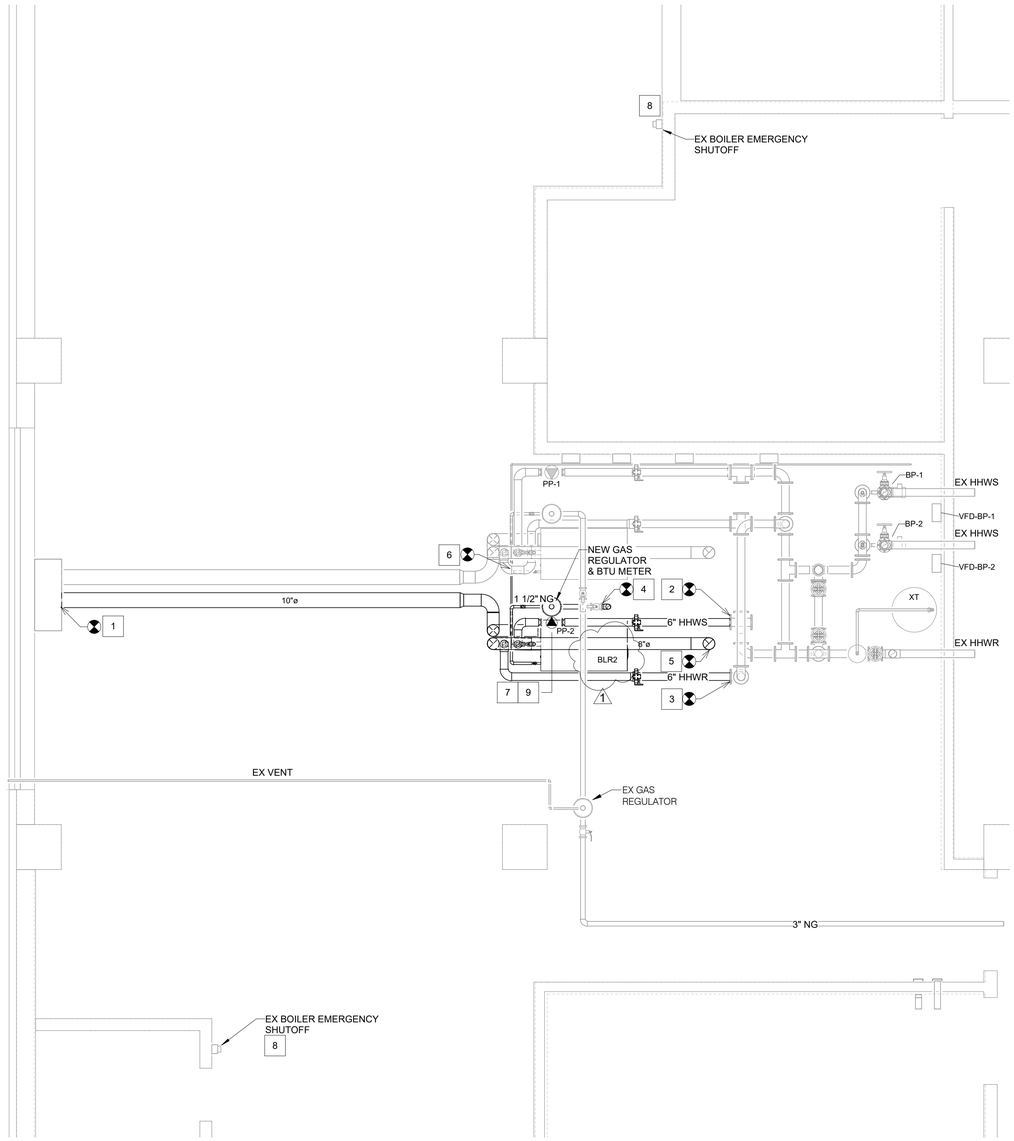
4 M102 **PHASE 2 RENO ISOMETRIC**
Scale:

RENOVATION KEYED NOTES

1	CONNECT NEW COMBUSTION AIR DUCT INTO PHASE 1 COMBUSTION AIR PLENUM.
2	CONNECT NEW SUPPLY PIPING TO EXISTING SUPPLY. CONNECTION IN THIS APPROXIMATE LOCATION. TRANSITION AS NECESSARY.
3	CONNECT NEW RETURN PIPING TO EXISTING RETURN CONNECTION IN THIS APPROXIMATE LOCATION. TRANSITION AS NECESSARY.
4	CONNECT NEW NATURAL GAS PIPING TO EXISTING GAS PIPING IN THIS APPROXIMATE LOCATION. TRANSITION AS NECESSARY. PROVIDE NEW BTU METER TO TIE INTO EX BAS. PROVIDE NEW REGULATOR OF PROPER TYPE.
5	ROUTE NEW FLUE DUCT THROUGH THE ROOF AND FLASH AND SEAL ANY PART OF THE OPENING NOT NEEDED DUE TO THE REDUCED SIZE OF THE DUCT. PROVIDE RAIN CAP AS RECOMMENDED BY MANUFACTURER.
6	ROUTE CONDENSATE FROM BOILER TO PHASE 1 CONDENSATE LINE AT B-1 AND CONNECT WITH BFP.
7	INSTALL NEW PRIMARY BOILER PUMP, VFD AND ACCESSORIES AS DETAILED IN THIS APPROXIMATE LOCATION.
8	TIE EXISTING BOILER SHUT OFF TO BOTH BOILERS THROUGH THIS PHASE IF NOT ALREADY ACCOMPLISHED. MOUNT RED ENGRAVED BOILER E-STOP LABEL ON WALL. FONT SHALL BE LARGE ENOUGH TO BE READABLE FROM ACROSS THE ROOM.
9	PROVIDE NEW FLEXIBLE PUMP CONNECTIONS. TYPICAL FOR ALL NEW PUMPS.



1 M102 **PHASE 2 DEMOLITION PLAN - MECHANICAL**
Scale: 1/4" = 1'-0"



2 M102 **PHASE 2 RENOVATION PLAN - MECHANICAL**
Scale: 1/4" = 1'-0"

FSM Engineering
150 John Knox Road
Tallahassee, FL, 32303
p.850.222.5683
FL CA 28968

ROBERT E GELHARDT II LICENSEE NO. 77568 STATE OF FLORIDA PROFESSIONAL ENGINEER

Robert Gelhardt II, PE FL 77568

RA GRAY BUILDING, DESIGN AND REPLACE BOILERS

100% CONSTRUCTION DOCUMENT

500 S. BRONOUGH STREET
TALLAHASSEE, FL 32399

REVISION		
No.	Date	Description
1	2025-1-15	CODE UPDATES
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-	-	-
-	-	-
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-	-	-
-	-	-

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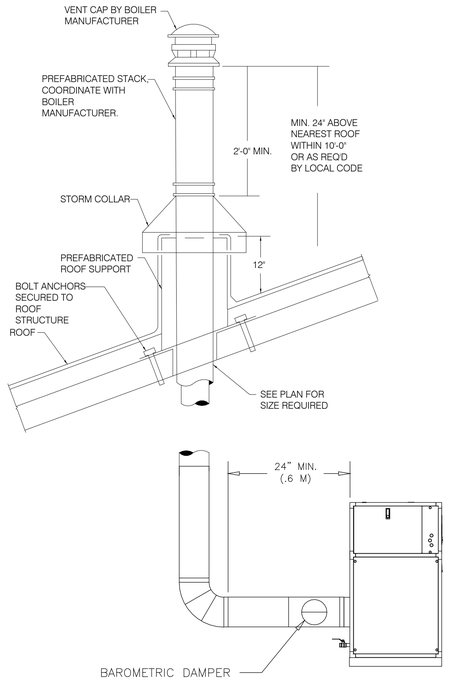
CHECKED BY:	REGII
APPROVED BY:	REGII

PROJECT: 22067
DATE: 01/15/2025

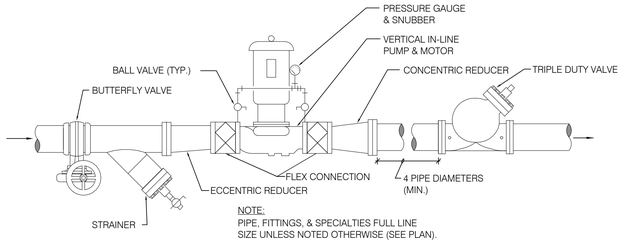
MECHANICAL PHASE 2 PLAN

M102



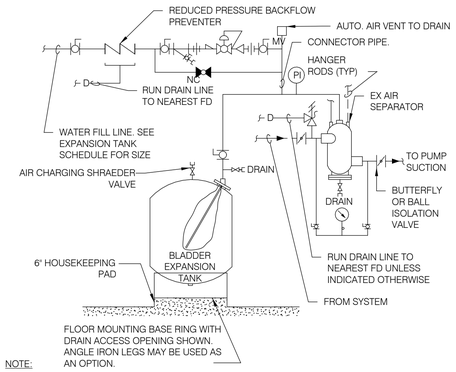
1 BOILER EXHAUST DETAIL

SCALE:NONE



2 VERTICAL IN-LINE PUMP PIPE MOUNTED TYPE

SCALE:NONE

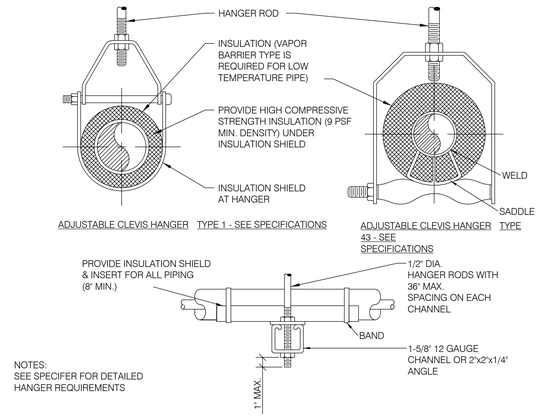


NOTE:

1. SEE EXPANSION TANK SYSTEM SCHEDULE FOR COMPONENT SIZES.
2. SET PRESSURE REDUCING VALVE SO PRESSURE AT HIGHEST POINT IN SYSTEM HAS A MINIMUM OF 4 PSIG.

3 FLOOR MOUNTED EXPANSION TANK - PIPING CONNECTIONS

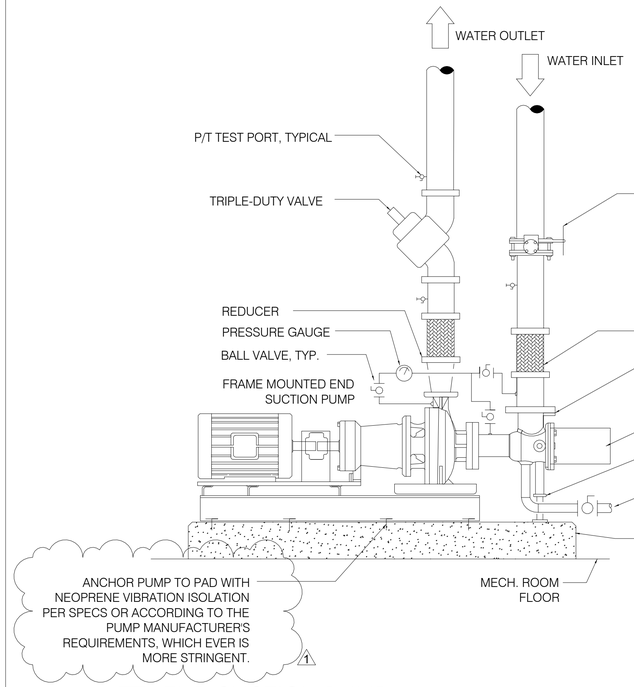
SCALE:NONE



MAXIMUM PIPE/TUBING SUPPORT SPACING																		
NOM. SIZE IN.	THRU 3/4	1	1 1/4	1 1/2	2	2 1/2	3	4	5	6	8	10	12	14	16	18	20	24
PIPE FT.	7	7	7	9	10	11	12	14	16	17	19	22	23	25	27	28	30	32
TUBING FT.	5 FT	6	7	8	8	9	10	12	13	14	16	-	-	-	-	-	-	-
NOTE: FOR TRAPEZE HANGER TAKE SPACING OF SMALLEST SIZE ON TRAPEZE.																		

4 PIPE HANGERS

SCALE:NONE



DETAIL NOTES:

1. VALVES AND PIPING SPECIALTIES SHALL BE FULL LINE SIZE UNLESS NOTED OTHERWISE.

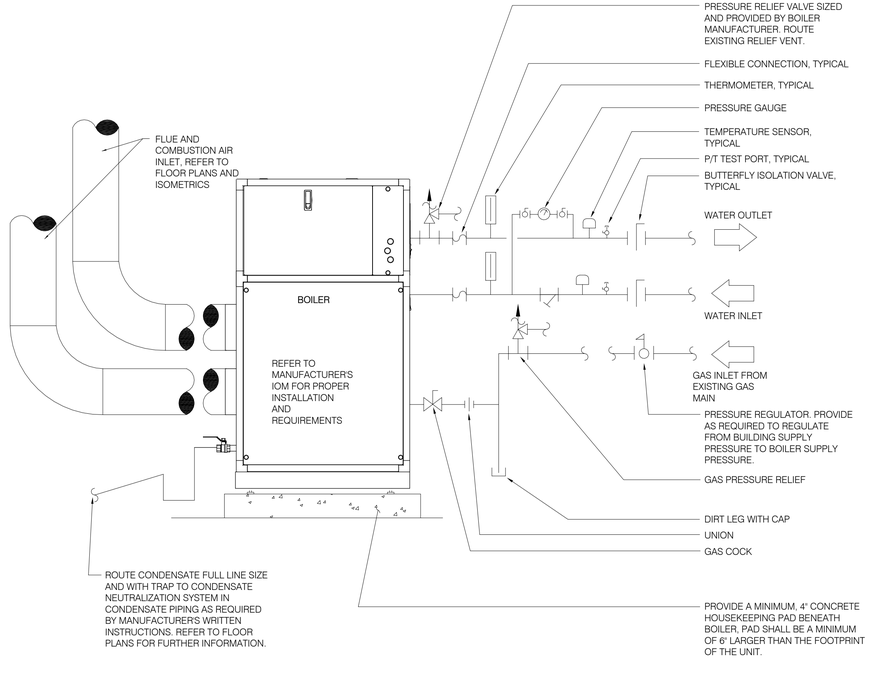
2. PRESSURE GAGE LINES SHALL BE A MINIMUM OF 1/4".

3. SUPPORT PIPING INDEPENDENTLY OF PUMP.

4. PROVIDE WELLS WHERE REQUIRED FOR SWITCHES AND OTHER DEVICES FOR CONTROLS. COORDINATE WITH CONTROLS VENDOR IN FIELD.

5 END SUCTION PUMP

SCALE:NONE



6 BOILER CONNECTION DETAIL

SCALE:NONE

FSM Engineering
150 John Knox Road
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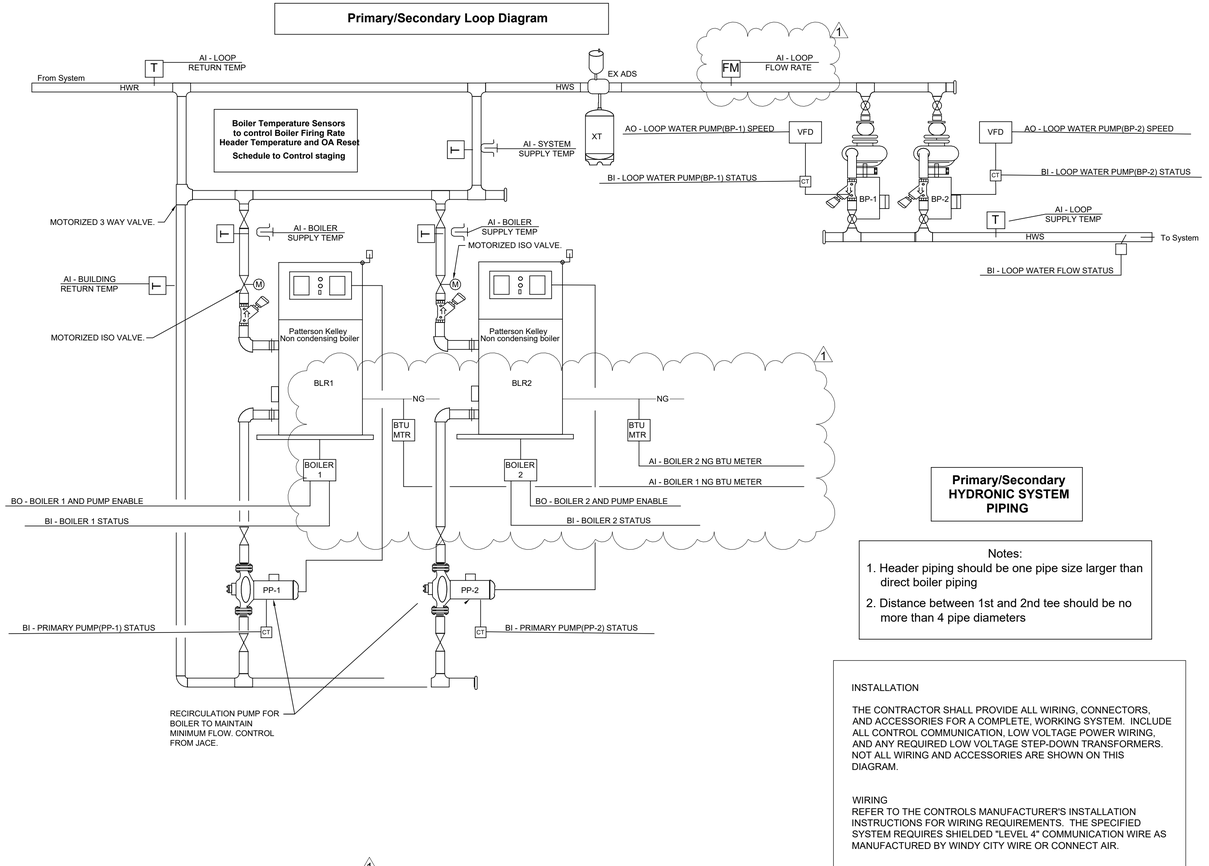
MECHANICAL DETAILS

M501

Primary/Secondary Loop Diagram



Primary/Secondary HYDRONIC SYSTEM PIPING

Notes:
1. Header piping should be one pipe size larger than direct boiler piping
2. Distance between 1st and 2nd tee should be no more than 4 pipe diameters

INSTALLATION

THE CONTRACTOR SHALL PROVIDE ALL WIRING, CONNECTORS, AND ACCESSORIES FOR A COMPLETE, WORKING SYSTEM. INCLUDE ALL CONTROL COMMUNICATION, LOW VOLTAGE POWER WIRING, AND ANY REQUIRED LOW VOLTAGE STEP-DOWN TRANSFORMERS. NOT ALL WIRING AND ACCESSORIES ARE SHOWN ON THIS DIAGRAM.

WIRING
REFER TO THE CONTROLS MANUFACTURER'S INSTALLATION INSTRUCTIONS FOR WIRING REQUIREMENTS. THE SPECIFIED SYSTEM REQUIRES SHIELDED "LEVEL 4" COMMUNICATION WIRE AS MANUFACTURED BY WINDY CITY WIRE OR CONNECT AIR.

ALL NIAGARA INSTANCES SHALL CONTAIN AN OPEN NIAGARA CAPABILITY STATEMENT WHERE ALL ATTRIBUTES ARE "" FOR OPEN.

HVAC CONTROLS

1. GENERAL SCOPE
 1.1. NEW APPLICATION SPECIFIC CONTROLLER, UTILIZING DIRECT DIGITAL CONTROLS. NIAGRA BASED.
 1.2. FURNISH ALL LABOR, MATERIALS, EQUIPMENT, AND SERVICE NECESSARY FOR A COMPLETE AND OPERATING BOILER CONTROL SYSTEM (BCS), UTILIZING DIRECT DIGITAL CONTROLS (DDC) AS SHOWN ON THE DRAWINGS AND DESCRIBED HEREIN.
 1.3. THE BCS SHALL PERFORM CONTROL ALGORITHMS, CALCULATIONS AND ALL MONITORING FUNCTIONS. THE BCS SHALL PROVIDE OPERATOR INTERACTION AND DYNAMIC PROCESS MANIPULATION, INCLUDING OVERALL SYSTEM SUPERVISION, COORDINATION AND CONTROL.
 1.4. THIS SHALL INCLUDE BOILER CONTROL, METERING, ENERGY MANAGEMENT, ALARM MONITORING, AND ALL TRENDING, REPORTING AND MAINTENANCE MANAGEMENT FUNCTIONS RELATED TO NORMAL BOILER OPERATIONS ALL AS INDICATED ON THE DRAWINGS OR ELSEWHERE IN THIS SPECIFICATION.
2. SYSTEM DESCRIPTION
 2.1. SCOPE: NEW BOILERS AND HYDRONIC PUMPS WILL BE TIED TO NEW NIAGRA BASED JACE AND CONNECT INTO THE NEW BAS SYSTEM BEING INSTALLED IN THE CURRENT UPGRADE. MANUFACTURER SHALL PROVIDE BOILER CONTROLLER. THE BOILER CONTROLLER WILL DIRECTLY CONTROL THE BOILERS, HYDRONIC PUMPS, AND MONITORING SYSTEMS.
  2.1.1. THE CONTROLS CONTRACTOR SHALL ASSUME COMPLETE RESPONSIBILITY FOR THE BOILER CONTROLS SYSTEM AS A SINGLE SOURCE. HE SHALL CERTIFY THAT HE HAS ON STAFF UNDER HIS DIRECT EMPLOY ON A DAILY BASIS, FACTORY TRAINED TECHNICAL PERSONNEL. THESE EMPLOYEES SHALL BE QUALIFIED TO PROJECT MANAGE, ENGINEER, COMMISSION, AND SERVICE ALL PORTIONS OF THE CONTROL SYSTEM.
  2.1.2. THE CONTROL SYSTEM SHALL BE DESIGNED SUCH THAT EACH MECHANICAL SYSTEM WILL BE ABLE TO OPERATE UNDER STAND-ALONE CONTROL. AS SUCH, IN THE EVENT OF A NETWORK COMMUNICATION FAILURE, OR THE LOSS OF ANY OTHER CONTROLLER, THE CONTROL SYSTEM SHALL CONTINUE TO INDEPENDENTLY OPERATE.
 2.2. BASIC SYSTEM FEATURES:
  2.2.1. EQUIPMENT MONITORING AND ALARM FUNCTION INCLUDING INFORMATION FOR DIAGNOSING EQUIPMENT PROBLEMS AND ALARM DIAL OUT TO REMOTE SITES OR PAGERS.
  2.2.2. THE COMPLETE SYSTEM, INCLUDING FIELD INSTALLED CONTROLLERS SHALL AUTO-RESTART, WITHOUT OPERATOR INTERVENTION, ON RESUMPTION OF POWER AFTER A POWER FAILURE. DATABASE STORED IN FIELD INSTALLED CONTROLLER MEMORY SHALL BE BATTERY BACKED UP FOR A MINIMUM OF 1 YEAR. BATTERIES ON UNITARY CONTROLLERS SHALL NOT BE ALLOWED.
  2.2.3. MODULAR SYSTEM DESIGN OF PROVEN RELIABILITY.
  2.2.4. EACH FIELD PANEL CAPABLE OF INDEPENDENT CONTROL.
  2.2.5. ALL SOFTWARE AND/OR FIRMWARE INTERFACE EQUIPMENT FOR CONNECTION TO REMOTE MONITORING STATION FROM FIELD HARDWARE.
  2.2.6. THE SYSTEM SHALL BE CAPABLE OF RECORDING EQUIPMENT RUNTIME TOTALIZATION OF BOILERS, PUMPS ETC., AND ALSO CAPABLE OF ALARM GENERATION AND ALARM DIAL OUT TO REMOTE SITES.
  2.2.7. COMMUNICATION WIRING FOR FIELD CONTROLLERS SHALL NOT BE RUN IN STAR PATTERNS.
  2.2.8. ALL DDC HARDWARE AND SOFTWARE SHALL BE DESIGNED AND MANUFACTURED BY U.S. CORPORATIONS. ALL HARDWARE SHALL BE LISTED UNDERWRITERS LABORATORY FOR OPEN ENERGY MANAGEMENT EQUIPMENT (PAZX) UNDER THE U.L. STANDARD FOR SAFETY 916, WITH INTEGRAL LABELS SHOWING RATING.
3. PRODUCT QUALIFICATION:
 3.1. ALL PRODUCTS USED IN THIS INSTALLATION SHALL BE NEW, CURRENTLY UNDER MANUFACTURE, AND SHALL NOT BE USED AS A TEST SITE FOR ANY NEW PRODUCTS UNLESS EXPLICITLY APPROVED BY THE ENGINEER IN WRITING. SPARE PARTS SHALL BE AVAILABLE FOR AT LEAST 5 YEARS AFTER COMPLETION OF THIS CONTRACT.
 3.2. ALL CONTROLLERS SHALL BE CAPABLE OF CONTAINING AND EXECUTING FACTORY DESIGNED AND TESTED, PRE-ENGINEERED CONTROL ALGORITHMS. FACTORY TESTED ALGORITHMS SHALL BE UTILIZED TO MEET THE SEQUENCE OF OPERATION (EXCEPT AS NOTED).
 3.3. OPERATION AND MAINTENANCE MANUALS:
 3.4. MANUALS WILL BE PROVIDED PRIOR TO FINAL ACCEPTANCE AND SHALL INCLUDE:
  3.4.1. INSTALLATION INSTRUCTIONS.
  3.4.2. PRINCIPLES OF OPERATION AND A DETAILED SYSTEM DESCRIPTION.
  3.4.3. STARTUP AND OPERATING INSTRUCTIONS.
 3.5. SYSTEM LAYOUT AND INTERCONNECTION SCHEMATIC DIAGRAMS.
 3.6. ROUTINE PREVENTIVE MAINTENANCE PROCEDURES AND CORRECTIVE DIAGNOSTIC
 3.7. TROUBLESHOOTING PROCEDURES.
 3.8. NAME, ADDRESS AND TELEPHONE NUMBER OF THE DDC SYSTEMS FIELD REPRESENTATIVE.
 3.9. COMPLETE RECOMMENDED SPARE PARTS LIST.
4. WARRANTY
 4.1. WARRANTY SHALL COVER ALL COSTS FOR PARTS, LABOR, ASSOCIATED TRAVEL, AND EXPENSES FOR A PERIOD OF TEN YEAR FROM COMPLETION AND ACCEPTANCE BY THE OWNER, EXCEPT FOR DAMAGES FROM OTHER CAUSES. IF TEN YEAR WARRANTY IS NOT AVAILABLE, OFFER MAXIMUM WARRANTY AVAILABLE.
 4.2. HARDWARE AND SOFTWARE PERSONNEL SUPPORTING THIS WARRANTY AGREEMENT SHALL PROVIDE ON-SITE OR OFF-SITE SERVICE IN A TIMELY MANNER AFTER FAILURE NOTIFICATION TO THE VENDOR. THE MAXIMUM ACCEPTABLE RESPONSE TIME TO PROVIDE THIS SERVICE AT THE SITE SHALL BE 24 HOURS DURING NORMAL BUSINESS HOURS.
 4.3. THIS WARRANTY SHALL APPLY EQUALLY TO BOTH HARDWARE AND SOFTWARE AND BE AT NO COST TO THE OWNER.

