

## ADDENDUM NO. 1

TO  
CONSTRUCTION DOCUMENTS  
FOR:

### Arkansas Forest Health Research Center University of Arkansas at Monticello

November 12, 2024

*This addendum forms a part of the contract documents and modifies or interprets the Project Manual and Drawings, as noted below. Acknowledge receipt of this addendum in the space provided on the Bid Form. Failure to do so may subject bidder to disqualification.*

**THIS ADDENDUM CONTAINS FIFTY-FIVE (55) 8 ½" x 11" and TEN (10) 22" x 34" PAGES, IF THIS COPY OF ADDENDUM NO. 1 DOES NOT CONTAIN THE ABOVE PAGE COUNT, PLEASE CONTACT SCM ARCHITECTS.**

#### **SPECIFICATIONS:**

1. Refer to Section 01 23 00 – Alternates, 1.05 Schedule of Alternates, Add “ C. Alternate No. 3, Please provide a price to change Turned Glu-Lam Column and Branches to Turned Solid Douglas Fir Columns and Branches of equal size and diameter.”
2. Refer to Section 06 12 50 – Tongue and Groove Wood Decking, Unfinished Tongue and Groove Wood Decking to be provided by owner and installed and finished on site by contractor.
3. Refer to Section 07 53 00 – Single Ply TPO Roofing Membrane, 2.05 Insulation System, Sub-Section A, Change Insulation System thickness to 3.5”.
4. Refer to Section 07 53 00 – Single Ply TPO Roofing Membrane, 2.05 Insulation System, ADD Sub-Section C as Follows: “C. Provide ½” thick mineral fiber cover board over insulation system.”
5. Refer to Section 09 51 13 – Suspended Acoustical Ceilings, 2.01 Acoustical Units, Sub-Section B, Change Product Number to #1912, Change “Tegular Chamfered” to “Tegular Beveled”.
6. Refer to Section 09 90 00 – Suspended Acoustical Ceilings, 3.06 – Schedule - Paint Systems, Sub-Section J, Exterior Stucco – DELETE Painting of Exterior Stucco. Provide Integrally Colored Stucco per Section 09 24 00 – Portland Cement Plaster.
7. Refer to Section 10 44 20 – Metal Letters and Cast Bronze Plaque, Remove the entire section and replace with the attached REVISED Section 10 44 20.
8. Refer to Section 12 52 00 – Motorized Window Shades, Remove the entire section and replace with the attached REVISED Section 12 52 00.
9. Refer to Section 23 07 05 – High Pressure Ductwork, Remove the entire section and replace with the attached REVISED Section 23 07 05.
10. Refer to Section 23 07 10 – HVAC Sheet Metal, Remove the entire section and replace with the attached REVISED Section 23 07 10.
11. Refer to Section 23 09 90 – Testing, Adjusting, and Balancing, Remove the entire section and replace with the attached REVISED Section 23 09 90.
12. Add Section 23 52 33 – Fire Tube SS Heating Boilers attached to this Addendum No. 01.
13. Add Section 23 90 00 – Automatic Controls attached to this Addendum No. 01..

14. Refer to Division 23 Mechanical Index, Replace current index with the attached REVISED index.

**DRAWINGS:**

1. Refer to Drawings Sheet S0.03, Update Structural Panels notes per attached SUP S1.
2. Refer to Drawings Sheet S1.02, Added slab recess per attached SUP S2.
3. Refer to Drawings Sheet S1.04, Added slab recess per attached SUP S3.
4. Refer to Drawings Sheet S3.03, Added steel framing per attached SUP S4.
5. Refer to Drawings Sheet S3.03, Added steel framing per attached SUP S5.
6. Refer to Drawings Sheet S4.03, Added details for steel framing per attached SUP S6.
7. Refer to Drawings Sheet S4.03, Detail 10, Steel Framing for Pre-Manufactured Canopy, this detail supersedes detail 5F/A8.05.
8. Refer to Drawings Sheet S4.03, Cast Conex Art-10.75 Column Base, Glu-Lam Manufacturer can provide a similar base instead of the Cast Conex Art-10.75. Please provide base design for Architect and Structural Engineer approval before the Bid Date.
9. Refer to Drawings Sheet A1.02, Furring note at door 115A shall reference detail 5F/A8.05.
10. Refer to Drawings Sheet 5B/A3.08, Elevation 5B – REPLACE Elevation 5B with the Elevation on Supplemental Drawing SUP A3.
11. Refer to Drawings Sheet 5D/A8.01, Top of framing shall be 18'-4" A.F.F. at cypress siding.
12. Refer to Drawings Sheet 5D/A8.01 and 5G/A8.03, Added details to clarify ACM column parapet cap per attached SUP A1.
13. Refer to Drawings Sheet 3F/A2.03 and 2E/A8.03, Coordinated head and jamb wood trim details per attached SUP A2.
14. Refer to Drawings Sheet P2.01, Added floor drain in Storage 108.
15. Refer to Drawings Sheet P3.01, Added wall box and water filter for Ice maker in Storage 108.
16. Refer to Drawings Sheet P5.01, Updated riser.
17. Refer to Drawings Sheet P5.03, Updated riser.
18. Refer to Drawings Sheet E4.01, Added power for ice maker.
19. Refer to Drawings Sheet E4.02, Revised lab equipment locations and lab circuiting.
20. Refer to Drawings Sheet E8.02, Updated panel schedules per power plan changes.
21. Refer to Drawings Sheet E8.03, Updated panel schedules per power plan changes.
22. Refer to Drawings Sheet P1.01 and Sheet M2.03, Provide 4" High Housekeeping Pads.
23. Refer to Drawings Sheet M3.01, Revised HVAC Pump Schedule.
24. Refer to Drawings Sheet M5.01, Revised control system notes.

**ATTACHMENTS**

**Specifications:** 10 44 20, 12 52 00, Division 23 Mechanical Index, 23 07 05, 23 07 10, 23 09 90, 23 52 33 and 23 90 00

**Supplemental Drawings:** SUP S1, SUP S2, SUP S3, SUP S4, SUP S5, SUP S6, SUP A1, SUP A2 and SUP A3.

**Sheets:** P2.01, P3.01, P5.01, P5.03, E4.01, E4.02, E8.02, E8.03, M3.01 and M5.01.

**End of Addendum 1**

## SECTION 10 44 20

### METAL LETTERS AND CAST BRONZE PLAQUE

#### PART 1 GENERAL

##### 1.01 SECTION INCLUDES

- A. Exterior Fabricated Aluminum Letters
- B. Exterior Fabricated Aluminum Logo
- C. Cast Bronze Plaque.

##### 1.02 RELATED SECTIONS

- A. Section 06 10 00 – Wood Framing, Blocking, Sheathing and Curbing: In-wall blocking for mounting exterior letters, logo and interior plaque.
- B. Section 09 21 16 - Gypsum Board Assemblies: Substrate for mounting plaque.

##### 1.03 REFERENCES

- A. ANSI/ICC A117.1 - American National Standard for Accessible and Usable Buildings and Facilities; International Code Council; 1998.

##### 1.04 SUBMITTALS

- A. See Section 01 33 00 - Submittals and Substitutions, for submittal procedures.
- B. Shop Drawings: Indicate letter and plaque styles, lettering font and background colors.
- D. Manufacturer's Installation Instructions: Include installation template and attachment devices.

##### 1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum ten years of documented experience.

#### PART 2 PRODUCTS

##### 2.01 MANUFACTURER

- A. Gemini Incorporated, [www.signletters.com](http://www.signletters.com).
- B. Substitutions: In accordance with Section 01 60 00 - Product Requirements.

##### 2.02 EXTERIOR PAINTED ALUMINUM LETTERS

- A. Material: Fabricated Aluminum
  - 1. Depth: 1 inch
  - 2. Height: 14 inches.
  - 3. Profile: Flat face with Straight Return.
- B. Character Style:
  - 1. Finish: Painted Satin Finish
  - 2. Font: GIL SANS
  - 3. Case: Upper Case Only
  - 4. Mounting: Concealed Studs.
- C. Text:
  - 1. **ARKANSAS FOREST HEALTH RESEARCH CENTER**

- D. Logo: 2-Inch Thick Fabricated Aluminum mounted to wall with studs.
  - 1. UAM Historic A&M interlocked Logo.
  - 2. Finish: Painted Satin Finish



### **2.03 CAST BRONZE PLAQUE**

- A. Cast bronze plaque shall be 24" wide by 36" tall with manufacturers standard double line beveled edge border, textured background and concealed stud mounting.
- B. Plaque text shall be similar to the example pictured on page 10 44 20-4, except that the names may be different. The text may be reconfigured to accommodate the dimensions of the actual plaque. The text shall be as large as possible while still conforming to the overall plaque size. Approval by owner of the plaque layout and lettering is required before manufacturing plaque. Manufacturer to provide mock-up for owner's approval.

### **2.04 ACCESSORIES**

- A. Provide mounting templates for all letters and plaque.
- B. Silicone Adhesive.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify that substrate surfaces are ready to receive work.

### **3.02 INSTALLATION**

- A. Install in accordance with manufacturer's instructions.
- B. Install signs after walls are finished, in location s as directed by the Architect or Owner.

# **ARKANSAS FOREST HEALTH RESEARCH CENTER**



**The University of Arkansas  
at Monticello**

**Dedicated May 14, 2026**

**Governor: Sarah Huckabee-Sanders**

**President: Dr. Donald R. Bobbitt**

**Chancellor: Peggy Doss**

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Scott Ford**

**Architects: SCM Architects, PLLC**

**General Contractor: Clark**



## MOTORIZED WINDOW SHADES

### PART 1 GENERAL

#### 1.1 SECTION INCLUDES

- A. Motorized, roll-up fabric interior window shades including motor operator, controls, and mounting hardware.

#### 1.2 RELATED SECTIONS

- A. Section 06 10 00 - Rough Carpentry.
- B. Section 06 20 00 – Finish Carpentry
- C. Section 09 21 16 - Gypsum Board Assemblies.
- D. Division 26 - Electrical: Electrical supply, conduit, and wiring for motorized window shades.

#### 1.3 REFERENCES

- A. NFPA 70 - National Electrical Code.
- B. NFPA 701-99 - Fire Tests for Flame-Resistant Textiles and Films.
- C. UL GREENGUARD Gold.
- D. US Green Building Council.
- E. ANSI/WCMA A100.1-2022.
- F. Window Covering Safety Council Best for Kids™.

#### 1.4 SUBMITTALS

- A. Submit under provisions of Section 01 33 00 - Source Quality Control Reporting:
- B. Product Data: Manufacturer's data sheets on each product specified, including:
  1. Preparation instructions and recommendations.
  2. Installation and maintenance instructions.
  3. Styles, material descriptions, dimensions of individual components, profiles, features, finishes, and operating instructions.
  4. Storage and handling requirements and recommendations.
  5. Mounting details and installation methods.
  6. Typical wiring diagrams including integration of motor controllers with building management system, audiovisual, and lighting control systems as applicable.

- C. Shop Drawings: Plans, elevations, sections, product details, installation details, operational clearances, wiring diagrams, and relationship to adjacent work.
- D. LEED Submittals: Provide documentation of how the requirements of credit will be met.
- E. Window Treatment Schedule: For all roller shades. Use same room designations as indicated on the Drawings, field verified window dimensions, quantities, type of shade, controls, fabric, and color, and include opening sizes and key to typical mounting details.
- F. Selection Samples: For each finish product specified, one complete set of shade cloth options and aluminum finish color samples representing manufacturer's full range of available colors and patterns.
- G. Verification Samples: For each finish product specified, one complete set of shade components, unassembled, demonstrating compliance with specified requirements. Shade fabric sample and aluminum finish sample as selected, representing actual product, color, and patterns. Mark face of material to indicate interior faces.
- H. Maintenance Data: Methods for maintaining roller shades, precautions regarding cleaning materials and methods, instructions for operating hardware, and controls.
- I. Manufacturer's Certificates: Certify products meet or exceed specified requirements.
- J. Standard manufacturer's defect warranty: Standard manufacturer's warranty documents

#### **1.5 QUALITY ASSURANCE**

- A. Manufacturer Qualifications: Obtain roller shades through one source from a single manufacturer with a minimum of twenty years' experience in manufacturing products comparable to those specified in this section.
- B. Shading system shall be UL listed. Provide documentation and proper labeling.
- C. NFPA Flame-Test: Passes NFPA 701. Materials tested shall be identical to products proposed for use. Show complete manufacturer data (name, location, contact) and certification from manufacturer that the fabrics sourced for this project comply with the test data provided.

#### **1.6 DELIVERY, STORAGE, AND HANDLING**

- A. Do not deliver window shades until building is enclosed and construction within spaces where shades will be installed is substantially complete.
- B. Deliver products in manufacturer's original, unopened, undamaged containers with labels intact.
- C. Label containers and shades according to Window Shade Schedule.
- D. Store products in manufacturer's unopened packaging until ready for installation.

#### **1.7 SEQUENCING**

- A. Ensure that locating templates and other information required for installation of products of this section are furnished to affected trades in time to prevent interruption of construction progress.
- B. Ensure that products of this section are supplied to affected trades in time to prevent interruption of construction progress.

## 1.8 PROJECT CONDITIONS

- A. Install roller shades after finish work and ambient temperature, humidity, and ventilation conditions are maintained at levels recommended for project upon completion.

## 1.9 WARRANTY

- A. Hardware and Shade Fabric: Standard twenty-five-year limited warranty.
- B. Motors and Controls: Standard five-year limited warranty.

## PART 2 PRODUCTS

### 2.1 MANUFACTURERS

- A. Acceptable Manufacturer: Draper, Inc., which is located at: 411 S. Pearl P. O. Box 425; Spiceland, IN 47385-0425. ASD. Toll Free Tel: 800-238-7999; Tel: 765-987-7999; Fax: 866-637-5611; Web:[www.draperinc.com](http://www.draperinc.com).
- B. Substitutions: Must be submitted to the Architect seven days before the bid date for approval.

### 2.2 MOTORIZED WINDOW SHADES

- A. Type: UL listed, motorized, vertical roll-up, fabric window shade with motors, controls, mounting brackets, and other components necessary for complete installation; Motorized FlexShade® RTS AC as manufactured by Draper, Inc.
  - 1. Ceiling pocket.
- B. Shade Motor and Control System
  - 1. Motorized FlexShade® RTS AC.
    - a. Quiet 120V AC RTS Motorized FlexShade. 120V AC quiet motor with built-in radio receiver. Operates at 38 dBA. Tubular motor concealed inside each shade roller tube.
    - b. Individual and Group Control:
      - 1) Single channel wireless wall switch for radio motor control-White.
      - 2) DecoFlex WireFree Surface 5-channel keypad – Controls Somfy-powered RTS (Radio Technology Somfy) shades.
- C. Configuration:
  - 1. Single Roller.
    - a. Mounting.
      - 1) Type D Shade pocket: Rectangular pocket with ceiling tile lip designed for recessed ceiling installation of window shades.
        - a) Material: Extruded aluminum alloy with white finish.
        - b) Size: 5 inches (127 mm) by 5-5/8 inches (137 mm) high.
        - c) Closure Panel:
          - 1) 1-1/2 (38 mm) closure dimension.
          - 2) 3 inch (78 mm)
        - d) Corners: Welded one-piece aluminum sections connecting to and matching pockets to allow continuous shade recess at ceiling corners.
        - e) Pocket ends: Welded one-piece aluminum sections connecting to and matching pockets.
        - f) Closure width: 3 inches (75 mm).
- D. Roller: Fabricated from extruded aluminum or steel. Wall thickness and material selected by



manufacturer to accommodate shade size. Provide with roller idler assembly of molded nylon and zinc-plated steel pin. Sliding pin to allow easy installation and removal of roller. Fabric connected to the roller tube with LSE (low surface energy) double sided adhesive specifically developed to attach coated textiles to metal. Adhesive attachment to eliminate

horizontal impressions in fabric.

## **2.3 FABRIC**

- A. Light-Filtering Fabrics
  - 1. PVC Coated Fiberglass
    - a. Basketweave
- B. SheerWeave® Series SW2400 (2410) by Phifer®: 500 denier fiberglass, vinyl coated and woven into a 2 x 2 basket weave. Fire rating: California U.S. Title 19 (small scale), NFPA 701 TM#1 (small scale), NFPA 101 (Class A Rating), IBC Section 803.1.1 (Class A Rating), BS 5867 Part 2 Type B Performance, NFPA 701 TM#2 (large scale), CAN/ULC-S 109 (large and small scale), CAN/CGSB2-4.162-M80. Bacteria and fungal resistance: ASTM E 2180, ASTM G21, ASTM G22, AATCC30 Part 3, ASTM D 3273, UL GREENGUARD® Mold and Bacteria Standard ASTM 6329; includes Microban® antimicrobial additives. Environmental certification: Certified to UL GREENGUARD and GREENGUARD Gold® standards for low chemical emissions into indoor air during product usage. Safe use: RoHS/Directive 2002/95/EC, US Consumer Product Safety Commission Section 101 and ANSI/WCMA A 100.1-2007 for lead content and REACH (EC 1907/2006) compliant. 3 percent open .019 inches thick. 14.1 oz/square yard. Color and pattern: As selected by Architect from manufacturer's standard range.

## **PART 3 EXECUTION**

### **3.1 EXAMINATION**

- A. Do not begin installation until substrates have been properly prepared.
- B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

### **3.2 PREPARATION**

- A. Coordinate requirements for blocking and structural supports to ensure adequate means for installation of window shades.
- B. Coordinate requirements for blocking, construction of shade pockets, and structural supports to ensure adequate means for installation of window shades.
- C. Coordinate requirements for power supply conduit, and wiring required for window shade motors and controls.

### **3.3 INSTALLATION**

- A. Install in accordance with manufacturer's instructions.
- B. Install roller shades level, plumb, square, and true. Allow proper clearances for window operation hardware.
- C. Install the following items to conceal roller and operating mechanism. Do not use exposed fasteners.
  - 1. Fascias.
  - 2. Closure panels.
  - 3. Endcaps
- D. Install headbox, side channels, and sill channel with sealant specified in Section 07 90 00 - Joint Protection.

- E. Position shades level, plumb, and at proper height relative to adjacent construction. Secure with fasteners recommended by manufacturer.

### **3.4 TESTING AND DEMONSTRATION**

- A. Test motorized window shades to verify that controls, limit switches, interface to other building systems, and other operating components are functional. Correct deficiencies.

### **3.5 PROTECTION**

- A. Protect installed products until completion of project.
- B. Touch-up, repair, or replace damaged products before Substantial Completion.

### **3.6 SCHEDULES**

- A. Provide Motorized Window Shades at all exterior windows in Conference Space 101. Refer to the drawings for size and location of windows.

**END OF SECTION**

## INDEX OF SPECIFICATIONS

### DIVISION 23 MECHANICAL

<u>SECTION</u>	<u>SECTION TITLE</u>
230010	MECHANICAL GENERAL
230015	FIRESTOPPING AND SMOKE STOPPING
230030	ELECTRICAL REQUIREMENTS FOR MECHANICAL EQUIPMENT
230060	BASIC PIPING
230075	MECHANICAL IDENTIFICATION
230086	PIPING INSULATION
230090	SUPPORTS, HANGERS AND ANCHORS
230100	SEISMIC RESTRAINT
230110	BASIC VALVES FOR HVAC
230120	PIPING SPECIALTIES
230150	HYDRONIC PIPING
230160	MECHANICAL SYSTEMS INSULATION
230184	REFRIGERANT PIPING
230705	HIGH PRESSURE DUCTWORK
230710	HVAC SHEET METAL
230895	AIR TERMINAL DEVICES
230990	TESTING, ADJUSTING AND BALANCING
235233	FIRE TUBE SS HEATING BOILERS
239000	AUTOMATIC CONTROLS

## SECTION 230705

### HIGH PRESSURE DUCTWORK

#### PART 1 - GENERAL

##### 1.01 DESCRIPTION OF WORK:

- A. Extent of high pressure ductwork is indicated on drawings and in schedules, and by requirements of this section. High pressure ductwork is hereby defined as supply ductwork between air handling units and terminal air boxes, see drawings for pressure classes.

##### 1.02 QUALITY ASSURANCE:

- A. Installer: A firm with at least 3 years of successful installation experience on projects with high pressure ductwork systems work similar to that required for project.
- B. SMACNA Standards: Comply with SMACNA "HVAC Duct Construction Standards" for fabrication and installation of high pressure ductwork.
- C. ASHRAE Standards: Comply with ASHRAE Handbook, 1988 Equipment Volume, Chapter 1 "Duct Construction," for fabrication and installation of high pressure ductwork.
- D. NFPA Compliance: Comply with ANSI/NFPA 90A "Standard for the Installation of Air Conditioning and Ventilating Systems" and ANSI/NFPA 90B "Standard for the Installation of Warm Air Heating and Air Conditioning Systems."
- E. Field Reference Manual: Have available at project field office, copy of "SMACNA HVAC Duct Construction Standards - current edition."

##### 1.03 SUBMITTALS:

- A. Product Data: Submit manufacturer's specifications on manufactured products and factory-fabricated ductwork and duct sealants, used for work of this section.
- B. Submit duct leakage tests.

##### 1.04 DELIVERY, STORAGE, AND HANDLING:

- A. Protect shop-fabricated and factory-fabricated ductwork, accessories and purchased products from damage during shipping, storage and handling. Prevent end damage and prevent dirt and moisture from entering ducts and fittings.
- B. Implement and document the applicable ANSI / SMACNA IAQ Guidelines, 2<sup>nd</sup> Edition, November 2007, for protecting stored and installed ductwork on the job site. Provide a written plan for compliance and provide regular photo documentation of compliance
- C. Where possible, store ductwork inside and protect from weather. Where necessary to store outside, store above grade and enclosure with waterproof wrapping.

## PART 2 - PRODUCTS

### 2.01 DUCTWORK MATERIALS:

- A. Sheet Metal: Except as otherwise indicated, fabricate ductwork from galvanized sheet steel complying with ANSI/ASTM A 527, lock-forming quality, with ANSI/ASTM A 525, G90 zinc coating; mill phosphatized for exposed locations.