SEQUENCE NOTES

SYSTEM DESCRIPTION:

THE HEATING HOT SYSTEM SHALL CONSIST OF BOILERS, PUMPS AND A SERIES OF EXISTING HYDRONIC AIR HANDLING UNITS. THE BOILERS SHALL BE CONTROLLED BY NEW JACE CONTROLLER, PROVIDED BY MANUFACTURER. THE BOILERS AND PUMPS SHALL BE TIED TO THE EXISTING OPCON REMOTE SITE FOR MONITORING AND BE CAPABLE OF TIEING INTO A NEW BAS SYSTEM WHEN THE TIME COMES THAT THE SYSTEM IS UPGRADED IN THE NEAR FUTURE. COORDINATION WITH THE SITE FOR PROPER TIE IN WILL BE REQUIRED. THE CONTROLLER SHALL HAVE ENOUGH POINTS TO CONTROL BOILER SYSTEM IN ACCORDANCE WITH SEQUENCE OF OPERATIONS HEREIN. PER THE BUILDING DEMAND OR EXISTING OCCUPIED SCHEDULE, THE BOILERS SHALL BE ENABLED TO MEET THE WATER SET POINT. THE PUMPS SHALL OPERATE IN A LEAD/STANDBY FASHION. THE BOILER MANUFACTURER AND CONTROL VENDOR ARE RESPONSIBLE FOR PROVIDING HARDWARE AND SOFTWARE EXPANSION DEVICES WHERE ADDITIONAL POINTS ARE REQUIRED.

ON-DEMAND OPERATION:

THE BOILER PLANT SHALL BE ENABLED IF ANY OF THE EXISTING AIR HANDLING EQUIPMENT UTILIZING HOT WATER CONTROL VALVES INDICATE AN OPEN POSITION. THE BOILER SHALL COMMAND THE LEAD HEATING HOT WATER PUMP TO ENERGIZE. ONCE PROOF THAT THE PUMP HAS ENERGIZED VIA THE FLOW METER AND BOILER SUPPLIED FLOW SWITCH, THE BOILER SHALL BE ALLOWED TO START. ONCE STARTED, THE BOILER SHALL FIRE IN STAGES AS REQUIRED TO MAINTAIN THE DESIRED HEATING HOT WATER SET POINT AS SENSED BY THE HEATING HOT WATER SUPPLY TEMPERATURE SENSOR. THE HEATING WATER RETURN TEMPERATURE SENSOR SHALL MONITOR THE RETURN HEATING HOT WATER TEMPERATURE AND INDICATE VALUE ON BOILER PANEL. THE HEATING HOT WATER PUMP SHALL MODULATE TO MAINTAIN FLOW AS SCHEDULED. MAINTAIN MINIMUM FLOWS BY BOILER RE-CIRCULATION PUMP. COORDINATE MINIMUM FLOWS WITH BOILER MANUFACTURER AS NEEDED.

OCCUPIED OPERATION:

BUILDING LOOP RUN CONDITIONS:
THE BOILER SHALL RUN WHENEVER:
1. THE BOILER PLANT SHALL BE ENABLED IF ANY OF THE EXISTING AIR HANDLING EQUIPMENT UTILIZING HOT WATER CONTROL VALVES INDICATE AN OPEN POSITION.

THE FOLLOWING LOOP WATER CONDITIONS SHALL BE MONITORED:
1. FLOW RATE AND STATUS.
2. SUPPLY TEMPERATURE.
3. RETURN TEMPERATURE.

ALARMS AND A UNIT SHUTDOWN SIGNAL SHALL BE GENERATED UPON ANY OF THE FOLLOWING LOOP WATER CONDITIONS:
1. NO LOOP FLOW.
2. HIGH LOOP WATER SUPPLY TEMP SHUTDOWN: IF THE LOOP WATER SUPPLY TEMPERATURE IS GREATER THAN SETPOINT +5 °F (ADJ.).

ALARMS SHALL BE PROVIDED AS FOLLOWS:
1. HIGH LOOP WATER SUPPLY TEMP: IF THE LOOP WATER SUPPLY TEMPERATURE IS GREATER THAN SETPOINT +5 °F (ADJ.).
2. LOW LOOP WATER SUPPLY TEMP: IF THE LOOP WATER SUPPLY TEMPERATURE IS LESS THAN SETPOINT -25°F (ADJ.) FOR MORE THAN 1 HOUR.

LOOP WATER PUMP LEAD/STANDBY OPERATION:
THE TWO LOOP WATER PUMPS SHALL OPERATE IN A LEAD/STANDBY FASHION.
1. ANY PUMP CAN BE THE LEAD OR LAG PUMP AT ANY TIME. THE PUMPS SHALL BE ROTATED ON A BI-WEEKLY BASIS.
2. THE LEAD PUMP SHALL RUN FIRST.
3. ON FAILURE OF THE LEAD PUMP, THE STANDBY PUMP SHALL RUN AND THE LEAD PUMP SHALL TURN OFF.

THE DESIGNATED LEAD PUMP SHALL ROTATE UPON ONE OF THE FOLLOWING CONDITIONS (USER SELECTABLE):
1. MANUALLY THROUGH A SOFTWARE SWITCH
2. IF PUMP RUNTIME (ADJ.) IS EXCEEDED
3. DAILY
4. WEEKLY(INITIAL SETTING)
5. MONTHLY

ALARMS SHALL BE PROVIDED AS FOLLOWS:
1. BOILER PUMP 1
 FAILURE: COMMANDED ON, BUT THE STATUS IS OFF.
 RUNNING IN HAND: COMMANDED OFF, BUT THE STATUS IS ON.
2. BOILER PUMP 2
 FAILURE: COMMANDED ON, BUT THE STATUS IS OFF.
 RUNNING IN HAND: COMMANDED OFF, BUT THE STATUS IS ON.

BOILER SYSTEM RUN CONDITIONS:
THE BOILER SYSTEM SHALL RUN SUBJECT TO ITS OWN INTERNAL SAFETIES AND CONTROLS.
THE BOILER SYSTEM SHALL BE ENABLED TO RUN WHENEVER:
1. THE BOILER IS ENABLED BY BUILDING LOOP REQUIREMENTS.
2. AND OUTSIDE AIR TEMPERATURE IS LESS THAN 68°F (ADJ.).

BOILERS LOOP WATER TEMPERATURE CONTROL:
THE CONTROLLER SHALL MEASURE THE LOOP WATER SUPPLY TEMPERATURE AND ENABLE THE BOILERS TO MAINTAIN SETPOINTS. THE TWO BOILERS SHALL RUN SUBJECT TO THEIR OWN INTERNAL SAFETIES AND CONTROLS. THE TWO BOILERS SHALL OPERATE SIMULTANEOUSLY PER THEIR MANUFACTURE BACNET CONTROLLER.

THE FOLLOWING SETPOINTS ARE RECOMMENDED VALUES. ALL SETPOINTS SHALL BE FIELD ADJUSTED DURING THE COMMISSIONING PERIOD TO MEET THE REQUIREMENTS OF ACTUAL FIELD CONDITIONS.
THE BOILER SHALL BE ENABLED TO MAINTAIN SETPOINTS AS FOLLOWS:
1. BOILER SETPOINT160°F(ADJ.).

ALARMS SHALL BE PROVIDED AS FOLLOWS:
1. BOILER 1
 FAILURE: COMMANDED ON BUT THE STATUS IS OFF.
 RUNNING IN HAND: COMMANDED OFF BUT THE STATUS IS ON.
 RUNTIME EXCEEDED: STATUS RUNTIME EXCEEDS A USER DEFINABLE LIMIT.
2. BOILER 2
 FAILURE: COMMANDED ON BUT THE STATUS IS OFF.
 RUNNING IN HAND: COMMANDED OFF BUT THE STATUS IS ON.
 RUNTIME EXCEEDED: STATUS RUNTIME EXCEEDS A USER DEFINABLE LIMIT.
3. BOILER FAILURE: BOILER IS IN FAILURE.

BOILERS NATURAL GAS MONITORING AND TRENDING:
THE CONTROLLER SHALL MEASURE THE NATURAL GAS SUPPLY FOR EACH BOILER AND TREND THE USAGE OF EACH UTILIZING AN INLINE BTU METER. THE TREND DATA SHALL FEED TO THE BAS FRONT END FOR ACCESS BY OPCON.

Hot Water

POINT NAME	DISPLAY NAME	FACETS	POINT TYPE	COMMAND PRIORITY	TREND TYPE	TREND NTERVAL	ALARM TYPE	ALARM CLASS	ALARM HIGH LIMIT	ALARM LOW LIMIT	ALARM DELAY (MIN)
	HARDWARE										
BLR1	BOILER 1 RUN COMMAND	ON/OFF	BO	Override On/Override Off/Auto	BooleanCov	COV	BooleanCommandFailure	Bldg_CriticalAlarmClass	N/A	N/A	5-Mins
BLR2	BOILER 2 RUN COMMAND	ON/OFF	BO	Override On/Override Off/Auto	BooleanCov	COV	BooleanCommandFailure	Bldg_CriticalAlarmClass	N/A	N/A	5-Mins
PHWP1	PRIMARY PUMP 1 RUN COMMAND	ON/OFF	BO	Override On/Override Off/Auto	BooleanCov	COV	BooleanCommandFailure	Bldg_CriticalAlarmClass	N/A	N/A	5-Mins
PHWP2	PRIMARY PUMP 2 RUN COMMAND	ON/OFF	BO	Override On/Override Off/Auto	BooleanCov	COV	BooleanCommandFailure	Bldg_CriticalAlarmClass	N/A	N/A	5-Mins
SHWP1	SECONDARY PUMP 1 RUN COMMAND	ON/OFF	BO	Override On/Override Off/Auto	BooleanCov	COV	BooleanCommandFailure	Bldg_CriticalAlarmClass	N/A	N/A	5-Mins
SHWP2	SECONDARY PUMP 2 RUN COMMAND	ON/OFF	BO	Override On/Override Off/Auto	BooleanCov	COV	BooleanCommandFailure	Bldg_CriticalAlarmClass	N/A	N/A	5-Mins
BLR1_IV	BOILER 1 HOT WATER ISOLATION VALVE COMMAND	ON/OFF	BO	Override On/Override Off/Auto	BooleanCov	COV	BooleanCommandFailure	Bldg_CriticalAlarmClass	N/A	N/A	N/A
BLR2_IV	BOILER 2 HOT WATER ISOLATION VALVE COMMAND	ON/OFF	BO	Override On/Override Off/Auto	BooleanCov	COV	BooleanCommandFailure	Bldg_CriticalAlarmClass	N/A	N/A	N/A
SHW_FL	HOT WATER SECONDARY LOOP FLOW	GPM	AI	READ ONLY	N/A		N/A	N/A	N/A	N/A	N/A
HW_BPF	HOT WATER BYPASS FLOW	GPM	AI	READ ONLY	N/A		N/A	N/A	N/A	N/A	N/A
BLR1_ST	BOILER 1 RUN STATUS	ON/OFF	BI	READ ONLY	BooleanCov	COV	N/A	N/A	N/A	N/A	N/A
BLR2_ST	BOILER 2 RUN STATUS	ON/OFF	BI	READ ONLY	BooleanCov	COV	N/A	N/A	N/A	N/A	N/A
PHWP1_ST	PRIMARY PUMP 1 RUN STATUS	ON/OFF	BI	READ ONLY	BooleanCov	COV	N/A	N/A	N/A	N/A	N/A
PHWP2_ST	PRIMARY PUMP 2 RUN STATUS	ON/OFF	BI	READ ONLY	BooleanCov	COV	N/A	N/A	N/A	N/A	N/A
SHWP1_ST	SECONDARY PUMP 1 RUN STATUS	ON/OFF	BI	READ ONLY	BooleanCov	COV	N/A	N/A	N/A	N/A	N/A
SHWP2_ST	SECONDARY PUMP 2 RUN STATUS	ON/OFF	BI	READ ONLY	BooleanCov	COV	N/A	N/A	N/A	N/A	N/A
SHW_DP1	HOT WATER SECONDARY LOOP DIFFERENTIAL PRESSURE 1	PSID	AI	READ ONLY	N/A	N/A	OutOfRange	N/A	N/A	N/A	N/A
SHW_DP2	HOT WATER SECONDARY LOOP DIFFERENTIAL PRESSURE 2	PSID	AI	READ ONLY	N/A	N/A	OutOfRange	N/A	N/A	N/A	N/A
PHWP1_REF	PRIMARY HOT WATER PUMP 1 SPEED COMMAND	%	AO	Override/Auto	BooleanCov	N/A	N/A	N/A	N/A	N/A	5-Mins
PHWP2_REF	PRIMARY HOT WATER PUMP 2 SPEED COMMAND	%	AO	Override/Auto	BooleanCov	N/A	N/A	N/A	N/A	N/A	5-Mins
SHWP1_REF	SECONDARY HOT WATER PUMP 1 SPEED COMMAND	%	AO	Override/Auto	BooleanCov	N/A	N/A	N/A	N/A	N/A	5-Mins
SHWP2_REF	SECONDARY HOT WATER PUMP 2 SPEED COMMAND	%	AO	Override/Auto	BooleanCov	N/A	N/A	N/A	N/A	N/A	5-Mins
SHWST	HOT WATER SECONDARY LOOP SUPPLY TEMPERATURE	DEG F	AI	READ ONLY	NumericInterval	15-Mins	OutOfRange	N/A	N/A	N/A	N/A
SHWRT	HOT WATER SECONDARY LOOP RETURN TEMPERATURE	DEG F	AI	READ ONLY	NumericInterval	15-Mins	N/A	N/A	N/A	N/A	N/A
BLR1_HWRT	BOILER 1 HOT WATER ENTERING TEMPERATURE	DEG F	AI	READ ONLY	NumericInterval	15-Mins	OutOfRange	Bldg_CriticalAlarmClass	N/A	-4	5-Mins
BLR1_HWST	BOILER 1 HOT WATER LEAVING TEMPERATURE	DEG F	AI	READ ONLY	NumericInterval	15-Mins	N/A	N/A	N/A	N/A	N/A
BLR2_HWRT	BOILER 2 HOT WATER ENTERING TEMPERATURE	DEG F	AI	READ ONLY	NumericInterval	15-Mins	OutOfRange	Bldg_CriticalAlarmClass	N/A	-4	5-Mins
BLR2_HWST	BOILER 2 HOT WATER LEAVING TEMPERATURE	DEG F	AI	READ ONLY	NumericInterval	15-Mins	N/A	N/A	N/A	N/A	N/A
HW_BPT	HOT WATER BYPASS TEMPERATURE	DEG F	AI	READ ONLY	NumericInterval	15-Mins	OutOfRange	N/A	N/A	N/A	N/A
BLR1_AL	BOILER 1 RUN STATUS ALARM	NORMAL/ALARM	BI	READ ONLY	NumericInterval	COV	BooleanChangeOfState	Bldg_CriticalAlarmClass	N/A	N/A	2-Mins
BLR2_AL	BOILER 2 RUN STATUS ALARM	NORMAL/ALARM	BI	READ ONLY	NumericInterval	COV	BooleanChangeOfState	Bldg_CriticalAlarmClass	N/A	N/A	2-Mins
	SOFTWARE										
HW_PLN_ENA	HOT WATER PLANT ENABLE COMMAND	ON/OFF	BV	Override On/Override Off	BooleanCov	COV	N/A	N/A	N/A	N/A	N/A
SHWST_SP	HOT WATER SECONDARY LOOP SUPPLY TEMPERATURE SETPOINT	DEG F	AV	SET	NumericCov	COV	N/A	N/A	N/A	N/A	N/A
SHW_DP_SP	HOT WATER SECONDARY LOOP DIFFERENTIAL PRESSURE SETPOINT	PSID	AV	SET	NumericCov	COV	N/A	N/A	N/A	N/A	N/A
HW_PLN_DP_SP	HOT WATER PLANT DIFFERENTIAL PRESSURE SETPOINT	PSID	AV	SET	NumericCov	COV	N/A	N/A	N/A	N/A	N/A
HW_PLN_MBH	HOT WATER PLANT CONSUMPTION	MBH	AV	READ ONLY	NumericInterval	15-Mins	N/A	N/A	N/A	N/A	N/A
HW_PLN_MBHTOT	HOW WATER PLANT CONSUMPTION TOTALIZED	MILLIONS BTUH	AV	READ ONLY	NumericInterval	15-Mins	N/A	N/A	N/A	N/A	N/A

FSM Engineering
150 John Knox Road
Tallahassee, FL, 32303
p.850.222.5683
FL CA 28968

ROBERT E GELHARDT II LICENSEE NO. 77568 STATE OF FLORIDA PROFESSIONAL ENGINEER

Robert Gelhardt II, PE FL 77568

RA GRAY BUILDING, DESIGN AND REPLACE BOILERS

100% CONSTRUCTION DOCUMENT

500 S. BRONOUGH STREET
TALLAHASSEE, FL 32399

REVISION		
No.	Date	Description
1	2025-1-15	CODE UPDATES
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DRAWN BY: REGII
CHECKED BY: REGII
APPROVED BY: REGII

PROJECT: 22067
DATE: 01/15/2025

MECHANICAL CONTROLS

M701

ELECTRICAL SPECIFICATIONS:

BASIC ELECTRICAL MATERIALS AND METHODS

1. ELECTRICAL COMPONENTS, DEVICES, AND ACCESSORIES: LISTED AND LABELED AS DEFINED IN NFPA 70, ARTICLE 100, BY A TESTING AGENCY ACCEPTABLE TO AUTHORITIES HAVING JURISDICTION, AND MARKED FOR INTENDED USE.
2. IDENTIFICATION DEVICE COLORS: USE THOSE PRESCRIBED BY ANSI A13.1, NFPA 70, AND THESE SPECIFICATIONS.
3. COLORED ADHESIVE MARKING TAPE FOR RACEWAYS, WIRES, AND CABLES: SELF-ADHESIVE VINYL TAPE, NOT LESS THAN 1 INCH WIDE BY 3 MILS THICK (25 MM WIDE BY 0.08 MM THICK).
4. TAPE MARKERS FOR CONDUCTORS: VINYL OR VINYL-CLOTH, SELF-ADHESIVE, WRAPAROUND TYPE WITH PREPRINTED NUMBERS AND LETTERS.
5. STOCK, MELAMINE PLASTIC LAMINATE PUNCHED OR DRILLED FOR MECHANICAL FASTENERS 1/16-INCH (1.6-MM) MINIMUM THICKNESS FOR SIGNS UP TO 20 SQ. IN. (129 SQ. CM) AND 1/8-INCH (3.2-MM) MINIMUM THICKNESS FOR LARGER SIZES. ENGRAVED LEGEND IN BLACK LETTERS ON WHITE BACKGROUND.
6. PULL STRINGS: PROVIDE PULL STRINGS IN ALL SPARE OR EMPTY CONDUITS AND RACEWAYS.
7. COORDINATE NAMES, ABBREVIATIONS, COLORS, AND OTHER DESIGNATIONS USED FOR ELECTRICAL IDENTIFICATION WITH CORRESPONDING DESIGNATIONS INDICATED IN THE CONTRACT DOCUMENTS OR REQUIRED BY CODES AND STANDARDS. USE CONSISTENT DESIGNATIONS THROUGHOUT PROJECT.
8. CUT, CHANNEL, CHASE, AND DRILL FLOORS, WALLS, PARTITIONS, CEILINGS, AND OTHER SURFACES REQUIRED TO PERMIT ELECTRICAL INSTALLATIONS. PERFORM CUTTING BY SKILLED MECHANICS OF TRADES INVOLVED. SEAL ALL CONDUIT PENETRATIONS. USE APPROVED METHODS TO MAINTAIN UL-RATED ASSEMBLIES.
9. REPAIR, REFINISH AND TOUCH UP DISTURBED FINISH MATERIALS AND OTHER SURFACES TO MATCH ADJACENT UNDISTURBED SURFACES.
10. ALL BOLTED OR SCREWED ELECTRICAL CONNECTIONS SHALL BE TIGHTENED TO MANUFACTURER'S SPECIFIED TORQUE; PROVIDE TEST REPORT FOR OWNER REVIEW.
11. ALL WORK SHALL COMPLY WITH CODES & STANDARDS LISTED ON THE PLANS.

GROUNDING AND BONDING

1. EQUIPMENT GROUNDING CONDUCTORS: COMPLY WITH NFPA 70, ARTICLE 250, FOR TYPES, SIZES, AND QUANTITIES OF EQUIPMENT GROUNDING CONDUCTORS, UNLESS SPECIFIC TYPES, LARGER SIZES, OR MORE CONDUCTORS THAN REQUIRED BY NFPA 70 ARE INDICATED.
2. INSTALL INSULATED EQUIPMENT GROUNDING CONDUCTORS IN ALL FEEDERS AND BRANCH CIRCUITS.
3. ALL GROUNDING CONDUCTORS SHALL BE COPPER; COMPLY WITH DIVISION 16 SECTION "CONDUCTORS AND CABLES" AND ASTM B, AS APPLICABLE.
4. EQUIPMENT GROUNDING CONDUCTORS: INSULATED WITH GREEN-COLORED INSULATION.
5. GROUNDING ELECTRODE CONDUCTORS: STRANDED COPPER CABLE.
6. UNDERGROUND CONDUCTORS: BARE, TINNED, STRANDED, UNLESS OTHERWISE INDICATED.
7. CONNECTORS: COMPLY WITH IEEE 837 AND UL 467; LISTED FOR USE FOR SPECIFIC TYPES, SIZES, AND COMBINATIONS OF CONDUCTORS AND CONNECTED ITEMS.
8. IN RACEWAYS, USE INSULATED EQUIPMENT GROUNDING CONDUCTORS.
9. EXOTHERMIC-WELDED CONNECTIONS: USE FOR CONNECTIONS TO STRUCTURAL STEEL AND FOR UNDERGROUND CONNECTIONS.
10. GROUNDING CONDUCTORS: ROUTE ALONG SHORTEST AND STRAIGHTEST PATHS POSSIBLE, UNLESS OTHERWISE INDICATED. AVOID OBSTRUCTING ACCESS OR PLACING CONDUCTORS WHERE THEY MAY BE SUBJECTED TO STRAIN, IMPACT, OR DAMAGE.
11. BONDING STRAPS AND JUMPERS: INSTALL SO VIBRATION BY EQUIPMENT MOUNTED ON VIBRATION ISOLATION HANGERS OR SUPPORTS IS NOT TRANSMITTED TO RIGIDLY MOUNTED EQUIPMENT.

CONDUCTORS AND CABLES

1. CONDUCTOR MATERIAL: COPPER COMPLYING WITH NEMA WC 5 OR 7; SOLID CONDUCTOR FOR NO. 14 AWG AND SMALLER, STRANDED FOR NO. 12 AWG AND LARGER.
2. CONDUCTOR INSULATION TYPES: TYPE THHN-THWN COMPLYING WITH NEMA WC 5 OR WC 7.
3. TYPE MC/NM CABLE SHALL NOT BE PERMITTED.
4. FEEDERS CONCEALED IN WALLS OR CEILING: TYPE THHN-THWN, SINGLE CONDUCTORS IN RACEWAY.
5. BRANCH CIRCUITS CONCEALED IN CEILINGS, WALLS, AND PARTITIONS: TYPE THHN-THWN, SINGLE CONDUCTORS IN RACEWAY.
6. CONCEAL CABLES AND RACEWAYS IN FINISHED WALLS, CEILINGS, AND FLOORS.
7. USE MANUFACTURER-APPROVED PULLING COMPOUND OR LUBRICANT WHERE NECESSARY; COMPOUND USED MUST NOT DETERIORATE CONDUCTOR OR INSULATION. DO NOT EXCEED MANUFACTURER'S RECOMMENDED MAXIMUM PULLING TENSIONS AND SIDEWALL PRESSURE VALUES.
8. INSTALL EXPOSED CABLES PARALLEL AND PERPENDICULAR TO SURFACES OF EXPOSED STRUCTURAL MEMBERS, AND FOLLOW SURFACE CONTOURS WHERE POSSIBLE.
9. MAKE SPLICES AND TAPS THAT ARE COMPATIBLE WITH CONDUCTOR MATERIAL AND THAT POSSESS EQUIVALENT OR BETTER MECHANICAL STRENGTH AND INSULATION RATINGS THAN UNSPLICED CONDUCTORS.
10. WIRING AT OUTLETS: INSTALL CONDUCTOR AT EACH OUTLET, WITH AT LEAST 6 INCHES (150 MM) OF SLACK.
11. MINIMUM SIZE FOR POWER CONDUCTORS: #12 AWG.
12. COLORS: 277/480V CONDUCTOR SHALL BE BROWN, ORANGE, YELLOW; GRAY NEUTRAL. 120/208V CONDUCTORS SHALL BE BLACK, RED, BLUE; WHITE NEUTRAL.

RACEWAYS AND BOXES

1. PERMANENENTLY LABEL ALL RACEWAYS AND JUNCTION/PULL BOX COVERS TO INDICATE PANEL/CIRCUIT NUMBERS CONTAINED.
2. UNLESS OTHERWISE NOTED, PROVIDE NEMA 1 ENCLOSURES IN INDOOR LOCATIONS, NEMA 3R ENCLOSURES IN OUTDOOR LOCATIONS.
3. MINIMUM RACEWAY SIZE: 3/4" TRADE SIZE. RACEWAYS SHALL BE EMT, RGSC, OR IMC. CONDUITS CONCEALED IN WALLS OR CEILINGS SHALL BE EMT. ALL OTHERS SHALL BE IMC OR RGS.
4. KEEP RACEWAYS AT LEAST 6 INCHES (150 MM) AWAY FROM PARALLEL RUNS OF HOT-WATER PIPES. INSTALL HORIZONTAL RACEWAY RUNS ABOVE WATER PIPING.
5. PROTECT STUB-UPS FROM DAMAGE WHERE CONDUITS RISE THROUGH FLOOR SLABS. ARRANGE SO CURVED PORTIONS OF BENDS ARE NOT VISIBLE ABOVE FINISHED SLAB.
6. MAKE BENDS AND OFFSETS SO ID IS NOT REDUCED. KEEP LEGS OF BENDS IN SAME PLANE AND KEEP STRAIGHT LEGS OF OFFSETS PARALLEL, UNLESS OTHERWISE INDICATED.
7. CONCEAL CONDUIT AND EMT WITHIN FINISHED WALLS AND CEILINGS, EXCEPT IN EQUIPMENT ROOMS.
9. INSTALL EXPOSED RACEWAYS PARALLEL OR AT RIGHT ANGLES TO NEARBY SURFACES OR STRUCTURAL MEMBERS AND FOLLOW SURFACE CONTOURS AS MUCH AS POSSIBLE.
10. INSTALL RACEWAY SEALING FITTINGS AT SUITABLE, APPROVED, AND ACCESSIBLE LOCATIONS AND FILL THEM WITH UL-LISTED SEALING COMPOUND. INSTALL RACEWAY SEALING FITTINGS WHERE CONDUITS PASS FROM WARM TO COLD LOCATIONS, SUCH AS BOUNDARIES OF REFRIGERATED SPACES AND WHERE OTHERWISE REQUIRED BY NFPA 70.
11. FLEXIBLE CONNECTIONS: USE MAXIMUM OF 72 INCHES (1830 MM) OF FLEXIBLE CONDUIT FOR RECESSED AND SEMIRECESSED LIGHTING FIXTURES; FOR EQUIPMENT SUBJECT TO VIBRATION, NOISE TRANSMISSION, OR MOVEMENT; AND FOR ALL MOTORS. USE LFMC IN DAMP OR WET LOCATIONS. INSTALL SEPARATE GROUND CONDUCTOR ACROSS FLEXIBLE CONNECTIONS.

ENCLOSED SWITCHES

1. ENCLOSED SWITCHES SHALL BE MANUFACTURED BY SQUARE-D, CUTLER-HAMMER, GE, OR SIEMENS.
2. ALL ENCLOSED SWITCHES SHALL BE LOCKABLE.
3. MOUNT INDIVIDUAL WALL-MOUNTING SWITCHES WITH TOPS AT UNIFORM HEIGHT, UNLESS OTHERWISE INDICATED.
4. ENCLOSED SWITCHES SHALL BE UL LISTED FOR THE APPLICATION USED; ENCLOSURES SHALL BE NEMA 1 FOR INDOORS DRY LOCATIONS, NEMA 3R FOR OUTDOORS OR DAMP LOCATIONS.

MOTOR STARTERS

1. MOTOR STARTERS SHALL BE MANUFACTURED BY SQUARE-D, CUTLER-HAMMER, GE, OR SIEMENS. ALL MOTOR STARTERS IN ONE PROJECT ARE TO BE PRODUCTS OF ONE MANUFACTURER.
2. UNLESS NOTED OTHERWISE, MOTOR STARTERS SHALL BE MAGNETIC TYPE FULL-VOLTAGE NON-REVERSING (FVNR), 480V, 3-POLE, WITH INTEGRAL FUSED SAFETY SWITCH, H-O-A SWITCH, AND NEMA-1 ENCLOSURE.
3. PROVIDE CONTROL POWER TRANSFORMER OR POWER SUPPLY AS REQUIRED. COORDINATE CONTROL VOLTAGE AND CHARACTERISTICS WITH CONTROLS VENDOR.
4. PROVIDE FUSES AND MELTING ALLOY THERMAL OVERLOADS FOR EACH POLE.

EXISTING PANEL: 6HA

MAIN: 200A MLO
SERVICE: 277/480V, 3-PHASE, 4-WIRE
LOCATION: SEE PLAN
RATING: 14,000 AIC
TYPE: NEMA-1, SURFACE

NOTE: EXISTING PANEL IS GE TYPE NHB.

CKT	DESCRIPTION	BKR	P	LOAD	KVA A	KVA B	KVA C	LOAD	BKR	P	DESCRIPTION	CKT
1	SPACE				---						SPACE	2
3	SPACE					---					SPACE	4
5	SPACE						---				SPACE	6
7	LTS-SOUTH & CENTER	20	1		---				20	3	EXISTING LOAD	8
9	LTS-SOUTH & CENTER	20	1			---						10
11	LTS-NORTH	20	1				---					12
13	EF LAB	20	3		---				20	1	EXISTING LOAD	14
15						---			20	1	EXISTING LOAD	16
17							---		20	1	SPARE	18
19	EF 14	20	3		---				20	1	SPARE	20
21						---			20	1	SPARE	22
23							---		20	1	SPARE	24
25	PANEL 6B *	30	2	5.00	---				20	3	EXISTING LOAD	26
27				5.00		---						28
29	SPACE						---					30
31	EXISTING LOAD	50	3		---				100	3	EXISTING LOAD	32
33						---						34
35							---					36
37	HW CIRC PUMP #2 **	30	3	1.47	---			1.47	30	3	HW CIRC PUMP #1 **	38
39				1.47		---		1.47				40
41				1.47			---	1.47				42
					---	---	---					

* NEW LOAD; PROVIDE NEW BREAKER.
** NEW LOAD ON EXISTING SPARE BREAKER

EXISTING PANEL: 6A

MAIN: 100A MLO
SERVICE: 120/208V, 3-PHASE, 4-WIRE
LOCATION: SEE PLAN
RATING: 10,000 AIC
TYPE: NEMA-1, SURFACE

NOTE: EXISTING PANEL IS GE TYPE NLAB

CKT	DESCRIPTION	BKR	P	LOAD	KVA A	KVA B	KVA C	LOAD	BKR	P	DESCRIPTION	CKT
1	REC-EQUIP RM SOUTH	20	1		---				20	1	REC-DUPLEX ELEV RM	2
3	REC-EQUIP RM SOUTH	20	1			---			20	1	REC-SHOP	4
5	REC-EQUIP RM SOUTH	20	1				---		20	1	EXISTING LOAD	6
7	WATER TREATMENT	20	1		---				20	1	EF 8	8
9	EF 14 CONTROL	20	1			---			20	1	EF 9	10
11	SIEMENS CONTROL PNL	20	1				---		20	1	EXISTING LOAD	12
13	EMCS CONTROL PANEL	20	1		---				20	1	BOILER CONTROL	14
15	REC-SHOP	20	1			---			30	1	REFRIG MONITOR	16
17	EXISTING LOAD	50	2				---		30	2	EXISTING LOAD	18
19					---							20
21	EXISTING LOAD	20	1			---			50	1	EXISTING LOAD	22
23	REC-GFCI	20	1				---				SPACE	24
25	EXISTING LOAD	50	2		---				60	3	EXISTING LOAD	26
27						---						28
29	SPACE						---					30
					---	---	---					

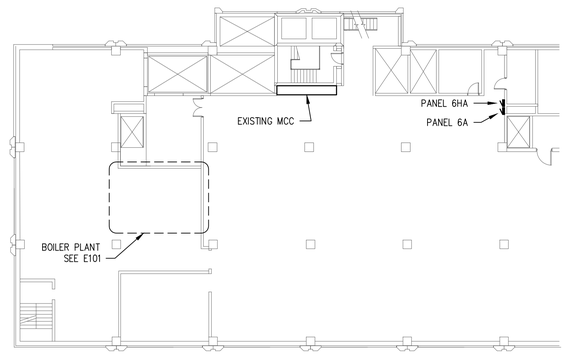
NEW PANEL: 6B

MAIN: 30A/2P PRIMARY, 60A/2P SECONDARY
SERVICE: 120/240V, 1-PHASE, 3-WIRE
LOCATION: SEE PLAN
RATING: 10,000 AIC
TYPE: NEMA-1, SURFACE

NOTE: PROVIDE "MINI-POWER ZONE" STYLE PANEL WITH INTEGRAL DRY TYPE TRANSFORMER.

CKT	DESCRIPTION	BKR	P	LOAD	KVA A	KVA B	LOAD	BKR	P	DESCRIPTION	CKT
1	BOILER B-1	25	2	2.40	4.80		2.40	25	2	BOILER B-2	2
3				2.40		4.80	2.40				4
5	SPACE				0.00					SPACE	6
7	SPACE					0.00				SPACE	8
9	SPACE				0.00					SPACE	10
11	SPACE					0.00				SPACE	12
					4.80	4.80					

TOTAL CONNECTED LOAD (KVA): 9.60 KVA 40.0 AMPS



PARTIAL 6TH FLOOR KEY PLAN

SCALE: 1" = 20' - 0"
0 10' 20'

ELECTRICAL LEGEND:

- ENCLOSED SAFETY SWITCH.
- MAGNETIC MOTOR STARTER.
- ELECTRICAL PANEL. SEE PANEL SCHEDULES.
- (P) CIRCULATION PUMP.

CODES AND STANDARDS

NFPA 70	NATIONAL ELECTRICAL CODE (NEC), 2020 EDITION
NFPA 72	NATIONAL FIRE ALARM CODE, 2019 EDITION
FLORIDA FIRE PREVENTION CODE, EIGHTH EDITION.	
FLORIDA BUILDING CODE, EIGHTH EDITION.	

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GENERAL ELECTRICAL NOTES:

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1. ALL WORK SHALL COMPLY WITH FLORIDA BUILDING CODE, EIGHTH EDITION, AND NATIONAL ELECTRICAL CODE, 2020 EDITION.
2. PLANS ARE SCHEMATIC IN NATURE AND ARE INTENDED TO SHOW THE GENERAL SCOPE OF THE PROJECT.
3. IN ADDITION TO THE WORK SHOWN ON THE PLANS, RELOCATE EXISTING RACEWAYS AND DEVICES, AS REQUIRED, TO FACILITATE INSTALLATION OF NEW EQUIPMENT.
4. SEQUENCE, COORDINATE, AND SCHEDULE WORK TO MINIMIZE FREQUENCY AND DURATION OF ANY OUTAGES REQUIRED.
5. BUILDING IS TO BE FULLY OCCUPIED FOR THE DURATION OF THE PROJECT. WORK MAY NOT DISRUPT NORMAL OPERATION OF THE FACILITY.
6. ANY OUTAGES SHALL BE SCHEDULED AND APPROVED BY THE DMS BUILDING MANAGER.
7. ALL CONDUCTORS SHALL BE COPPER, THHN/THWN INSULATION.
8. ALL FEEDERS AND BRANCH CIRCUITS SHALL BE INSTALLED IN EMT/IMC. PROVIDE NOT MORE THAN 36" METAL FLEX TO MECHANICAL EQUIPMENT.
9. WHERE EMT IS USED, PROVIDE COMPRESSION-TYPE FITTINGS.
10. ALL EQUIPMENT PROVIDED SHALL BE NEW, CLEAN, AND FREE OF DEFECTS.
11. CONTRACTOR SHALL SUBMIT PRODUCT DATA ON ALL EQUIPMENT, DEVICES, FIXTURES, AND MATERIALS PROPOSED TO BE INCORPORATED INTO THE WORK.SEE MECHANICAL PLANS FOR PROPOSED PROJECT PHASING.
12. ALL NEW RACEWAY INSTALLED BELOW 8FT A.F.F. IN MECHANICAL ROOMS SHALL BE IMC.

ELECTRICAL DEMOLITION NOTES:

1. SEE MECHANICAL PLANS, AS WELL AS ELECTRICAL PLANS, FOR EXTENT OF DEMOLITION.
2. CONTROLS WIRING IS TO REMAIN, UNLESS INDICATED OTHERWISE ON MECHANICAL DRAWINGS.
3. WHERE DEVICES, EQUIPMENT OR FIXTURES ARE TO BE REMOVED, REMOVE ALL ASSOCIATED DISCONNECTS, WIRING, AND RACEWAY BACK TO PANEL, OR NEXT DEVICE TO REMAIN.
4. PROJECT OR RELOCATE EXISTING RACEWAY OR CABLING, TO REMAIN, IN AREA TO BE RENOVATED.
5. RECIRCUIT EXISTING EQUIPMENT AND FIXTURES TO REMAIN, AS REQUIRED, TO MAINTAIN CONTINUITY.
6. ALL MATERIALS TO BE REMOVED SHALL BE DISPOSED OF BY THE CONTRACTOR IN AN APPROVED LEGAL MANNER.
7. SEE MECHANICAL PLANS FOR PROPOSED PROJECT PHASING.

ELECTRICAL DRAWING LIST:

ARD Project # 2169

APPLIED RESEARCH AND DESIGN, INC.
2623 S. BLAIR STONE ROAD
TALLAHASSEE, FL 32301
FL CA#8948
JAMES M. LAMB, PE#52688
Tel: (850) 668-6324 -- E-mail: jlamb@ard-eng.com

FSM Engineering
150 John Knox Rd.
Tallahassee, FL 32303
p.850.222.5683
FL CA 28968

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RA GRAY BUILDING, DESIGN AND REPLACE BOILERS

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REVISION

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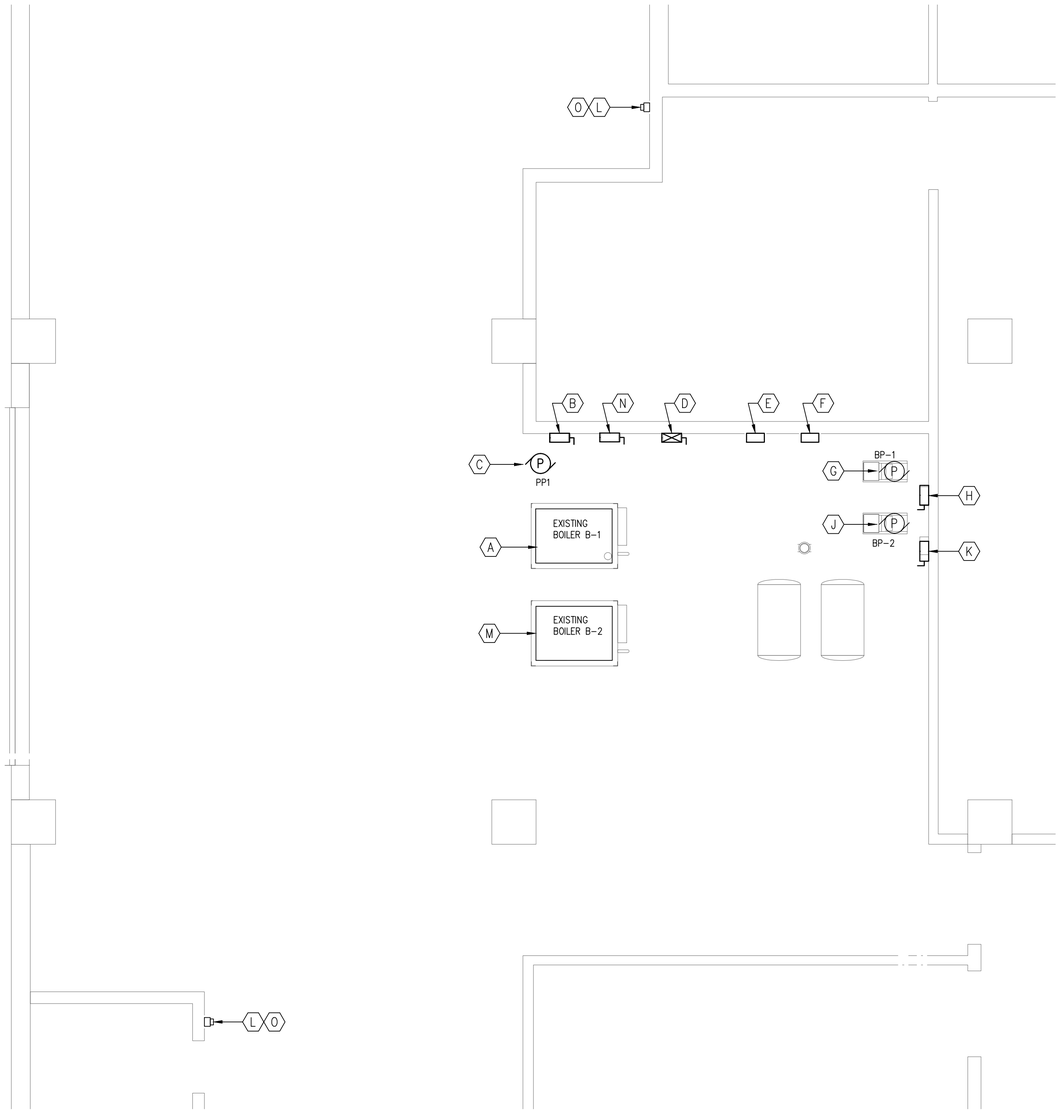
DRAWN BY: TAW / JML
CHECKED BY: JML
APPROVED BY: JML

PROJECT: 22067
DATE: 01/15/2025

ELECTRICAL LEGEND & NOTES

E001



EXISTING / DEMO NOTES:

PHASE 1

A. EXISTING BOILER B-1, TO BE REPLACED. REMOVE ELECTRICAL FEEDER CONNECTIONS AND SECURE FOR RE-USE.

B. EXISTING 30A/3P 480V N.F. NEMA-1 SAFETY SWITCH (SERVING BOILER B-1); TO BE REMOVED. EXISTING FEEDER RACWAYS AND CONDUCTORS MAY BE RE-USED.

C. EXISTING PUMP, TO BE REPLACED. REMOVE EXISTING FEEDER CONDUIT/CONDUCTORS AS REQUIRED.

D. EXISTING NEMA SIZE 1 COMBINATION-TYPE MOTOR STARTER (SERVING EXISTING PUMP PP1), WITH INTEGRAL DISCONNECT; TO BE REMOVED.

E. EXISTING BOILER CONTROLS, TO BE REMOVED.

F. EXISTING CONTROLS, TO BE REMOVED.

G. EXISTING PUMP, TO BE REMOVED.

H. EXISTING 30A/3P 480V N.F. NEMA-1 SAFETY SWITCH (SERVING PUMP BP-1); TO BE REMOVED. EXISTING FEEDER RACWAYS AND CONDUCTORS MAY BE RE-USED. EQUIPMENT IS SERVED FROM MOTOR CONTROL CENTER (MCC).

J. EXISTING PUMP, TO BE REMOVED.

K. EXISTING 30A/3P 480V N.F. NEMA-1 SAFETY SWITCH (SERVING PUMP BP-1); TO BE REMOVED. EXISTING FEEDER RACWAYS AND CONDUCTORS MAY BE RE-USED. EQUIPMENT IS SERVED FROM MOTOR CONTROL CENTER (MCC).

L. EXISTING EMERGENCY SHUT-OFF (ESO) PUSHBUTTON, WIRED TO SHUT-DOWN BOILER EQUIPMENT; ESO TO REMAIN IN SERVICE FOR THE DURATION OF THE PROJECT.

PHASE 2

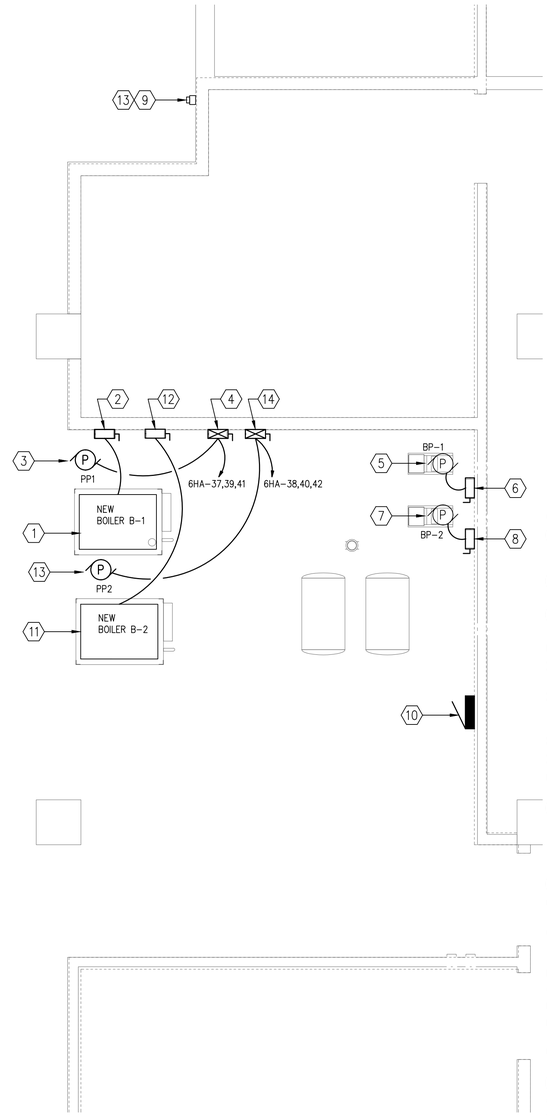
M. EXISTING BOILER B-2, TO BE REPLACED. REMOVE ELECTRICAL FEEDER CONNECTIONS AND SECURE FOR RE-USE.

N. EXISTING 30A/3P 480V N.F. NEMA-1 SAFETY SWITCH (SERVING BOILER B-2); TO BE REMOVED. EXISTING FEEDER RACWAYS AND CONDUCTORS MAY BE RE-USED.

O. EXISTING EMERGENCY SHUT-OFF (ESO) PUSHBUTTON, WIRED TO SHUT-DOWN BOILER EQUIPMENT; EESO TO REMAIN IN SERVICE FOR THE DURATION OF THE PROJECT.