### 2.02 MISCELLANEOUS DUCTWORK MATERIAL:

- A. General: Provide miscellaneous materials and products of types and sizes indicated and, where not otherwise indicated, provide type and size required to comply with ductwork system requirements including proper connection of ductwork and equipment.
- B. Fittings: Provide radius type fittings fabricated of multiple sections with maximum 15 degree change of direction per section. Unless specifically detailed otherwise, use 45 degree laterals and 45 degree elbows for branch take-off connections. Where 90 degree branches are indicated, provide conical type tees.
- C. Duct Sealant: Non-hardening, low VOC, non-migrating mastic or liquid elastic sealant (type applicable for fabrication/installation detail) as compounded and recommended by manufacturer specifically for sealing joints and seams in ductwork.
- D. Duct Cement: Non-hardening, migrating mastic or liquid neoprene based cement (type applicable for fabrication/installation detail) as compounded and recommended by manufacturer specifically for cementing fitting components, or longitudinal seams in ductwork.
- E. Ductwork Support Materials: Except as otherwise indicated, provide hot-dipped galvanized steel fasteners, anchors, rods, straps, trim and angles for support of ductwork.
  - 1. Except where space is indicated as "High-Humidity area, interior support materials of not less than 1/4" diameter or 3/16" thickness may be plain (not galvanized).
  - 2. For exposed stainless steel ductwork, provide matching stainless steel support materials.
- F. Flexible Duct: Furnish and install where indicated on the drawings semi-rigid lightweight aluminum duct. Duct to be manufactured using a soft aluminum strip which is spirally wound and mechanically joined. Duct to be listed under UL #181 Class 1 and NFPA 90A. Insulation shall be 1-1/2" thick, 3/4 lb. density fiberglass blanket, maximum "K" value of 0.25 btu-in/hr.-ft-F and vapor barrier shall be metalized Mylar film. Semi-rigid duct shall be rated for 12" positive and 12" negative static pressure. Duct to be equal to Flexmaster Type TL-M. Vinyl or non-aluminized vapor barriers will not be allowed. Maximum runouts shall not exceed lengths indicated on drawings.
- G. Access Doors: Access doors in high velocity ducts shall be equal to Semco Type 5-3I. Door shall be rated for installation in duct systems with pressures up to 8 in w.g. Where required for fire dampers, door shall be furnished as a factory fabricated unit along with extended sleeve and fire damper (installed downstream of fire reinforced corners). Door shall be 20 gage galvanized steel sheet with 1" inch thick foil faced duct liner insulation, sandwiched to 22 gage perforated inner liner. Door panel shall have spring clips designed

to relieve a minimum of 150 cfm at 2-1/2" negative. Panels shall be: 12" x 12" on ducts less than 12" diameter; 12" x 18" on ducts from 12" to 24" diameter; and 18" x 18" on ducts from 26" to 36" diameter.

2.03 FABRICATION:

- A. Shop fabricate ductwork in 4, 8, 10 or 12-foot lengths, unless otherwise indicated or required to complete runs.
- B. Shop fabricate ductwork of gages and reinforcement complying with SMACNA "HVAC Duct Standards."
- C. Fabricate duct fittings to match adjoining ducts, and to comply with duct requirements as applicable to fittings. Except as otherwise indicated, fabricate elbows with centerline radius equal to associated duct width. Limit angular tapers to 30 degrees for contracting tapers and 20 degrees for expanding tapers.
- D. Fabricate ductwork with accessories installed during fabrication to the greatest extent possible.

2.04 FACTORY-FABRICATED DUCTWORK:

- A. General: At Installer's option, provide factory-fabricated duct and fittings, in lieu of shop-fabricated duct and fittings.

B. Round Ductwork:

- 1. Construct of galvanized sheet steel complying with ANSI/ASTM A 527 by the following methods and in minimum gages listed.

<u>DIAMETER</u>	<u>MINIMUM GAGE</u>	<u>METHOD OF MANUFACTURE</u>
3" to 14"	26	Spiral Lockseam
15" to 26"	24	Spiral Lockseam
27" to 36"	22	Spiral Lockseam
37" to 50"	20	Spiral Lockseam
51" to 60"	18	Spiral Lockseam
over 60"	16	Longitudinal Seam

- 2. Provide locked seams for spiral duct; fusion-welded butt seam for longitudinal seam duct.
- 3. Fittings and Couplings: Construct of minimum gages listed. Provide continuous welds along seams.

<u>DIAMETER</u>	<u>MINIMUM GAGE</u>
3" to 36"	20
38" to 50"	18
Over 50"	16

- C. Flat-Oval Ductwork: Construct of galvanized sheet steel complying with ANSI/ASTM A 527, of spiral lockseam construction, in minimum gages listed.

<u>MAXIMUM WIDTH</u>	<u>MINIMUM GAGE</u>
Under 25"	24

25" to 48"	22
49" to 70"	20
Over 70"	18

1. Fittings and Couplings: Construct of minimum gages listed. Provide continuous weld along seams.

<u>MAXIMUM WIDTH</u>	<u>MINIMUM GAGE</u>
Up to 8"	22
8" to 37"	20
37" to 50"	18
Over 50"	16

- D. Internally Insulated Duct and Fittings: Construct with outer pressure shell, 1" thick insulation layer, and perforated inner liner. Construct shell and liner of galvanized sheet steel complying with ANSI/ASTM A 527, of spiral lockseam construction (use longitudinal seam for over 59"), in minimum gages listed.

ROUND NOMINAL DUCT

<u>DIAMETER</u>	<u>OUTER SHELL</u>	<u>INNER LINER</u>
3" to 12"	26 ga.	28 ga.
13" to 24"	24 ga.	28 ga.
25" to 34"	22 ga.	28 ga.
35" to 48"	20 ga.	28 ga.
49" to 58"	18 ga.	28 ga.
Over 59"	16 ga.	28 ga.

FLAT OVAL OUTER DUCT

<u>MAJOR AXIS</u>	<u>OUTER SHELL</u>	<u>INNER LINER</u>
To 12"	26 ga.	28 ga.
13" to 24"	24 ga.	28 ga.
25" to 34"	22 ga.	28 ga.
35" to 48"	20 ga.	28 ga.
49" to 58"	18 ga.	28 ga.

1. Fittings and Couplings: Construct of minimum gages listed. Provide continuous weld along seams of outer shell.

2. NOMINAL DUCT

<u>DIAMETER</u>	<u>OUTER SHELL</u>	<u>INNER LINER</u>
3" to 34"	20 ga.	20 ga.
36" to 48"	18 ga.	20 ga.
Over 48"	16 ga.	20 ga.

3. Inner Liner: Perforate with 3/32" holes for 22% open area. Provide metal spacers welded in position to maintain spacing and concentricity.

4. Hospital grade insulation shall completely fill the 1" space between the liner and the outer shell and shall have the following UL ratings:

Flame Spread 10-20

Fuel Contributed 10-15



Smoke Developed      10-20

5. At the end of an insulated section or run, where internally insulated duct connects to insulated spiral duct or fittings, fire damper or flex, a manufactured insulation end fitting shall be installed to bring the outer pressure shell down to nominal size.

E. Fittings shall be equal to Semco Mfg., Inc. machine formed fittings as follows:

1. 90 degree elbow - 10 inch and smaller ..... E901
2. 45 degree elbow - 10 inch and smaller ..... E451
3. 90 degree elbow - over 10 inch..... E905
4. 45 degree elbow - over 10 inch..... E453
5. 90 degree conical tee..... CT
6. 90 degree reducing conical tee..... CTR
7. 180 degree conical cross ..... CC
8. 180 degree conical cross, reducing ..... CCR
9. 45 degree lateral..... L
10. 45 degree double lateral cross..... LC
11. 45 degree reducing lateral..... LR
12. 45 degree double reducing lateral ..... LDR
13. Two-way "Y" ..... WYE
14. Concentric Reducer..... RC
15. Non-Concentric Reducer ..... RE
16. Coupling (Male)..... CPL-M
17. Coupling (Female) ..... CPL-F
18. Offset ..... OFF
19. Round to Oval Transition (Concentric) ..... RC
20. Round to Oval Transition (Non-Concentric) ..... RE

F. Available Manufacturers: Subject to compliance with requirements, manufacturers offering factory-fabricated ductwork which may be incorporated in the work include, but are not limited to, the following:

1. Semco, Inc.
2. McGill Airflow, LLC.
3. Spiral Pipe of Texas

PART 3 - EXECUTION

3.01 INSTALLATION OF DUCTWORK:

- A. General: Assemble and install ductwork in accordance with recognized industry practices which will achieve an airtight system and noiseless (no objectionable noise) systems, capable of performing each indicated service. Install each run with minimum of joints. Align ductwork accurately at connections, within 1/8" misalignment tolerance and with internal surfaces smooth. Support ducts rigidly with suitable ties, braces, hangers, and anchors of type which will hold ducts true-to-shape and to prevent buckling.

3.02 DUCT SEALING

A. Seal supply, return and exhaust ductwork per SMACNA high pressure standards with mastic equal to "Hard Cast" FTA-20 with DT tape for indoor use and RTA-50 with DT tape for outdoor use.

1. Seal per SMACNA Standards to achieve airtight system.

2. Duct Seal Levels:

Duct Location	Duct Type		
	Supply	Exhaust	Return
Outdoors	A	A	A
Unconditioned Spaces	A	B	B
Conditioned spaces (concealed ductwork)	B	B	B
Conditioned spaces (exposed ductwork)	B	B	B
Lab and Animal Room Exhaust		A	A

3. Seal Level Description:

Seal Level	Sealing Requirements
A	All transverse joints, longitudinal seams, and duct wall penetration
B	All transverse joints and longitudinal seams
C	Transverse joints only

4. Seal ductwork, after installation, in accordance with recommendations of SMACNA Standards.

5. All high velocity ductwork joints shall be either welded or joint shall be sealed.

6. Water-Based Joint and Seam Sealant:

- a. Application Method: Brush on.
- b. Solids Content: Minimum 65 percent.
- c. Shore A Hardness: Minimum 20.
- d. Water Resistant.
- e. Mold and Mildew Resistant.
- f. VOC: Maximum 75g/L (less water).
- g. Maximum Static-Pressure Class: 10-inch wg, positive and negative.
- h. Service: Indoor or Outdoor.
- i. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum sheets.

7. Flanged Joint Sealant: Comply with ASTM C 920.

- a. General: Single-component, acid curing, silicone, elastomeric.
- b. Type: S.

- c. Grade: NS.
  - d. Class: 25.
  - e. Use: O.
- B. Install concrete inserts for support of ductwork in coordination with formwork, as required to avoid delays in work. Drilled expansion anchors selected and installed as directed by manufacturer may be used. Expansion anchors shall be equal to "Phillips Red Head", verify with structural engineer that drilled anchors are suitable for the deck design.
  - C. Complete fabrication of work at project as necessary to match shop-fabricated work and accommodate installation requirements.
  - D. Locate ductwork runs, except as otherwise indicated, vertically and horizontally and avoid diagonal runs wherever possible. Locate runs as indicated by diagrams, details and notations or, if not otherwise indicated, run ductwork in shortest route which does not obstruct usable space or block access for servicing building and its equipment. Hold ducts close to walls, overhead construction, columns, and other structural and permanent-enclosure elements of building. Limit clearance to 1/2" where furring is shown for enclosure or concealment of ducts, but allow for insulation thickness, if any. Where possible, locate insulated ductwork for 1" clearance outside of insulation. Where possible in finished and occupied spaces, conceal ductwork from view, by locating in mechanical shafts, hollow wall construction or above suspended ceilings. Do not encase horizontal runs in solid partitions, except as specifically shown. Coordinate layout with suspended ceiling and lighting layouts and similar finished work.
  - E. Electrical Equipment Spaces: Do not run ductwork through transformer vaults and other electrical equipment spaces and enclosures.
  - F. Where ducts pass through interior partitions and exterior walls, conceal space between construction opening and duct or duct-plus-insulation with sheet metal flanges of same gage as duct. Overlap opening on 4 sides by at least 1-1/2".
  - G. Where ducts pass through fire-rated floors, walls, or partitions, install fire dampers, provide firestopping between duct and substrate.
  - H. Coordinate duct installations with installation of accessories, dampers, coil frames, equipment, controls and other associated work of ductwork system.
  - I. Support ductwork in manner complying with SMACNA "HVAC Duct Standards."

### 3.03 CLEANING AND PROTECTION:

- A. Clean ductwork internally, unit-by-unit as it is installed, of dust and debris. Clean external surfaces of foreign substances which might cause corrosive deterioration of metal or, where ductwork is to be painted, might interfere with painting or cause paint deterioration.
- B. Strip protective paper from stainless ductwork surfaces, and repair finish wherever it has been damaged.

- C. Temporary Closure: At ends of ducts which are not connected to equipment or air distribution devices at time of ductwork installation, provide temporary closure of polyethylene film or other covering which will prevent entrance of dust and debris until time connections are to be completed.
- D. Implement and document the applicable ANSI / SMACNA IAQ Guidelines, 2<sup>nd</sup> Edition, November 2007, for protecting stored and installed ductwork on the job site. Provide a written plan for compliance and provide regular photo documentation of compliance

3.04 TESTING FOR LEAKAGE:

- A. General: After each duct system is completed, test for duct leakage in accordance with SMACNA HVAC Air Duct Leakage Test Manual, 1995 Edition. Repair leaks and repeat test until total leakage is less than limits outlined in the manual.
- B. See Mechanical Drawings “Duct Testing Schedule” for project specific duct pressure requirements. To facilitate witness of the testing, advise the Owner, Commissioning Authority and Design team 5 days prior to duct pressure testing.

END OF SECTION

## SECTION 23 0710 - HVAC SHEET METAL

### PART 1 - GENERAL

#### 1.01 SCOPE:

- A. All low pressure duct work including supply, exhaust, and outside air to complete the systems as shown on the Drawings or specified herein.

#### 1.02 SUBMITTALS:

- A. Submit the following:
  - 1. Air distribution devices.
  - 2. Life safety dampers and doors.
  - 3. Flexible duct.
  - 4. Flexible connections.
  - 5. Access doors and duct access doors.
  - 6. Turning vanes.
  - 7. Duct take-off, fittings.
  - 8. Roof outside air intake.
  - 9. Duct sealants.
  - 10. Duct leak testing.

#### 1.03 GOVERNING PUBLICATIONS AND AUTHORITIES:

- A. ASHRAE "Guide".
- B. SMACNA "Low Velocity Duct Construction Standards".
- C. Underwriters' Laboratories, Inc.
- D. NFPA Pamphlets No. 90A, 90B, 91 and 96.

### PART 2 - PRODUCTS

#### 2.01 DUCT MATERIALS:

- A. Unless noted otherwise, galvanized steel sheets shall be lock-forming quality (LFQ), shall have a galvanized 690 zinc coating of 1-1/4 oz. total for both sides of one square foot, and the gauge of galvanized steel sheets shall be as prescribed by the latest edition of SMACNA for pressure classification of ductwork.
- B. Stainless steel ducting shall be used for general exhaust mixed with fume hood

exhaust as shown on the project drawings.

- B. Aluminum sheets shall be made from an aluminum base alloy having not more than 0.5% copper (for corrosion resistance), a minimum tensile strength of 16,000 psi and the ability to satisfactorily make a Pittsburgh lock seam without splitting.

#### 2.02 FLEXIBLE CONNECTIONS:

- A. Flexible connections shall be made on duct connections of air moving equipment greater than 2000 CFM or as required for equipment installation and vibration isolation.
- B. Connections shall be made of 30 ounce woven glass fabric; fire-, water-, and weather-resistant fabric equal to "Ventfab", double coated with neoprene "Ventglas", or equal. Canvas connections to give no less than 3" clear break between metals joined. Insulate with 1" minimum fiberglass duct wrap with a vapor barrier facing of foil reinforced kraft. Seal with reinforced aluminum tape.
- C. Flexible connections on exterior shall be protected from weather with sheetmetal cover which shall be coated for protection same as ductwork.
- D. Connections in high pressure systems, fume hoods, and for those exposed to the weather shall be made from "Ventglas", neoprene coated glass fabric.

#### 2.03 ACCESS DOORS:

- A. Access doors to 16" by 24" size shall be "Ventlock" stamped insulated access doors.
- B. Larger access doors shall be double panel construction with one inch thick 1.5 pcf density rigid insulation between panels. Doors with largest dimension over 24", but less than 48", shall use "Ventlock" series 200 latches, hinges and gasketing, and construction shall be 22 gage galvanized steel. Doors with largest dimension over 48" shall use "Ventlock" series 300 latches, hinges and gasketing, and construction shall be 20 gage galvanized steel.
- C. Provide vision panels on access doors for fire dampers and control dampers.

#### 2.04 FLEXIBLE DUCT:

- A. Low Pressure: furnish and install, where indicated on the drawings, flexible metal insulated round ductwork, factory fabricated, listed under U.L. #181, Class 1 and NFPA 90A, capable of a minimum centerline bend radius equal to duct inside diameter. Insulation shall be 1-1/2" thick, 3/4 lb. density fiberglass blanket, maximum "K" value of 0.25 btu-in/hr-ft<sup>2</sup>-EF., and vapor barrier shall be neoprene coated fiberglass fabric laminated to aluminized polyester film. Flexible duct shall be rated for 10" positive and 2" negative static pressure.
- B. Vinyl or non- aluminized vapor barriers will not be allowed. Maximum runouts shall not exceed length indicated on drawings in notes or details.

#### 2.05 AIR DISTRIBUTION DEVICES:

- A. General:

1. All outlet grilles shall have gaskets.
  2. Furnish opposed blade volume controls on all supply outlets and return grilles.
- B. Devices: Devices shall be as scheduled on the drawings.
- 2.06 LIFE SAFETY DAMPERS:
- A. Dampers shall be equal to those manufactured by the Ruskin Corporation or Greenheck.
  - B. Dampers shall be U.L. listed.
  - C. Fire, smoke or combination fire/smoke dampers shall be provided in rated assemblies requiring them.
  - D. All dampers, methods and location of installation shall comply with the requirements of the International Building Code, National Fire Protection Association and all authorities having jurisdiction. In the case of discrepancies, most stringent requirements shall dictate installation.
  - E. Fire and smoke dampers shall be provided with an approved means of access, large enough to permit inspection and maintenance of the damper and its operating parts. Access shall be provided on either side of damper assemblies.
  - F. Access panels or doors shall not affect the integrity of fire-resistance-rated assemblies. The access openings shall not reduce the fire-resistance rating of the assembly.
  - G. Provide access door minimum 12" x 12".
  - H. Access points shall be permanently identified on the exterior by a label having letters not less than 0.5 inch (12.7 mm) in height reading: fire/smoke damper, smoke damper or fire damper.
  - I. Access doors in ducts shall be tight fitting and suitable for the required duct construction. Contractor shall install dampers in accordance with the following:
  - J. Fire dampers shall be constructed and tested in accordance with UL Safety Standard 555. Dampers shall have an hourly rating as indicated on the drawings, a 212°F fusible link, and shall include a UL label.
  - K. All outlet grilles shall have gaskets.
  - L. Contractor shall furnish opposed blade volume controls on all supply outlets and return grilles.
  - M. Dampers shall be equipped for vertical or horizontal installation as required by the location.
  - N. Manufacturer's integral sleeves and frames may be used at the contractor's option.
  - O. Dampers shall be provided which are tested and rated for design duct velocity and

pressure.

- P. Dampers rating shall meet or exceed the rating of the wall in which it is housed.
- Q. Contractor shall install fire or smoke or combination dampers in all rated walls as necessary to maintain the integrity of all rated walls whether indicated on the plans or not.

#### 2.07 ACCESSORIES:

- A. Manufactured Turning Vanes: Furnish and install single thickness, multiple radius, airfoil steel turning vanes. Static pressure loss for square ducts shall be no more than 20% of velocity head. Turning vanes shall be furnished with a mounting plate to facilitate installation in ductwork.
- B. Manual Balancing Damper:
  - 1. Square or Rectangular: Minimum 16 ga. body and 18 ga. blades, equal to Ruskin or Greenheck with vinyl blade seal and extended locking hand operator quadrant.
  - 2. Round: Minimum 20 ga. body and 22 ga. blades, equal to Ruskin or Greenheck with extended locking hand operator
- C. Control Dampers:
  - 1. Control dampers shall be furnished by the Mechanical Equipment Manufacturer or Control System provider.
- D. All dampers shall be capable of 100% seal off.

### PART 3 - EXECUTION

#### 3.01 GENERAL:

- A. All ductwork not specifically indicated on drawings or specified elsewhere to be high- pressure duct shall be fabricated, braced and erected in accordance with SMACNA "Low Velocity Duct Construction Standard" or the latest edition of ASHRAE "Guide".
- B. Ductwork shall be galvanized steel unless otherwise noted.
- C. Stainless steel and aluminum ductwork shall welded seam.
- D. Adhere to drawings as closely as possible. However, where required to meet structural or other interferences vary the run and shape of ducts and make offsets during progress of work. Duct routes shall be established and field measurements shall be taken before duct work is fabricated. Where pipes or other items are "taken-in" to the duct, streamline collars shall be formed and placed around the item. If collar obstructs more than 20% of the cross sectional area, the duct shall be enlarged to accommodate obstruction.
- E. All changes of direction and elbows shall be fitted with turning vanes. Standard radius elbows may be used if space permits.



- F. Ductwork shall be free of any objectionable self-generating noise or rattles.
- G. Furnish and install shop fabricated ductwork. Pre-assemble work in shop to the greatest extent possible, so as to minimize field assembly of systems. Fabricate ductwork with accessories installed during fabrication to the greatest extent possible.
- H. Fabricate duct fittings to match adjoining ducts, and to comply with duct requirements as applicable to fittings. Except as otherwise indicated, fabricate elbows with center-line radius equal to associated duct width. Limit angular tapers to 30 degrees for contracting tapers and 20 degrees for expanding tapers.
- I. Duct Sealing: All ductwork, regardless of system pressure classification, shall be sealed in accordance with Seal Class A, as referenced in SMACNA Standards. All transverse joints, longitudinal seams, and duct wall penetrations shall be sealed.
  - 1. All seams and joints in shop and field fabricated ductwork shall be sealed by applying duct sealant complying with manufacturer's recommendations. Tapes recommended by the sealant manufacturer may be used in addition to sealant to achieve leakage limit requirements.
  - 2. Sealant shall be water based latex UL 181A-M sealant with flame spread of 0 and smoke developed of 0. Sealants shall be Hard Cast Iron Grip 601, Ductmate Pro Seal, Foster 32-19, Childers CP-146 or Design Polymerics DP 1010.
  - 3. Sealing tapes shall be from the same manufacturer as duct sealants.
  - 4. Sealer shall be rated by the manufacturer and shall be suitable for use at the system pressure classification of applicable ductwork.
  - 5. Except as noted, oil or solvent-based sealants are specifically prohibited.
  - 6. For exterior applications, "Uni-Weather" (United McGill Corporation), solvent-based sealant, or Foster 32-19 shall be used.
- J. Support materials shall be hot dipped galvanized steel fasteners, anchors, rods, straps, trim and angles. (Support duct with all thread rods and unistrut as equal trapeze hangers).
- K. Install air flow measuring stations, furnished by Control Contractor, where indicated on the drawings.
- L. Implement and document the applicable ANSI / SMACNA IAQ Guidelines, 2<sup>nd</sup> Edition, November 2007, for protecting stored and installed ductwork on the job site. Provide a written plan for compliance and provide regular photo documentation of compliance.

### 3.02 MANUAL BALANCING DAMPERS:

- A. All low pressure branch ducts on either supply, return or exhaust shall be provided by some means of balancing in addition to dampers at registers.
- B. Splitter dampers shall be made of at least the same thickness material as duct (minimum thickness 22 gage). They shall be securely hinged at air leaving edge and

made of 2 thicknesses so that entering edge presents a rounded surface to air flow.

- C. Butterfly dampers shall be made of 16 gage galvanized steel. Butterfly dampers may be used in widths up to 10" wide. Dampers that require blades over 10" wide shall be multi-blade louver dampers.
- D. Multi-blade louver dampers used for balancing shall be of the opposed blade type. Damper blades shall be constructed of 16 gage steel. Individual blade width shall not exceed 10" and blade length shall not exceed 48".
- E. All dampers shall be so constructed and installed that there shall be no vibration due to air flow over damper.
- F. Extend all handles and levers to outside of insulation.