EXISTING CONDITIONS

SCALE: 1/4" = 1' - 0" 0 2' 4'



RENOVATION NOTES:

PHASE 1

1. NEW BOILER B-1 TO BE INSTALLED. RECONNECT TO SAFETY SWITCH (SEE NOTE 2, BELOW) 120V CONTROL POWER (FROM PANEL 6A-14).
2. NEW 30A/3P 480V FUSED SAFETY SWITCH, SERVING NEW BOILER B-1. PROVIDE 3/4" EMT-3 #10, #10 GND, TO PANEL 6B-1,3.
3. NEW PUMP PP1 (3HP/480V) TO BE INSTALLED. FIELD-COORDINATE EXACT LOCATION WITH OTHERS.
4. NEW NEMA SIZE 1 COMBINATION-TYPE FVNR MAGNETIC MOTOR STARTER (480V/3-POLE), WITH INTEGRAL FUSED DISCONNECT, H-O-A SWITCH, AND NEMA 1 ENCLOSURE. PROVIDE 3/4" EMT-3 #10, #10 GND, TO PANEL. PROVIDE 15A RK-5 FUSES AT MOTOR STARTER.
5. NEW PUMP BP-1 (5HP/480V).
6. NEW VFD (SUPPLIED BY MECHANICAL), SERVING NEW PUMP BP-1. PROVIDE NEW 30A/3P 480V N.F. SAFETY SWITCH, WITH AUXILIARY CONTACTS, ON LOAD SIDE OF VFD. RECONNECT TO EXISTING PUMP FEEDER, FROM MCC.
7. NEW PUMP BP-2 (5HP/480V).
8. NEW VFD (SUPPLIED BY MECHANICAL), SERVING NEW PUMP BP-2. PROVIDE NEW 30A/3P 480V N.F. SAFETY SWITCH, WITH AUXILIARY CONTACTS, ON LOAD SIDE OF VFD. RECONNECT TO EXISTING PUMP FEEDER, FROM MCC.
9. RE-CONNECT EXISTING ESO SWITCH TO PROVIDE SHUTDOWN OF BOILER B-1 EQUIPMENT.
10. PROVIDE NEW 120/240V SINGLE-PHASE PANEL 6B, WITH INTEGRAL DRY-TYPE 480:120/240V STEP-DOWN TRANSFORMER, EQUAL TO SQUARE-D MINI-POWER-ZONE. FEED PANEL WITH NEW 3/4" EMT-2 #10, #10 GND, TO PANEL 6HA. SEE PANEL SCHEDULE.

PHASE 2

11. NEW BOILER B-2 TO BE INSTALLED. RECONNECT TO SAFETY SWITCH (SEE NOTE 2, BELOW) 120V CONTROL POWER (FROM PANEL 6A-14).
12. NEW 30A/3P 480V FUSED SAFETY SWITCH, SERVING NEW BOILER B-2. PROVIDE 3/4" EMT-3 #10, #10 GND, TO PANEL 6B-2,4.
13. NEW PUMP PP2 (3HP/480V) TO BE INSTALLED. FIELD-COORDINATE EXACT LOCATION WITH OTHERS.
14. NEW NEMA SIZE 1 COMBINATION-TYPE FVNR MAGNETIC MOTOR STARTER (480V/3-POLE), WITH INTEGRAL FUSED DISCONNECT, H-O-A SWITCH, AND NEMA 1 ENCLOSURE. PROVIDE 3/4" EMT-3 #10, #10 GND, TO PANEL. PROVIDE 15A RK-5 FUSES AT MOTOR STARTER.
15. RE-CONNECT EXISTING ESO SWITCH TO PROVIDE SHUTDOWN OF BOILER B-2 EQUIPMENT.

RENOVATIONS

SCALE: 1/4" = 1' - 0" 0 2' 4'

ARD Project # 2169

APPLIED RESEARCH AND DESIGN, INC.
2623 S. BLAIR STONE ROAD
TALLAHASSEE, FL 32301
FL CA#8948
JAMES M. LAMB, PE#52688
Tel: (850) 668-6324 -- E-mail: jlamb@ard-eng.com

FSM Engineering
150 John Knox Rd.
Tallahassee, FL, 32303
p.850.222.5683
FL CA 28968

RA GRAY BUILDING, DESIGN AND REPLACE BOILERS

100% CONSTRUCTION DOCUMENTS

500 S. BRONOUGH STREET
TALLAHASSEE, FL 32399

REVISION

No.	Date	Description
1	2025-1-15	CODE UPDATES
-	-	-
-	-	-
-	-	-
-	-	-
-	-	-
-	-	-
-	-	-
-	-	-

DRAWN BY:	TAW / JML
CHECKED BY:	JML
APPROVED BY:	JML

PROJECT: 22067
DATE: 01/15/2025

ELECTRICAL PLAN

E101

SYMBOLS

D"▯ ROUND DUCT
D=INSIDE DIAMETER DIMENSION

SQUARE TO ROUND

DEMOLITION HATCH INDICATION

EQUIPMENT, PIPE, DUCT, FITTINGS, ETC TO BE DEMOLISHED WILL BE INDICATED SPECIFICALLY OR BY DIAGONAL HATCH MARKING.

◇# DEMOLITION KEYNOTE

▯# KEYNOTE

CONNECT TO EXISTING AT THIS POINT

DEMOLISH BACK TO THIS POINT

END SUCTION PUMP

AIR/DIRT SEPARATOR

CHEMICAL SHOT FEEDER

EXPANSION TANK

D"▯ PIPE CONTINUES UP
D=INSIDE DIAMETER DIMENSION

D"▯ PIPE CONTINUES DOWN
D=INSIDE DIAMETER DIMENSION

THERMOMETER

PRESSURE GAUGE

MOTORIZED 3-WAY CONTROL VALVE

MOTORIZED 2-WAY CONTROL VALVE

BUTTERFLY ISOLATION/SHUT-OFF VALVE

GATE ISOLATION/SHUT-OFF VALVE

BALL ISOLATION/SHUT-OFF VALVE

PLUG ISOLATION/SHUT-OFF VALVE

PRESSURE REDUCING VALVE

PRESSURE RELIEF VALVE

UNION

FLEXIBLE CONNECTION

CHECK VALVE

STRAINER

RE-CIRCULATION PUMP

ABBREVIATION

ALL MAY NOT APPLY

ADS	AIR/DIRT SEPARATOR
B	BOILER
BP	BOILER PUMP
BRP	BOILER RE-CIRCULATION PUMP
BTU	BRITISH THERMAL UNIT
CD	CONDENSATE
CKV	CHECK VALVE
CV	CONTROL VALVE
ΔP	DIFFERENCE IN PRESSURE
ΔT	DIFFERENCE IN TEMPERATURE
DEG. F	DEGREES FAHRENHEIT
DDC	DISTRIBUTED DIGITAL CONTROLS
DN	DOWN
EWT	ENTERING WATER TEMPERATURE
EX	EXISTING
GPM	GALLONS PER MINUTE
HHWS	HEATING HOT WATER SUPPLY
HHWR	HEATING HOT WATER RETURN
In W.C.	INCHES OF WATER COLUMN
IV	ISOLATION VALVE
LWT	LEAVING WATER TEMPERATURE
MBH	1,000 BTUS PER HOUR
MFG.	MANUFACTURER
OA	OUTSIDE AIR
PG	PRESSURE GAUGE
RA	RETURN AIR
RND	ROUND
RPM	REVOLUTIONS PER MINUTE
STR	STRAINER
THM	THERMOMETER
TSP	TOTAL STATIC PRESSURE
UNO	UNLESS NOTED OTHERWISE
V/PZ	VOLT/PHASE
VFD	VARIABLE FREQUENCY DRIVE
VSD	VARIABLE SPEED DRIVE
XT	EXPANSION TANK

CODE REFERENCE

THE LATEST EDITIONS OF THE ESTABLISHED STANDARDS OF THE FOLLOWING ORGANIZATIONS, AND INDIVIDUAL STANDARDS NAMED SHALL BE FOLLOWED THE SAME AS IF THEY WERE FULLY WRITTEN HEREIN AND CONSTITUTE A PART OF THE SPECIFICATION REQUIREMENTS EXCEPT WHERE OTHERWISE SPECIFIED:

FBC, BUILDING	FLORIDA BUILDING CODE 7TH EDITION
FBC, MECHANICAL	FLORIDA BUILDING CODE 7TH EDITION
FBC, EXISTING BUILDING	FLORIDA BUILDING CODE 7TH EDITION
FBC, FUEL GAS	FLORIDA BUILDING CODE 7TH EDITION
FBC, ENERGY CONSERVATION	FLORIDA BUILDING CODE 7TH EDITION
FFPC	FLORIDA FIRE PREVENTION CODE, 2020 7TH EDITION
NFPA 13	STANDARD FOR THE INSTALLATION OF FIRE SPRINKLER SYSTEMS
NFPA 51B	STANDARD FOR FIRE PREVENTION DURING WELDING, CUTTING AND OTHER HOT WORK
NFPA 54	NATIONAL FUEL GAS CODE
NFPA 90A	STANDARD FOR THE INSTALLATION OF AIR CONDITIONING AND VENTILATION SYSTEMS
NFPA 90B	STANDARD FOR THE INSTALLATION OF WARM AIR HEATING AND AIR CONDITIONING SYSTEMS
NFPA 101	LIFE SAFETY CODE
NFPA 101A	GUIDE ON ALTERNATIVE APPROACHES TO LIFE SAFETY
NFPA 101B	CODE FOR MEANS OF EGRESS FOR BUILDINGS AND STRUCTURES
NFPA 900	BUILDING ENERGY CODE
ASTM	AMERICAN SOCIETY FOR TESTING AND MATERIALS
ANSI	AMERICAN NATIONAL STANDARDS INSTITUTE
ASME	AMERICAN SOCIETY OF MECHANICAL ENGINEERS
ADA	AMERICAN WITH DISABILITIES ACT
UL	UNDERWRITERS LABORATORIES

THESE CODE AND STANDARDS SHALL BE CONSIDERED A MINIMUM REQUIREMENT. THE CONTRACTOR SHALL NOT RELIEVED FROM PROVIDING HIGHER GRADE MATERIALS, PRODUCTS AND WORKMANSHIP WHICH MAY BE SPECIFIED WITHIN THESE DOCUMENTS

ENERGY SYSTEMS - GENERAL

1. PROVIDE A TEST AND BALANCE OF THE SYSTEM IN COMPLIANCE WITH FBC-EC SECTION 408.2.2 IN ACCORDANCE WITH THE LATEST NEBB, ASHRAE, OR EQUIVALENT GUIDELINES FOR SUCH WORK. TAB CONTRACTORS SHALL BE PRE APPROVED BY THE ENGINEER OF RECORD.
2. PROVIDE OWNER A COMPLETE SET OF OPERATIONS AND MAINTENANCE MANUALS FOR ALL EQUIPMENT WITHIN 90 DAYS OF SYSTEM ACCEPTANCE.
3. HVAC EQUIPMENT EFFICIENCY MUST BE VERIFIED PER TABLES C403.2.3(1-11) UNDER FBC CHAPTER 4, C403.2.3.
4. DRAWINGS, MANUALS, SYSTEM BALANCING REPORTS, AND A FINAL COMMISSIONING REPORT SHALL BE PROVIDED TO THE BUILDING OWNER WITHIN 90 DAYS OF THE RECEIPT OF THE CERTIFICATE OF OCCUPANCY.
5. A COMMISSIONING PLAN SHALL BE DEVELOPED BY A REGISTERED DESIGN PROFESSIONAL OR APPROVED AGENCY IN ACCORDANCE WITH FBC CHAPTER 4, C408.2.1.
6. HVAC EQUIPMENT SHALL UNDERGO FUNCTIONAL PERFORMANCE TESTING AS SPECIFIED UNDER FBC CHAPTER 4, SECTIONS C408.2.3.1-3. THIS INCLUDES ALL CONTROL SYSTEMS. TESTING SHALL SHOW EFFECTIVE OPERATION IN ACCORDANCE WITH ALL APPROVED PLANS AND SPECIFICATIONS.
7. ALL PIPING SERVING AS PART OF A HEATING OR COOLING SYSTEM SHALL BE THERMALLY INSULATED IN ACCORDANCE WITH FBC CHAPTER 4, TABLE C403.2.10. WHERE PIPING IS INSTALLED IN OR UNDER A SLAB, VERIFICATION MAY NEED TO OCCUR DURING FOUNDATION INSPECTION.
8. AUTOMATIC START CONTROLS SHALL BE PROVIDED FOR EACH HVAC SYSTEM. THE CONTROLS SHALL BE CAPABLE OF AUTOMATICALLY ADJUSTING THE DAILY START TIME OF THE HVAC SYSTEM IN ORDER TO BRING EACH SPACE THE DESIRED OCCUPIED TEMPERATURE IMMEDIATELY PRIOR TO SCHEDULED OCCUPANCY.
9. HVAC WATER-HEATING CONTROL SYSTEMS SHALL BE TESTED TO DOCUMENT THAT CONTROL DEVICES, COMPONENTS, EQUIPMENT, AND SYSTEMS ARE CALIBRATED AND ADJUSTED AND OPERATE IN ACCORDANCE WITH APPROVED PLANS AND SPECIFICATIONS. SEQUENCES OF OPERATION SHALL BE FUNCTIONALLY TESTED TO DOCUMENT THEY OPERATE IN ACCORDANCE WITH APPROVED PLANS AND SPECIFICATIONS.
10. HVAC PERFORMANCE EFFICIENCY SHALL BE CONSISTENT WITH WHAT IS SHOWN IN THE APPROVED PLANS.

ENERGY SYSTEMS - HYDRONIC SYSTEMS

1. THREE-PIPE HYDRONIC SYSTEMS ARE NOT PERMITTED TO USE A COMMON RETURN FOR BOTH HOT WATER AND CHILLED WATER.
2. TWO-PIPE HYDRONIC SYSTEMS THAT USE A COMMON DISTRIBUTION SYSTEM TO SUPPLY HEATED WATER SHALL BE DESIGNED WITH OPERATION CONTROLS, CHANGEOVER DEADBAND, AND TEMPERATURE CONTROLS IN ACCORDANCE WITH FBC CHAPTER 4, C403.4.3.2.
3. HYDRONIC SYSTEMS 300,000 BTU/H OR GREATER IN DESIGN OUTPUT CAPACITY SHALL INCLUDE CONTROLS WHICH HAVE THE CAPABILITY TO AUTOMATICALLY RESET SUPPLY-WATER TEMPERATURE AND REDUCE SYSTEM PUMP FLOW IN ACCORDANCE WITH FBC CHAPTER 4, C403.4.3.4.
4. BOILER PLANTS WITH MULTIPLE BOILERS SHALL HAVE THE CAPABILITY TO AUTOMATICALLY REDUCE FLOW THROUGH THE PLANT WHEN A BOILER IS SHUT DOWN.

HYDRONIC PIPING

1. ALL HYDRONIC PIPING SHALL BE WELDED STEEL, 2-1/2" TO 6" FLANGED AND ¾" TO 2" THREADED.
2. ALL HYDRONIC PIPING SHALL BE INSULATED. INTERIOR WITH 1-1/2" MINIMUM, EXTERIOR 2" MINIMUM, CLOSED CELL INSULATION. ALL PIPING SHALL BE ALUMINUM JACKETED, SEALED AS RECOMMENDED BY THE MANUFACTURER, SECURED WITH STAINLESS STEEL BANDS 12" O.C.
3. PIPE SHALL BE HUNG WITH CLEVIS OR UNISTRUT PRODUCTS WITH THREADED RODS IN COMPLIANCE WITH FBC-M SECTION 305.
4. PIPE PENETRATIONS THROUGH FIRE RATED ASSEMBLIES SHALL BE SEALED WITH FIRE CAULKING EQUAL TO METACAULK: UL-CAJ2134, UL-WL2135

HVAC GENERAL NOTES

1. ONLY NEW EQUIPMENT SHALL BE PROVIDED UNLESS INDICATED AS EXISTING TO REMAIN.
2. ALL CONNECTIONS TO EQUIPMENT SHALL BE MADE WITH FLEXIBLE REGIONS FOR VIBRATION ISOLATION.
3. ALL EQUIPMENT SHALL BE LABELED SO THAT USERS CAN IDENTIFY EACH PIECE OF EQUIPMENT. LABELS SHALL BE CONSISTENT WITH EQUIPMENT TAGS THAT ARE LISTED IN THE SCHEDULES WITHIN THESE DOCUMENTS.
4. ALL EQUIPMENT SHALL BE INSTALLED PER MANUFACTURERS WRITTEN INSTRUCTIONS AND RECOMMENDATIONS.
5. INSTALL DUCTWORK AND PIPING AS HIGH AS POSSIBLE ABOVE CEILING.
6. COORDINATE THE INSTALLATION OF DUCTWORK AND PIPING WITH ELECTRICAL EQUIPMENT SO THAT THE REQUIRED CODE CLEARANCES TO ELECTRICAL EQUIPMENT IS MAINTAINED.
7. DUCTWORK AND PIPING INSTALLATIONS SHALL ALLOW FOR EQUIPMENT RECOMMENDED MAINTENANCE CLEARANCES. CONVENIENT ACCESS FOR REMOVAL OF FILTERS SHALL BE MAINTAINED.
8. ENSURE ALL EQUIPMENT HAS BEEN CLEANED AT THE END OF THE PROJECT.
9. DO NOT LOCATE AIR INTAKES CLOSER THAN 10 FEET FROM ANY VENT OR EXHAUST OUTLETS. ROUTE TOILET EXHAUST TO LOCATION SHOWN ON PLANS. WALL CAPS SHALL BE ALUMINUM CONSTRUCTION WITH BACKDRAFT DAMPER, BIRD AND INSECT SCREENS.

DESIGN CRITERIA

BUILDING TYPE	GROUP B, BUSINESS
CLIMATE ZONE	2A, LEON COUNTY, FLORIDA
OUTDOOR DESIGN CONDITIONS (SUMMER)	95 DEG Fdb, 77 DEG Fwb
OUTDOOR DESIGN CONDITIONS (WINTER)	20 DEG Fdb
INTERIOR DESIGN CONDITIONS	75 DEG F COOLING, 72 DEG F HEATING

SUBMITTAL REQUIREMENTS

1. USE OF AN APPROVAL STAMP ON SUBMITTAL DOCUMENTS CERTIFIES THAT THE CONTRACTOR HAS COMPLIED WITH THE CONTRACT DOCUMENT REQUIREMENTS.
2. THE CONTRACTOR SHALL NOT BE RELIEVED OF RESPONSIBILITY FOR DEVIATIONS FROM REQUIREMENTS OF THE CONTRACT DOCUMENTS BY THE ARCHITECT/ENGINEER'S APPROVAL OF SHOP DRAWINGS, PRODUCT DATA, SAMPLES, OR SIMILAR SUBMITTAL ITEMS UNLESS THE CONTRACTOR HAS SPECIFICALLY INFORMED THE ARCHITECT/ENGINEER IN WRITING OF SUCH DEVIATION AT THE TIME OF SUBMITTAL AND THE ARCHITECT/ENGINEER HAS GIVEN WRITTEN APPROVAL TO THE SPECIFIC DEVIATION. THE CONTRACTOR SHALL NOT BE RELIEVED OF RESPONSIBILITY FOR ERRORS OR OMISSIONS IN SHOP DRAWINGS, PRODUCT DATA, SAMPLES, OR SIMILAR SUBMITTAL ITEMS BY THE ARCHITECT/ENGINEER'S APPROVAL THEREOF.
3. CONTRACTOR SHALL SUPPLY TO THE ARCHITECT SUBMITTALS ON THE FOLLOWING WHERE APPLICABLE (ALL MAY NOT APPLY):

3.1. HVAC EQUIPMENT (BOILERS, PUMPS AND ACCESSORIES)
3.1.1. INCLUDING PERFORMANCE DATA AT LISTED ENTERING CONDITIONS
3.2. DUCTWORK MATERIALS AND CONSTRUCTION METHODS
3.3. DUCT FITTINGS
3.4. INSULATION MATERIALS
3.5. DUCT ACCESSORIES AND SPECIALITIES
3.6. PIPING
3.7. CONTROLS
3.8. ROOF EQUIPMENT AND MOUNTING

COMMISSIONING

1. BUILDING MECHANICAL SYSTEMS SHALL BE COMMISSIONED IN ACCORDANCE WITH THE FLORIDA BUILDING CODE, ENERGY CONSERVATION, SECTION C408 'SYSTEM COMMISSIONING'.
2. BUILDING POWER AND LIGHTING SYSTEMS SHALL BE COMMISSIONED IN ACCORDANCE WITH FLORIDA BUILDING CODE, ENERGY CONSERVATIONS, SECTION C408 'SYSTEMS COMMISSIONING'. TESTING SHALL ENSURE THAT CONTROL HARDWARE AND SOFTWARE ARE CALIBRATED, ADJUSTED, PROGRAMMED, AND IN PROPER WORKING CONDITION IN ACCORDANCE WITH CONSTRUCTION DOCUMENTS AND MANUFACTURER'S INSTALLATION INSTRUCTIONS. TESTING SHALL BE PERFORMED ON SYSTEMS, INCLUDING OCCUPANT SENSORS, TIME SWITCHES, PROGRAMMABLE SCHEDULE CONTROLS, PHOTO SENSORS, AND DAYLIGHT CONTROLS.
3. A COMMISSIONING PLAN SHALL BE DEVELOPED BY AN APPROVED COMMISSIONING AUTHORITY (REGISTERED DESIGN PROFESSIONAL OR AGENCY) AND SHALL INCLUDE THE FOLLOWING ITEMS: (1) A NARRATIVE DESCRIPTION OF THE ACTIVITIES THAT WILL BE ACCOMPLISHED DURING EACH PHASE OF COMMISSIONING, INCLUDING THE PERSONNEL INTENDED TO ACCOMPLISH EACH OF THE ACTIVITIES; (2) A LISTING OF THE SPECIFIC EQUIPMENT, APPLIANCES OR SYSTEMS TO BE TESTING AND A DESCRIPTION OF THE TESTS TO BE PERFORMED; (3) FUNCTIONS TO BE TESTED, INCLUDING BUT NOT LIMITED TO, CALIBRATIONS AND CONTROLS; CONDITIONS UNDER WHICH THE TEST WILL BE PERFORMED, INCLUDING BUT NOT LIMITED TO, AFFIRMING WINTER AND SUMMER DESIGN CONDITIONS AND FULL OUTSIDE AIR CONDITIONS; (5) MEASURABLE CRITERIA FOR PERFORMANCE.
4. PRIOR TO PASSING THE FIRST MECHANICAL INSPECTION, THE COMMISSIONING AUTHORITY SHALL PROVIDE EVIDENCE OF MECHANICAL SYSTEMS COMMISSIONING AND COMPLETION. PROVIDE A COMPLETED PRELIMINARY REPORT OF COMMISSIONING TEST PROCEDURES AND RESULTS TO THE OWNER, CERTIFIED BY COMMISSIONING AUTHORITY. THE REPORT SHALL BE IDENTIFIED AS "PRELIMINARY COMMISSIONING REPORT" AND SHALL IDENTIFY: (1) ITEMIZATION OF DEFICIENCIES FOUND DURING TESTING THAT HAVE NOT BEEN CORRECTED AT THE TIME OF THE REPORT PREPARATION; (2) DEFERRED TESTS THAT CANNOT BE PERFORMED
5. PROVIDE FINAL COMMISSIONING REPORT TO OWNER WITHIN 90 DAYS OF CERTIFICATE OF OCCUPANCY. THE REPORT SHALL BE IDENTIFIED AS "FINAL COMMISSIONING REPORT" AND SHALL INCLUDE: (1) RESULTS OF FUNCTIONAL PERFORMANCE TESTS; (2) DISPOSITION OF DEFICIENCIES FOUND DURING TESTING, INCLUDING DETAILS OF CORRECTIVE MEASURES USED OR PROPOSED; (3) FUNCTIONAL PERFORMANCE TEST ACCEPTANCE, PROVIDE FOR REPEATABILITY. EXCEPTION: DEFERRED TESTS WHICH CANNOT BE PERFORMED AT THE TIME OF REPORT PREPARATION FOR CLIMATIC CONDITIONS.
6. THE GENERAL CONTRACTOR SHALL BE RESPONSIBLE FOR PROVIDING THE SERVICES OF AN APPROVED COMMISSIONING AUTHORITY.

GENERAL NOTES

1. THE ENGINEER SHALL NOT BE HELD RESPONSIBLE FOR ANY MISUSE AND/OR MISREPRESENTATION OF THIS SET OF DOCUMENTS.
2. THE CONTRACTOR ASSUMES RESPONSIBILITY FOR THE USE OF THE CONTRACT DOCUMENTS. THE CONTRACTOR SHALL MAKE THEMSELVES AWARE OF PROJECT CONDITIONS AND OWNER REQUIREMENTS PRIOR TO PROCUREMENT OF EQUIPMENT AND SERVICES. CHANGES IN PROJECT COST WILL NOT BE GRANTED DUE TO FIELD CONFLICTS AND OR PROJECT CONDITIONS.
3. THIS SET OF DRAWINGS AND SPECIFICATIONS SHALL NOT BE CONSIDERED A SET OF CONSTRUCTION DOCUMENTS UNLESS A SIGNATURE AND DATE ARE AFFIXED TO THE DRAWINGS AND SPECIFICATIONS BY THE ENGINEER OF RESPONSIBLE CHARGE OF THE GIVEN DISCIPLINE. PRINTED COPIES OF THIS DOCUMENT ARE NOT CONSIDERED SIGNED AND SEALED UNLESS EMBOSSED AND THE SHA AUTHENTICATION CODE MUST BE VERIFIED ON ELECTRONIC COPIES.
4. CONFLICTS BETWEEN THIS SET OF DRAWINGS AND THE CONTRACT SPECIFICATIONS SHALL BE RESOLVED BY THE ENGINEER OF RECORD. THE CONTRACTOR DOES NOT HAVE THE AUTHORITY TO INTERPRET CONFLICTS AND RESOLVE ISSUES WITHOUT WRITTEN DIRECTION FROM THE ENGINEER OF RECORD.
5. ANY CONFLICTS IN THE FIELD OR WITHIN THESE DOCUMENTS SHALL BE RECORDED AND PROVIDED TO THE ENGINEER OF RECORD ON THE CONTRACTOR'S STANDARD LETTERHEAD. WRITTEN DIRECTION RESOLVING CONFLICT WILL BE ISSUED BY THE ENGINEER OF RECORD.
6. PRIOR TO INSTALLATION, COORDINATE AND ADJUST THE FINAL LOCATION OF ALL WALL MOUNTED DEVICES AND EQUIPMENT WITH ALL CASEWORK, SHELVING OR OTHER WALL MOUNTED FURNISHINGS.
7. PLANS ARE DIAGRAMMATIC IN NATURE AND INTENDED TO SHOW THE GENERAL SCOPE OF THE WORK TO BE PERFORMED. REFER TO ARCHITECTURAL AND STRUCTURAL DRAWINGS FOR ALL DIMENSIONS.
8. DUE TO THE SMALL SCALE OF THE DRAWINGS, AND TO UNFORESEEN JOB CONDITIONS, ALL REQUIRED OFFSETS, TRANSITIONS AND FITTINGS MAY NOT BE SHOWN BUT SHALL BE PROVIDED AT NO ADDITIONAL COST.
9. THE CONTRACTOR SHALL COORDINATE WITH OTHER TRADES AND EXISTING EQUIPMENT TO ENSURE THE EQUIPMENT SPECIFIED WILL WORK FOR THE SPACES PROVIDED. FINAL DIMENSIONS OF SYSTEMS SHOWN ON THESE PLANS SHALL BE COORDINATED IN THE FIELD. THE CONTRACTOR SHALL ASSUME RESPONSIBILITY FOR PROVIDING OFFSETS AND TRANSITIONS TO FIT IN SPACES PROVIDED AND AT NO COST TO THE OWNER.
10. THE CONTRACTOR IS RESPONSIBLE FOR ANY SPECIAL REQUIREMENTS INVOLVED IN INSTALLING EQUIPMENT IN THE BUILDING. DISMANTLING AND REASSEMBLING OF ANY EQUIPMENT SHALL BE DONE AS REQUIRED TO BRING INTO THE BUILDING AND EQUIPMENT ROOMS.
11. ALL WORK PERFORMED AS PART OF THIS PROJECT SHALL BE PERFORMED BY EXPERIENCED TRADESMEN WHO ARE TRAINED, EXPERIENCED, AND SKILLED IN THE TASKS INCIDENTAL TO THE PROJECT.
12. ALL WORK SHALL COMPLY WITH APPLICABLE OSHA AND EPS REGULATIONS AND GUIDELINES.
13. THE CONTRACTOR PERFORMING WORK ON THIS PROJECT WILL BE RESPONSIBLE FOR REGULARLY CLEANING THE WORK AREA OF ANY DEBRIS ASSOCIATED WITH THE WORK BEING PERFORMED. THE SITE SHALL BE CLEAN OF ALL CONSTRUCTION DEBRIS AT THE COMPLETION OF THE JOB, BEFORE FINAL PAYMENT IS MADE.
14. REASONABLE PRECAUTIONS SHALL BE MADE FOR SAFETY AND HEALTH INCLUDING BUT NOT LIMITED TO WARNING SIGNS, SAFETY PRECAUTIONS, AND BARRICADES FOR PEDESTRIANS.
15. COORDINATE ALL DEMOLITION, CLEANING, AND CONSTRUCTION WORK. CONTRACTOR SHALL PROVIDE OWNER A FULL CONSTRUCTION SCHEDULE.
16. CONTRACTOR SHALL BE HELD TO PROVIDED SCHEDULE. THEY SHALL BE RESPONSIBLE FOR PROVIDING SUFFICIENT MANPOWER AND EQUIPMENT TO COMPLETE THE WORK IN THE TIME INDICATED.
17. THE CONTRACTOR IS RESPONSIBLE FOR THE PROTECTION AND SECURITY OF ALL EQUIPMENT AND MATERIALS. THE LOCATION OF STORAGE SHALL BE RESTRICTED SPECIFICALLY TO THE AREA ALLOTTED BY THE OWNER.
18. ALL ITEMS INSTALLED UNDER THE SCOPE OF THIS PROJECT SHALL BE NEW, CLEAN, AND FREE OF DEFECTS.
19. IF DRAWING CHANGES ARE NEEDED FOR INSPECTION DUE TO FIELD CHANGES MADE BY THE CONTRACTOR WITHOUT PRIOR APPROVAL OF THE ENGINEER AND AGREED UPON TERMS, THEN THE CONTRACTOR SHALL PAY HOURLY RATES TO THE ENGINEER OF RECORD FOR MAKING NECESSARY CHANGES.
20. SUPPORTS, HANGERS, WIRING, AND PIPING SHALL BE INSTALLED IN A NEAT FASHION AND IN AN ORDERLY APPEARANCE.
21. ALL ROOF EQUIPMENT SHALL BE SECURED TO STRUCTURE TO RESIST A 130 MPH WIND LOAD.
22. PROTECT THE ROOF FROM DAMAGE WHENEVER ANY WORK ON THE ROOF IS REQUIRED.
23. CONTRACTOR SHALL MAINTAIN THE INTEGRITY OF ALL PARTITIONS LABELED WITH A SPECIAL LISTING ON THE ARCHITECTURAL PLANS. THIS INCLUDES FIRE, SMOKE ACOUSTICAL AND OTHER UL WALL OR CEILING ASSEMBLIES.
24. STRUCTURAL PENETRATIONS INCLUDING BUT NOT LIMITED TO WALL, FLOOR, OR BEAM SHALL BE APPROVED BY THE STRUCTURAL ENGINEER. ALL BEAM SLEEVES AND REINFORCING APPROVED BY STRUCTURAL ENGINEER SHALL BE FURNISHED AND INSTALLED BY THE CONTRACTOR.
25. CONTRACTOR SHALL GUARANTEE THE WORK AND MATERIALS FOR PERIOD OF ONE YEAR FROM THE DATE OF FINAL ACCEPTANCE. THIS GUARANTEE SHALL BE IN ADDITION TO THE WARRANTIES PROVIDED BY THE MATERIAL SUPPLIES AND MANUFACTURERS.
26. VALUE ENGINEERING OR CHANGES TO PLANS MUST BE APPROVED BY THE ENGINEER OF RECORD AND RESUBMITTED THROUGH THE BUILDING DEPARTMENT PRIOR TO BEING INSTALLED.

BOILER SCHEDULE

TAG	B-1 & B-2
MANUFACTURER	PATTERSON KELLY
MODEL NUMBER	STORM - ST-2000
GAS INPUT (MBH)	2000
HEATING OUTPUT(MBH)	1940
MIN GAS INPUT PRESSURE ("W.C)	3.5
MAX GAS INPUT PRESSURE ("W.C)	14
EFFICIENCY (%)	97%
ENTERING TEMP (F)	140
LEAVING TEMP (F)	160
MAX FLOW (GPM)	170
MIN FLOW (GPM)	54
WEIGHT (LBS)	1305
ELECTRICAL (V/PH)	208/1
OPERATING CURRENT (AMPS)	20
MINIMUM CIRCUIT CAPACITY	20

NOTES
1. BOILER INSTALLATION SHALL COMPLY WITH THE INTERNATIONAL BUILDING CODE-MECHANICAL AND THE BOILER SAFETY ACT (F.S. 554) AND ALL REFERENCED STANDARDS ASSOCIATED WITH THESE SECTIONS OF LAW.

2. PROVIDE BOILER CONTROLLER FROM MANUFACTURER. (BACNET COMPATIBLE)

3. PROVIDE WITH A PRESSURE RELIEF VALVE/PRESSURE-TEMPERATURE GAUGE

4. PROVIDE TURNDOWN RATIO OF 10:1

5. PROVIDE STAINLESS STEEL HX

6. PROVIDE 10 YEAR PARTS AND LABOR WARRANTY (OR MAXIMUM AVAILABLE)

PUMP SCHEDULE

MARK	PP-1&PP-2	BP-1&BP-2
MANUFACTURER	TACO	TACO
MODEL	3007D	SCI3007D-A-4P-PD
TYPE	INLINE	CCES
SERVICE	BOILER PRIMARY HHW	BUILDING HHW
FLUID TEMP	160	160
FLUID SERVICE	WATER	WATER
LOCATION	RA GRAY BUILDING MECHANICAL ROOM	RA GRAY BUILDING MECHANICAL ROOM
WEIGHT (LBS)	220	220
FLOW (GPM)	170	289
MINIMUM FLOW (GPM)	54	30
TOTAL DYNAMIC HEAD (FT)	35	40
MAXIMUM SPEED (RPM)	1760	1760
MINIMUM EFFICIENCY (%)	88	65
MAX BREAK HORSEPOWER (BHP)	1.9	3.51
NAMEPLATE HORSEPOWER (HP)	3	5
ELECTRICAL (V/PH/HZ)	460/3	460/3
ESTIMATED AMP DRAW	5.3	6.9

NOTES:
1. PROVIDE FACTORY MOUNTED VFD, SELF SENSING WITH INSTALLED DP SENSOR IN THE PIPING SYSTEM. THE VFD SHOULD NOT CONTAIN A BYPASS.
2. PUMPS INSTALLED MUST BE BACNET COMPATIBLE.

EXPANSION TANK SCHEDULE

TAG	XT
MANUFACTURER	TACO
MODEL NUMBER	CW600
MAX WORKING PRESSURE (PSI)	125
APPROX WEIGHT (LBS)	620
MAX VOLUME	158
DIAMETER INCHES	30
HEIGHT INCHES	74

MECHANICAL SHEET INDEX

FSM Engineering
150 John Knox Road
Tallahassee, FL, 32303
p.850.222.5683
FL CA 28968

ROBERT E. GELHARDT II LICENSED NO. 77568 STATE OF FLORIDA PROFESSIONAL ENGINEER
NOT FOR CONSTRUCTION

Robert Gelhardt II, PE FL 77568

RA GRAY BUILDING BOILER REPLACEMENT

100 % CHECK SET

500 S. BRONOUGH STREET
TALLAHASSEE, FL 32399

REVISION

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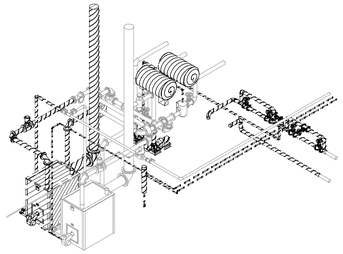
PROJECT: 22067
DATE: 05/19/2023

GENERAL NOTES LEGENDS, SHEET INDEX, SCHEDULES - MECH

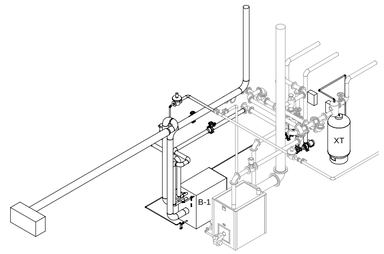
M001

DEMOLITION KEYED NOTES

1	DEMOLISH EXISTING BOILER, POWER, SUPPORTS, CONTROLS, AND OTHER APPURTENANCES AS NECESSARY FOR COMPLETE REMOVAL.
2	DEMOLISH THE EXISTING HOT WATER RETURN PIPING BACK TO THE APPROXIMATE LIMITS INDICATED OR AS NEEDED TO PIPE IN THE NEW TEMPORARY BOILER.
3	DEMOLISH EXISTING GAS PIPING BACK TO JUST BEFORE THE BTU METER. OR AS NEEDED FOR PROPER INSTALLATION OF NEW TEMPORARY BOILER.
4	DEMOLISH EXISTING HOT WATER SUPPLY PIPING BACK TO LIMITS INDICATED OR NEDED FOR PROPER INSTALLATION OF NEW TEMPORARY BOILER.
5	DEMOLISH EXISTING PIPING BACK TO WALL AND CAP AIR AND WATER TIGHT.
6	DEMOLISH EXISTING ABANDONED FUEL OIL PIPING AND ACCESSORIES BACK TO AN APPORPRIATE LOCATION OUTSIDE OF THIS MECHANICAL ROOM. CAP AND ABANDON REMAINING PIPING.
7	DEMOLISH MIDDLE TOP SECTION OF THE SHEET METAL COVER OF THE EXISTING LOUVER TO ALLOW FOR INSTALLATION OF COMBUSTION AIR INTAKE PLENUM IN RENO PHASE. COORDINATE EXACT SIZE ON SITE.
8	DEMOLISH EXISTING FLUE THRU ROOF, NEW FLUE WILL BE INSTALLED IN NEXT PHASE.
9	EXISTING BOILER EMERGENCY SHUTOFF SWITCH SHALL REMAIN.



3 M101 **PHASE 1 DEMO ISOMETRIC**
No Scale



4 M101 **PHASE 1 RENO ISOMETRIC**
No Scale

RENOVATION KEYED NOTES

1	INSTALL NEW COMBUSTION AIR PLENUM ON BACK OF EXISTING LOUVER SECTION. SEAL AIR AND WATER TIGHT, PROVIDE BIRD SCREEN.
2	CONNECT NEW SUPPLY PIPING TO EXISTING SUPPLY CONNECTION IN THIS APPROXIMATE LOCATION. TRANSITION AS NECESSARY.
3	CONNECT NEW RETURN PIPING TO EXISTING RETURN CONNECTION IN THIS APPROXIMATE LOCATION. TRANSITION AS NECESSARY.
4	CONNECT NEW NATURAL GAS PIPING TO EXISTING GAS PIPING IN THIS APPROXIMATE LOCATION. TRANSITION AS NECESSARY. PROVIDE NEW BTU METER TO TIE INTO EX BAS. PROVIDE NEW REGULATOR OF PROPER TYPE.
5	ROUTE NEW FLUE DUCT THROUGH THE ROOF AND FLASH AND SEAL ANY PART OF THE OPENING NOT NEEDED DUE TO THE REDUCED SIZE OF THE DUCT. PROVIDE RAIN CAP AS RECOMMENDED BY MANUFACTURER.
6	ROUTE CONDENSATE FROM BOILER TO FLOOR DRAIN IN THIS APPROXIMATE LOCAITON. SECURE AND PROTECT FROM DAMAGE AND TERMINATE WITH OPEN AIR GAP.
7	INSTALL NEW BLADDER TYPE EXPANSION TANK AND CONNECT INTO EXISTING AIR DIRT SEPERATOR IN THIS APPROXIMATE LOCATION.
8	INSTALL NEW BUILDING PUMPS, VFD'S AND ACCESSORIES AS DETAILED IN THIS APPROXIMATE LOCATION.
9	INSTALL NEW PRIMARY BOILER PUMP, VFD AND ACCESSORIES AS DETAILED IN THIS APPROXIMATE LOCATION.
10	TIE EXISTING BOILER SHUT OFF TO BOTH BOILERS THROUGH THIS PHASE. MOUNT RED ENGRAVED BOILER E-STOP LABEL ON WALL. FONT SHALL BE LARGE ENOUGH TO BE READABLE FROM ACROSS THE ROOM.
11	PROVIDE NEW FLEXIBLE PUMP CONNECTIONS. TYPICAL FOR ALL NEW PUMPS.

FSM Engineering
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Tallahassee, FL, 32303
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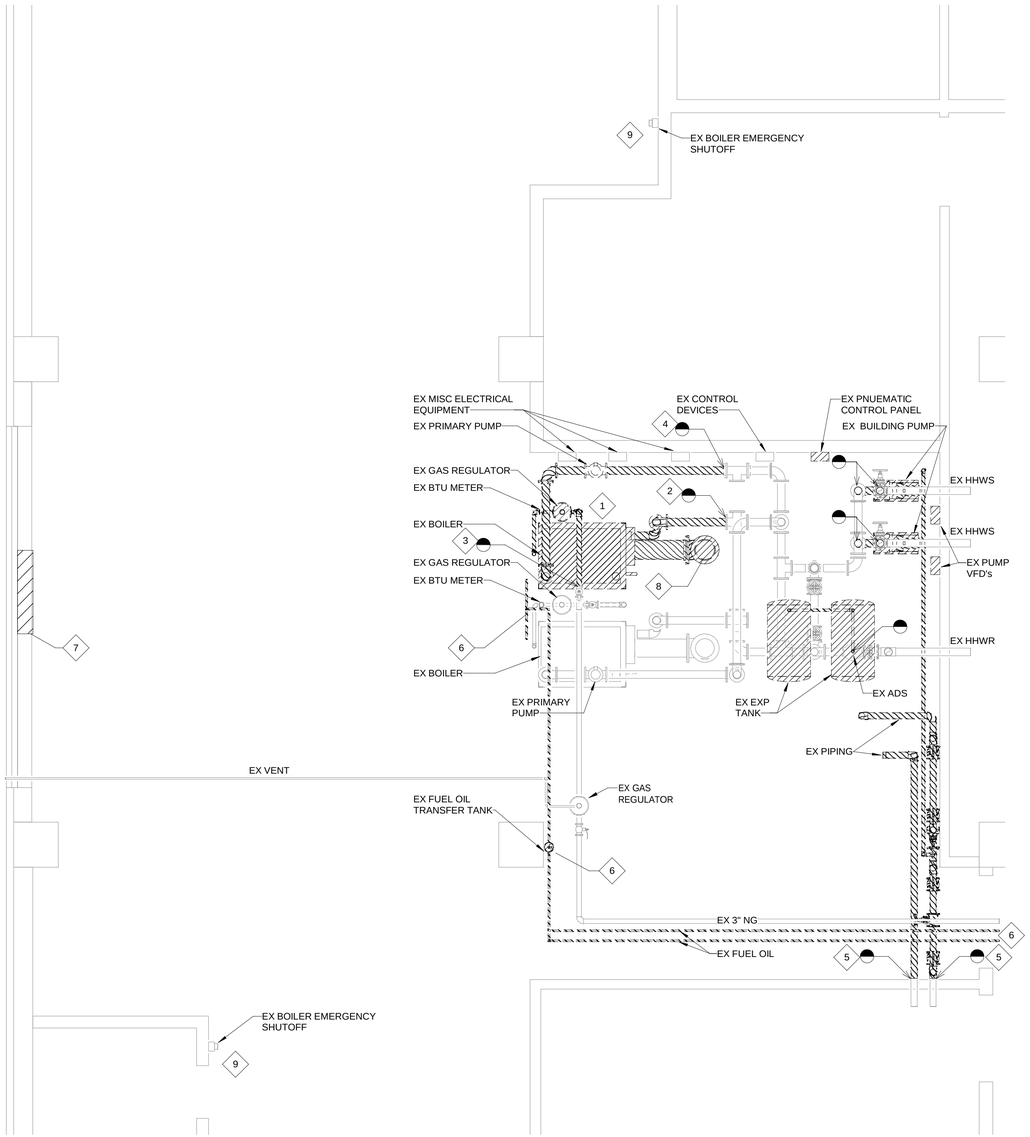
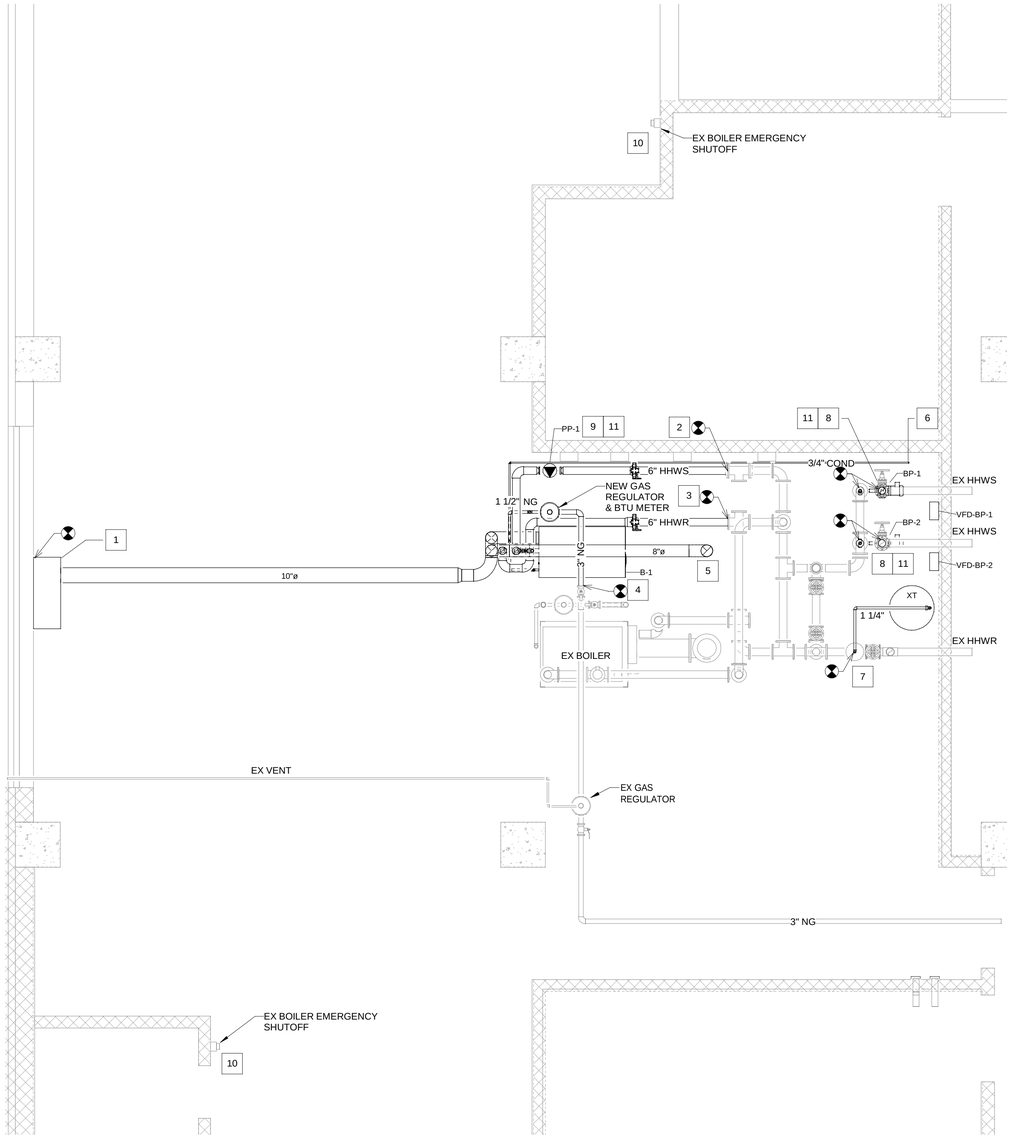


1 M101 **PHASE 1 DEMOLITION PLAN - MECHANICAL**
Scale: 1/4" = 1'-0"



2 M101 **PHASE 1 RENOVATION PLAN - MECHANICAL**
Scale: 1/4" = 1'-0"

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MECHANICAL PHASE 1 PLAN

M101

DEMOLITION KEYED NOTES

1	DEMOLISH EXISTING BOILER, POWER, SUPPORTS, CONTROLS, AND OTHER APPURTENANCES AS NECESSARY FOR COMPLETE REMOVAL.
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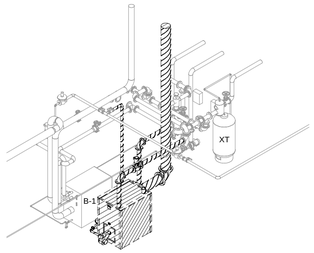
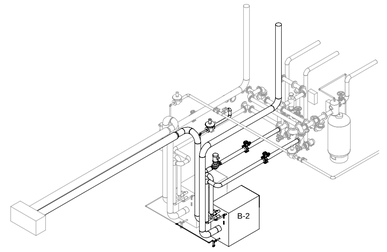
5	DEMOLISH EXISTING FLUE THRU ROOF, NEW FLUE WILL BE INSTALLED IN NEXT PHASE.
6	EXISTING BOILER EMERGENCY SHUTOFF SWITCH SHALL REMAIN.