### 3.03 ACCESS DOOR:

- A. Access doors shall be provided at all dampers, equipment in duct and as indicated on drawings.
- B. Access doors shall be minimum of 12" X 12" unless a larger size is required for maintenance of equipment or a smaller size must be used because of small duct size.
- C. Provide access doors at all fire dampers, smoke dampers, humidifiers, and as indicated on the drawings.

### 3.04 FLEXIBLE CONNECTIONS:

- A. Furnish and install sound isolating flexible connections on the inlet and outlet of each fan and unit to which duct connectors are made.
- B. At least one inch slack shall be allowed in these connections to insure that no vibration is transmitted from fan to ductwork.
- C. The fabric shall either be folded in with the metal or attached with metal collar frames at each end to prevent air leakage.

### 3.05 FLEXIBLE DUCT

- A. Maximum runout shall not exceed lengths indicated on drawings.
- B. Ducts shall be supported at intervals indicated in SMACNA and not laid on top of ceiling.
- C. Minimum bend radius shall be as recommended by manufacturer.
- D. Ducts shall be run straight and true with minimum offsets, and with excess duct lengths removed.
- E. Connections to ducts and air devices shall be with minimum of one duct diameter straight into connection (kinked or pinched installations restricting flows are not acceptable).
- F. Connections to duct and air devices shall be air tight.

3.06 TESTS:

- A. Test all low pressure exhaust duct systems in accordance with SMACNA HVAC Air Duct Leakage Test Manual to achieve air tight systems not exceeding the limits outlined in the manual. Seal Class A, Leakage Class 24 as tested at 1” . Submit test results.
- B. See “Duct Testing Schedule” below for project specific duct pressure requirements. To facilitate witness of the testing, advise the Owner, Commissioning Authority and Design team 5 days prior to duct pressure testing.

DUCT PRESSURE TESTING SCHEDULE				
DUCT SYSTEM TYPE	SMACNA Seal Class	SMACNA Leakage Class	Test Pressure ("wg)	NOTES
Low Pressure Supply Duct	A	24	1"	TEST 50%
Low Pressure Exhaust Duct (Small Exhaust Systems and Downstream of Laboratory Air Terminals)	A	12	1	TEST 50%
Medium Pressure Supply Duct	A	6	3	TEST 100%
Medium Pressure Exhaust Duct (Defined as all of the large central exhaust and all laterals upstream of exhaust air terminals,	A	6	3	TEST 100%

END OF SECTION

## SECTION 23 0990 - TESTING, ADJUSTING, AND BALANCING (TAB)

### PART 1 - GENERAL

#### 1.01 SUMMARY:

- A. This section specifies the requirements and procedures for total mechanical systems testing, adjusting, and balancing. Requirements include measurement and establishment of the fluid quantities and temperatures of the mechanical systems as required to meet design specifications, and recording and reporting the results.
1. Test, adjust, and balance (TAB) the following mechanical systems:
    - a. Supply air systems, all pressure ranges.
    - b. Return air systems.
    - c. Exhaust air systems.
    - d. Outside air systems.
    - e. Hydronic Systems
    - f. Laboratory Safety Cabinets (Fume Hoods)
    - g. Verify control system(s) calibrations and operation.
  2. Contractor shall:
    - a. Put heating, ventilating, and air conditioning systems and equipment into full operation and continue the operation of same during each working day of testing-adjusting- balancing.
    - b. Put Safety Cabinets (Fume Hoods) into full operation and maintain operation during the testing-adjusting- balancing activities.
    - c. Allow the balancing agency to schedule this work in cooperation with other trades involved and comply with the completion date.
    - d. Make available to the balance agency a complete copy of submittal data on mechanical equipment and safety cabinets including pump performance curves, fan curves, manufacturer's balancing factors and other manufacturers ratings for installed equipment.
    - e. Make any changes in fan drive components, automatic or manual dampers, hydronic systems as required for correct balance as recommended by the balancing agency, at no additional cost to the Owner.
    - f. Have strainers and filters clean prior to starting of testing-adjusting-balancing activity.
- B. This section does not include:

1. Specifications for materials for patching mechanical systems.
2. Specifications for materials and installation of adjusting and balancing devices. If devices must be added to achieve proper adjusting and balancing, refer to the respective system sections for materials and installation requirements.
3. Requirements and procedures for piping and ductwork systems leakage tests.

#### 1.02 DEFINITIONS:

- A. Systems testing-adjusting- balancing is the process of checking and adjusting building environmental systems to produce design objectives. It includes:
  1. Balance of air and hydronic distribution;
  2. Adjustment of total system to provide design qualities.
  3. Testing and adjusting of Safety Cabinets.
  4. Detailed electrical measurement and reporting of all system components.
  5. Verification of performance of equipment and systems, including associated automatic controls;
- B. Commissioning Authority. An independent third party agent, retained by the owner to insure proper installation and function of the mechanical and electrical systems.
- C. Test: To determine quantitative performance of equipment.
- D. Adjust: To regulate the specified fluid flow rate and air patterns at the terminal equipment (e.g., reduce fan speed, throttle valves and dampers to proportion flows within the distribution system (mains, branches, and terminals) according to specified design quantities.
- E. Report Forms: Certified test data sheets arranged for collecting test data in logical order for submission and review. These data should also form the permanent record to be used as the basis for required future testing, adjusting and balancing.
- F. Terminal: The point where controlled fluid enters or leaves the distribution system. These are supply inlets on water terminals, supply outlets on air terminals, return outlets on water terminals, and exhaust or return inlets on air terminals such as registers, grilles, diffusers, louvers, and hoods.

#### 1.03 SUBMITTALS:

- A. Agency Data: Submit proof that the proposed testing-adjusting-balancing agency meets the qualifications specified below.
- B. Technicians Data: Submit proof that the test and balance staff assigned to supervise the procedures, and the technicians proposed to perform the procedures meet the qualifications specified below.
- C. Procedures and Agenda: Submit a synopsis of the testing-adjusting-balancing procedures and agenda proposed to be used for this project.

- D. Sample Forms: Submit sample forms for each system or device to be balanced.
- E. Certified Reports: Submit testing-adjusting- balancing reports bearing the seal and signature of the test and balance certified professional and firm.. The reports shall be certified proof that the systems have been tested, adjusted, and balanced in accordance with the referenced standards; are an accurate representation of how the systems have been installed; are a true representation of how the systems are operating at the completion of the testing, adjusting, and balancing procedures; and are an accurate record of all final quantities measured, to establish normal operating values of the systems. Follow the procedures and format specified below.
- F. Draft Reports: Upon completion of testing, adjusting, and balancing procedures, prepare draft reports on the approved forms. Draft reports may be hand written, but must be complete, factual, accurate, and legible. Organize and format draft reports in the same manner specified for the final reports. Submit 2 complete sets of draft reports. Only 1 complete set of draft reports will be returned.
- G. Final Report: Upon verification and approval of draft reports, prepare final reports, type written, and organized and formatted as specified below. Submit 2 complete sets of final reports.
- H. Report Format: Report forms shall be those standard forms prepared by the referenced standard for each respective item and system to be tested, adjusted, and balanced. Bind report forms complete with schematic systems diagrams and other data in reinforced, vinyl, binders. Provide binding edge labels with the project identification and a title descriptive of the contents. Divide contents of binder into divisions consistent with the requirements of the procedural standards of the certifying authority. Additionally add sections including:
1. Safety Cabinet (fume hood) testing.
  2. Temperature Control Systems
- I. Report Contents: Provide the following minimum information, forms and data:
1. General Information and Summary: Inside cover sheet to identify testing, adjusting, and balancing agency, Contractor and Project. Include addresses, and contact names and telephone numbers. Also include a sheet containing the seal and name address, telephone number, and signature of the test and balance certified professional. Include in this division a listing of the instrumentations used for the procedures along with the proof of calibration.
  2. The remainder of the report shall contain the appropriate forms for each respective component and system. Prepare a schematic diagram for each item of equipment and system to accompany each respective report form.
  3. Air and Hydronic System(s) reporting shall be as per the current edition of the National Environmental Balancing Bureau (NEBB) Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems.
- J. Calibration Reports: Submit proof that required instrumentation has been calibrated to tolerances specified in the referenced standards, within a period of 6 months prior to starting the project.

1.04 QUALITY ASSURANCE:

A. Agency Qualifications:

1. Employ the services of an NEBB certified, independent testing, adjusting, and balancing agency meeting the qualifications specified below, to be the single source of responsibility to test, adjust, and balance the building mechanical systems identified above, to produce the design objectives. Services shall include checking installations for conformity to design, measurement and establishment of the fluid quantities of the mechanical systems as required to meet design specifications, and recording and reporting the results.
2. The independent testing, adjusting, and balancing agency shall be certified by National Environmental Balancing Bureaus (NEBB) in those testing and balancing disciplines required for this project, and having at least one technician on site, certified by NEBB.

B. Codes and Standards:

1. NEBB: "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems".
3. ASHRAE: ASHRAE Handbook, Current Systems Volume, Chapter 37, Testing, Adjusting, and Balancing.

C. Pre-Balancing Conference: Prior to beginning testing, adjusting, and balancing procedures, schedule and conduct a conference with the Owner, Contractors and Commissioning Agent and representatives of installers of the mechanical systems. The objective of the conference is final coordination and verification of system operation and readiness for testing, adjusting, and balancing.

1.05 PROJECT CONDITIONS:

A. Systems Operation: Systems shall be fully operational prior to beginning procedures.

1.06 ACCEPTANCE:

The Owner will not accept the building until the systems have been properly started, balanced, and the TAB Report is approved.

PART 2 - PRODUCTS: NOT USED

PART 3 - EXECUTION

3.01 PRELIMINARY PROCEDURES FOR AIR SYSTEM BALANCING:

Before operating the system, perform these steps:

- A. Obtain design drawings and specifications and become thoroughly acquainted with design intent.
- B. Obtain copies of approved shop drawings of air handling equipment, outlets (supply and return) and temperature control diagrams.

- C. Compare design to installed equipment and field installations.
- D. Inspect the system from the system air handling equipment to terminal units to determine variations of installation from design.
- E. Check filters for cleanliness.
- F. Check dampers (volume, smoke and fire) for correct and locked position, and temperature control for completeness of installation before starting fans.
- G. Determine best locations in main and branch ductwork for most accurate duct traverses.
- H. Place outlet dampers in full open position.
- I. Prepare schematic diagrams of system "as-built" ductwork and piping layouts to facilitate reporting.
- J. Verify that motors and bearings have been lubricated.
- K. Check fan belt tension.
- L. Check fan rotation.

3.02 **PRELIMINARY PROCEDURES FOR HYDRONIC SYSTEM BALANCING:**  
Before operating the system, perform these steps:

- A. Open valves to full open position. Close coil bypass valves.
- B. Verify that all strainers have been cleaned.
- C. Examine hydronic systems and determine if water has been treated and cleaned.
- D. Check pump rotation.
- E. Clean and set automatic fill valves for required system pressure.
- F. Check expansion tanks to determine that they are not air bound and that the system is completely full of water.
- G. Check air vents at high points of systems and determine if all are installed and operating freely (automatic type) or to bleed air completely (manual type).
- H. Set temperature controls so all coils are calling for full flow.
- I. Check operation of automatic bypass valves.
- J. Check and set operating temperatures of equipment to design requirements.
- K. Verify that pump motors and bearings have been lubricated.

3.03 **3.03 MEASUREMENTS:**

- A. Provide required instrumentation to obtain proper measurements, calibrated to the tolerances specified in referenced standards. Instruments shall be properly maintained and protected against damage.



- B. Provide instruments meeting the specifications of the NEBB standards.
- C. Use only those instruments which have the maximum field measuring accuracy and are best suited to the function being measured.
- D. Use instruments with minimum scale and maximum subdivisions and with scale ranges proper for the value being measured.

3.04 PERFORMING TESTING, ADJUSTING, BALANCING:

- A. Perform testing and balancing procedures on each system identified, in accordance with the detailed procedures outlined in the NEBB standards.
- B. Execute Safety Cabinet (Fume Hood) testing consistent with NEBB Procedural Standards for Fume Hood Testing and the current ANSI standards.
- C. Mark equipment settings, including damper control positions, valve indicators, fan speed control levers, and similar control devices, to show final settings. Mark with paint or other suitable, permanent identification materials.
- D. Retest, adjust, and balance systems subsequent to significant system modifications, and resubmit test results.

3.05 CONTROL SYSTEM VERIFICATION:

- A. In conjunction with Control System provider, during the process of TAB work, manipulate control system devices as required to facilitate necessary system TAB. Provide listing of control system components and/or sequences that are not operating properly in TAB report and to Control System provider.

3.06 RECORD AND REPORT DATA:

- A. Record data obtained during testing, adjusting, and balancing in accordance with, and on the forms recommended by NEBB Procedural Standards, and as approved on sample report forms.
- B. Along with the owners Commissioning Agent prepare report(s) of recommendations for correcting unsatisfactory mechanical and safety cabinet performances when system cannot be successfully adjusted and balanced.

3.07 DEMONSTRATION:

- A. Training:
  - 1. Along with the Owner's Commissioning Agent, facilitate training of maintenance personnel on troubleshooting procedures and testing, adjusting, and balancing procedures. Review with personnel the information contained in Operating and Maintenance Data.
  - 2. Schedule training through the Owner with at least 7 days' prior notice.

END OF SECTION

DIVISION 23 52 33.13

FIRE-TUBE STAINLESS STEEL HEATING  
BOILERS

PART 1- GENERAL

1.1 SUMMARY

- A. Section includes fire-tube, condensing, gas-fired, stainless steel, hydronic heating boilers

1.2 REFERENCES

- A. ANSI Z21.13/CSA 4.9
- B. ANSI 2.17
- C. ASME, Section II, IV, VIII, and IX
- D. 2006 UMC, Section 1107.6
- E. ANSI/ASHRAE 15-1994, Section 8.13.6
- F. National Fuel Gas Code, ANSI Z223.1/NFPA 54
- G. AHRI 1500
- H. NEC, ANSI/NFPA 70
- I. ASME CSD-1, latest edition (when required)

1.3 SUBMITTALS

- A. Product data sheet (including dimensions, rated-capacities, shipping weights, accessories)
- B. Wiring diagram
- C. Warranty information
- D. Installation and operating instructions

1.4 QUALITY ASSURANCE

- A. Regulatory
  - Requirements 1. ANSI Z21.13/CSA4.9
  - 2. Local and national air quality regulations for low NOx boilers. Units can be tuned onsite to 9 PPM NOx where required.
- B. Certifications
  - 1. CSA
  - 2. CEC (as applicable)
  - 3. CFC
  - 4. ASME, Section IV, H-Stamped and National Board registered
  - 5. SCAQMD Rule 1146.2 certified – NOx < 20 ppm (Models H7-1007 to H7-2007)
  - 6. BAAQMD Rule 9-7-307.1 certified – NOx < 30 ppm (Models H7-2507 to H7-4007)
  - 7. SJVAPCD Rule 4307 and 4308 propane-certified – NOx < 30 ppm

1.5 WARRANTY

- A. Limited one-year parts warranty
- B. Limited ten-year closed-system heat exchanger warranty
- C. Limited twenty-five-year thermal shock warranty

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Raypak XVer with KOR condensing stainless steel fire-tube hydronic heating boilers
- B. Engineer Approved.

### 2.2 BOILERS

#### A. General

1. The boiler(s) shall be fired with natural gas at a rated input per schedule.
2. The boiler(s) shall be CSA tested and AHRI certified with a minimum thermal efficiency of 94.5% (up to 99% at part load).
3. The boiler(s) shall have a user setting for percentage of glycol to be used in the piping system and, using a patent-pending algorithm, will automatically and dynamically adjust maximum allowable firing-rate, maximum temperature differential, minimum required fluid flow and burner response timing. This feature will provide maximum protection for the heat exchanger and provide for the maximum achievable life of the boiler under varying system conditions. The default setting for this feature shall be 50% glycol, to ensure the maximum protection level is provided as-shipped.
4. The boiler shall have a user setting to select the vent material being installed with the boiler. This setting, along with a flue gas temperature sensor, will dynamically adjust firing rate to provide protection for the vent system selected by the user. The default setting shall be for PVC vent material, to ensure the maximum protection level is provided as-shipped.
5. The boiler(s) shall operate at elevations up to 5,000 feet without component changes. High elevation models shall be required for elevations from 5,001 feet to 10,000 feet with specific derates.
6. The boiler shall be capable of field-conversion between natural gas and propane without changing components.

#### B. Heat Exchanger

1. The primary heat exchanger shall be of a single-pass flue gas, vertically oriented fire-tube design with water surrounding the combustion chamber for maximum efficiency.
2. The heat exchanger shall be fully-welded construction utilizing 316L stainless steel for the fire-tubes, tube sheets, combustion chamber and flue collector. The pressure vessel shell shall be 304L stainless steel. The boiler water connections shall be 304L stainless steel, 3-inch ANSI/ASME B16.5 150-pound flanges.
3. The heat exchanger shall be explosion-proof on the water side.
4. The heat exchanger shall be ASME inspected and stamped and National Board registered for 160 PSIG maximum allowable working pressure and 210°F maximum allowable temperature, complete with a Manufacturer's Data Report.
5. 60 PSIG ASME pressure relief valve mounted on the boiler.
6. Temperature and pressure gauge factory-mounted.
7. The heat exchanger must have two lifting lugs welded to the top of the vessel to aid in rigging the unit for installation.
8. A built-in flue gas test port must be included as a standard part of the heat exchanger flue collector.

#### C. Condensate Drain

1. The boiler(s) will feature a condensate trap and drain with float switch, which will shutdown the boiler(s) if the condensate drain is blocked.

#### D. Burner

1. The combustion chamber shall be of the sealed-combustion type employing the high-temperature FeCrAlloy knitted mesh-burner, mounted in a vertical orientation.

2. The burner must be capable of firing at 100% of rated-input when supplied with a minimum of 4.0" WC of inlet natural gas pressure, or 8.0" WC when supplied with propane gas, so as to maintain service under heavy demand conditions, no exceptions.
  3. The burner shall use a fully-sealed, non-sparking combustion air blower to precisely mix and control the flow of fuel/air mixture for maximum efficiency throughout the entire range of modulation. The combustion air blower shall operate for a pre-purge period before burner ignition and a post-purge period after burner operation to clear the combustion chamber.
  4. The blower shall infinitely vary its output in response to a Pulse Width Modulation (PWM) signal supplied directly from the modulating temperature control, thereby electronically and precisely adjusting the volume of air and gas supplied for combustion.
- E. Combustion Chamber
1. The combustion chamber shall be constructed of 316L stainless steel and fully surround the burner for maximum efficiency.
- F. Ignition System
1. The boiler(s) shall be equipped with a 100% safety shutdown.
  2. The ignition shall be proven Hot Surface Ignition (HSI) type with full-flame rectification by remote sensing separately from the ignition source. A three-try-for-ignition sequence is standard (single-try optional).
  3. Unit to employ the "Rich-Start" system (patent pending) to ensure reliable ignition under a very broad range of operational conditions.
  4. The igniter will be oriented vertically.
  5. The platform ignition control module (PIM) shall include an LED display that indicates up to fifteen (15) individual diagnostic flash codes locally and transmits any faults to the touchscreen display when present.
- G. Gas Train
1. The boiler(s) gas valve shall have a firing/leak test valve and pressure test valve as required by CSD-1.
  2. The boiler(s) shall have dual-seated main gas valve.
  3. Gas train shall have a redundant safety shut-off feature, main gas regulation, shut-off cock and plugged pressure tapping to meet the requirements of ANSI Z21.13/CSA 4.9.
  4. A gas sediment trap with flanged connection shall be included as a standard on the gas line connection point to the boiler.
- H. Cabinet
1. The corrosion-resistant galvanized-steel jackets shall be finished with a baked-on epoxy powder-coat suitable for outdoor installation, applied prior to assembly for complete coverage, and shall incorporate louvers in the outer panels to divert air past the heated surfaces.
  2. The boiler top shall be fabricated from reinforced, UV-stable polymer rated for outdoor use.
  3. The boiler(s), if located on a combustible surface, shall not require a separate combustible floor base.
  4. The boiler(s) shall connect the combustion air through the top of the cabinet (for indoor installation) and flue products through the back of the unit.
  5. The boiler shall have as standard an internal, high-capacity combustion air filter rated to MERV 8 (equal to or greater than 95% arrestance).
  6. The formed structural steel base shall include properly-sized openings for forklift from either side or a pallet jack from the front or rear of the unit.
  7. The cabinet base shall include seismic anchor holes.
- I. Boiler Pump
1. The boiler(s) shall have the variable-speed boiler pump controlled by the VERSA IC<sup>®</sup> integral control system. (shipped loose for field-installation by others)

## 2.3 BOILER OPERATING CONTROLS

### A. Boiler Control

1. The following safety controls shall be provided:
  - a. High limit control with manual-reset, mounted and wired
  - b. Flow switch, mounted and wired (*OPTIONAL*)
  - c. Low water cut-off with manual-reset, mounted and wired
  - d. Blocked vent pressure switch, mounted and wired
  - e. Blocked condensate switch, mounted and wired
  - f. Cabinet temperature limit switch
  - g. *Adjustable high limit control with auto-reset, mounted and wired*
2. The boiler(s) shall be equipped with modulating temperature controller with capacitive color touchscreen display and platform ignition control module (PIM).
3. The boiler(s) shall be equipped with three (3) adjustable energy-saving pump control relays (boiler, system, indirect DHW).
4. The boiler(s) shall have at least five water temperature sensors included (inlet and outlet factory mounted and wired; system sensor, indirect domestic hot water sensor, indirect supply sensor shipped loose for field-installation by others).
5. The boiler(s) shall include an outdoor air sensor (shipped loose for field-installation by others).
6. The boiler(s) shall allow for 0-10 VDC input connection for building control signal which can be used to control setpoint temperature of single boiler and cascade configuration or firing rate. Each boiler shall have an alarm contact for connection to the central EMS system.
7. Each boiler shall be equipped with Modbus communications compatibility with up to 146 points of data available.
  - a. *B-85 Gateway – BACnet MS/TP, BACnet IP, N2 Metasys or Modbus TCP installed*
8. The boiler(s) shall be equipped with a water flow meter, mounted and wired, displaying flow in GPM and available via BMS data port, shall enable the following features:
  - a. The PIM will only allow for ignition as long as the flow meter detects a flow higher than the minimum flow requirement for the unit. If minimum flow is not achieved within 90-seconds, the unit will broadcast a "Flow Error" condition and will hold from ignition until proper flow is observed. When flow error occurs, an alarm will notify the user that the unit did not ignite due to insufficient flow. If sufficient flow is present, user can override the Flow Error and allow ignition up to 80% firing rate with flow override expiring every 24-hours.
  - b. Allow for adjustable cascade flow offset function, where in a cascaded system the master boiler will only allow the next unit in the cascade to operate when flow requirements are met.
  - c. The boiler integrated control provides Delta-T protection zones, which include a "Flow Warning Zone", which broadcasts an error when Delta-T is higher than expected given a flow rate and firing rate. A "Hold Firing Rate Zone", where firing rate is held constant to prevent an increase in Delta-T, and a "Min Firing Rate Zone", where the firing rate will drop to its minimum-rate to prevent a Delta-T fault.
9. The boiler(s) shall have built-in "Cascade" function for up to eight (8) units of same or different BTUH inputs without utilizing an external controller or sequencer.
  - a. The Cascade function shall include selectable modes for parallel modulation and sequential modulation with lead boiler rotation and lead-lag operation.
  - b. System shall be capable of leader redundancy and lead rotation every forty-eight (48) hours.
  - c. Cascade function shall allow users to enable or disable alarm sharing across cascaded appliances when an alarm condition occurs.
  - d. Cascade functions shall include an interstage delay setting with auto-delay option.
10. Firing Mode: Provide electronic modulating control of the gas input to the boiler.
11. Boiler Diagnostics – The front panel shall be illuminated to provide external display of

the following boiler status/faults:

- a. Solid White: Power On
  - b. Pulsing Blue: Call-for-heat
  - c. Solid Blue: Burner On
  - d. Pulsing White: Post-Purge (gas purge)
  - e. Pulsing Red: Error
12. Provide monitoring of all safeties, internal/external interlocks with fault display by a 7" capacitive color touchscreen display:
- a. System status
  - b. Condensate blockage
  - c. Manual-reset high limit
  - d. Auto-reset high limit
  - e. Low water cut-off
  - f. Blocked vent
  - g. Low-gas pressure switch
  - h. High-gas pressure switch
  - i. Controller alarm
  - j. Flow switch
  - k. External interlock
  - l. Ignition lock-out
  - m. Blower speed error
  - n. Low 24VAC
  - o. Sensor failure
    1. Inlet sensor (open or short)
    2. Outlet sensor (open or short)
    3. System (cascade) sensor (open or short)
    4. Air sensor (open or short)
    5. Temperature to indirect sensor (open or short)
    6. Indirect DHW tank sensor (open or short)
    7. Water flow rate sensor
    8. Vent temperature sensor
    9. Internal control fault
    10. ID card fault
    11. Cascade communication error
13. The capacitive touchscreen display shall include a digital document viewer.
14. The control system shall be equal to VERSA IC, capable of multiple modes of operation:
- a. Mode 1 = Hydronic, without indirect domestic hot water
  - b. Mode 2 = Hydronic, with indirect domestic hot water plumbed into system-loop-piping
  - c. Mode 3 = Hydronic, with indirect domestic hot water plumbed into boiler-loop-plumbing (Primary/Secondary Piping Only)
15. The control system shall be capable of controlling up to three (3) connected pumps:
- a. Boiler pump (Variable-Speed)
    1. Variable-speed pump (offered by manufacturer or field-supplied) to be installed in the boiler connected piping and interlocked with the boiler-mounted control system via the "Boiler" pilot-duty pump relay and 0-20mA variable-speed boiler pump output located in the rear wiring box on the back of the unit. Pump will be operated only during a call-for-heat from the system and only when there is a call for the unit's burner to operate. Variable-speed boiler pump speed and flow will work in concert with the connected boilers firing rate to provide for maximum operating efficiency of the overall system. Pump is maintained in the idle position when the associated unit's burner is not operating.
  - b. System pump
  - c. Indirect DHW pump
16. The control system shall include freeze-protection capability where if the water temperature drops below 45°F (7°C) the boiler pump or isolation valve will enable. The boiler pump will turn off (or isolation valve close) when both inlet and outlet temperatures rise above 50°F

(10°C). If either the Outlet or Inlet temperature drops below 38°F (3°C), the burner will fire at the minimum firing-rate. The burner cycle will terminate when both the Inlet and Outlet temperatures rise above 42°F (6°C).