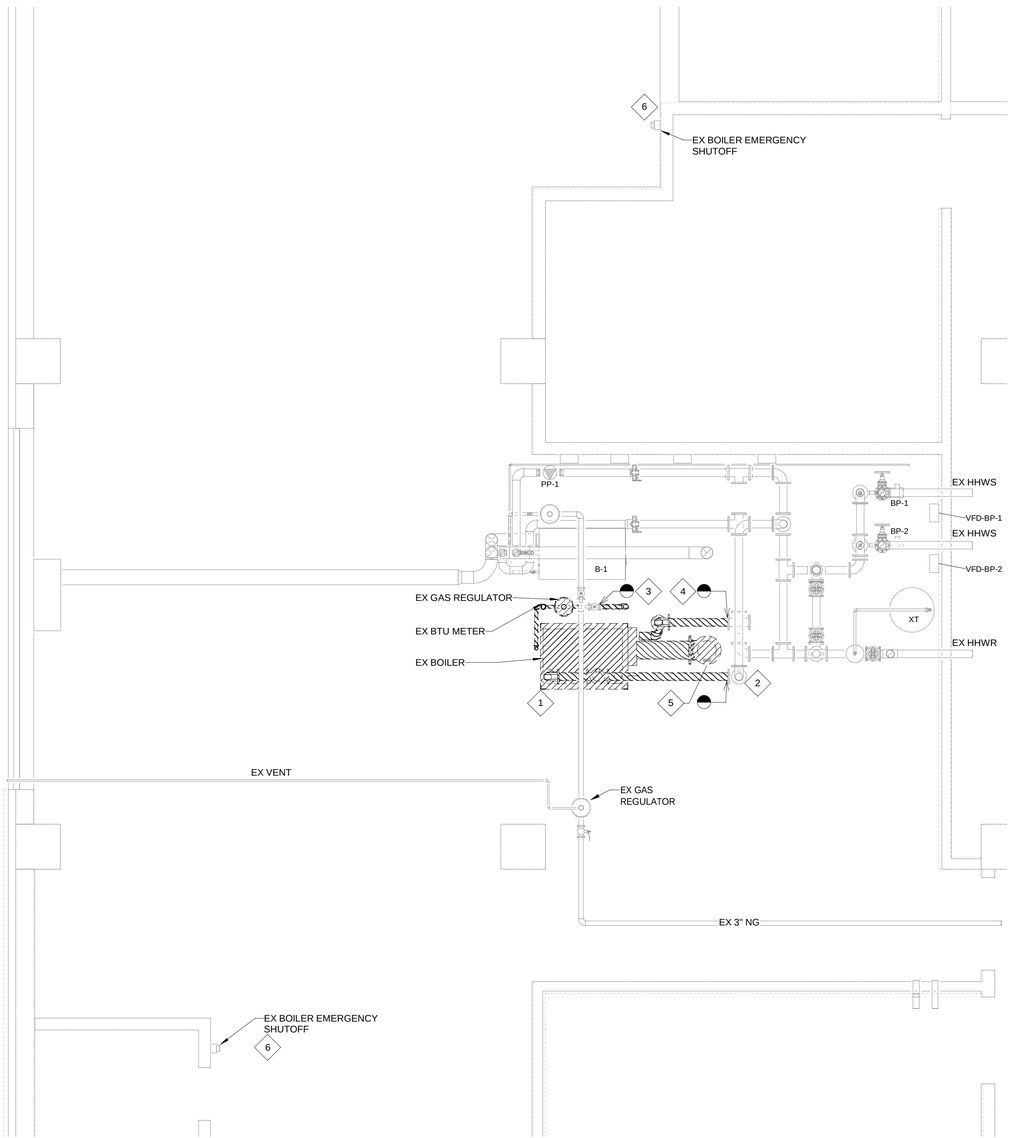
3 M102 **PHASE 2 DEMO ISOMETRIC**
Scale:



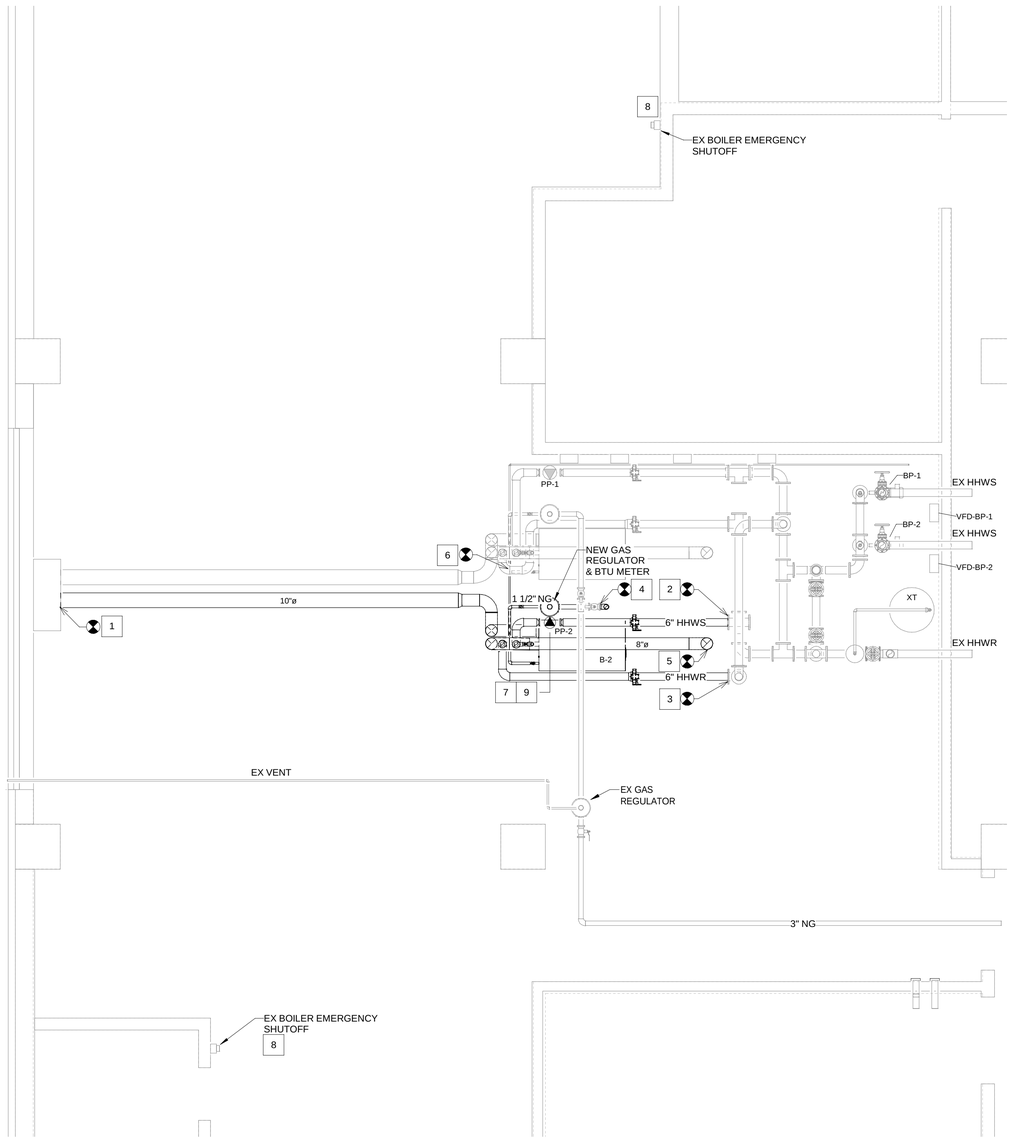
4 M102 **PHASE 2 RENO ISOMETRIC**
Scale:

RENOVATION KEYED NOTES

1	CONNECT NEW COMBUSTION AIR DUCT INTO PHASE 1 COMBUSTION AIR PLENUM.
2	CONNECT NEW SUPPLY PIPING TO EXISTING SUPPLY CONNECTION IN THIS APPROXIMATE LOCATION. TRANSITION AS NECESSARY.
3	CONNECT NEW RETURN PIPING TO EXISTING RETURN CONNECTION IN THIS APPROXIMATE LOCATION. TRANSITION AS NECESSARY.
4	CONNECT NEW NATURAL GAS PIPING TO EXISTING GAS PIPING IN THIS APPROXIMATE LOCATION. TRANSITION AS NECESSARY. PROVIDE NEW BTU METER TO TIE INTO EX BAS. PROVIDE NEW REGULATOR OF PROPER TYPE.
5	ROUTE NEW FLUE DUCT THROUGH THE ROOF AND FLASH AND SEAL ANY PART OF THE OPENING NOT NEEDED DUE TO THE REDUCED SIZE OF THE DUCT. PROVIDE RAIN CAP AS RECOMMENDED BY MANUFACTURER.
6	ROUTE CONDENSATE FROM BOILER TO PHASE 1 CONDENSATE LINE AT B-1 AND CONNECT WITH BFP.
7	INSTALL NEW PRIMARY BOILER PUMP. VFD AND ACCESSORIES AS DETAILED IN THIS APPROXIMATE LOCATION.
8	TIE EXISTING BOILER SHUT OFF TO BOTH BOILERS THROUGH THIS PHASE IF NOT ALREADY ACCOMPLISHED. MOUNT RED ENGRAVED BOILER E-STOP LABEL ON WALL. FONT SHALL BE LARGE ENOUGH TO BE READABLE FROM ACROSS THE ROOM.
9	PROVIDE NEW FLEXIBLE PUMP CONNECTIONS. TYPICAL FOR ALL NEW PUMPS.



1 M102 **PHASE 2 DEMOLITION PLAN - MECHANICAL**
Scale: 1/4" = 1'-0"



2 M102 **PHASE 2 RENOVATION PLAN - MECHANICAL**
Scale: 1/4" = 1'-0"

FSM Engineering
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Tallahassee, FL, 32303
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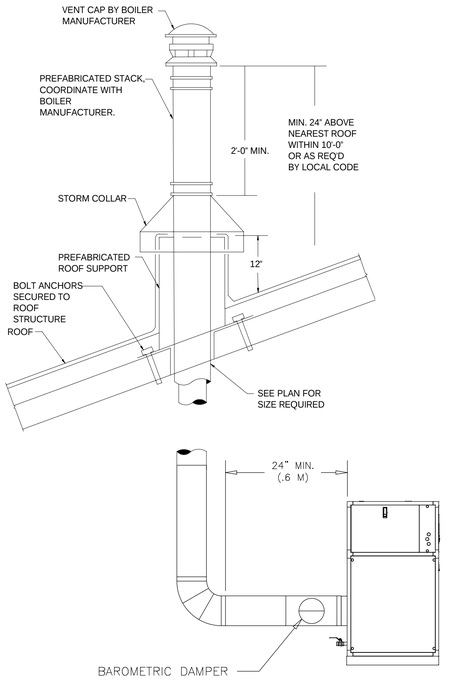
DATE: 05/19/2023

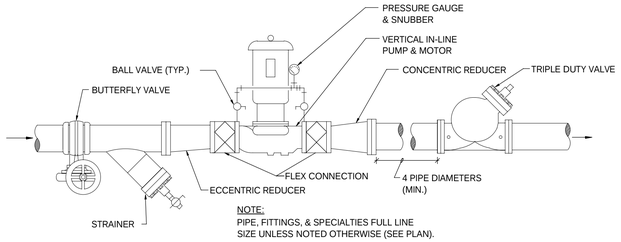
MECHANICAL PHASE 2 PLAN

M102



1 BOILER EXHAUST DETAIL

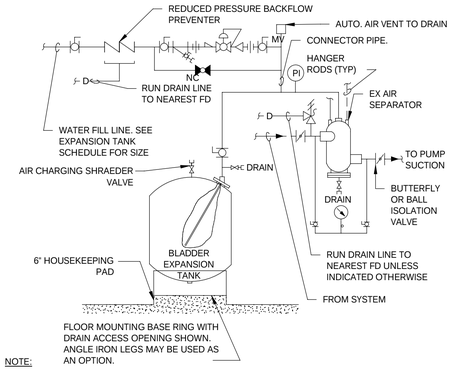
SCALE:NONE



NOTE:
PIPE, FITTINGS, & SPECIALTIES FULL LINE SIZE UNLESS NOTED OTHERWISE (SEE PLAN).

2 VERTICAL IN-LINE PUMP PIPE MOUNTED TYPE

SCALE:NONE

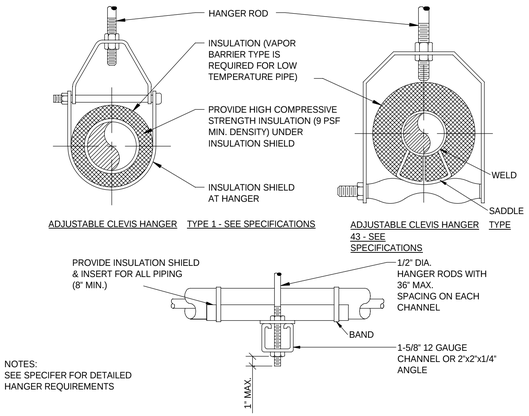


NOTE:

1. SEE EXPANSION TANK SYSTEM SCHEDULE FOR COMPONENT SIZES.
2. SET PRESSURE REDUCING VALVE SO PRESSURE AT HIGHEST POINT IN SYSTEM HAS A MINIMUM OF 4 PSIG.

3 FLOOR MOUNTED EXPANSION TANK - PIPING CONNECTIONS

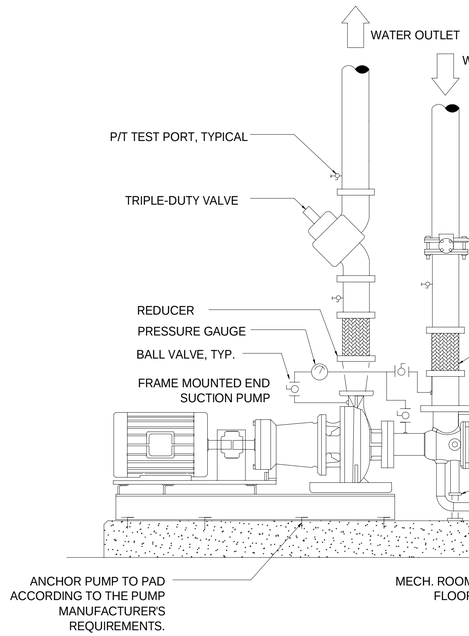
SCALE:NONE



MAXIMUM PIPE/TUBING SUPPORT SPACING																		
NOM. SIZE	IN.	THRU 3/4	1	1 1/4	1 1/2	2	2 1/2	3	4	5	6	8	10	12	14	16	18	20	24
PIPE	FT.	7	7	7	9	10	11	12	14	16	17	19	22	23	25	27	28	30	32
TUBING	FT.	5 FT	6	7	8	8	9	10	12	13	14	16	-	-	-	-	-	-	-
NOTE: FOR TRAPEZE HANGER TAKE SPACING OF SMALLEST SIZE ON TRAPEZE.																			

4 PIPE HANGERS

SCALE:NONE

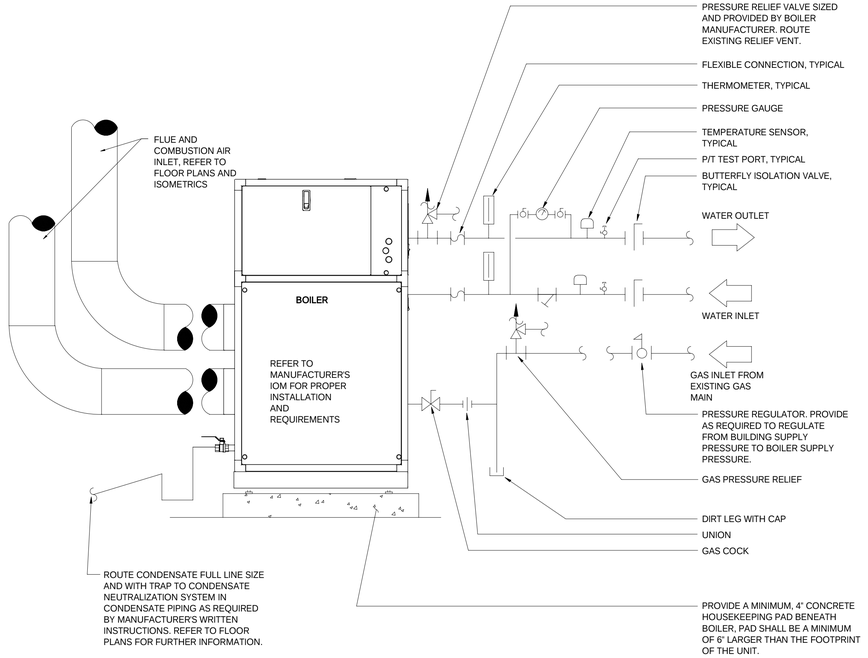


DETAIL NOTES:

1. VALVES AND PIPING SPECIALTIES SHALL BE FULL LINE SIZE UNLESS NOTED OTHERWISE.
2. PRESSURE GAGE LINES SHALL BE A MINIMUM OF 1/4".
3. SUPPORT PIPING INDEPENDENTLY OF PUMP.
4. PROVIDE WELLS WHERE REQUIRED FOR SWITCHES AND OTHER DEVICES FOR CONTROLS. COORDINATE WITH CONTROLS VENDOR IN FIELD.

5 END SUCTION PUMP

SCALE:NONE



6 BOILER CONNECTION DETAIL

SCALE:NONE

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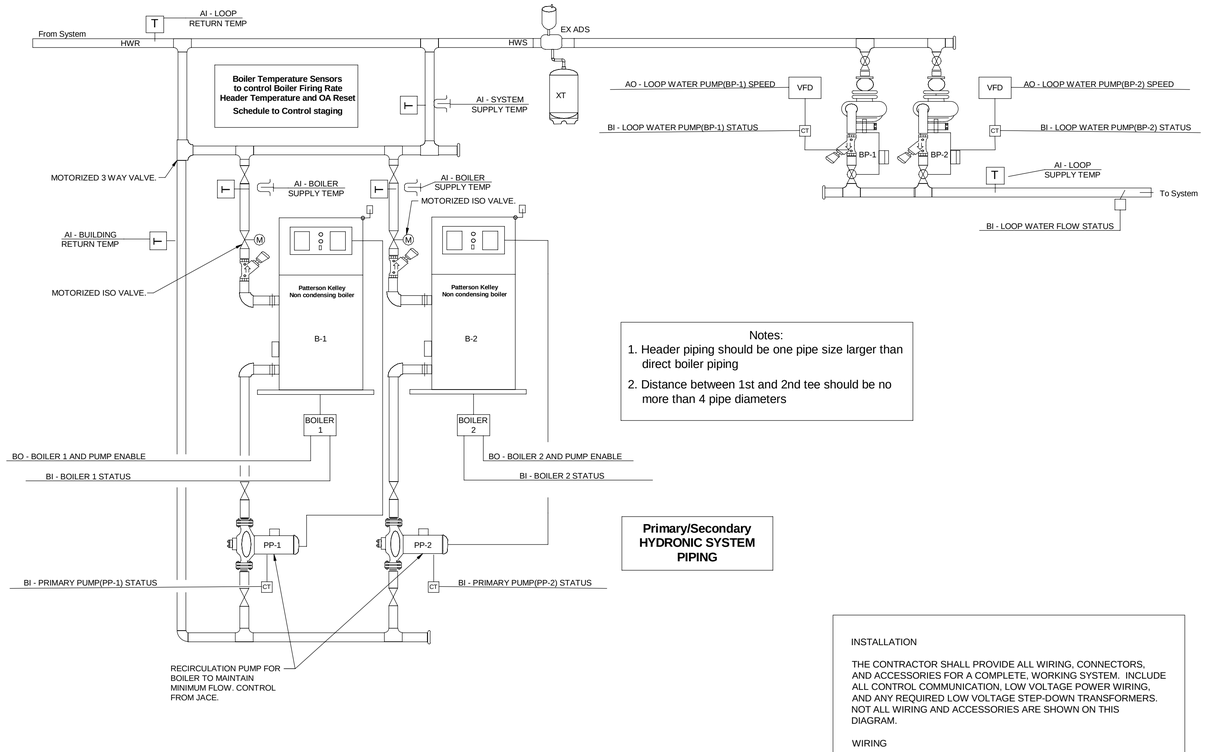
MECHANICAL DETAILS

M501

Primary/Secondary Loop Diagram



Notes:

1. Header piping should be one pipe size larger than direct boiler piping
2. Distance between 1st and 2nd tee should be no more than 4 pipe diameters

Primary/Secondary HYDRONIC SYSTEM PIPING

INSTALLATION

THE CONTRACTOR SHALL PROVIDE ALL WIRING, CONNECTORS, AND ACCESSORIES FOR A COMPLETE, WORKING SYSTEM. INCLUDE ALL CONTROL COMMUNICATION, LOW VOLTAGE POWER WIRING, AND ANY REQUIRED LOW VOLTAGE STEP-DOWN TRANSFORMERS. NOT ALL WIRING AND ACCESSORIES ARE SHOWN ON THIS DIAGRAM.

WIRING

REFER TO THE CONTROLS MANUFACTURER'S INSTALLATION INSTRUCTIONS FOR WIRING REQUIREMENTS. THE SPECIFIED SYSTEM REQUIRES SHIELDED "LEVEL 4" COMMUNICATION WIRE AS MANUFACTURED BY WINDY CITY WIRE OR CONNECT AIR.

ALL NIAGARA INSTANCES SHALL CONTAIN AN OPEN NIAGARA CAPABILITY STATEMENT WHERE ALL ATTRIBUTES ARE "*" FOR OPEN.

HVAC CONTROLS

1. GENERAL SCOPE
 1.1. NEW APPLICATION SPECIFIC CONTROLLER, UTILIZING DIRECT DIGITAL CONTROLS. NIAGRA BASED
 1.2. FURNISH ALL LABOR, MATERIALS, EQUIPMENT, AND SERVICE NECESSARY FOR A COMPLETE AND OPERATING BOILER CONTROL SYSTEM (BCS), UTILIZING DIRECT DIGITAL CONTROLS (DDC) AS SHOWN ON THE DRAWINGS AND DESCRIBED HEREIN.
 1.3. THE BCS SHALL PERFORM CONTROL ALGORITHMS, CALCULATIONS AND ALL MONITORING FUNCTIONS. THE BCS SHALL PROVIDE OPERATOR INTERACTION AND DYNAMIC PROCESS MANIPULATION, INCLUDING OVERALL SYSTEM SUPERVISION, COORDINATION AND CONTROL.
 1.4. THIS SHALL INCLUDE BOILER CONTROL, METERING, ENERGY MANAGEMENT, ALARM MONITORING, AND ALL TRENDING, REPORTING AND MAINTENANCE MANAGEMENT FUNCTIONS RELATED TO NORMAL BOILER OPERATIONS ALL AS INDICATED ON THE DRAWINGS OR ELSEWHERE IN THIS SPECIFICATION.
2. SYSTEM DESCRIPTION
 2.1. SCOPE: NEW BOILERS AND HYDRONIC PUMPS WILL BE TIED TO NEW NIAGRA BASED JACE TO FEED ITS MONITORING DATA TO THE EXISTING OPCON CONTROL SYSTEM. THE MANUFACTURER SHALL PROVIDE JACE BOILER CONTROLLER. JACE WILL DIRECTLY CONTROL THE BOILERS, HYDRONIC PUMPS, AND MONITORING SYSTEMS.
  2.1.1. THE CONTROLS CONTRACTOR SHALL ASSUME COMPLETE RESPONSIBILITY FOR THE ENTIRE CONTROLS SYSTEM AS A SINGLE SOURCE. HE SHALL CERTIFY THAT HE HAS ON STAFF UNDER HIS DIRECT EMPLOY ON A DAILY BASIS, FACTORY TRAINED TECHNICAL PERSONNEL. THESE EMPLOYEES SHALL BE QUALIFIED TO PROJECT MANAGE, ENGINEER, COMMISSION, AND SERVICE ALL PORTIONS OF THE CONTROL SYSTEM.
  2.1.2. THE CONTROL SYSTEM SHALL BE DESIGNED SUCH THAT EACH MECHANICAL SYSTEM WILL BE ABLE TO OPERATE UNDER STAND-ALONE CONTROL. AS SUCH, IN THE EVENT OF A NETWORK COMMUNICATION FAILURE, OR THE LOSS OF ANY OTHER CONTROLLER, THE CONTROL SYSTEM SHALL CONTINUE TO INDEPENDENTLY OPERATE.
 2.2. BASIC SYSTEM FEATURES:
  2.2.1. EQUIPMENT MONITORING AND ALARM FUNCTION INCLUDING INFORMATION FOR DIAGNOSING EQUIPMENT PROBLEMS AND ALARM DIAL OUT TO REMOTE SITES OR PAGERS.
  2.2.2. THE COMPLETE SYSTEM, INCLUDING FIELD INSTALLED CONTROLLERS SHALL AUTO-RESTART, WITHOUT OPERATOR INTERVENTION, ON RESUMPTION OF POWER AFTER A POWER FAILURE. DATABASE STORED IN FIELD INSTALLED CONTROLLER MEMORY SHALL BE BATTERY BACKED UP FOR A MINIMUM OF 1 YEAR. BATTERIES ON UNITARY CONTROLLERS SHALL NOT BE ALLOWED.
  2.2.3. MODULAR SYSTEM DESIGN OF PROVEN RELIABILITY.
  2.2.4. EACH FIELD PANEL CAPABLE OF INDEPENDENT CONTROL.
  2.2.5. ALL SOFTWARE AND/OR FIRMWARE INTERFACE EQUIPMENT FOR CONNECTION TO REMOTE MONITORING STATION FROM FIELD HARDWARE.
  2.2.6. THE SYSTEM SHALL BE CAPABLE OF RECORDING EQUIPMENT RUNTIME TOTALIZATION OF BOILERS, PUMPS ETC., AND ALSO CAPABLE OF ALARM GENERATION AND ALARM DIAL OUT TO REMOTE SITES.
  2.2.7. COMMUNICATION WIRING FOR FIELD CONTROLLERS SHALL NOT BE RUN IN STAR PATTERNS.
  2.2.8. ALL DDC HARDWARE AND SOFTWARE SHALL BE DESIGNED AND MANUFACTURED BY U.S. CORPORATIONS. ALL HARDWARE SHALL BE LISTED UNDERWRITERS LABORATORY FOR OPEN ENERGY MANAGEMENT EQUIPMENT (PAZX) UNDER THE U.L. STANDARD FOR SAFETY 916, WITH INTEGRAL LABELS SHOWING RATING.
3. PRODUCT QUALIFICATION:
 3.1. ALL PRODUCTS USED IN THIS INSTALLATION SHALL BE NEW, CURRENTLY UNDER MANUFACTURE, AND SHALL NOT BE USED AS A TEST SITE FOR ANY NEW PRODUCTS UNLESS EXPLICITLY APPROVED BY THE ENGINEER IN WRITING. SPARE PARTS SHALL BE AVAILABLE FOR AT LEAST 5 YEARS AFTER COMPLETION OF THIS CONTRACT.
 3.2. ALL CONTROLLERS SHALL BE CAPABLE OF CONTAINING AND EXECUTING FACTORY DESIGNED AND TESTED, PRE-ENGINEERED CONTROL ALGORITHMS. FACTORY TESTED ALGORITHMS SHALL BE UTILIZED TO MEET THE SEQUENCE OF OPERATION (EXCEPT AS NOTED).
 3.3. OPERATION AND MAINTENANCE MANUALS:
 3.4. MANUALS WILL BE PROVIDED PRIOR TO FINAL ACCEPTANCE AND SHALL INCLUDE:
  3.4.1. INSTALLATION INSTRUCTIONS.
  3.4.2. PRINCIPLES OF OPERATION AND A DETAILED SYSTEM DESCRIPTION.
  3.4.3. STARTUP AND OPERATING INSTRUCTIONS.
 3.5. SYSTEM LAYOUT AND INTERCONNECTION SCHEMATIC DIAGRAMS.
 3.6. ROUTINE PREVENTIVE MAINTENANCE PROCEDURES AND CORRECTIVE DIAGNOSTIC
 3.7. TROUBLESHOOTING PROCEDURES.
 3.8. NAME, ADDRESS AND TELEPHONE NUMBER OF THE DDC SYSTEMS FIELD REPRESENTATIVE.
 3.9. COMPLETE RECOMMENDED SPARE PARTS LIST.
4. WARRANTY
 4.1. WARRANTY SHALL COVER ALL COSTS FOR PARTS, LABOR, ASSOCIATED TRAVEL, AND EXPENSES FOR A PERIOD OF TEN YEAR FROM COMPLETION AND ACCEPTANCE BY THE OWNER, EXCEPT FOR DAMAGES FROM OTHER CAUSES. IF TEN YEAR WARRANTY IS NOT AVAILABLE, OFFER MAXIMUM WARRANTY AVAILABLE.
 4.2. HARDWARE AND SOFTWARE PERSONNEL SUPPORTING THIS WARRANTY AGREEMENT SHALL PROVIDE ON-SITE OR OFF-SITE SERVICE IN A TIMELY MANNER AFTER FAILURE NOTIFICATION TO THE VENDOR. THE MAXIMUM ACCEPTABLE RESPONSE TIME TO PROVIDE THIS SERVICE AT THE SITE SHALL BE 24 HOURS DURING NORMAL BUSINESS HOURS.
 4.3. THIS WARRANTY SHALL APPLY EQUALLY TO BOTH HARDWARE AND SOFTWARE AND BE AT NO COST TO THE OWNER.

SEQUENCE NOTES

SYSTEM DESCRIPTION:

THE HEATING HOT SYSTEM SHALL CONSIST OF BOILERS, PUMPS AND A SERIES OF EXISTING HYDRONIC AIR HANDLING UNITS. THE BOILERS SHALL BE CONTROLLED BY NEW JACE CONTROLLER, PROVIDED BY MANUFACTURER. THE BOILERS AND PUMPS SHALL BE TIED TO THE EXISTING OPCON REMOTE SITE FOR MONITORING AND BE CAPABLE OF TIEING INTO A NEW BAS SYSTEM WHEN THE TIME COMES THAT THE SYSTEM IS UPGRADED IN THE NEAR FUTURE. COORDINATION WITH THE SITE FOR PROPER TIE IN WILL BE REQUIRED. THE CONTROLLER SHALL HAVE ENOUGH POINTS TO CONTROL BOILER SYSTEM IN ACCORDANCE WITH SEQUENCE OF OPERATIONS HEREIN. PER THE BUILDING DEMAND OR EXISTING OCCUPIED SCHEDULE, THE BOILERS SHALL BE ENABLED TO MEET THE WATER SET POINT. THE PUMPS SHALL OPERATE IN A LEAD/STANDBY FASHION. THE BOILER MANUFACTURER AND CONTROL VENDOR ARE RESPONSIBLE FOR PROVIDING HARDWARE AND SOFTWARE EXPANSION DEVICES WHERE ADDITIONAL POINTS ARE REQUIRED.

ON-DEMAND OPERATION:

THE BOILER PLANT SHALL BE ENABLED IF ANY OF THE EXISTING AIR HANDLING EQUIPMENT UTILIZING HOT WATER CONTROL VALVES INDICATE AN OPEN POSITION. THE BOILER SHALL COMMAND THE LEAD HEATING HOT WATER PUMP TO ENERGIZE. ONCE PROOF THAT THE PUMP HAS ENERGIZED VIA THE FLOW METER AND BOILER SUPPLIED FLOW SWITCH, THE BOILER SHALL BE ALLOWED TO START. ONCE STARTED, THE BOILER SHALL FIRE IN STAGES AS REQUIRED TO MAINTAIN THE DESIRED HEATING HOT WATER SET POINT AS SENSED BY THE HEATING HOT WATER SUPPLY TEMPERATURE SENSOR. THE HEATING WATER RETURN TEMPERATURE SENSOR SHALL MONITOR THE RETURN HEATING HOT WATER TEMPERATURE AND INDICATE VALUE ON BOILER PANEL. THE HEATING HOT WATER PUMP SHALL MODULATE TO MAINTAIN FLOW AS SCHEDULED. MAINTAIN MINIMUM FLOWS BY BOILER RE-CIRCULATION PUMP. COORDINATE MINIMUM FLOWS WITH BOILER MANUFACTURER AS NEEDED.

OCCUPIED OPERATION:

BUILDING LOOP RUN CONDITIONS:
THE BOILER SHALL RUN WHENEVER:
1. THE BOILER PLANT SHALL BE ENABLED IF ANY OF THE EXISTING AIR HANDLING EQUIPMENT UTILIZING HOT WATER CONTROL VALVES INDICATE AN OPEN POSITION.

THE FOLLOWING LOOP WATER CONDITIONS SHALL BE MONITORED:
1. FLOW STATUS.
2. SUPPLY TEMPERATURE.
3. RETURN TEMPERATURE.

ALARMS AND A UNIT SHUTDOWN SIGNAL SHALL BE GENERATED UPON ANY OF THE FOLLOWING LOOP WATER CONDITIONS:
1. NO LOOP FLOW.
2. HIGH LOOP WATER SUPPLY TEMP SHUTDOWN: IF THE LOOP WATER SUPPLY TEMPERATURE IS GREATER THAN SETPOINT +5 °F (ADJ.).

ALARMS SHALL BE PROVIDED AS FOLLOWS:
1. HIGH LOOP WATER SUPPLY TEMP: IF THE LOOP WATER SUPPLY TEMPERATURE IS GREATER THAN SETPOINT +5 °F (ADJ.).
2. LOW LOOP WATER SUPPLY TEMP: IF THE LOOP WATER SUPPLY TEMPERATURE IS LESS THAN SETPOINT -25°F (ADJ.) FOR MORE THAN 1 HOUR.

LOOP WATER PUMP LEAD/STANDBY OPERATION:
THE TWO LOOP WATER PUMPS SHALL OPERATE IN A LEAD/STANDBY FASHION.
1. ANY PUMP CAN BE THE LEAD OR LAG PUMP AT ANY TIME. THE PUMPS SHALL BE ROTATED ON A BI-WEEKLY BASIS.
2. THE LEAD PUMP SHALL RUN FIRST.
3. ON FAILURE OF THE LEAD PUMP, THE STANDBY PUMP SHALL RUN AND THE LEAD PUMP SHALL TURN OFF.

THE DESIGNATED LEAD PUMP SHALL ROTATE UPON ONE OF THE FOLLOWING CONDITIONS (USER SELECTABLE):
1. MANUALLY THROUGH A SOFTWARE SWITCH
2. IF PUMP RUNTIME (ADJ.) IS EXCEEDED
3. DAILY
4. WEEKLY(INITIAL SETTING)
5. MONTHLY

ALARMS SHALL BE PROVIDED AS FOLLOWS:
1. BOILER PUMP 1
 FAILURE: COMMANDED ON, BUT THE STATUS IS OFF.
 RUNNING IN HAND: COMMANDED OFF, BUT THE STATUS IS ON.
2. BOILER PUMP 2
 FAILURE: COMMANDED ON, BUT THE STATUS IS OFF.
 RUNNING IN HAND: COMMANDED OFF, BUT THE STATUS IS ON.

BOILER SYSTEM RUN CONDITIONS:
THE BOILER SYSTEM SHALL RUN SUBJECT TO ITS OWN INTERNAL SAFETIES AND CONTROLS.
THE BOILER SYSTEM SHALL BE ENABLED TO RUN WHENEVER:
1. THE BOILER IS ENABLED BY BUILDING LOOP REQUIREMENTS.
2. AND OUTSIDE AIR TEMPERATURE IS LESS THAN 68°F (ADJ.).

BOILERS LOOP WATER TEMPERATURE CONTROL:
THE CONTROLLER SHALL MEASURE THE LOOP WATER SUPPLY TEMPERATURE AND ENABLE THE BOILERS TO MAINTAIN SETPOINTS. THE TWO BOILERS SHALL RUN SUBJECT TO THEIR OWN INTERNAL SAFETIES AND CONTROLS. THE TWO BOILERS SHALL OPERATE SIMULTANEOUSLY PER THEIR MANUFACTURE BACNET CONTROLLER.

THE FOLLOWING SETPOINTS ARE RECOMMENDED VALUES. ALL SETPOINTS SHALL BE FIELD ADJUSTED DURING THE COMMISSIONING PERIOD TO MEET THE REQUIREMENTS OF ACTUAL FIELD CONDITIONS.
THE BOILER SHALL BE ENABLED TO MAINTAIN SETPOINTS AS FOLLOWS:
1. BOILER SETPOINT 160°F(ADJ.).

ALARMS SHALL BE PROVIDED AS FOLLOWS:
1. BOILER 1
 FAILURE: COMMANDED ON BUT THE STATUS IS OFF.
 RUNNING IN HAND: COMMANDED OFF BUT THE STATUS IS ON.
 RUNTIME EXCEEDED: STATUS RUNTIME EXCEEDS A USER DEFINABLE LIMIT.
2. BOILER 2
 FAILURE: COMMANDED ON BUT THE STATUS IS OFF.
 RUNNING IN HAND: COMMANDED OFF BUT THE STATUS IS ON.
 RUNTIME EXCEEDED: STATUS RUNTIME EXCEEDS A USER DEFINABLE LIMIT.
3. BOILER FAILURE: BOILER IS IN FAILURE.

Point Name	Hardware Points AI	AO	BI	BO	Software Points AV	BV	Loop	Sched	Trend	Alarm	Show On Graphic
Boiler 1 Supply Temp	x								x		x
Boiler 2 Supply Temp	x								x		x
Boiler 1 Status			x						x		x
Boiler 2 Status			x						x		x
Boiler 1 & Pump Enable				x							x
Boiler 2 & Pump Enable				x							x
Outside Air Temp					x						x
Boiler 1 Failure										x	
Boiler 1 Running in Hand										x	
Boiler 1 Runtime Exceeded										x	
Boiler 2 Failure										x	
Boiler 2 Running in Hand										x	
Boiler 2 Runtime Exceeded										x	
Low Boiler Supply Temp										x	
Low Boiler Supply GPM										x	
Totals	3	0	2	2	1	0	0	0	5	8	8
Total Hardware (7)					Total Software (14)						

Point Name	Hardware Points AI	AO	BI	BO	Software Points AV	BV	Loop	Sched	Trend	Alarm	Show On Graphic
Loop Water Return Temp	x								x		x
Loop Water Supply Temp	x								x		x
Loop Water Flow Status			x								x
Loop Water Pump(BP-1) Status			x						x		x
Loop Water Pump(BP-2) Status			x						x		x
Loop Water Pump(BP-1) Speed		x									x
Loop Water Pump(BP-2) Speed		x									x
Outside Air Temp					x						x
High Loop Water Supply Temp										x	
High Loop Water Supply Temp Shutdown										x	
Loop Water Pump 1 Failure										x	
Loop Water Pump 1 Running in Hand										x	
Loop Water Pump 1 Runtime Exceeded										x	
Loop Water Pump 2 Failure										x	
Loop Water Pump 2 Running in Hand										x	
Loop Water Pump 2 Runtime Exceeded										x	
Low Loop Water Supply Temp										x	
Low Loop Water Supply Temp Shutdown										x	
No Loop Flow										x	
Totals	2	2	3	0	1	0	0	0	4	11	8
Total Hardware (7)					Total Software (16)						

FSM Engineering
150 John Knox Road
Tallahassee, FL, 32303
p.850.222.5683
FL CA 28968

ROBERT E. GELHARDT II LICENSED NO. 77568 STATE OF FLORIDA PROFESSIONAL ENGINEER NOT FOR CONSTRUCTION

Robert Gelhardt II, PE FL 77568

RA GRAY BUILDING BOILER REPLACEMENT

100% CHECK SET

500 S. BRONOUGH STREET
TALLAHASSEE, FL 32399

REVISION

No.	Date	Description
-	-	-
-	-	-
-	-	-
-	-	-
-	-	-
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-	-	-
-	-	-

DRAWN BY: REGII
CHECKED BY: REGII
APPROVED BY: REGII

PROJECT: 22067
DATE: 05/19/2023

MECHANICAL CONTROLS

M701

ELECTRICAL SPECIFICATIONS:

BASIC ELECTRICAL MATERIALS AND METHODS

1. ELECTRICAL COMPONENTS, DEVICES, AND ACCESSORIES: LISTED AND LABELED AS DEFINED IN NFPA 70, ARTICLE 100, BY A TESTING AGENCY ACCEPTABLE TO AUTHORITIES HAVING JURISDICTION, AND MARKED FOR INTENDED USE.
2. IDENTIFICATION DEVICE COLORS: USE THOSE PRESCRIBED BY ANSI A13.1, NFPA 70, AND THESE SPECIFICATIONS.
3. COLORED ADHESIVE MARKING TAPE FOR RACEWAYS, WIRES, AND CABLES: SELF-ADHESIVE VINYL TAPE, NOT LESS THAN 1 INCH WIDE BY 3 MILS THICK (25 MM WIDE BY 0.08 MM THICK).
4. TAPE MARKERS FOR CONDUCTORS: VINYL OR VINYL-CLOTH, SELF-ADHESIVE, WRAPAROUND TYPE WITH PREPRINTED NUMBERS AND LETTERS.
5. STOCK, MELAMINE PLASTIC LAMINATE PUNCHED OR DRILLED FOR MECHANICAL FASTENERS 1/16-INCH (1.6-MM) MINIMUM THICKNESS FOR SIGNS UP TO 20 SQ. IN. (129 SQ. CM) AND 1/8-INCH (3.2-MM) MINIMUM THICKNESS FOR LARGER SIZES. ENGRAVED LEGEND IN BLACK LETTERS ON WHITE BACKGROUND.
6. PULL STRINGS: PROVIDE PULL STRINGS IN ALL SPARE OR EMPTY CONDUITS AND RACEWAYS.
7. COORDINATE NAMES, ABBREVIATIONS, COLORS, AND OTHER DESIGNATIONS USED FOR ELECTRICAL IDENTIFICATION WITH CORRESPONDING DESIGNATIONS INDICATED IN THE CONTRACT DOCUMENTS OR REQUIRED BY CODES AND STANDARDS. USE CONSISTENT DESIGNATIONS THROUGHOUT PROJECT.
8. CUT, CHANNEL, CHASE, AND DRILL FLOORS, WALLS, PARTITIONS, CEILINGS, AND OTHER SURFACES REQUIRED TO PERMIT ELECTRICAL INSTALLATIONS. PERFORM CUTTING BY SKILLED MECHANICS OF TRADES INVOLVED. SEAL ALL CONDUIT PENETRATIONS. USE APPROVED METHODS TO MAINTAIN UL-RATED ASSEMBLIES.
9. REPAIR, REFINISH AND TOUCH UP DISTURBED FINISH MATERIALS AND OTHER SURFACES TO MATCH ADJACENT UNDISTURBED SURFACES.
10. ALL BOLTED OR SCREWED ELECTRICAL CONNECTIONS SHALL BE TIGHTENED TO MANUFACTURER'S SPECIFIED TORQUE; PROVIDE TEST REPORT FOR OWNER REVIEW.
11. ALL WORK SHALL COMPLY WITH CODES & STANDARDS LISTED ON THE PLANS.

GROUNDING AND BONDING

1. EQUIPMENT GROUNDING CONDUCTORS: COMPLY WITH NFPA 70, ARTICLE 250, FOR TYPES, SIZES, AND QUANTITIES OF EQUIPMENT GROUNDING CONDUCTORS, UNLESS SPECIFIC TYPES, LARGER SIZES, OR MORE CONDUCTORS THAN REQUIRED BY NFPA 70 ARE INDICATED.
2. INSTALL INSULATED EQUIPMENT GROUNDING CONDUCTORS IN ALL FEEDERS AND BRANCH CIRCUITS.
3. ALL GROUNDING CONDUCTORS SHALL BE COPPER; COMPLY WITH DIVISION 16 SECTION "CONDUCTORS AND CABLES" AND ASTM B, AS APPLICABLE.
4. EQUIPMENT GROUNDING CONDUCTORS: INSULATED WITH GREEN-COLORED INSULATION.
5. GROUNDING ELECTRODE CONDUCTORS: STRANDED COPPER CABLE.
6. UNDERGROUND CONDUCTORS: BARE, TINNED, STRANDED, UNLESS OTHERWISE INDICATED.
7. CONNECTORS: COMPLY WITH IEEE 837 AND UL 467; LISTED FOR USE FOR SPECIFIC TYPES, SIZES, AND COMBINATIONS OF CONDUCTORS AND CONNECTED ITEMS.
8. IN RACEWAYS, USE INSULATED EQUIPMENT GROUNDING CONDUCTORS.
9. EXOTHERMIC-WELDED CONNECTIONS: USE FOR CONNECTIONS TO STRUCTURAL STEEL AND FOR UNDERGROUND CONNECTIONS.
10. GROUNDING CONDUCTORS: ROUTE ALONG SHORTEST AND STRAIGHTEST PATHS POSSIBLE, UNLESS OTHERWISE INDICATED. AVOID OBSTRUCTING ACCESS OR PLACING CONDUCTORS WHERE THEY MAY BE SUBJECTED TO STRAIN, IMPACT, OR DAMAGE.
11. BONDING STRAPS AND JUMPERS: INSTALL SO VIBRATION BY EQUIPMENT MOUNTED ON VIBRATION ISOLATION HANGERS OR SUPPORTS IS NOT TRANSMITTED TO RIGIDLY MOUNTED EQUIPMENT.

CONDUCTORS AND CABLES

1. CONDUCTOR MATERIAL: COPPER COMPLYING WITH NEMA WC 5 OR 7; SOLID CONDUCTOR FOR NO. 14 AWG AND SMALLER, STRANDED FOR NO. 12 AWG AND LARGER.
2. CONDUCTOR INSULATION TYPES: TYPE THHN-THWN COMPLYING WITH NEMA WC 5 OR WC 7.
3. TYPE MC/NM CABLE SHALL NOT BE PERMITTED.
4. FEEDERS CONCEALED IN WALLS OR CEILING: TYPE THHN-THWN, SINGLE CONDUCTORS IN RACEWAY.
5. BRANCH CIRCUITS CONCEALED IN CEILINGS, WALLS, AND PARTITIONS: TYPE THHN-THWN, SINGLE CONDUCTORS IN RACEWAY.
6. CONCEAL CABLES AND RACEWAYS IN FINISHED WALLS, CEILINGS, AND FLOORS.
7. USE MANUFACTURER-APPROVED PULLING COMPOUND OR LUBRICANT WHERE NECESSARY; COMPOUND USED MUST NOT DETERIORATE CONDUCTOR OR INSULATION. DO NOT EXCEED MANUFACTURER'S RECOMMENDED MAXIMUM PULLING TENSIONS AND SIDEWALL PRESSURE VALUES.
8. INSTALL EXPOSED CABLES PARALLEL AND PERPENDICULAR TO SURFACES OF EXPOSED STRUCTURAL MEMBERS, AND FOLLOW SURFACE CONTOURS WHERE POSSIBLE.
9. MAKE SPLICES AND TAPS THAT ARE COMPATIBLE WITH CONDUCTOR MATERIAL AND THAT POSSESS EQUIVALENT OR BETTER MECHANICAL STRENGTH AND INSULATION RATINGS THAN UNSPLICED CONDUCTORS.
10. WIRING AT OUTLETS: INSTALL CONDUCTOR AT EACH OUTLET, WITH AT LEAST 6 INCHES (150 MM) OF SLACK.
11. MINIMUM SIZE FOR POWER CONDUCTORS: #12 AWG.
12. COLORS: 277/480V CONDUCTOR SHALL BE BROWN, ORANGE, YELLOW; GRAY NEUTRAL. 120/208V CONDUCTORS SHALL BE BLACK, RED, BLUE; WHITE NEUTRAL.

RACEWAYS AND BOXES

1. PERMANENENTLY LABEL ALL RACEWAYS AND JUNCTION/PULL BOX COVERS TO INDICATE PANEL/CIRCUIT NUMBERS CONTAINED.
2. UNLESS OTHERWISE NOTED, PROVIDE NEMA 1 ENCLOSURES IN INDOOR LOCATIONS, NEMA 3R ENCLOSURES IN OUTDOOR LOCATIONS.
3. MINIMUM RACEWAY SIZE: 3/4" TRADE SIZE. RACEWAYS SHALL BE EMT, RGSC, OR IMC. CONDUITS CONCEALED IN WALLS OR CEILINGS SHALL BE EMT. ALL OTHERS SHALL BE IMC OR RGS.
4. KEEP RACEWAYS AT LEAST 6 INCHES (150 MM) AWAY FROM PARALLEL RUNS OF HOT-WATER PIPES. INSTALL HORIZONTAL RACEWAY RUNS ABOVE WATER PIPING.
5. PROTECT STUB-UPS FROM DAMAGE WHERE CONDUITS RISE THROUGH FLOOR SLABS. ARRANGE SO CURVED PORTIONS OF BENDS ARE NOT VISIBLE ABOVE FINISHED SLAB.
6. MAKE BENDS AND OFFSETS SO ID IS NOT REDUCED. KEEP LEGS OF BENDS IN SAME PLANE AND KEEP STRAIGHT LEGS OF OFFSETS PARALLEL, UNLESS OTHERWISE INDICATED.
7. CONCEAL CONDUIT AND EMT WITHIN FINISHED WALLS AND CEILINGS, EXCEPT IN EQUIPMENT ROOMS.
9. INSTALL EXPOSED RACEWAYS PARALLEL OR AT RIGHT ANGLES TO NEARBY SURFACES OR STRUCTURAL MEMBERS AND FOLLOW SURFACE CONTOURS AS MUCH AS POSSIBLE.
10. INSTALL RACEWAY SEALING FITTINGS AT SUITABLE, APPROVED, AND ACCESSIBLE LOCATIONS AND FILL THEM WITH UL-LISTED SEALING COMPOUND. INSTALL RACEWAY SEALING FITTINGS WHERE CONDUITS PASS FROM WARM TO COLD LOCATIONS, SUCH AS BOUNDARIES OF REFRIGERATED SPACES AND WHERE OTHERWISE REQUIRED BY NFPA 70.
11. FLEXIBLE CONNECTIONS: USE MAXIMUM OF 72 INCHES (1830 MM) OF FLEXIBLE CONDUIT FOR RECESSED AND SEMIRECESSED LIGHTING FIXTURES; FOR EQUIPMENT SUBJECT TO VIBRATION, NOISE TRANSMISSION, OR MOVEMENT; AND FOR ALL MOTORS. USE LFMC IN DAMP OR WET LOCATIONS. INSTALL SEPARATE GROUND CONDUCTOR ACROSS FLEXIBLE CONNECTIONS.

ENCLOSED SWITCHES

1. ENCLOSED SWITCHES SHALL BE MANUFACTURED BY SQUARE-D, CUTLER-HAMMER, GE, OR SIEMENS.
2. ALL ENCLOSED SWITCHES SHALL BE LOCKABLE.
3. MOUNT INDIVIDUAL WALL-MOUNTING SWITCHES WITH TOPS AT UNIFORM HEIGHT, UNLESS OTHERWISE INDICATED.
4. ENCLOSED SWITCHES SHALL BE UL LISTED FOR THE APPLICATION USED; ENCLOSURES SHALL BE NEMA 1 FOR INDOORS DRY LOCATIONS, NEMA 3R FOR OUTDOORS OR DAMP LOCATIONS.