**B. Connectivity**

1. The controls shall include a connectivity feature to allow remote access to boiler or water heater data, and to provide maintenance reminders and error notifications on iOS and Android devices or by website access.
2. The system allows for registering of multiple devices at various locations and multiple devices in a single cascade installation. The system also allows separate Groups to be established with various levels of access and control permission to be set by the equipment owner.
3. Controls shall be capable of providing reminders and alerts via iOS or Android notification, text, or email. All notification features are user-set.
4. The app and website will allow remote monitoring of the following:
  - a. Outlet and inlet temperature monitoring
  - b. Vent temperature
  - c. Flow (if equipped)
  - d. Blower speed
  - e. Modulation percentage
  - f. Flame current
  - g. Run-time
  - h. Boiler Status
  - i. Cycles
  - j. Historical data
5. The app and website will allow remote control/adjustment of the following:
  - a. Temperature setpoint
  - b. Temperature differential
  - c. Outdoor reset settings
  - d. Indirect setpoint
  - e. Indirect differential
  - f. Custom notification
  - g. Full historical data reports will be available for review via website.
6. The app and website will allow export of historical data for boiler system performance analysis and monitoring.

**2.4 ELECTRICAL POWER**

- A. Controllers, electrical devices and wiring: Electrical devices and connections are specified in Division 26 sections.
- B. Single-Point Field Power Connection: Factory-installed and factory-wired switches, motor controllers, transformers, and other electrical devices shall provide single-point field power connection to the boiler.

C. Electrical characteristics:

	Models 1007-2007	Standard on Models 2507-4007 <i>(Optional on</i>	Optional (all models)
Voltage (VAC)	120	240	208/240 and 480/600*
Phase	Single	Single or Three	Single or Three
Frequency (Hz)	60	60	60
Full-load current (Amps)	-	-	-

\*Factory-wired for 480VAC 3-phase 60Hz. 600VAC is field-wired only.

2.5 VENTING AND COMBUSTION AIR

- A. Standard vent connection shall be equal to Duravent FasNSeal.
- B. The exhaust vent must be UL-listed for use with Category II and IV appliances and compatible with operating temperatures up to 230°F (110°C), condensing flue gas service. UL-listed vents of Category IV stainless steel must be used with boilers.
- C. The minimum exhaust vent duct size for each boiler is 6” diameter for sizes 1007, 8” diameter for sizes 1257-2007, 10” for sizes 2507 – 3007 and 12” for sizes 3507-4007.
- D. Combustion-Air Intake: Boilers shall be capable of drawing combustion air from the outdoors via a metal or PVC duct connected between the boiler and the outdoors.
- E. The boiler-mounted control shall include a feature allowing for the user to select the vent material during setup, which will automatically adjust unit operation to not exceed a maximum safe flue exhaust temperature.

2.6 DIRECT VENT

- A. The boiler(s) shall meet safety standards for direct vent equipment as noted by the 2006 Uniform Mechanical Code, Section 1107.6, and ASHRAE 15-1994, Section 8.13.6.

2.7 SOURCE QUALITY CONTROL

- A. The boiler(s) shall be completely assembled, wired, and fire-tested prior to shipment from the factory.
- B. The boiler(s) shall be furnished with the ASME Manufacturer’s Data Report(s), inspection sheet, wiring diagram, rating plate, and Installation and Operating Manual.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Must comply with:
  1. Local, state, provincial, and national codes, laws, regulations and ordinances
  2. National Fuel Gas Code, ANSI Z223.1/NFPA 54 – latest edition
  3. National Electrical Code, ANSI/NFPA 70 – latest edition
  4. Standard for controls and safety devices for automatically-fired boilers, ANSI/ASME CSD-1, when required.
  5. Canada only: CAN/CSA B149 Installation Code and CSA C22.1 CEC Part I.
  6. Manufacturer’s installation instructions, including required service clearances and venting guidelines
- B. Manufacturer’s representative to verify proper and complete installation.

3.2 START-UP

- A. Shall be performed by factory-trained personnel.



- B. Test during operation and adjust if necessary:
  - 1. Safeties
  - 2. Operating controls
  - 3. Static and full-load gas supply pressure
  - 4. Gas manifold and blower suction pressure
  - 5. Amp draw of blower
  - 6. Combustion analysis
- C. Submit copy of start-up report to Architect and Engineer.

### 3.3 TRAINING

- A. Provide factory-authorized service representative to train maintenance personnel on procedures and schedules related to start-up, shutdown, troubleshooting, servicing, and preventive maintenance.
- B. Schedule training at least seven-days in advance.

END OF SECTION

Project Name / Date

Division 23 52 33.13 - 9

## SECTION 239000

### AUTOMATIC CONTROL SYSTEM

#### PART 1 GENERAL

##### 1.01. WORK INCLUDED

- A. Furnish a totally native BACnet-based Building Automation System (BAS). Provide the building control system suitable for integration with the existing Siemens campus control system provided by Powers of AR.
- B. Building Automation System
  - 1. Provide all necessary BACnet-compliant hardware and software to meet the system's functional specifications.
  - 2. Prepare individual hardware layouts, interconnection drawings, and software configuration from project design data.
  - 3. Implement the detailed design for all analog and binary objects, system databases, graphic displays, logs, and management reports based on control descriptions, logic drawings, configuration data, and bid documents.
  - 4. Design, provide, and install all equipment cabinets, panels, data communication network cables needed, and all associated hardware.
  - 5. Provide and install all interconnecting cables between supplied cabinets, application controllers, and input/output devices.
  - 6. Provide and install all interconnecting cables between all equipment controllers.
  - 7. Provide complete manufacturer's specifications for all items that are supplied. Include vendor name of every item supplied.
  - 8. Provide supervisory specialists and technicians at the job site to assist in all phases of system installation, startup, and commissioning.
  - 9. Provide a comprehensive operator and technician training program as described herein.
  - 10. Provide as-built documentation, operator's terminal software, diagrams, and all other associated project operational documentation (such as technical manuals) on approved media, the sum total of which accurately represents the final system.
  - 11. All measurable points on each piece of hardware, duct, or equipment monitored by the building control system shall be made available to view, control, and trend from the user interface.

##### 1.02. SYSTEM DESCRIPTION

- A. A distributed logic control system complete with all software and hardware functions shall be provided and installed. System shall be completely based on ANSI/ASHRAE Standard 135-

2001, BACnet. This system is to control all mechanical equipment, using native BACnet-compliant components. Non-BACnet-compliant or proprietary equipment or systems shall not be acceptable and are specifically prohibited.

- B. Room sensors shall be provided with digital readout that allow the user to view room temperature, view outside air temperature, adjust the room setpoint within preset limits and set desired override time. User shall also be able to start and stop unit from the digital sensor. Include all necessary wiring and firmware such that room sensor includes field service mode.

#### 1.03. APPROVED MANUFACTURERS

- A. Siemens, Alerton, or engineer-approved equal

#### 1.04. QUALITY ASSURANCE

- A. Responsibility: The supplier of the EMCS shall be responsible for inspection and Quality Assurance (QA) for all materials and workmanship furnished.
- B. Component Testing: Maximum reliability shall be achieved through extensive use of high-quality, pre-tested components. Each and every controller, sensor, and all other DDC components shall be individually tested by the manufacturer prior to shipment.
- C. Tools, Testing and Calibration Equipment: The EMCS supplier shall provide all tools, testing, and calibration equipment necessary to ensure reliability and accuracy of the system.
- D. The systems control contractor shall have been in business a minimum of five years and be the authorized installing contractor for the manufacturer of the BACnet components.
- E. Control system shall be engineered, programmed and supported completely by representative's local office that must be within 75 miles of project site.

#### 1.05. SUBMITTALS

- A. Drawings
  - 1. The system supplier shall submit engineered drawings, control sequence, and bill of materials for approval.
  - 2. Drawings shall be submitted in the following standard sizes: 11" x 17" (ANSI B).
  - 3. Eight complete sets (copies) of submittal drawings shall be provided.
  - 4. Drawings shall be available on CD-ROM.

#### 1.06. WARRANTY

- A. Warranty shall cover all costs for parts, labor, associated travel, and expenses for a period of one year from completion of system acceptance.
- B. 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 Monday through Friday, 48 hours on Saturday and Sunday.
- C. This warranty shall apply equally to both hardware and software.

## PART 2 PRODUCTS

### 2.01. BACnet APPLICATION EQUIPMENT CONTROLLERS

- A. Provide one or more native BACnet application controllers for each controlled piece of equipment. All controllers shall interface to building controller via MS/TP LAN using BACnet protocol. No gateways shall be used. Controllers shall include input, output and self-contained logic program as needed for complete control of units. Controllers shall be fully programmable using graphical programming blocks. Programming tool shall be resident at the operator workstation.
- B. BACnet Conformance
  - 1. Application controllers shall as a minimum support MS/TP BACnet LAN types. They shall communicate directly via this BACnet LAN at 9.6, 19.2, 38.4 and 76.8 Kbps, as native BACnet devices. Application controllers shall be of BACnet conformance class 3 and support all BACnet services necessary to provide the following BACnet functional groups:
    - a. Files Functional Group
    - b. Reinitialize Functional Group
    - c. Device Communications Functional Group
  - 2. Please refer to section 22.2, BACnet Functional Groups, in the BACnet standard, for a complete list of the services that must be directly supported to provide each of the functional groups listed above. All proprietary services, if used in the system, shall be thoroughly documented and provided as part of the submittal data. All necessary tools shall be supplied for working with proprietary information.
  - 2. Standard BACnet object types supported shall include as a minimum—Analog Input, Analog Output, Analog Value, Binary Input, Binary Output, Binary Value, Device, File, and Program object types. All proprietary object types, if used in the system, shall be thoroughly documented and provided as part of the submittal data. All necessary tools shall be supplied for working with proprietary information.
- C. Application controllers shall include universal inputs with 10-bit resolution that accept 3K and 10K thermistors, 0–10VDC, 0–5 VDC, 4–20 mA and dry contact signals. Any input on a controller may be either analog or digital with a minimum of 3 inputs that accept pulses. Controller shall also include support and modifiable programming for interface to intelligent room sensor with digital display. Controller shall include binary and analog outputs on board. Analog outputs shall be switch selectable as either 0–10VDC or 0–20mA. Software shall include scaling features for analog outputs. Application controller shall include 24VDC voltage supply for use as power supply to external sensors.
- D. All program sequences shall be stored on board application controller in EEPROM. No batteries shall be needed to retain logic program. All program sequences shall be executed by controller 10 times per second and capable of multiple PID loops for control of multiple devices. All calculations shall be completed using floating-point math and system shall support display of all information in floating-point nomenclature at operator's terminal. Programming of application

controller shall be completely modifiable in the field over the installed BACnet LANs from the Touch Screen Interface.

- E. Application controller shall include support for intelligent room sensor (see section 2.9.B.) Display on intelligent room sensor shall be programmable at application controller and include an operating mode and a field service mode. All button functions and display data shall be programmable to show specific controller data in each mode based on which button is pressed on the sensor.

## 2.02. OPERATOR'S WORKSTATION

- A. Contractor shall furnish and install (1) new operator workstation and associated software for graphical user interface (GUI).

## 2.03. SENSORS and MISCELLANEOUS DEVICES

### A. Temperature Sensors

- 1. All temperature sensors to be solid state electronic, factory-calibrated to within 0.5°F, totally interchangeable with housing appropriate for application. Wall sensors to be installed as indicated on drawings. Mount top of thermostat at approximately 44 inches above finished floor, align with light switch of associated room. Duct sensors to be installed such that the sensing element is in the main air stream.

### B. Room Sensor with LCD Readout

- 1. Sensor shall contain a backlit LCD digital display and user function keys along with temperature sensor. Controller shall function as room control unit, and shall allow occupant to raise and lower setpoint, and activate terminal unit for override use—all within limits as programmed by building operator. Sensor shall also allow service technician access to hidden functions as described in sequence of operation.
- 2. Room Sensor shall simultaneously display room setpoint, room temperature, outside temperature, and fan status (if applicable) at each controller. This unit shall be programmable, allowing site developers the flexibility to configure the display to match their application.
- 3. Override time may be set and viewed in half-hour increments. Override time count down shall be automatic, but may be reset to zero by occupant from the sensor. Time remaining shall be displayed. Display shall show the word "OFF" in unoccupied mode unless a function button is pressed.

## 2.04. ENCLOSURES

- A. All controllers, power supplies and relays shall be mounted in enclosures.
- B. Enclosures may be NEMA 1 when located in a clean, dry, indoor environment. Indoor enclosures shall be NEMA 12 when installed in other than a clean environment.
- C. Enclosures shall have hinged, locking doors.
- D. Provide laminated plastic nameplates for all enclosures in any mechanical room or electrical room. Include location and unit served on nameplate. Laminated plastic shall be 1/8" thick sized appropriately to make label easy to read.

## PART 3 EXECUTION

### 3.01. EXAMINATION

- A. Prior to starting work, carefully inspect installed work of other trades and verify that such work is complete to the point where work of this Section may properly commence.
- B. Notify the owners' representative in writing of conditions detrimental to the proper and timely completion of the work.
- C. Do not begin work until all unsatisfactory conditions are resolved.

### 3.02. INSTALLATION (GENERAL)

- A. Install in accordance with manufacturer's instructions.
- B. Provide all miscellaneous devices, hardware, software, interconnections installation and programming required to ensure a complete operating system in accordance with the sequences of operation and point schedules.

### 3.03. INTERLOCKING AND CONTROL WIRING

- A. Provide all interlock and control wiring. All wiring shall be installed neatly and professionally, in accordance with Specification Division 16 and all national, state and local electrical codes.
- B. Provide wiring as required by functions as specified and as recommended by equipment manufacturers, to serve specified control functions. Provide shielded low capacitance wire for all communications trunks.
- C. Control wiring shall not be installed in power circuit raceways. Magnetic starters and disconnect switches shall not be used as junction boxes. Provide auxiliary junction boxes as required. Coordinate location and arrangement of all control equipment with the owner's representative prior to rough-in.
- D. Provide auxiliary pilot duty relays on motor starters as required for control function.
- E. Provide power for all control components from nearest electrical control panel or as indicated on the electrical drawings—coordinate with electrical contractor.
- F. All control wiring in the mechanical, electrical, telephone and boiler rooms to be installed in raceways. All other wiring to be installed neatly and inconspicuously per local code requirements. If local code allows, control wiring above accessible ceiling spaces may be run with plenum rated cable (without conduit).

### 3.04. TRAINING

- A. Provide application engineer to instruct owner in operation of systems and equipment.
- B. Provide on-site training above as required, up to 8 hours as part of this contract.

END OF SECTION

STRUCTURAL PANELS

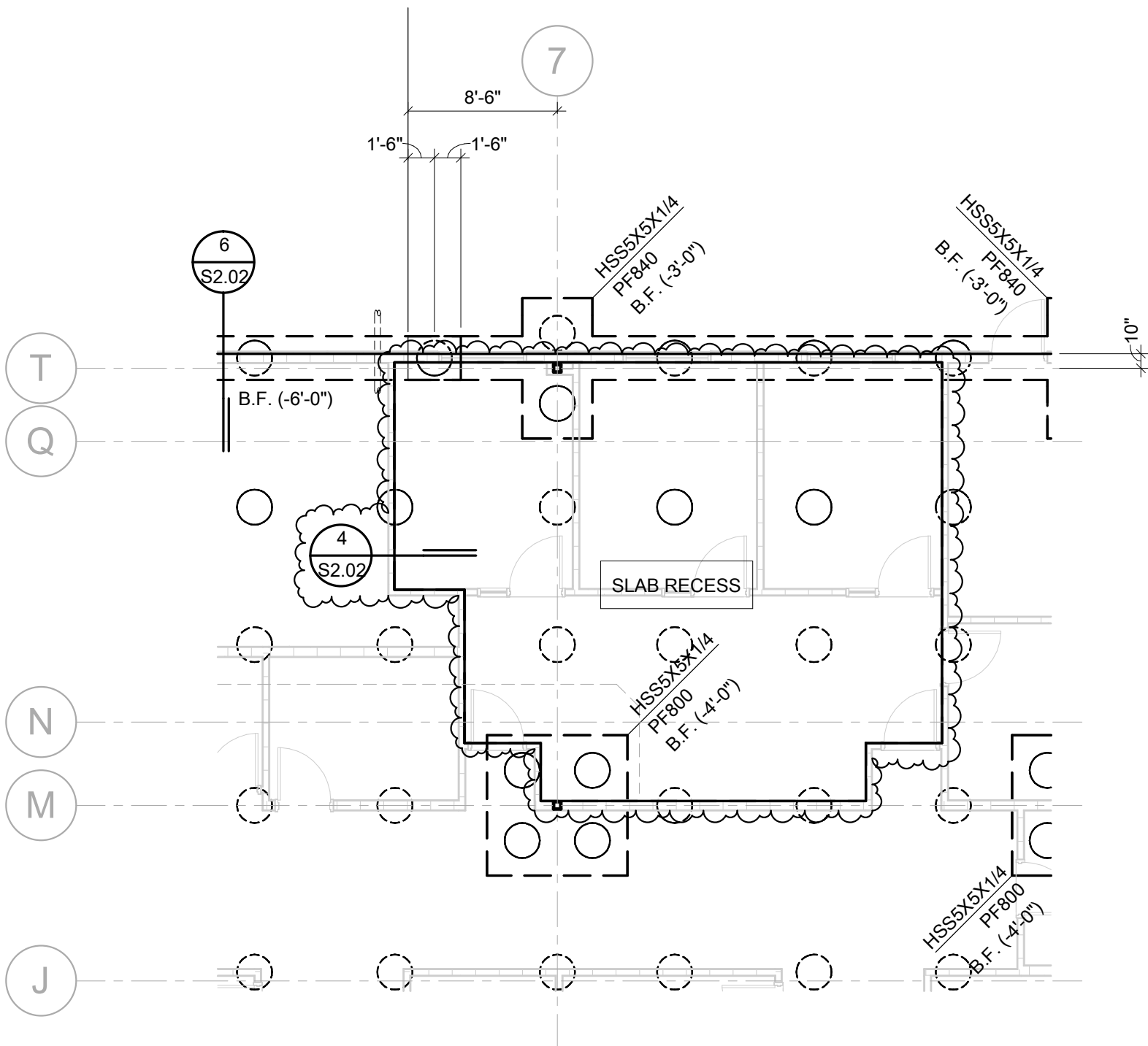
1. ROOF SHEATHING SHALL BE 1/2", APA RATED, ORIENTED STRAND BOARD (OSB) (SPAN INDEX 40/20). ATTACHMENT SHALL BE WITH 8d x 1-1/2" NAILS AT 6" ON CENTER AT SUPPORTED EDGES AND AT 12" ON CENTER ALONG ALL INTERMEDIATE SUPPORTS. EXERCISE CARE TO PREVENT NAILS FROM PENETRATING THROUGH DECK. PLYCLIPS SHALL BE USED AT ALL FREE EDGES, ONE AT MID POINT BETWEEN ALL SUPPORTS.

2. PNEUMATIC NAILING MAY BE SUBSTITUTED FOR COMMON NAILS UNDER THE FOLLOWING CONDITIONS:

- A. PNEUMATIC NAIL SUBSTITUTE FOR 8d COMMON NAILS SHALL HAVE A MINIMUM DIAMETER OF 0.131 INCHES AND LENGTH OF 1-1/2 INCHES.
- B. PNEUMATIC NAIL SUBSTITUTE FOR 10d COMMON NAILS SHALL HAVE A MINIMUM DIAMETER OF 0.148 INCHES AND LENGTH OF 3 INCHES.

T-HEAD NAILS OR STAPLES ARE NOT ACCEPTABLE.