MOTOR STARTERS

1. MOTOR STARTERS SHALL BE MANUFACTURED BY SQUARE-D, CUTLER-HAMMER, GE, OR SIEMENS. ALL MOTOR STARTERS IN ONE PROJECT ARE TO BE PRODUCTS OF ONE MANUFACTURER.
2. UNLESS NOTED OTHERWISE, MOTOR STARTERS SHALL BE MAGNETIC TYPE FULL-VOLTAGE NON-REVERSING (FVNR), 480V, 3-POLE, WITH INTEGRAL FUSED SAFETY SWITCH, H-O-A SWITCH, AND NEMA-1 ENCLOSURE.
3. PROVIDE CONTROL POWER TRANSFORMER OR POWER SUPPLY AS REQUIRED. COORDINATE CONTROL VOLTAGE AND CHARACTERISTICS WITH CONTROLS VENDOR.
4. PROVIDE FUSES AND MELTING ALLOY THERMAL OVERLOADS FOR EACH POLE.

EXISTING PANEL: 6HA

MAIN: 200A MLO
SERVICE: 277/480V, 3-PHASE, 4-WIRE
LOCATION: SEE PLAN
RATING: 14,000 AIC
TYPE: NEMA-1, SURFACE

NOTE: EXISTING PANEL IS GE TYPE NHB.

CKT	DESCRIPTION	BKR	P	LOAD	KVA A	KVA B	KVA C	LOAD	BKR	P	DESCRIPTION	CKT
1	SPACE				---						SPACE	2
3	SPACE					---					SPACE	4
5	SPACE						---				SPACE	6
7	LTS-SOUTH & CENTER	20	1		---				20	3	EXISTING LOAD	8
9	LTS-SOUTH & CENTER	20	1			---						10
11	LTS-NORTH	20	1				---					12
13	EF LAB	20	3		---				20	1	EXISTING LOAD	14
15						---			20	1	EXISTING LOAD	16
17							---		20	1	SPARE	18
19	EF 14	20	3		---				20	1	SPARE	20
21						---			20	1	SPARE	22
23							---		20	1	SPARE	24
25	PANEL 6B *	30	2	5.00	---				20	3	EXISTING LOAD	26
27				5.00		---						28
29	SPACE						---					30
31	EXISTING LOAD	50	3		---				100	3	EXISTING LOAD	32
33						---						34
35							---					36
37	HW CIRC PUMP #2 **	30	3	1.47	---			1.47	30	3	HW CIRC PUMP #1 **	38
39				1.47		---		1.47				40
41				1.47			---	1.47				42
					---	---	---					

* NEW LOAD; PROVIDE NEW BREAKER.
** NEW LOAD ON EXISTING SPARE BREAKER

EXISTING PANEL: 6A

MAIN: 100A MLO
SERVICE: 120/208V, 3-PHASE, 4-WIRE
LOCATION: SEE PLAN
RATING: 10,000 AIC
TYPE: NEMA-1, SURFACE

NOTE: EXISTING PANEL IS GE TYPE NLAB

CKT	DESCRIPTION	BKR	P	LOAD	KVA A	KVA B	KVA C	LOAD	BKR	P	DESCRIPTION	CKT
1	REC-EQUIP RM SOUTH	20	1		---				20	1	REC-DUPLEX ELEV RM	2
3	REC-EQUIP RM SOUTH	20	1			---			20	1	REC-SHOP	4
5	REC-EQUIP RM SOUTH	20	1				---		20	1	EXISTING LOAD	6
7	WATER TREATMENT	20	1		---				20	1	EF 8	8
9	EF 14 CONTROL	20	1			---			20	1	EF 9	10
11	SIEMENS CONTROL PNL	20	1				---		20	1	EXISTING LOAD	12
13	EMCS CONTROL PANEL	20	1		---				20	1	BOILER CONTROL	14
15	REC-SHOP	20	1			---			30	1	REFRIG MONITOR	16
17	EXISTING LOAD	50	2				---		30	2	EXISTING LOAD	18
19					---							20
21	EXISTING LOAD	20	1			---			50	1	EXISTING LOAD	22
23	REC-GFCI	20	1				---				SPACE	24
25	EXISTING LOAD	50	2		---				60	3	EXISTING LOAD	26
27						---						28
29	SPACE						---					30
					---	---	---					

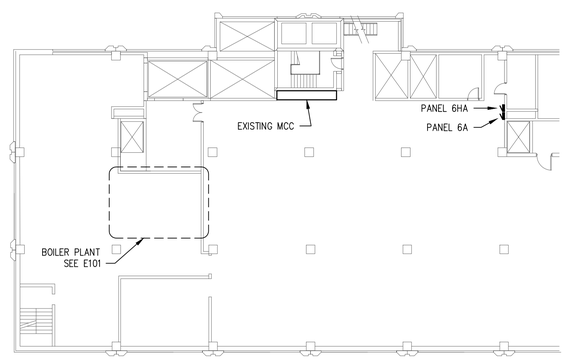
NEW PANEL: 6B

MAIN: 30A/2P PRIMARY, 60A/2P SECONDARY
SERVICE: 120/240V, 1-PHASE, 3-WIRE
LOCATION: SEE PLAN
RATING: 10,000 AIC
TYPE: NEMA-1, SURFACE

NOTE: PROVIDE "MINI-POWER ZONE" STYLE PANEL WITH INTEGRAL DRY TYPE TRANSFORMER.

CKT	DESCRIPTION	BKR	P	LOAD	KVA A	KVA B	LOAD	BKR	P	DESCRIPTION	CKT
1	BOILER B-1	25	2	2.40	4.80		2.40	25	2	BOILER B-2	2
3				2.40		4.80	2.40				4
5	SPACE				0.00					SPACE	6
7	SPACE					0.00				SPACE	8
9	SPACE				0.00					SPACE	10
11	SPACE					0.00				SPACE	12
					4.80	4.80					

TOTAL CONNECTED LOAD (KVA): 9.60 KVA 40.0 AMPS



PARTIAL 6TH FLOOR KEY PLAN

SCALE: 1" = 20' - 0"
0 10' 20'

ELECTRICAL LEGEND:

- ENCLOSED SAFETY SWITCH.
- MAGNETIC MOTOR STARTER.
- ELECTRICAL PANEL. SEE PANEL SCHEDULES.
- (P) CIRCULATION PUMP.

CODES AND STANDARDS

NFPA 70	NATIONAL ELECTRICAL CODE (NEC), 2017 EDITION
NFPA 72	NATIONAL FIRE ALARM CODE, 2016 EDITION

FLORIDA FIRE PREVENTION CODE, SEVENTH EDITION.

FLORIDA BUILDING CODE, SEVENTH EDITION.

GENERAL ELECTRICAL NOTES:

1. ALL WORK SHALL COMPLY WITH FLORIDA BUILDING CODE, SEVENTH EDITION, AND NATIONAL ELECTRICAL CODE, 2017 EDITION.
2. PLANS ARE SCHEMATIC IN NATURE AND ARE INTENDED TO SHOW THE GENERAL SCOPE OF THE PROJECT.
3. IN ADDITION TO THE WORK SHOWN ON THE PLANS, RELOCATE EXISTING RACEWAYS AND DEVICES, AS REQUIRED, TO FACILITATE INSTALLATION OF NEW EQUIPMENT.
4. SEQUENCE, COORDINATE, AND SCHEDULE WORK TO MINIMIZE FREQUENCY AND DURATION OF ANY OUTAGES REQUIRED.
5. BUILDING IS TO BE FULLY OCCUPIED FOR THE DURATION OF THE PROJECT. WORK MAY NOT DISRUPT NORMAL OPERATION OF THE FACILITY.
6. ANY OUTAGES SHALL BE SCHEDULED AND APPROVED BY THE DMS BUILDING MANAGER.
7. ALL CONDUCTORS SHALL BE COPPER, THHN/THWN INSULATION.
8. ALL FEEDERS AND BRANCH CIRCUITS SHALL BE INSTALLED IN EMT/IMC. PROVIDE NOT MORE THAN 36" METAL FLEX TO MECHANICAL EQUIPMENT.
9. WHERE EMT IS USED, PROVIDE COMPRESSION-TYPE FITTINGS.
10. ALL EQUIPMENT PROVIDED SHALL BE NEW, CLEAN, AND FREE OF DEFECTS.
11. CONTRACTOR SHALL SUBMIT PRODUCT DATA ON ALL EQUIPMENT, DEVICES, FIXTURES, AND MATERIALS PROPOSED TO BE INCORPORATED INTO THE WORK.SEE MECHANICAL PLANS FOR PROPOSED PROJECT PHASING.
12. ALL NEW RACEWAY INSTALLED BELOW 8FT A.F.F. IN MECHANICAL ROOMS SHALL BE IMC.

ELECTRICAL DEMOLITION NOTES:

1. SEE MECHANICAL PLANS, AS WELL AS ELECTRICAL PLANS, FOR EXTENT OF DEMOLITION.
2. CONTROLS WIRING IS TO REMAIN, UNLESS INDICATED OTHERWISE ON MECHANICAL DRAWINGS.
3. WHERE DEVICES, EQUIPMENT OR FIXTURES ARE TO BE REMOVED, REMOVE ALL ASSOCIATED DISCONNECTS, WIRING, AND RACEWAY BACK TO PANEL, OR NEXT DEVICE TO REMAIN.
4. PROTECT OR RELOCATE EXISTING RACEWAY OR CABLING, TO REMAIN, IN AREA TO BE RENOVATED.
5. RECIRCUIT EXISTING EQUIPMENT AND FIXTURES TO REMAIN, AS REQUIRED, TO MAINTAIN CONTINUITY.
6. ALL MATERIALS TO BE REMOVED SHALL BE DISPOSED OF BY THE CONTRACTOR IN AN APPROVED LEGAL MANNER.
7. SEE MECHANICAL PLANS FOR PROPOSED PROJECT PHASING.

ELECTRICAL DRAWING LIST:

ARD Project # 2169

APPLIED RESEARCH AND DESIGN, INC.
2623 S. BLAIR STONE ROAD
TALLAHASSEE, FL 32301
FL CA#8948
JAMES M. LAMB, PE#52688
Tel: (850) 668-6324 -- E-mail: jlamb@ard-eng.com

FSM Engineering
1834-A Jaclif Ct.
Tallahassee, FL, 32308
p.850.222.5683
CA 28968

NOT FOR CONSTRUCTION

RA GRAY BUILDING BOILER REPLACEMENT

100% CONSTRUCTION DOCUMENTS

500 S. BRONOUGH STREET
TALLAHASSEE, FL 32399

Revision

No.	Date	Description
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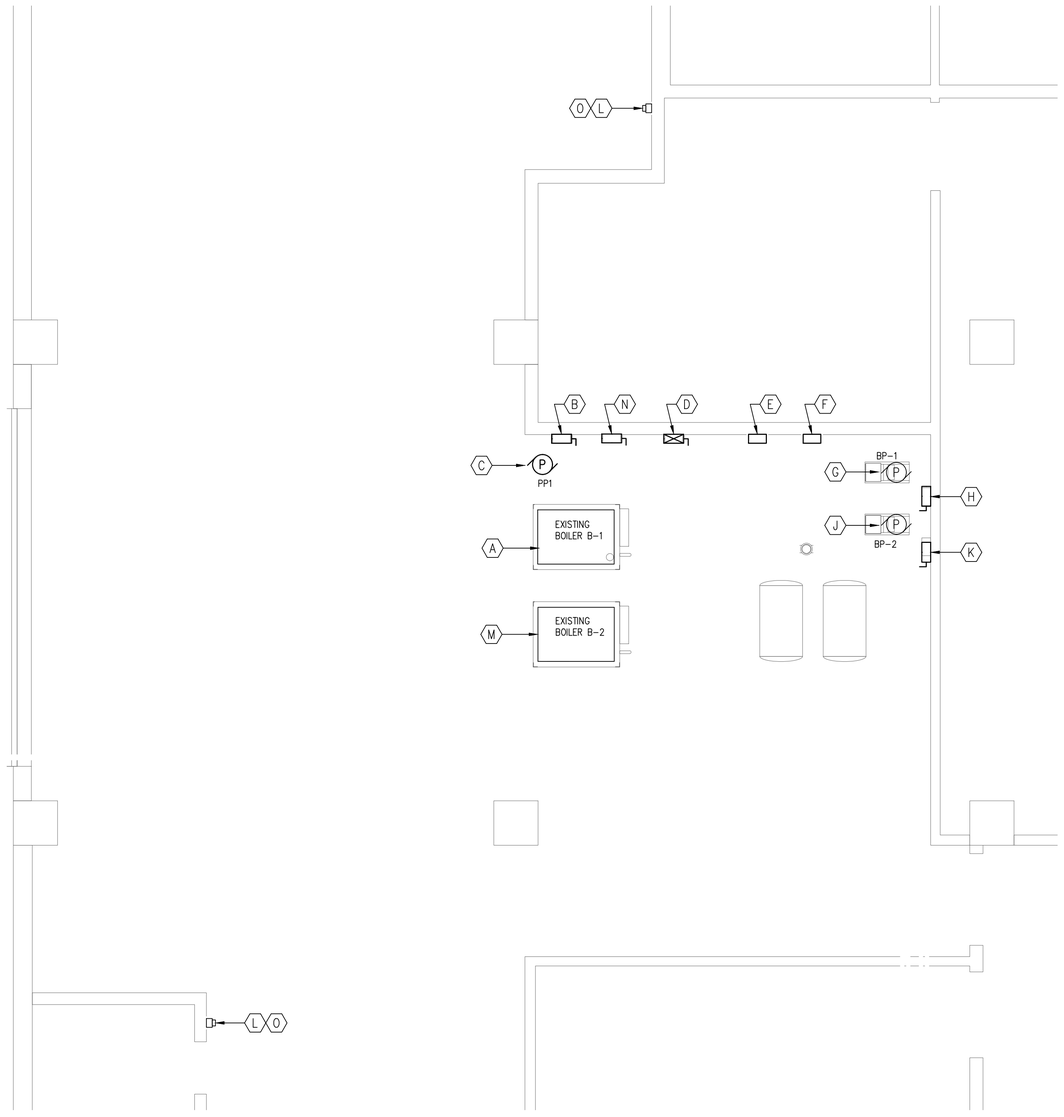
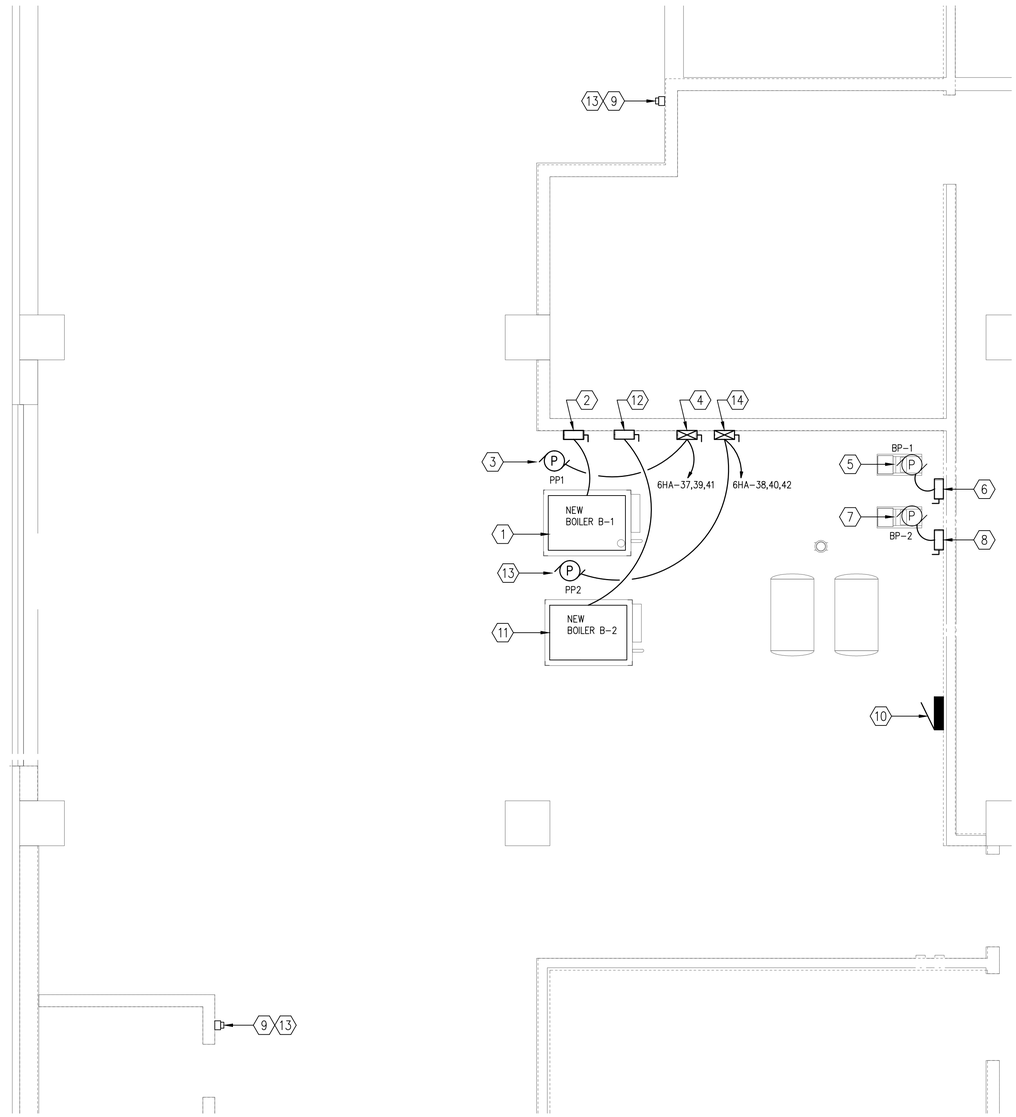
DRAWN BY: TAW / JML
CHECKED BY: JML
APPROVED BY: JML

PROJECT: 22067
DATE: 05/19/2023

ELECTRICAL LEGEND & NOTES

E001





EXISTING / DEMO NOTES:

PHASE 1

(A) EXISTING BOILER B-1, TO BE REPLACED. REMOVE ELECTRICAL FEEDER CONNECTIONS AND SECURE FOR RE-USE.

(B) EXISTING 30A/3P 480V N.F. NEMA-1 SAFETY SWITCH (SERVING BOILER B-1); TO BE REMOVED. EXISTING FEEDER RACWAYS AND CONDUCTORS MAY BE RE-USED.

(C) EXISTING PUMP, TO BE REPLACED. REMOVE EXISTING FEEDER CONDUIT/CONDUCTORS AS REQUIRED.

(D) EXISTING NEMA SIZE 1 COMBINATION-TYPE MOTOR STARTER (SERVING EXISTING PUMP PP1), WITH INTEGRAL DISCONNECT; TO BE REMOVED.

(E) EXISTING BOILER CONTROLS, TO BE REMOVED.

(F) EXISTING CONTROLS, TO BE REMOVED.

(G) EXISTING PUMP, TO BE REMOVED.

(H) EXISTING 30A/3P 480V N.F. NEMA-1 SAFETY SWITCH (SERVING PUMP BP-1); TO BE REMOVED. EXISTING FEEDER RACWAYS AND CONDUCTORS MAY BE RE-USED. EQUIPMENT IS SERVED FROM MOTOR CONTROL CENTER (MCC).

(J) EXISTING PUMP, TO BE REMOVED.

(K) EXISTING 30A/3P 480V N.F. NEMA-1 SAFETY SWITCH (SERVING PUMP BP-1); TO BE REMOVED. EXISTING FEEDER RACWAYS AND CONDUCTORS MAY BE RE-USED. EQUIPMENT IS SERVED FROM MOTOR CONTROL CENTER (MCC).

(L) EXISTING EMERGENCY SHUT-OFF (ESO) PUSHBUTTON, WIRED TO SHUT-DOWN BOILER EQUIPMENT; ESO TO REMAIN IN SERVICE FOR THE DURATION OF THE PROJECT.

PHASE 2

(M) EXISTING BOILER B-2, TO BE REPLACED. REMOVE ELECTRICAL FEEDER CONNECTIONS AND SECURE FOR RE-USE.

(N) EXISTING 30A/3P 480V N.F. NEMA-1 SAFETY SWITCH (SERVING BOILER B-2); TO BE REMOVED. EXISTING FEEDER RACWAYS AND CONDUCTORS MAY BE RE-USED.

(O) EXISTING EMERGENCY SHUT-OFF (ESO) PUSHBUTTON, WIRED TO SHUT-DOWN BOILER EQUIPMENT; EESO TO REMAIN IN SERVICE FOR THE DURATION OF THE PROJECT.

EXISTING CONDITIONS

SCALE: 1/4" = 1' - 0" 0 2' 4'

RENOVATION NOTES:

PHASE 1

(1) NEW BOILER B-1 TO BE INSTALLED. RECONNECT TO SAFETY SWITCH (SEE NOTE 2, BELOW) 120V CONTROL POWER (FROM PANEL 6A-14).

(2) NEW 30A/3P 480V FUSED SAFETY SWITCH, SERVING NEW BOILER B-1. PROVIDE 3/4" EMT-3 #10, #10 GND, TO PANEL 6B-1,3.

(3) NEW PUMP PP1 (3HP/480V) TO BE INSTALLED. FIELD-COORDINATE EXACT LOCATION WITH OTHERS.

(4) NEW NEMA SIZE 1 COMBINATION-TYPE FVNR MAGNETIC MOTOR STARTER (480V/3-POLE), WITH INTEGRAL FUSED DISCONNECT, H-O-A SWITCH, AND NEMA 1 ENCLOSURE. PROVIDE 3/4" EMT-3 #10, #10 GND, TO PANEL. PROVIDE 15A RK-5 FUSES AT MOTOR STARTER.

(5) NEW PUMP BP-1 (5HP/480V).

(6) NEW VFD (SUPPLIED BY MECHANICAL), SERVING NEW PUMP BP-1. PROVIDE NEW 30A/3P 480V N.F. SAFETY SWITCH, WITH AUXILIARY CONTACTS, ON LOAD SIDE OF VFD. RECONNECT TO EXISTING PUMP FEEDER, FROM MCC.

(7) NEW PUMP BP-2 (5HP/480V).

(8) NEW VFD (SUPPLIED BY MECHANICAL), SERVING NEW PUMP BP-2. PROVIDE NEW 30A/3P 480V N.F. SAFETY SWITCH, WITH AUXILIARY CONTACTS, ON LOAD SIDE OF VFD. RECONNECT TO EXISTING PUMP FEEDER, FROM MCC.

(9) RE-CONNECT EXISTING ESO SWITCH TO PROVIDE SHUTDOWN OF BOILER B-1 EQUIPMENT.

(10) PROVIDE NEW 120/240V SINGLE-PHASE PANEL 6B, WITH INTEGRAL DRY-TYPE 480:120/240V STEP-DOWN TRANSFORMER, EQUAL TO SQUARE-D MINI-POWER-ZONE. FEED PANEL WITH NEW 3/4" EMT-2 #10, #10 GND, TO PANEL 6HA. SEE PANEL SCHEDULE.

PHASE 2

(11) NEW BOILER B-2 TO BE INSTALLED. RECONNECT TO SAFETY SWITCH (SEE NOTE 2, BELOW) 120V CONTROL POWER (FROM PANEL 6A-14).

(12) NEW 30A/3P 480V FUSED SAFETY SWITCH, SERVING NEW BOILER B-2. PROVIDE 3/4" EMT-3 #10, #10 GND, TO PANEL 6B-2,4.

(13) NEW PUMP PP2 (3HP/480V) TO BE INSTALLED. FIELD-COORDINATE EXACT LOCATION WITH OTHERS.

(14) NEW NEMA SIZE 1 COMBINATION-TYPE FVNR MAGNETIC MOTOR STARTER (480V/3-POLE), WITH INTEGRAL FUSED DISCONNECT, H-O-A SWITCH, AND NEMA 1 ENCLOSURE. PROVIDE 3/4" EMT-3 #10, #10 GND, TO PANEL. PROVIDE 15A RK-5 FUSES AT MOTOR STARTER.

(15) RE-CONNECT EXISTING ESO SWITCH TO PROVIDE SHUTDOWN OF BOILER B-2 EQUIPMENT.

RENOVATIONS

SCALE: 1/4" = 1' - 0" 0 2' 4'

ARD Project # 2169

APPLIED RESEARCH AND DESIGN, INC.
2623 S. BLAIR STONE ROAD
TALLAHASSEE, FL 32301
FL CA#8948
JAMES M. LAMB, PE#52688
Tel: (850) 668-6324 -- E-mail: jlamb@ard-eng.com

FSM Engineering
1834-A Jaclif Ct.
Tallahassee, FL, 32308
p.850.222.5683
CA 28968

NOT FOR CONSTRUCTION

RA GRAY BUILDING BOILER REPLACEMENT

100% CONSTRUCTION DOCUMENTS

500 S. BRONOUGH STREET
TALLAHASSEE, FL 32399

Revision

No.	Date	Description
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DRAWN BY:	TAW / JML
CHECKED BY:	JML
APPROVED BY:	JML

PROJECT: 22067
DATE: 05/19/2023

ELECTRICAL PLAN

E101