(REF SHEET S0.03)

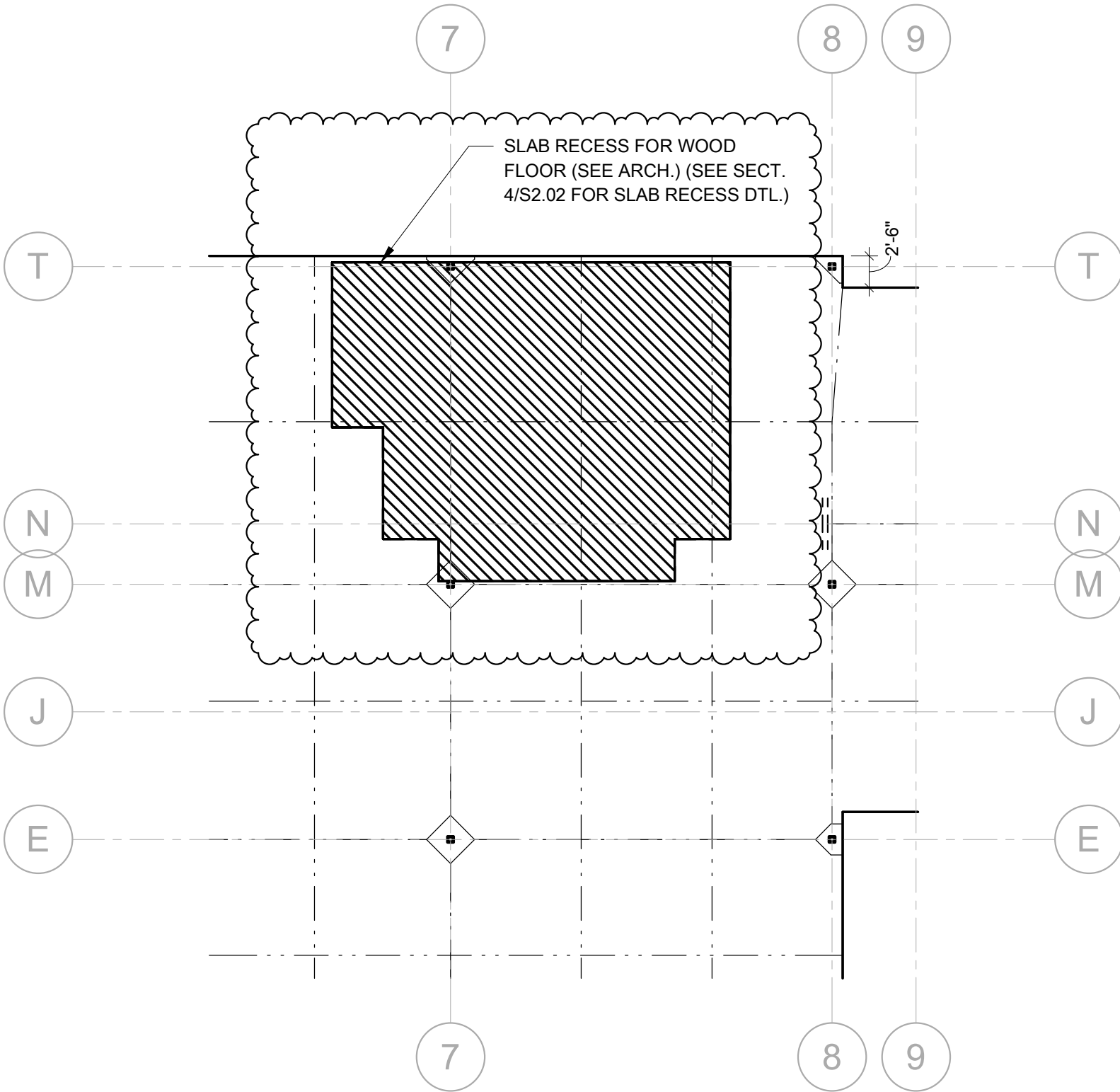


# FOUNDATION PLAN - SOUTH

1/8" = 1'-0"

(REF SHEET S1.02)



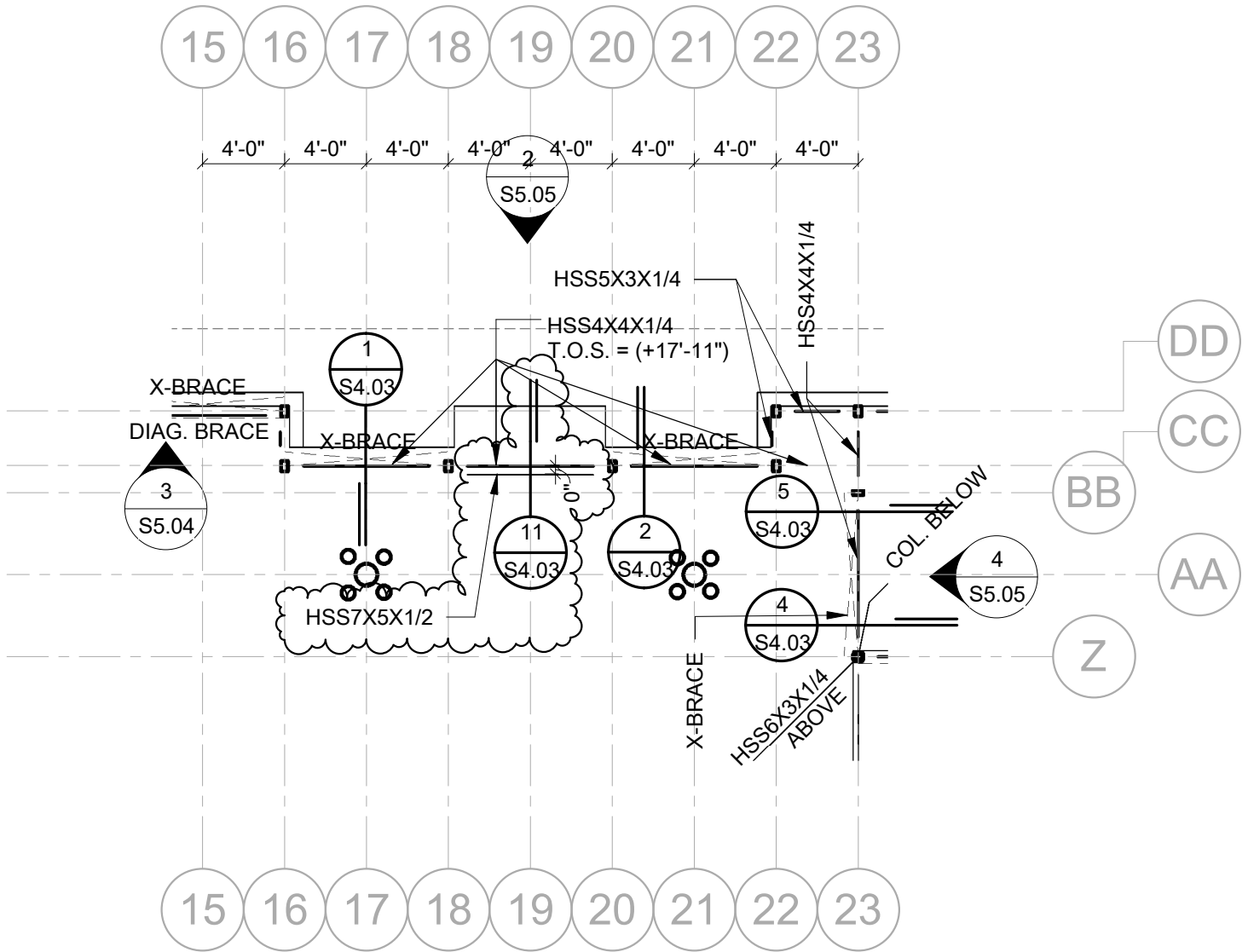


NORTH

# SLAB DIMENSION PLAN

3/32" = 1'-0"

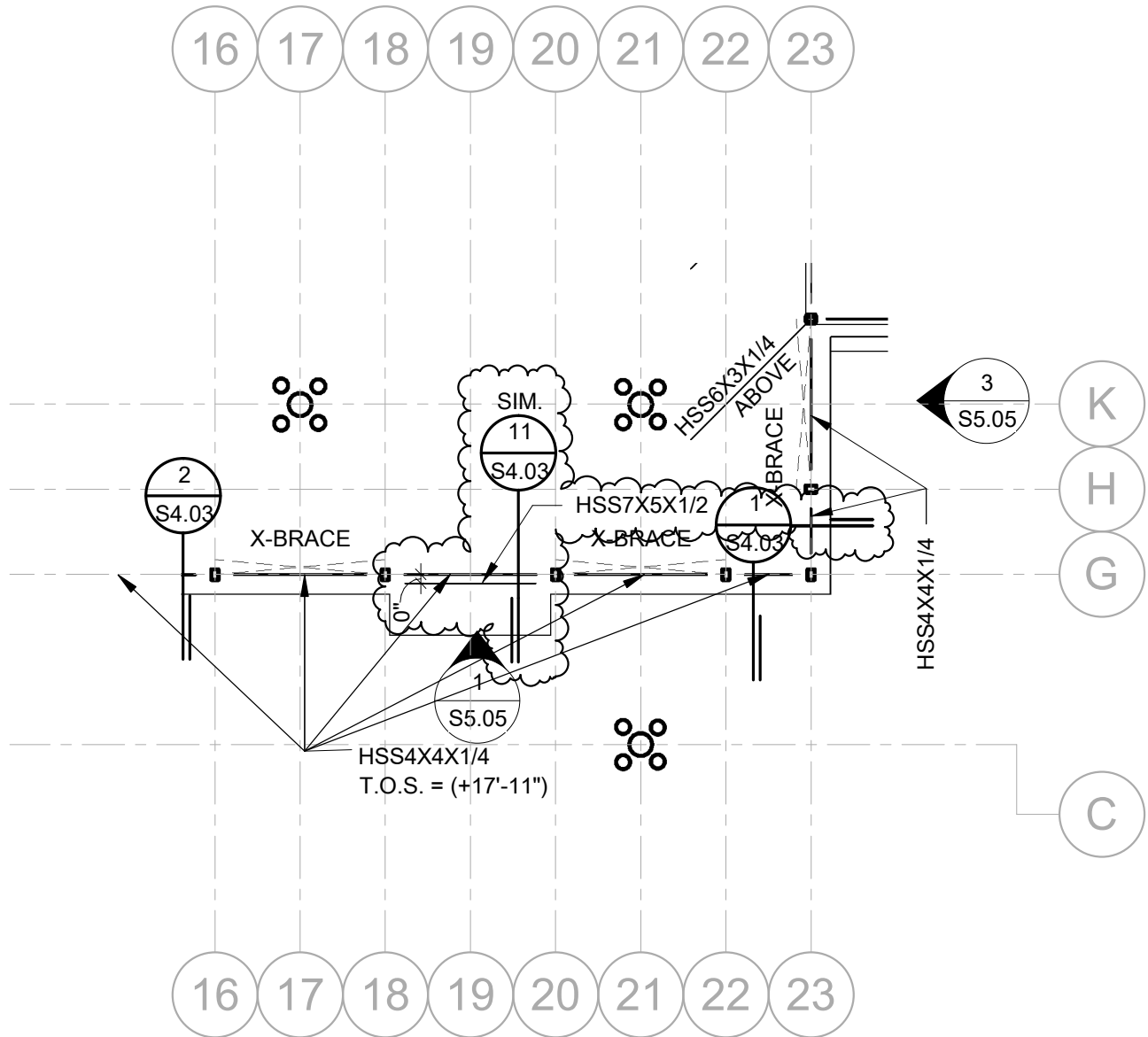
(REF SHEET S1.04)



# ROOF FRAMING PLAN - NORTH

1/8" = 1'-0"

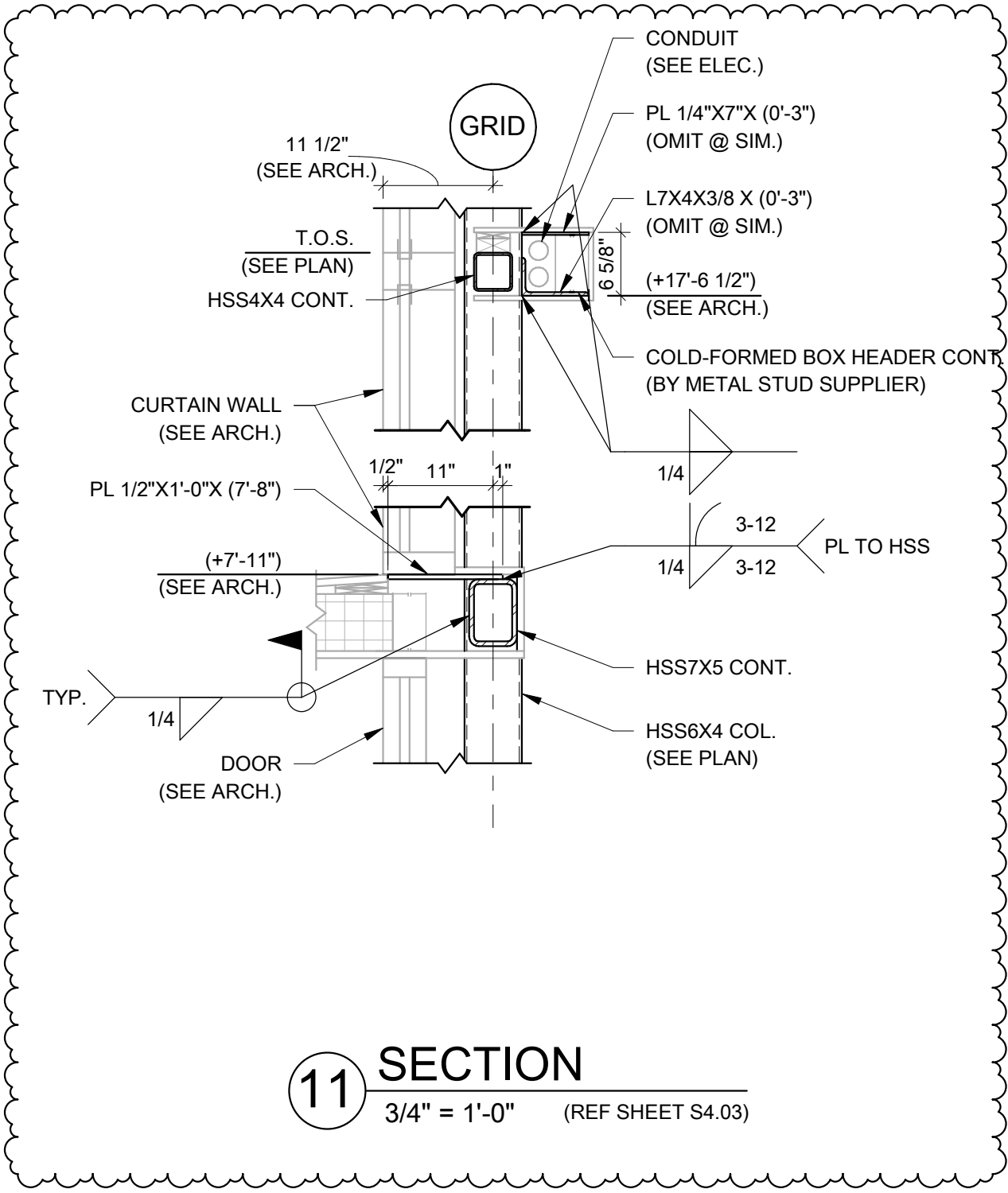
(REF SHEET S3.03)



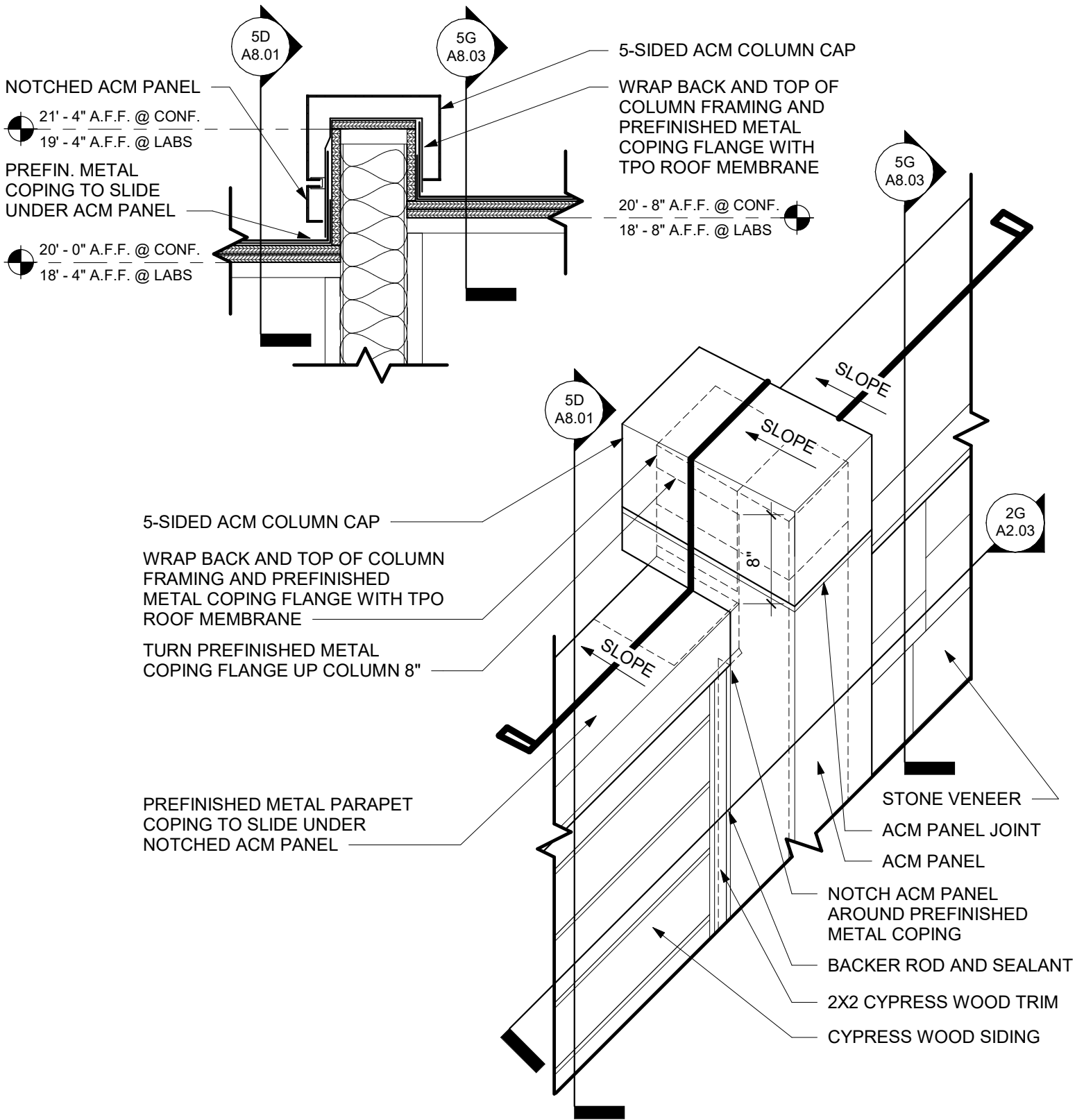
# ROOF FRAMING PLAN - NORTH

1/8" = 1'-0"

(REF SHEET S3.03)

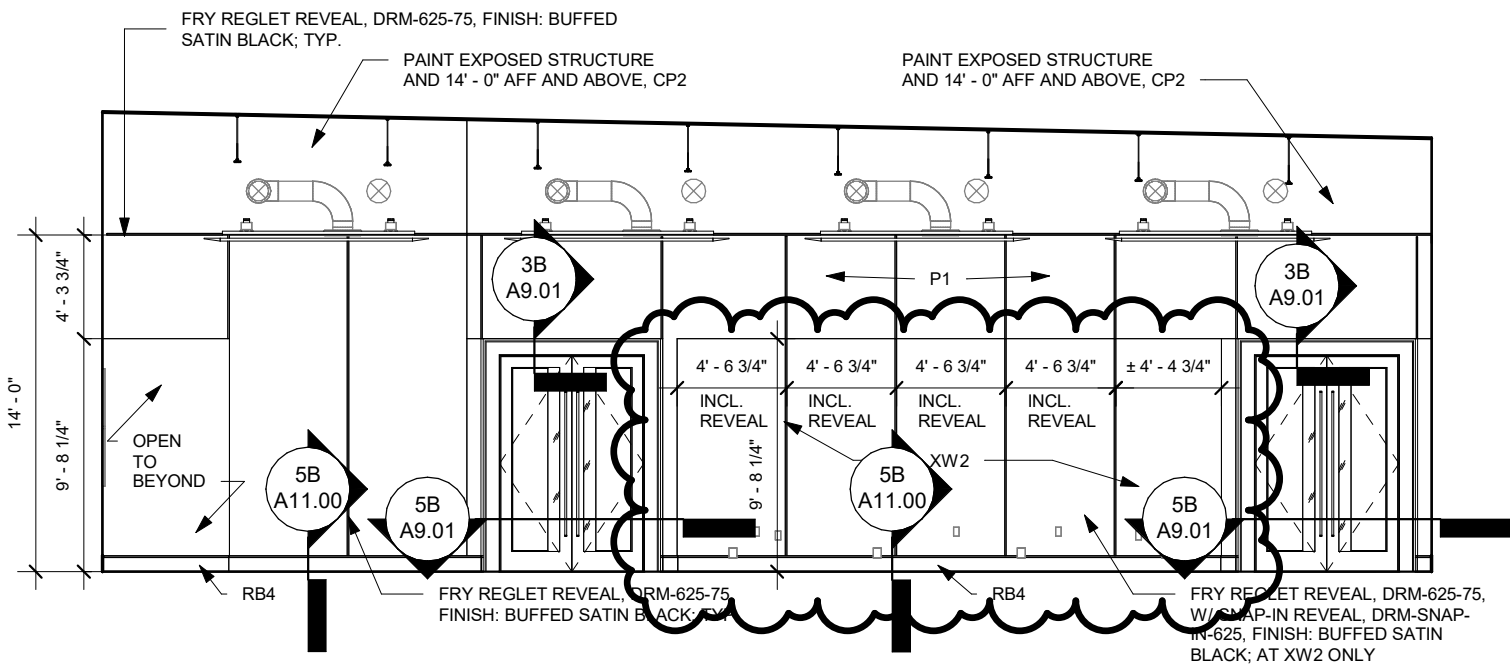


**11 SECTION**  
 3/4" = 1'-0" (REF SHEET S4.03)



1 ACM COLUMN PARAPET DETAIL  
1" = 1'-0"





1

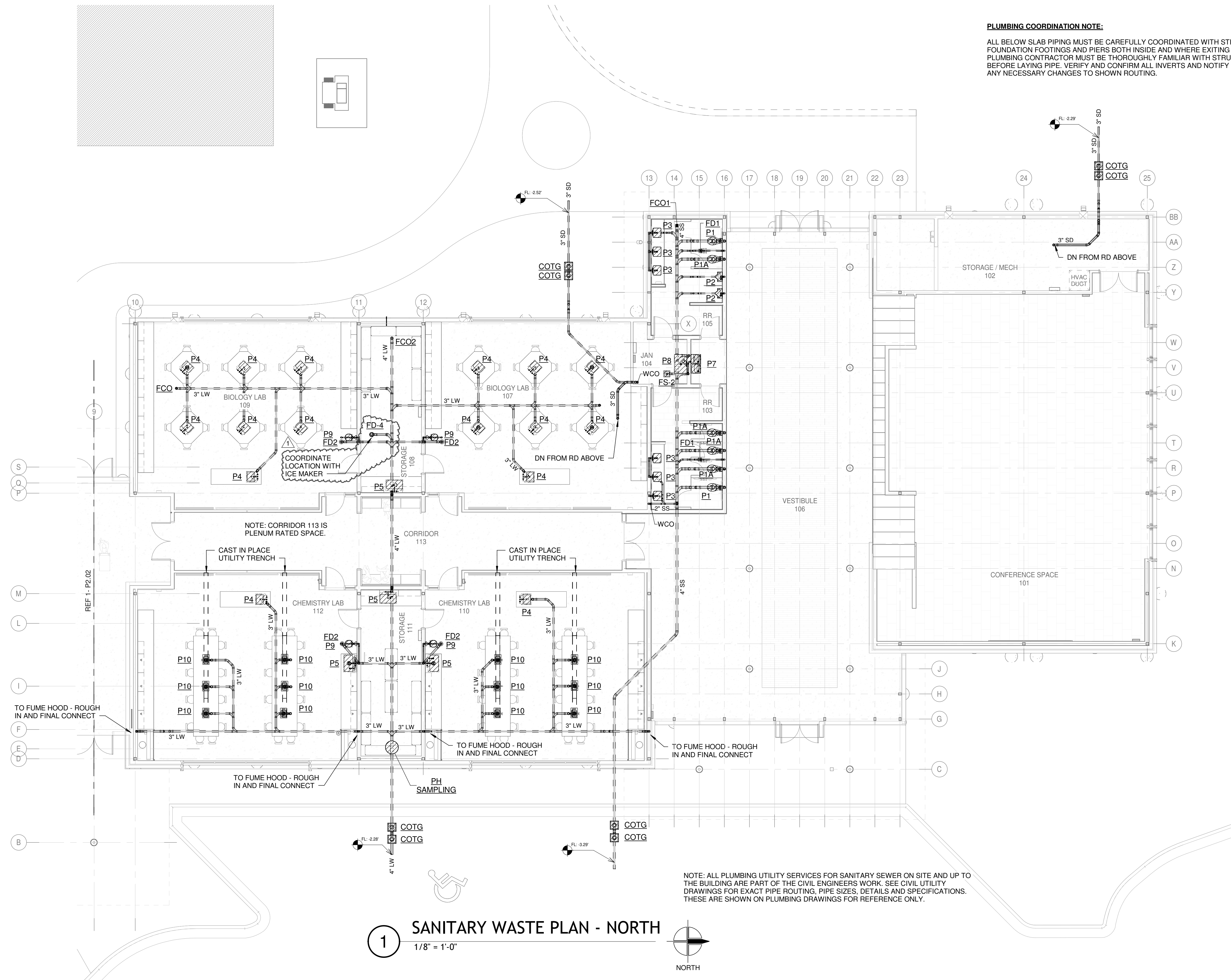
CONFERENCE ROOM ELEV. 2

1/8" = 1'-0"

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**PLUMBING COORDINATION NOTE:**

ALL BELOW SLAB PIPING MUST BE CAREFULLY COORDINATED WITH STRUCTURAL FOUNDATION FOOTINGS AND PIERS BOTH INSIDE AND WHERE EXITING THE BUILDING. PLUMBING CONTRACTOR MUST BE THOROUGHLY FAMILIAR WITH STRUCTURAL SYSTEM BEFORE LAYING PIPE. VERIFY AND CONFIRM ALL INVERTS AND NOTIFY ARCHITECT OF ANY NECESSARY CHANGES TO SHOWN ROUTING.



**1** SANITARY WASTE PLAN - NORTH  
1/8" = 1'-0"

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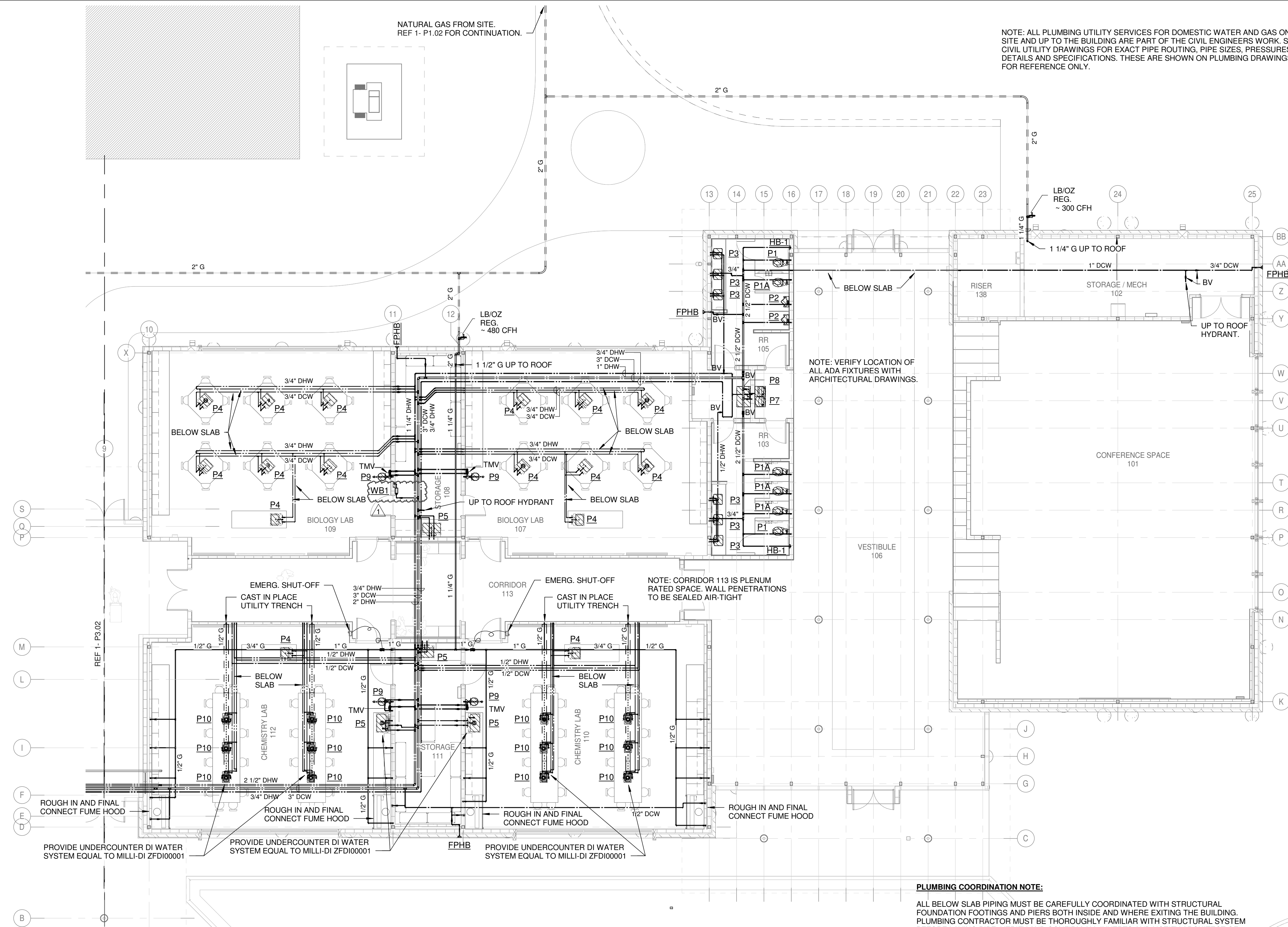
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OCTOBER 22, 2024

SANITARY WASTE  
PLAN - NORTH

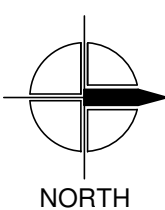
P2.01



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**1 DOMESTIC WATER / GAS PLAN - NORTH**  
1/8" = 1'-0"



NOTE: ALL PLUMBING UTILITY SERVICES FOR DOMESTIC WATER AND GAS ON SITE AND UP TO THE BUILDING ARE PART OF THE CIVIL ENGINEERS WORK. SEE CIVIL UTILITY DRAWINGS FOR EXACT PIPE ROUTING, PIPE SIZES, PRESSURES, DETAILS AND SPECIFICATIONS. THESE ARE SHOWN ON PLUMBING DRAWINGS FOR REFERENCE ONLY.

NOTE: VERIFY LOCATION OF ALL ADA FIXTURES WITH ARCHITECTURAL DRAWINGS.

NOTE: CORRIDOR 113 IS PLENUM RATED SPACE. WALL PENETRATIONS TO BE SEALED AIR-TIGHT

**PLUMBING COORDINATION NOTE:**

ALL BELOW SLAB PIPING MUST BE CAREFULLY COORDINATED WITH STRUCTURAL FOUNDATION FOOTINGS AND PIERS BOTH INSIDE AND WHERE EXITING THE BUILDING. PLUMBING CONTRACTOR MUST BE THOROUGHLY FAMILIAR WITH STRUCTURAL SYSTEM BEFORE LAYING PIPE. VERIFY AND CONFIRM ALL INVERTS AND NOTIFY ARCHITECT OF ANY NECESSARY CHANGES TO SHOWN ROUTING.

**NATURAL GAS GENERAL NOTES:**

1. ALL GAS PIPE SIZING IS BASED ON SYSTEM LONGEST LENGTH FROM THE REGULATOR AND EQUIPMENT DEMAND SHOWN ON THE SCHEMATIC. CONTRACTOR SHALL FIELD VERIFY EXISTING CONDITIONS AND NOTIFY ENGINEER IF CONDITIONS DIFFER FROM SCHEMATIC PLAN.
2. REFER TO CIVIL DETAILS AND SPECIFICATIONS FOR INSTALLATION OF EXTERIOR OR BELOW GRADE PIPING. REFER TO DETAILS FOR GAS CONNECTION TO MECHANICAL EQUIPMENT REQUIREMENTS.

**DOMESTIC WATER GENERAL NOTES:**

1. PROVIDE LEAD-FREE ISOLATION VALVE FOR EACH RESTROOM MAIN AND EACH BRANCH MAIN SERVING A BATTERY OF FIXTURES.
2. PERMANENTLY LABEL ALL VALVES TO INDICATED AREA THAT VALVE SERVES.
3. PROVIDE WATER HAMMER ARRESTOR AT END OF ALL DCW AND DHW BRANCH LINES BEFORE LAST FIXTURE. REFER TO DETAILS FOR WATER HAMMER ARRESTOR SCHEDULE. PROVIDE ACCESS TO WATER HAMMER ARRESTORS WHEN REQUIRED BY THE MANUFACTURER.
4. ROUTE ALL DOMESTIC WATER LINES CONCEALED ABOVE CEILING. WHERE DOMESTIC WATER LINES MUST BE ROUTED EXPOSED, PAINT EXPOSED PIPE AND COORDINATE WITH ARCHITECT FOR COLOR.

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**DATE:**

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DOMESTIC WATER /  
GAS PLAN - NORTH

**P3.01**

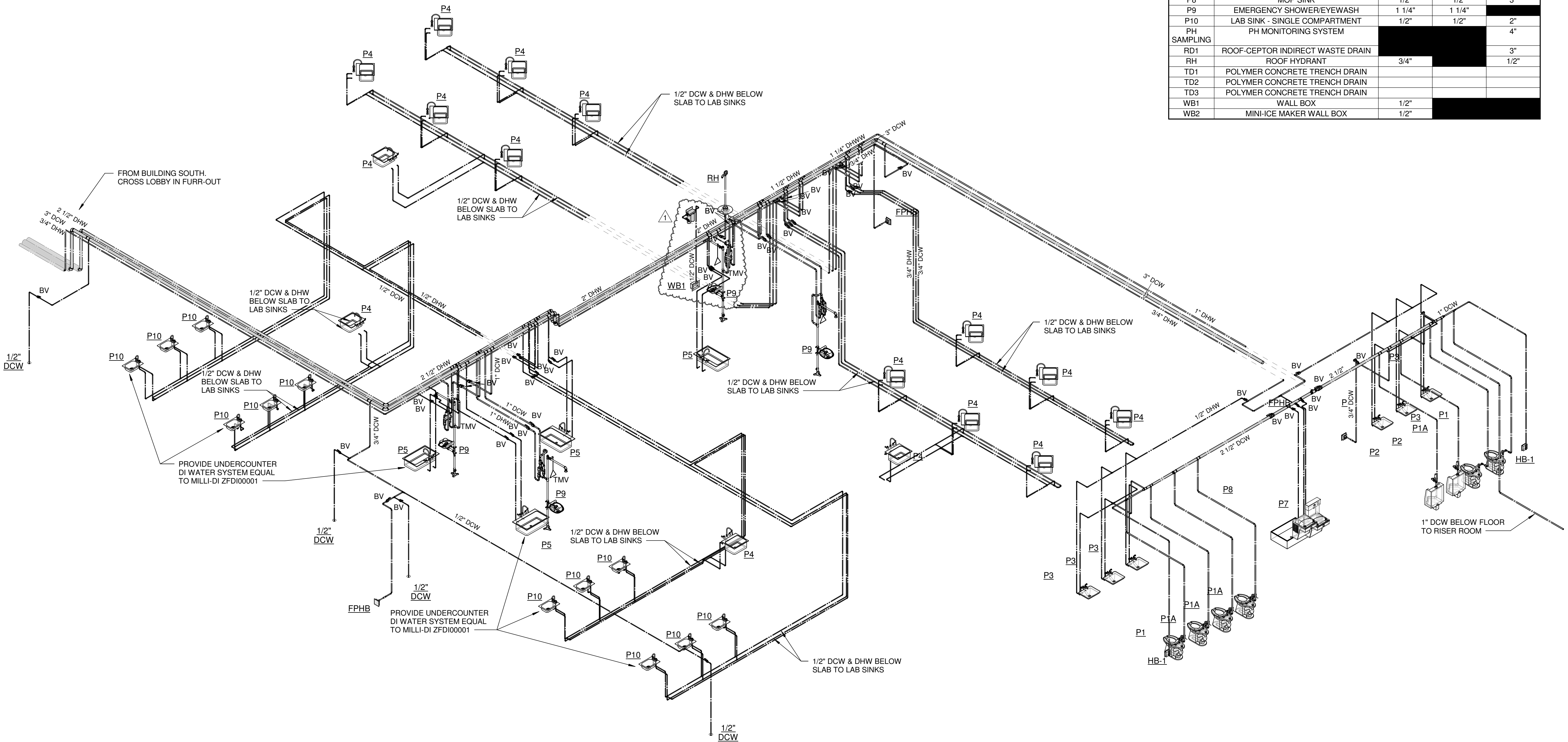
SCM ARCHITECTS P.L.L.C.



**DOMESTIC WATER GENERAL NOTES:**

1. PROVIDE LEAD-FREE ISOLATION VALVE FOR EACH RESTROOM MAIN AND EACH BRANCH MAIN SERVING A BATTERY OF FIXTURES.
2. PERMANENTLY LABEL ALL VALVES AS INDICATED AREA THAT VALVE SERVES.
3. PROVIDE WATER HAMMER ARRESTOR AT END OF ALL DCW AND DHW BRANCH LINES BEFORE LAST FIXTURE. REFER TO DETAILS FOR WATER HAMMER ARRESTOR SCHEDULE. PROVIDE ACCESS TO WATER HAMMER ARRESTORS WHEN REQUIRED BY THE MANUFACTURER.
4. ROUTE ALL DOMESTIC WATER LINES CONCEALED ABOVE CEILING. WHERE DOMESTIC WATER LINES MUST BE ROUTED EXPOSED, PAINT EXPOSED PIPE AND COORDINATE WITH ARCHITECT FOR COLOR.

PLUMBING -- FIXTURE CONNECTION Ø				
TAG	DESCRIPTION	BRANCH CONNECTIONS		
		DCW	DHW	SS
COTG	CLEAN OUT TO GRADE			<varies>
FCO	FLOOR CLEANOUT			3"
FCO1	FLOOR CLEANOUT - SQUARE COVER			4"
FCO2	FLOOR CLEANOUT - ROUND			4"
FD1	FLOOR DRAIN, 6" SQUARE STRAINER			2"
FD2	FLOOR DRAIN			3"
FD-4	FLOOR DRAIN WITH TYPE I STRAINER			3"
FPHB	ENCLOSED WALL HYDRANT - EXTERIOR	3/4"		
FS1	12x12 FLOOR SINK - 6" DEPTH			4"
FS-2	12x12 FLOOR SINK - 6" DEPTH			3"
HB-1	ENCLOSED WALL HYDRANT - INTERIOR	3/4"		
P1	WATER CLOSET - ADA HEIGHT	1"		4"
P1A	WATER CLOSET - STANDARD HEIGHT	1"		4"
P2	URINAL	3/4"		2"
P2B	WALL MOUNT LAVATORY	1/2"	1/2"	2"
P3	LAVATORY - SQUARE UNDERMOUNT	1/2"	1/2"	1 1/2"
P4	LAB SINK (SMALL) - SINGLE COMPARTMENT	1/2"	1/2"	2"
P5	LAB SINK (LARGE) - SINGLE COMPARTMENT	1/2"	1/2"	2"
P6	BREAKROOM SINK - SINGLE COMPARTMENT	1/2"	1/2"	2"
P7	BI-LEVEL WATER COOLER	1/2"		1 1/2"
P8	MOP SINK	1/2"	1/2"	3"
P9	EMERGENCY SHOWER/EYEWASH	1 1/4"	1 1/4"	
P10	LAB SINK - SINGLE COMPARTMENT	1/2"	1/2"	2"
PH	PH MONITORING SYSTEM			4"
SAMPLING				
RD1	ROOF-CEPTOR INDIRECT WASTE DRAIN			3"
RH	ROOF HYDRANT	3/4"		1/2"
TD1	POLYMER CONCRETE TRENCH DRAIN			
TD2	POLYMER CONCRETE TRENCH DRAIN			
TD3	POLYMER CONCRETE TRENCH DRAIN			
WB1	WALL BOX	1/2"		
WB2	MINI-ICE MAKER WALL BOX	1/2"		



1 DOMESTIC WATER RISER - NORTH

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PLUMBING RISERS  
III - DOM. WATER

P5.03

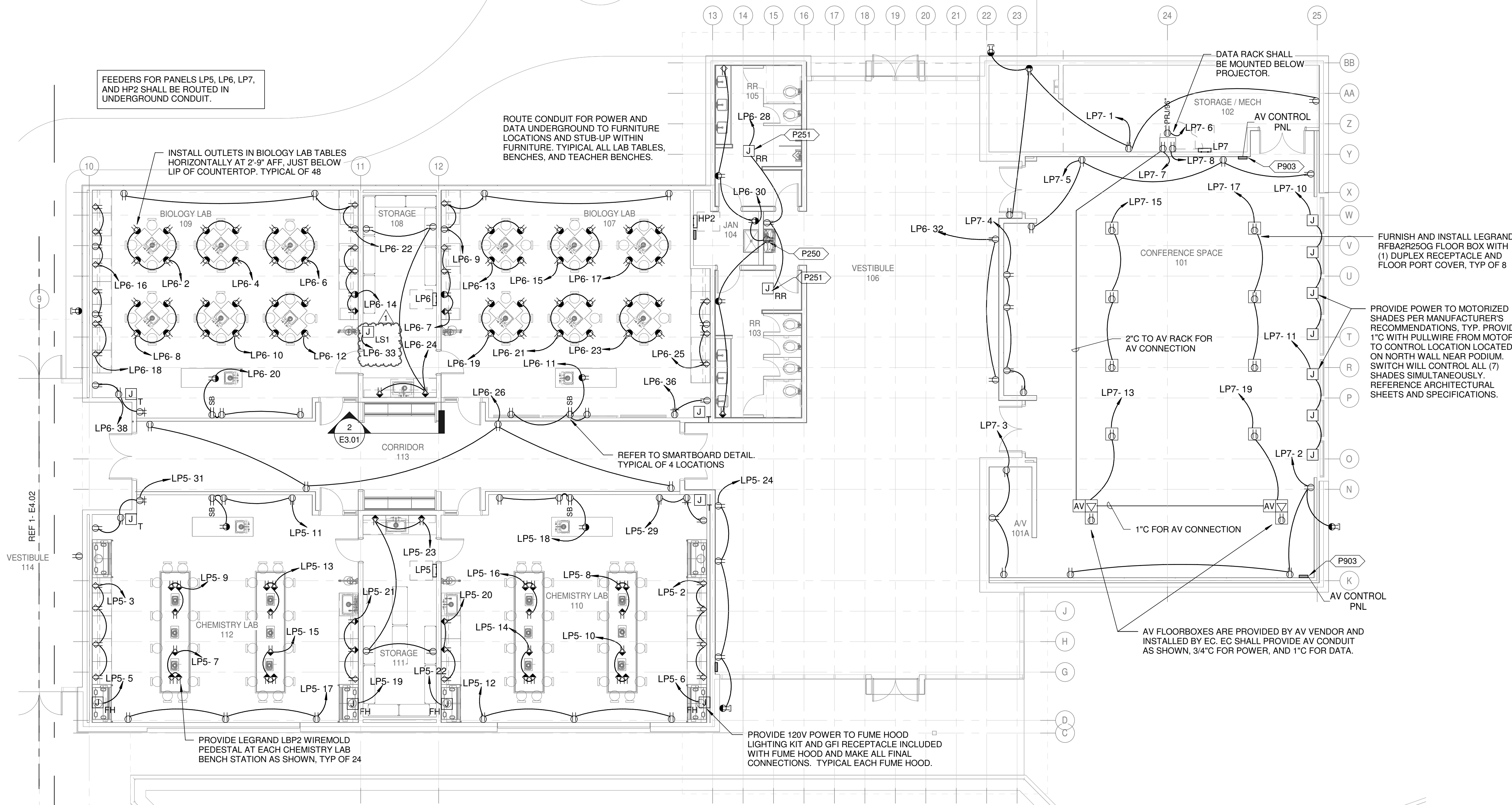
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1

# POWER NORTH PLAN

1/8" = 1'-0"



FEEDERS FOR PANELS LP5, LP6, LP7, AND HP2 SHALL BE ROUTED IN UNDERGROUND CONDUIT.

ROUTE CONDUIT FOR POWER AND DATA UNDERGROUND TO FURNITURE LOCATIONS AND STUB-UP WITHIN FURNITURE. TYPICAL ALL LAB TABLES, BENCHES, AND TEACHER BENCHES.

INSTALL OUTLETS IN BIOLOGY LAB TABLES HORIZONTALLY AT 2'-9" AFF. JUST BELOW LIP OF COUNTERTOP. TYPICAL OF 48

REFER TO SMARTBOARD DETAIL. TYPICAL OF 4 LOCATIONS

PROVIDE LEGRAND LBP2 WIREMOLD PEDESTAL AT EACH CHEMISTRY LAB BENCH STATION AS SHOWN, TYP OF 24

PROVIDE 120V POWER TO FUME HOOD LIGHTING KIT AND GFI RECEPTACLE INCLUDED WITH FUME HOOD AND MAKE ALL FINAL CONNECTIONS. TYPICAL EACH FUME HOOD.

AV FLOORBOXES ARE PROVIDED BY AV VENDOR AND INSTALLED BY EC. EC SHALL PROVIDE AV CONDUIT AS SHOWN, 3/4" FOR POWER, AND 1" FOR DATA.

FURNISH AND INSTALL LEGRAND RFBA2R250G FLOOR BOX WITH (1) DUPLEX RECEPTACLE AND FLOOR PORT COVER, TYP OF 8

PROVIDE POWER TO MOTORIZED SHADES PER MANUFACTURER'S RECOMMENDATIONS. TYP. PROVIDE 1" WITH PULLWIRE FROM MOTORS TO CONTROL LOCATION LOCATED ON NORTH WALL NEAR PODIUM. SWITCH WILL CONTROL ALL (7) SHADES SIMULTANEOUSLY. REFERENCE ARCHITECTURAL SHEETS AND SPECIFICATIONS.

### SMART BOARD NOTES:

1. PROVIDE (1) LEGRAND EFSB4 WALL BOX 48" AFF AT SMARTBOARD LOCATION WITH (1) DATA DROP AND (1) DUPLEX ELECTRICAL OUTLET.
2. PROVIDE (1) DUPLEX ELECTRICAL OUTLET BELOW SMARTBOARD LOCATION AT 18" AFF.
3. PROVIDE (1) QUAD ELECTRICAL OUTLET AND (1) DATA DROP AT INSTRUCTOR LOCATION AT 18" AFF.
4. PROVIDE (1) SINGLE GANG BOX AT INSTRUCTOR LOCATION AT 18" AFF WITH A 1" PATHWAY TO (1) SINGLE GANG BOX AT SMARTBOARD LOCATION.
5. PROVIDE (1) DATA DROP ON REAR WALL OF LAB AT 84" AFF FOR CAMERA.

### KEYNOTES

- P250 ELECTRIC WATER COOLER RECEPTACLE: CONCEAL WITHIN CABINET PER MANUFACTURER'S REQUIREMENTS.
- P251 PROVIDE 120V CONNECTION TO POWER CONVERTER FOR HARDWIRED AUTOMATIC SENSOR-CONTROLLED PLUMBING FIXTURES IN RESTROOMS. HARDWIRE POWER FROM CONVERTER TO URINAL, WATER CLOSETS, AND LAVATORIES. MAKE ALL FINAL CONNECTIONS.
- P903 PROVIDE 3/4" FROM TOUCHPAD BACKBOX TO ACCESSIBLE CEILING. BACK BOX IS OFCI. COORDINATE FINAL LOCATION WITH AV VENDOR. INSTALL BACKBOX AT SWITCH HEIGHT.

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POWER NORTH  
PLAN

**E4.01**

IN ALL RESEARCH AND TEACHING LAB AREAS PROVIDE LABEL ON EVERY DEVICE AND/OR EQUIPMENT DISCONNECT TO INDICATE THE CIRCUIT THAT SERVES EACH DEVICE OR PIECE OF EQUIPMENT. ALL RECEPTACLE AND LIGHT SWITCH WALL PLATES SHALL INCLUDE PRINTED LABEL INDICATING ITS ASSOCIATED CIRCUIT. ALL DISCONNECTS OR WALL PLATES FOR HARD-WIRED CONNECTIONS SHALL INCLUDE LABEL INDICATING EQUIPMENT NAME, VOLTAGE, AND ASSOCIATED CIRCUIT.

**KEYNOTES**

P250 ELECTRIC WATER COOLER RECEPTACLE: CONCEAL WITHIN CABINET PER MANUFACTURER'S REQUIREMENTS.

P251 PROVIDE 120V CONNECTION TO POWER CONVERTER FOR HARDWIRED AUTOMATIC SENSOR-CONTROLLED PLUMBING FIXTURES IN RESTROOMS. HARDWIRE POWER FROM CONVERTER TO URINAL, WATER CLOSETS, AND LAVATORIES. MAKE ALL FINAL CONNECTIONS.

P902 PROVIDE DOUBLE GANG BOX WITH 1" C BACK TO NEAREST PANELBOARD FOR FUTURE USE. PROVIDE WITH PULLSTRING AND BLANK COVERPLATE.

COORDINATE WITH DUCT, AIR TERMINALS, AND LIGHT FIXTURES TO AVOID CONFLICTS WITH UNISTRUT STRUCTURE

COORDINATE WITH DUCT, AIR TERMINALS, AND LIGHT FIXTURES TO AVOID CONFLICTS WITH UNISTRUT STRUCTURE

COORDINATE BRACING WITH BUILDING STRUCTURE

COORDINATE BRACING WITH BUILDING STRUCTURE

UNISTRUT CHANNELS SUPPORTED FROM STRUCTURE. ASSEMBLY PROVIDED WITH POWDER COAT FINISH.

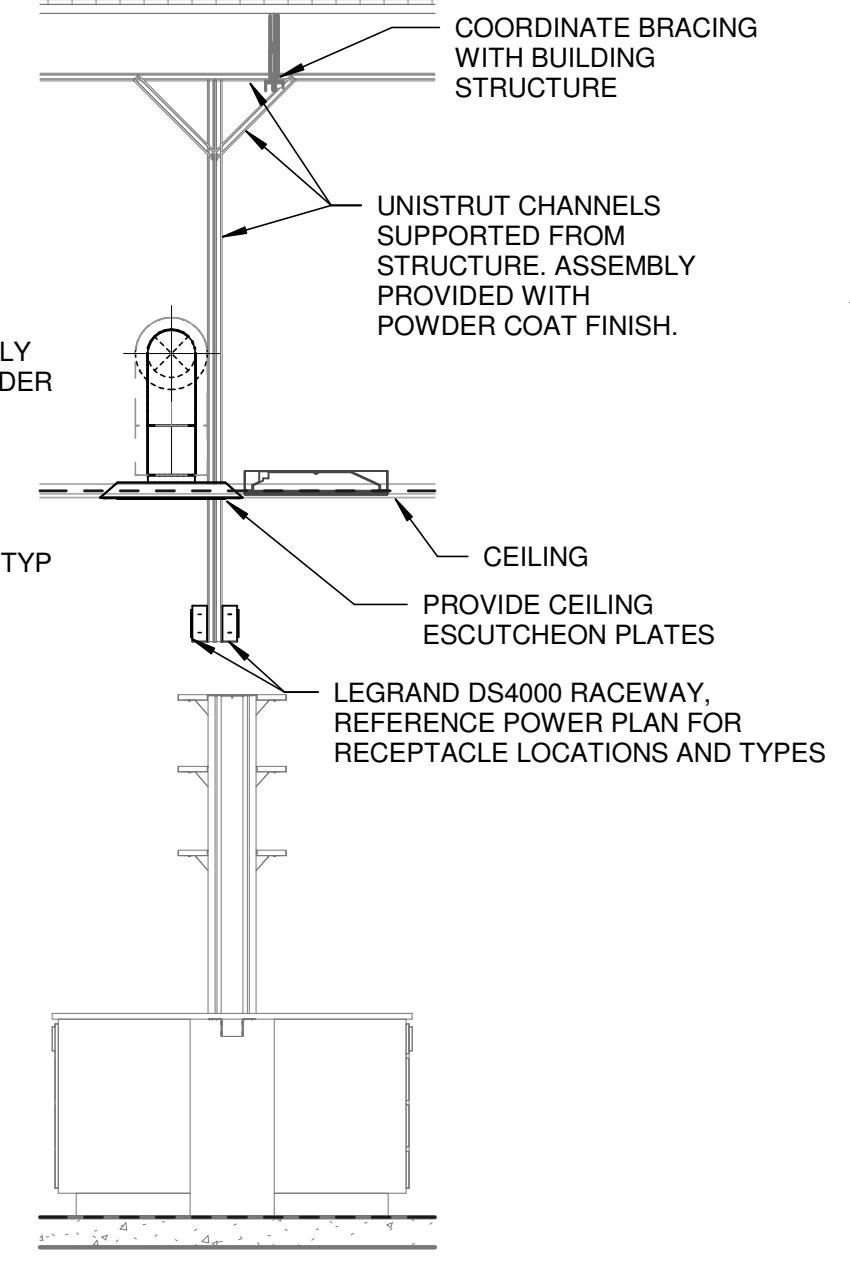
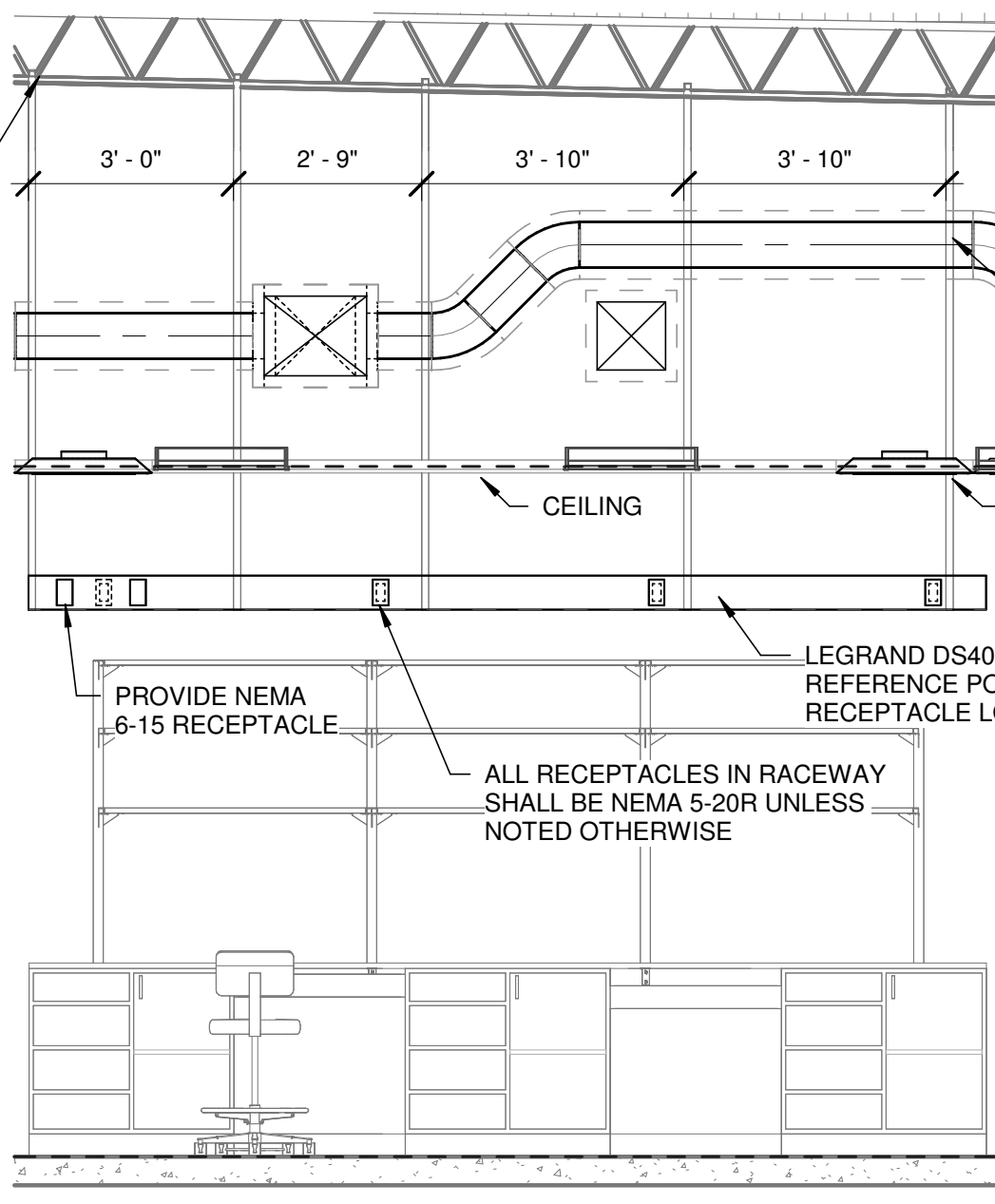
UNISTRUT CHANNELS SUPPORTED FROM STRUCTURE. ASSEMBLY PROVIDED WITH POWDER COAT FINISH.

PROVIDE CEILING ESCUTCHEON PLATES, TYP

PROVIDE CEILING ESCUTCHEON PLATES

LEGRAND DS4000 RACEWAY, REFERENCE POWER PLAN FOR RECEPTACLE LOCATIONS

LEGRAND DS4000 RACEWAY, REFERENCE POWER PLAN FOR RECEPTACLE LOCATIONS AND TYPES

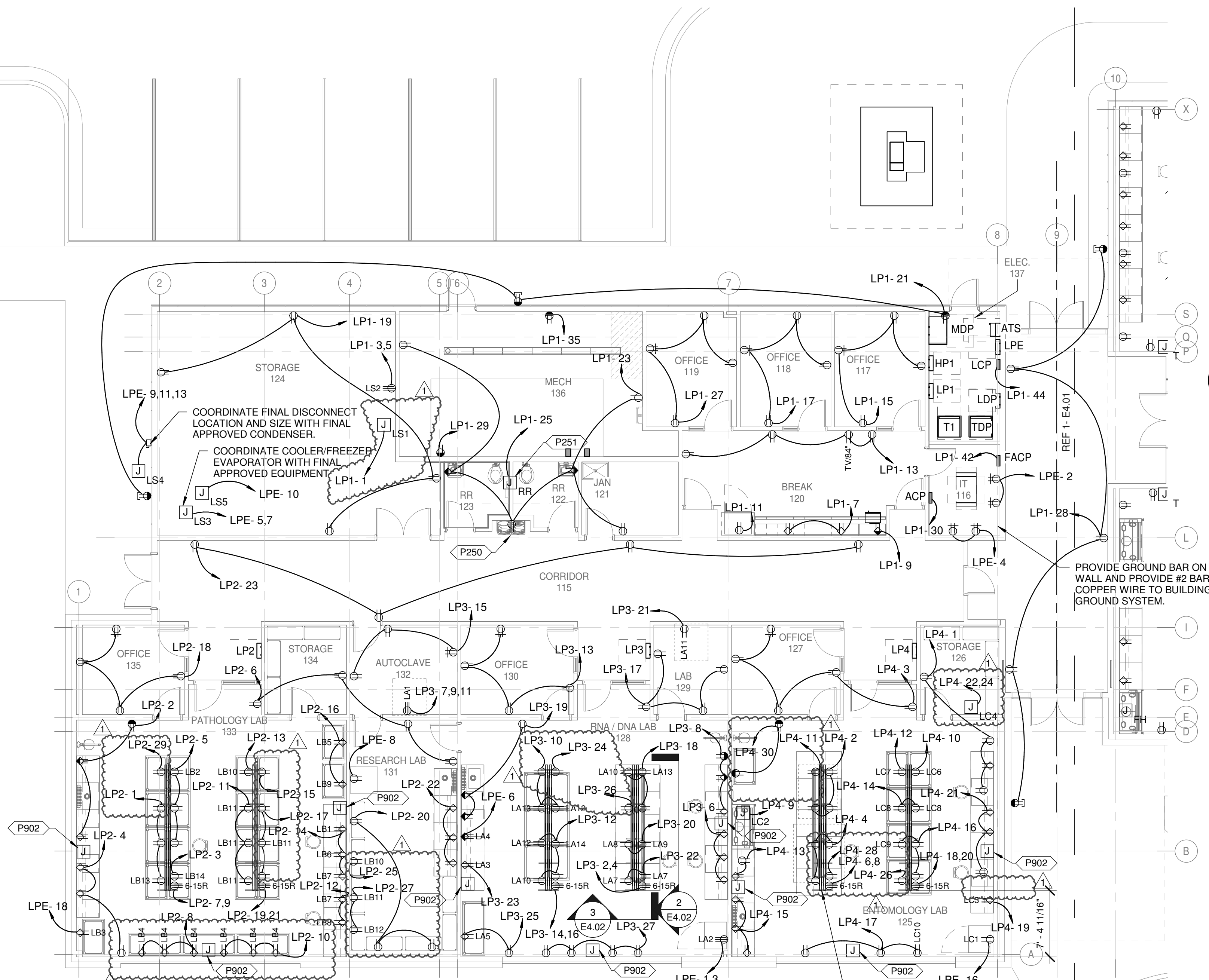


2 NORTH RACEWAY DETAIL  
3/8" = 1'-0"

3 EAST RACEWAY DETAIL  
3/8" = 1'-0"

LAB EQUIPMENT SCHEDULE

ITEM NUMBER	DESCRIPTION	MANUFACTURER	MODEL	VOLTAGE	POLES	kVA	TERMINATION
LA1	AUTOCCLAVE	HEIDOLPH	13-890-052	208 V	3	18.00 kVA	DIRECT CONNECTION
LA2	LAB FREEZER	PHCBI	MDF-DU702VH-PA	208 V	2	2.00 kVA	NEMA 6-15R
LA3	DESKTOP INCUBATOR	THOMAS SCIENTIFIC	1154J61	120 V	1	1.00 kVA	NEMA 5-20R
LA4	DESKTOP FREEZER	THOMAS SCIENTIFIC	1154J61	120 V	1	1.00 kVA	GFI NEMA 5-20R
LA5	PCR WORKSTATION	AIRCLEAN	AC6000HLF	120 V	1	0.18 kVA	NEMA 5-15R
LA7	THERMOCYCLER	APPLIED BIOSYSTEMS	A48141	120 V	1	0.70 kVA	NEMA 5-20R
LA8	REAL-TIME PCR SYSTEM	APPLIED BIOSYSTEMS	A43186	120 V	1	0.96 kVA	NEMA 5-20R
LA9	PLATE SPINNER	FISHERBRAND	14-955-300	120 V	1	0.18 kVA	NEMA 5-20R
LA10	MICROCENTRIFUGE	CORNING	CLS6770	120 V	1	0.18 kVA	NEMA 5-20R
LA11	BIO SAFETY CABINET	ESCO	LABCULTURE TYPE A2	120 V	1	1.20 kVA	NEMA 5-15R
LA12	MICROCENTRIFUGE	FISHERBRAND	13-100-675	120 V	1	0.18 kVA	NEMA 5-20R
LA13	VORTEX MIXER	FISHERBRAND	14-955-151	120 V	1	0.18 kVA	NEMA 5-20R
LA14	ANALYTIC BALANCE	COLE-PARMER	TB-800	120 V	1	0.18 kVA	NEMA 5-20R
LB1	SPORE PLATE READER	BIOSENSE	OCELLSCOPE	120 V	1	0.18 kVA	NEMA 5-15R
LB2	ORBITAL SHAKER	OHAUS	SHHD6850DG	120 V	1	0.08 kVA	NEMA 5-20R
LB3	CENTRIFUGE	FISHERBRAND	75-888-617	120 V	1	1.30 kVA	NEMA 5-15R
LB4	INCUBATOR	PARMER	INC-400G-50-120	120 V	1	0.30 kVA	NEMA 5-15R
LB5	DISSECTING MICROSCOPE (CAMERA)	ZEISS		120 V	1	0.18 kVA	NEMA 5-15R
LB6	DISSECTING MICROSCOPE (STEREO)	ZEISS		120 V	1	0.04 kVA	NEMA 5-15R
LB7	STANDARD MICROSCOPE	ZEISS	STEMI DRC	120 V	1	0.18 kVA	NEMA 5-15
LB8	COMPOUND MICROSCOPE	ZEISS	AxioObserver 3	120 V	1	0.44 kVA	NEMA 5-15R
LB9	LAMINAR FLOW HOOD	AIRCLEAN	AC6000HLF	120 V	1	0.18 kVA	NEMA 5-15R
LB10	MICROWAVE OVEN	PANASONIC	24406-39	120 V	1	1.00 kVA	NEMA 5-20R
LB11	HOT PLATE	CORNING	PC-220	120 V	1	0.31 kVA	NEMA 5-20R
LB12	ANALYTIC BALANCE	COLE-PARMER	TB-800	120 V	1	0.18 kVA	NEMA 5-20R
LB13	47MM VACUUM SYSTEM			120 V	1	0.07 kVA	NEMA 5-20R
LB14	FREEZE DRYER	HARVESTRIGHT	MEDIUM PHARMA	120 V	1	1.44 kVA	NEMA 5-20R
LC1	INSECT CHAMBER	CARON	7340-25-1	120 V	1	1.92 kVA	NEMA 5-20R
LC2	FUME HOOD	LABCONCO	3' PROTECTOR XL	120 V	1	1.20 kVA	DIRECT CONNECTION
LC3	MINI CUTTING MILL	LABFORCE	1173U48	120 V	1	1.00 kVA	NEMA 5-20R
LC4	PELLETIZER			208 V	2	3.00 kVA	DIRECT CONNECTION
LC6	PH SCALE	THERMO SCIENTIFIC	STARA2110	120 V	1	0.18 kVA	NEMA 5-20R
LC7	MICROWAVE OVEN	PANASONIC	24406-39	120 V	1	1.00 kVA	NEMA 5-20R
LC8	HOT PLATE	FISHERBRAND	ISOTEMP	120 V	1	0.40 kVA	NEMA 5-20R
LC9	PORTABLE BALANCE	METTLER TOLEDO	MA12001L	120 V	1	0.06 kVA	NEMA 5-20R
LC10	WEIGHING PLATFORM	ULINE	H-5837	120 V	1	0.03 kVA	NEMA 5-15R
LS1	ICE MACHINE	HOSHIZAKI	KM-350MAJ	120 V	1	1.09 kVA	DIRECT CONNECTION
LS2	GROWTH CHAMBER	BINDER	KBWF720-230V	208 V	2	2.70 kVA	NEMA 6-15R
LS3	WALK-IN EVAPORATOR			208 V	2	1.09 kVA	DIRECT CONNECTION
LS4	WALK-IN CONDENSER			208 V	3	4.00 kVA	DIRECT CONNECTION
LS5	WALK-IN DOOR HEATER/LIGHTS			120 V	1	0.50 kVA	DIRECT CONNECTION



FOR ALL NEMA 6-15 RECEPTACLES, CIRCUIT SHALL UTILIZE A MINIMUM OF #10W.

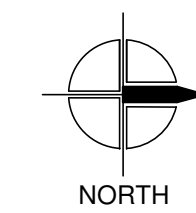
ALL ABOVE COUNTER RECEPTACLES AND DATA OUTLETS IN LAB AREAS SHALL BE INSTALLED IN LEGRAND ALDS4000 RACEWAY.

PROVIDE EACH ROW OF OUTLETS IN LEGRAND AL4000 SERIES RACEWAY MOUNTED TO STEEL CHANNEL SUSPENDED FROM ABOVE-CEILING STRUCTURE. REF 2- E4.02 AND REF 3- E4.02, TYPICAL OF (6) LABTABLE LOCATIONS

PROVIDE GROUND BAR ON WALL AND PROVIDE #2 BARE COPPER WIRE TO BUILDING GROUND SYSTEM.

11/8/2024 8:28:10 AM

1 POWER SOUTH PLAN  
1/8" = 1'-0"



Branch Panel: LP1

Location: ELEC. 137
Supply From: T1
Mounting: Surface
Enclosure: 1

Volts: 120/208 Wye
Phases: 3
Wires: 4

A.I.C. Rating: 14kA
Panel Rating: 400 A MCB

Notes:

Table with columns: CKT, Load Name, Trip, Poles, A, B, C, A, B, C, Poles, Trip, Load Name, CKT. Lists various equipment like LS1 ICE MACHINE, LS2 GROWTH CHAMBER, etc.

Panel Totals

Summary table for Panel LP1 showing Total Load (25.34 kVA), Total Amps (211 A), Total Conn. Load (73.65 kVA), and Total Design Current (320 A).

Notes:

Branch Panel: LP2

Location: CORRIDOR 115
Supply From: LDP
Mounting: Surface
Enclosure: 1

Volts: 120/208 Wye
Phases: 3
Wires: 4

A.I.C. Rating: 14kA
Panel Rating: 100 A MLO

Notes:

Table with columns: CKT, Load Name, Trip, Poles, A, B, C, A, B, C, Poles, Trip, Load Name, CKT. Lists equipment like LB13 VACUUM / OVERHEAD, LB14 FREEZE DRYER, etc.

Panel Totals

Summary table for Panel LP2 showing Total Load (6.81 kVA), Total Amps (58 A), Total Conn. Load (18.44 kVA), and Total Design Current (82 A).

Notes:

Branch Panel: LP3

Location: CORRIDOR 115
Supply From: LDP
Mounting: Surface
Enclosure: 1

Volts: 120/208 Wye
Phases: 3
Wires: 4

A.I.C. Rating: 14kA
Panel Rating: 225 A MLO

Notes:

Table with columns: CKT, Load Name, Trip, Poles, A, B, C, A, B, C, Poles, Trip, Load Name, CKT. Lists equipment like SPARE, LA1 AUTOCLAVE, RECEPTACLES OFFICE 130, etc.

Panel Totals

Summary table for Panel LP3 showing Total Load (11.66 kVA), Total Amps (100 A), Total Conn. Load (33.94 kVA), and Total Design Current (150 A).

Notes:

Branch Panel: LP4

Location: CORRIDOR 115
Supply From: LDP
Mounting: Surface
Enclosure: 1

Volts: 120/208 Wye
Phases: 3
Wires: 4

A.I.C. Rating: 14kA
Panel Rating: 225 A MLO

Notes:

Table with columns: CKT, Load Name, Trip, Poles, A, B, C, A, B, C, Poles, Trip, Load Name, CKT. Lists equipment like RECEPTACLES Room 125, 126, RECEPTACLES OFFICE 127, etc.

Panel Totals

Summary table for Panel LP4 showing Total Load (5.60 kVA), Total Amps (47 A), Total Conn. Load (17.21 kVA), and Total Design Current (75 A).

Notes:

PANELBOARD NOTES

- (1) INSTALL LOCKING DEVICE (LOCK-OFF FOR MAINTENANCE)
(2) INSTALL LOCKING DEVICE (LOCK-ON FOR CRITICAL LOAD)
(3) REFER TO SITE LIGHTING PLAN FOR WIRE SIZES.
(4) PROVIDE GFI CIRCUIT BREAKER OR INLINE GFI FOR PERSONNEL PROTECTION (5 mA).
(5) PROVIDE GFI CIRCUIT BREAKER OR INLINE GFI FOR EQUIPMENT PROTECTION (30 mA).
(6) PROVIDE U.L. LISTED OVERCURRENT DEVICE TO COORDINATE AND MAINTAIN MANUFACTURER'S SERIES RATED SYSTEM.
(7) EXISTING CIRCUIT TO REMAIN.
(8) EXISTING CIRCUIT BREAKER TO REMAIN. VERIFY CONDITION OF CIRCUIT BREAKER TO ENSURE THAT IT IS OPERATIONAL AND MEETS ALL U.L. RATINGS.
(9) TRACE EXISTING CIRCUIT, IDENTIFY LOAD AND PROVIDE TYPEWRITTEN PANELBOARD SCHEDULE AND PLACE ON INTERIOR OF PANELBOARD DOOR. IF CIRCUIT IS A "SPARE", REFER TO NOTE (8).



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MONTICELLO, AR

REVISIONS:

1 ADDENDUM 1 11/7/24

PROJECT NO. SCM-098
DATE: OCTOBER 22, 2024

PANEL SCHEDULES II

E8.02

11/8/2024 8:28:13 AM

Branch Panel: LPE													
Location: ELEC. 137				Volts: 120/208 Wye				A.I.C. Rating: 10kA					
Supply From: LDP				Phases: 3				Panel Rating: 125 A MLO					
Mounting: Surface				Wires: 4				Enclosure: 1					
Notes:													
CKT	Load Name	Trip	Poles	A	B	C	A	B	C	Poles	Trip	Load Name	CKT
1				1.00			0.72			1	20 A	RECEPTACLES IT 116	2
3	LA2 LAB FREEZER	20 A	2		1.00		0.72			1	20 A	RECEPTACLES IT 116	4
5						0.55			1.00	1	20 A	LA4 DESKTOP FREEZER	6
7	LS3 WALK-IN EVAPORATOR	20 A	2	0.55		0.55	0.18			1	20 A	FREEZER	8
9					1.33			0.50		1	20 A	LS5 WALK-IN DOOR HTR/LTS	10
11	LS4 WALK-IN CONDENSER	20 A	3			1.33			1.50	1	20 A	BATTERY CHARGER	12
13				1.33			1.50			1	20 A	BLOCK HEATER	14
15					0.00			1.92		1	20 A	LC1 INSECT CHAMBER	16
17	SPARE	20 A	2			0.00			1.30	1	20 A	LB3 CENTRIFUGE	18
19				0.00			0.00			1	20 A	SPARE	20
21	SPARE	20 A	2		0.00		0.00			1	20 A	SPARE	22
23						0.00			0.00	1	20 A	SPARE	24
25	SPARE	20 A	3	0.00			0.00			1	20 A	SPARE	26
27					0.00			0.00		1	20 A	SPARE	28
29	SPACE	--	1			--			0.00	1	20 A	SPARE	30
Panel Totals													
				PHASE A	PHASE B	PHASE C							
Total Load:				5.28 kVA	5.47 kVA	5.68 kVA							
Total Amps:				44 A	46 A	48 A							
Total Conn. Load:				16.43 kVA									
Total Design Current:				72 A									
Notes:													

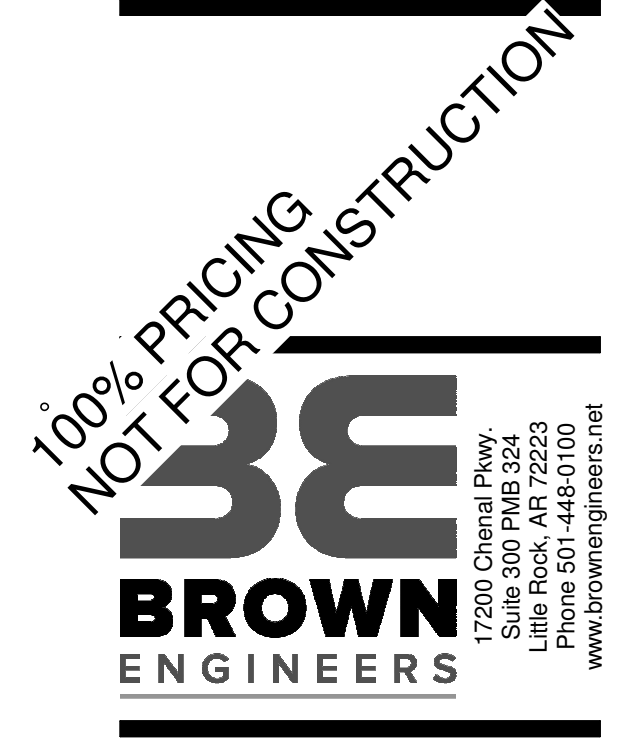
Branch Panel: LP5													
Location: STORAGE 111				Volts: 120/208 Wye				A.I.C. Rating: 14kA					
Supply From: LP1				Phases: 3				Panel Rating: 100 A MLO					
Mounting: Surface				Wires: 4				Enclosure: 1					
Notes:													
CKT	Load Name	Trip	Poles	A	B	C	A	B	C	Poles	Trip	Load Name	CKT
1	EV ROOM CONTROLLERS	20 A	1	0.35			0.72			1	20 A	RECEPTACLES CHEMISTRY LAB 110	2
3	RECEPTACLES CHEMISTRY LAB 112	20 A	1		0.72			0.00		1	20 A	LAB GAS CONTROLLER	4
5	FUME HOOD CHEMISTRY LAB 112	20 A	1			1.20			1.20	1	20 A	FUME HOOD CHEMISTRY LAB 110	6
7	RECEPTACLES CHEMISTRY LAB 112	20 A	1	0.54			0.54			1	20 A	RECEPTACLES CHEMISTRY LAB 110	8
9	RECEPTACLES CHEMISTRY LAB 112	20 A	1		0.54			0.54		1	20 A	RECEPTACLES CHEMISTRY LAB 110	10
11	RECEPTACLES CHEMISTRY LAB 112	20 A	1			0.72			0.54	1	20 A	RECEPTACLES CHEMISTRY LAB 110	12
13	RECEPTACLES CHEMISTRY LAB 112	20 A	1	0.54			0.54			1	20 A	RECEPTACLES CHEMISTRY LAB 110	14
15	RECEPTACLES CHEMISTRY LAB 112	20 A	1		0.54			0.54		1	20 A	RECEPTACLES CHEMISTRY LAB 110	16
17	RECEPTACLES CHEMISTRY LAB 112	20 A	1			0.54			0.72	1	20 A	RECEPTACLES CHEMISTRY LAB 110	18
19	FUME HOOD CHEMISTRY LAB 112	20 A	1	1.20			0.54			1	20 A	RECEPTACLES CHEMISTRY LAB 110	20
21	RECEPTACLES CHEMISTRY LAB 112	20 A	1		0.54			1.20		1	20 A	FUME HOOD CHEMISTRY LAB 110	22
23	RECEPTACLES STORAGE 111	20 A	1			0.72			0.90	1	20 A	RECEPTACLES VESTIBULE 106	24
25	VAVS	20 A	1	0.15			0.25			2	20 A	REF-02 DAMPER ACTUATOR	26
27	LAB GAS CONTROLLER	20 A	1		0.00			0.25		1	20 A	REF-02 DAMPER ACTUATOR	28
29	RECEPTACLES CHEMISTRY LAB 110	20 A	1			0.72			0.00	1	20 A	SPARE	30
31	RECEPTACLES CHEMISTRY LAB 112	20 A	1	0.72			0.00			1	20 A	SPARE	32
33	SPARE	20 A	1		0.00			0.00		1	20 A	SPARE	34
35	SPARE	20 A	1			0.00			0.00	1	20 A	SPARE	36
37	SPARE	20 A	1	0.00			0.00			1	20 A	SPARE	38
39	SPARE	20 A	1		0.00			0.00		1	20 A	SPARE	40
41	SPARE	20 A	1			0.00			0.00	1	20 A	SPARE	42
Panel Totals													
				PHASE A	PHASE B	PHASE C							
Total Load:				6.08 kVA	4.87 kVA	7.26 kVA							
Total Amps:				52 A	41 A	62 A							
Total Conn. Load:				18.21 kVA									
Total Design Current:				81 A									
Notes:													

Branch Panel: LP6													
Location: STORAGE 108				Volts: 120/208 Wye				A.I.C. Rating: 14kA					
Supply From: LP1				Phases: 3				Panel Rating: 225 A MLO					
Mounting: Surface				Wires: 4				Enclosure: 1					
Notes:													
CKT	Load Name	Trip	Poles	A	B	C	A	B	C	Poles	Trip	Load Name	CKT
1				3.06			0.72			1	20 A	RECEPTACLES BIOLOGY LAB 109	2
3	LP7	100 A	3		2.98			0.72		1	20 A	RECEPTACLES BIOLOGY LAB 109	4
5						3.59		0.72		1	20 A	RECEPTACLES BIOLOGY LAB 109	6
7	RECEPTACLES BIOLOGY LAB 107	20 A	1	0.72			0.72			1	20 A	RECEPTACLES BIOLOGY LAB 109	8
9	RECEPTACLES BIOLOGY LAB 107	20 A	1		0.72			0.72		1	20 A	RECEPTACLES BIOLOGY LAB 109	10
11	RECEPTACLES BIOLOGY LAB 107	20 A	1			0.72			0.72	1	20 A	RECEPTACLES BIOLOGY LAB 109	12
13	RECEPTACLES BIOLOGY LAB 107	20 A	1	0.72			0.72			1	20 A	RECEPTACLES BIOLOGY LAB 109	14
15	RECEPTACLES BIOLOGY LAB 107	20 A	1		0.72			0.72		1	20 A	RECEPTACLES BIOLOGY LAB 109	16
17	RECEPTACLES BIOLOGY LAB 107	20 A	1			0.72		0.72		1	20 A	RECEPTACLES BIOLOGY LAB 109	18
19	RECEPTACLES BIOLOGY LAB 107	20 A	1	0.72			0.72			1	20 A	RECEPTACLES BIOLOGY LAB 109	20
21	RECEPTACLES BIOLOGY LAB 107	20 A	1		0.72			0.72		1	20 A	RECEPTACLES BIOLOGY LAB 109	22
23	RECEPTACLES BIOLOGY LAB 107	20 A	1			0.72			0.72	1	20 A	RECEPTACLES STORAGE 108	24
25	RECEPTACLES BIOLOGY LAB 107	20 A	1	0.72			0.72			1	20 A	RECEPTACLES CORRIDOR 113	26
27	ROOFTOP RECEPTACLES	20 A	1		0.36			0.58		1	20 A	RESTROOM SENSORS	28
29	VAVS	20 A	1			0.15			1.08	1	20 A	RECEPTS JANITOR / RESTROOM (4)	30
31	EF-1	20 A	1	0.48			0.36			1	20 A	RECEPTACLES VESTIBULE 106	32
33	ICE MAKER STORAGE 108	20 A	1	1.09				0.25		1	20 A	EV ROOM CONTROLLERS	34
35	SPARE	20 A	1			0.00			0.54	1	20 A	RECEPTACLES BIOLOGY LAB 107	36
37	SPARE	20 A	1	0.00			0.54			1	20 A	RECEPTACLES BIOLOGY LAB 109	38
39	SPARE	20 A	1		0.00			0.06		1	20 A	LCP2	40
41	SPARE	20 A	1			0.00			0.00	1	20 A	SPARE	42
Panel Totals													
				PHASE A	PHASE B	PHASE C							
Total Load:				10.92 kVA	10.36 kVA	10.39 kVA							
Total Amps:				91 A	86 A	87 A							
Total Conn. Load:				31.66 kVA									
Total Design Current:				137 A									
Notes:													

Branch Panel: LP7													
Location: STORAGE / MECH 102				Volts: 120/208 Wye				A.I.C. Rating: 14kA					
Supply From: LP6				Phases: 3				Panel Rating: 100 A MLO					
Mounting: Surface				Wires: 4				Enclosure: 1					
Notes:													
CKT	Load Name	Trip	Poles	A	B	C	A	B	C	Poles	Trip	Load Name	CKT
1	RECEPTACLES Room 138, 102, 106	20 A	1	1.08			0.90			1	20 A	RECEPTACLES Room 101, 106	2
3	RECEPTACLES A/V 101A	20 A	1		0.54			0.72		1	20 A	RECEPTACLES CONFERENCE SPACE...	4
5	RECEPTACLES CONFERENCE SPACE...	20 A	1			0.72			0.18	1	20 A	PROJECTOR	6
7	AV RACK	20 A	1	0.18			0.18			1	20 A	AV RACK	8
9	ROOFTOP RECEPTACLE	20 A	1		0.18			1.00		1	20 A	MOTORIZED SHADES	10
11	MOTORIZED SHADES	20 A	1			0.75			1.40	1	20 A	LIGHTING CONFERENCE SPACE 101	12
13	RECEPTACLES CONFERENCE SPACE...	20 A	1	0.36			0.00			1	20 A	SPARE	14
15	RECEPTACLES CONFERENCE SPACE...	20 A	1		0.54			0.00		1	20 A	SPARE	16
17	RECEPTACLES CONFERENCE SPACE...	20 A	1			0.54			0.00	1	20 A	SPARE	18
19	RECEPTACLES CONFERENCE SPACE...	20 A	1	0.36			0.00			1	20 A	SPARE	20
21	SPARE	--	1		--			0.00		1	20 A	SPARE	22
23	SPARE	--	1			--			0.00	1	20 A	SPARE	24
25	SPARE	--	1	--			0.00			1	20 A	SPARE	26
27	SPARE	--	1			--		0.00		1	20 A	SPARE	28
29	SPACE	--	1			--			0.00	1	20 A	SPARE	30
Panel Totals													
				PHASE A	PHASE B	PHASE C							
Total Load:				3.06 kVA	2.98 kVA	3.59 kVA							
Total Amps:				26 A	25 A	30 A							
Total Conn. Load:				9.63 kVA									
Total Design Current:				42 A									
Notes:													

- ### PANELBOARD NOTES
- INSTALL LOCKING DEVICE (LOCK-OFF FOR MAINTENANCE)
  - INSTALL LOCKING DEVICE (LOCK-ON FOR CRITICAL LOAD).
  - REFER TO SITE LIGHTING PLAN FOR WIRE SIZES.
  - PROVIDE GFI CIRCUIT BREAKER OR INLINE GFI FOR PERSONNEL PROTECTION (5 mA).
  - PROVIDE GFI CIRCUIT BREAKER OR INLINE GFI FOR EQUIPMENT PROTECTION (30 mA).
  - PROVIDE U.L. LISTED OVERCURRENT DEVICE TO COORDINATE AND MAINTAIN MANUFACTURER'S SERIES RATED SYSTEM.
  - EXISTING CIRCUIT TO REMAIN.
  - EXISTING CIRCUIT BREAKER TO REMAIN. VERIFY CONDITION OF CIRCUIT BREAKER TO ENSURE THAT IT IS OPERATIONAL AND MEETS ALL U.L. RATINGS.
  - TRACE EXISTING CIRCUIT, IDENTIFY LOAD AND PROVIDE TYPEWRITTEN PANELBOARD SCHEDULE AND PLACE ON INTERIOR OF PANELBOARD DOOR. IF CIRCUIT IS A "SPARE", REFER TO NOTE (8).





**HVAC -- RTU DEDICATED OUTSIDE AIR UNIT SCHEDULE**

DESIGNATION		DESCRIPTION	MANUFACTURER	MODEL	AIRFLOW DATA	SUPPLY FAN		COOLING DATA				HEATING DATA			ELECTRICAL DATA				REMARKS	
TYPE	MARK				EXTERNAL STATIC PRESS.	TOTAL STATIC PRESS.	TOTAL COOLING	SENSIBLE COOLING @ 97°F	ENTERING	LEAVING	PRIMARY HEAT TYPE	ENTERING AIR	LEAVING AIR	VOLTAGE	PHASE	MCA	MOCP			
RTU	01	PACKAGED DX OUTDOOR AIR UNIT	GREENHECK	RV-75-701-2-E2	9,840 CFM	1.50 in-wg	2.35 in-wg	735,600 Btu/h	275,100 Btu/h	84.8 °F	78.0 °F	56.7 °F	56.4 °F	HOT WATER	13 °F	70 °F	480 V	3	132.5 A	150.0 A
RTU	02	PACKAGED DX OUTDOOR AIR UNIT	GREENHECK	RV-75-701-2-E2	9,925 CFM	1.75 in-wg	2.37 in-wg	739,700 Btu/h	276,700 Btu/h	84.8 °F	78.0 °F	56.8 °F	56.5 °F	HOT WATER	13 °F	70 °F	480 V	3	132.5 A	150.0 A

**HVAC -- RTU HOT WATER COIL SCHEDULE**

DESIGNATION		MANUFACTURER	MODEL	HEATING COIL PERFORMANCE				NUMBER OF ROWS	HW VALVE CV
TYPE	MARK			AIR FLOW	WATER FLOW	ENTERING TEMP F°	LEAVING TEMP F°		
RTU-HWC	01	GREENHECK	RV-75-701-2-E2	13.0 °F	70.0 °F	12.30 FT	68 GPM	2	2.52
RTU-HWC	02	GREENHECK	RV-75-701-2-E2	13.0 °F	70.0 °F	13.00 FT	70 GPM	2	2.32

**RTU (DOAS) NOTES, PROVIDE EACH WITH THE FOLLOWING:**

- VARIABLE CAPACITY DX COOLING, HOT GAS REHEAT
- HOT WATER HEATING COIL, FLUID TYPE = WATER/PROPYLENE GLYCOL 70%/30%. REFER TO RTU HOT WATER COIL SCHEDULE.
- INTEGRAL DISCONNECT
- FIELD POWERED CONVENIENCE OUTLET
- INSULATED DOUBLE WALL PANELS
- STAINLESS STEEL DRAIN PAN
- 18" HEIGHT INSULATED SEISMIC-RATED ROOF CURB WITH VIBRATION ISOLATION RAILS EQUAL TO CURB TECHNOLOGIES MODEL VIR 1.
- DOWNFLOW SUPPLY AND RETURN.
- SMOKE DETECTORS ON SUPPLY

**HVAC -- RTU MIXED AIR - PACKAGED SCHEDULE**

DESIGNATION		DESCRIPTION	MANUFACTURER	MODEL	AIRFLOWS		SUPPLY FAN		(QTY) @ HP	COOLING DATA		HEATING DATA		ELECTRICAL DATA				REMARKS				
TYPE	MARK				SUPPLY AIR	OUTSIDE AIR (MINIMUM)	EXTERNAL STATIC PRESS.	TOTAL STATIC PRESS.		NET TOTAL COOLING	NET SENSIBLE COOLING	ENTERING	LEAVING	TYPE	INPUT	OUTPUT	VOLTAGE		PHASE	MCA	MOCP	
RTU	03	ROOFTOP DX AIR HANDLER	GREENHECK	RV-25-12.5I-J-G2	3,850 CFM	1,030 CFM	1.50 in-wg	3.13 in-wg	1 @ 5	141,900 Btu/h	104,200 Btu/h	81.0 °F	67.0 °F	55.0 °F	55.0 °F	GAS	300,000 Btu/h	243,000 Btu/h	480 V	3	46.9 A	60 A
RTU	04	ROOFTOP DX AIR HANDLER	GREENHECK	RV-25-15I-J-G2	4,750 CFM	1,020 CFM	1.50 in-wg	3.63 in-wg	1 @ 5	185,900 Btu/h	131,700 Btu/h	80.0 °F	66.0 °F	53.0 °F	53.0 °F	GAS	300,000 Btu/h	243,000 Btu/h	480 V	3	50.1 A	60 A

**RTU (MIXED AIR) NOTES, PROVIDE WITH THE FOLLOWING:**

- VARIABLE CAPACITY DX COOLING WITH MODULATING HOT GAS REHEAT
- GAS HEAT WITH STAINLESS STEEL HEAT EXCHANGER
- INTEGRAL DISCONNECT
- FIELD POWERED CONVENIENCE OUTLET
- INSULATED DOUBLE WALL PANELS
- STAINLESS STEEL DRAIN PAN
- 18" HEIGHT SEISMIC-RATED ROOF CURB WITH VIBRATION ISOLATION RAILS EQUAL TO CURB TECHNOLOGIES, MODEL VIR 1.
- DOWNFLOW SUPPLY AND RETURN
- SMOKE DETECTORS ON SUPPLY AND RETURN
- LOW AMBIENT COOLING ON RTU-04

**HVAC -- ROOFTOP FUME EXHAUST FAN SCHEDULE**

DESIGNATION		MANUFACTURER	MODEL	EXHAUST AIR CFM	EXTERNAL STATIC PRESSURE	ELECTRIC MOTOR DATA				REMARKS
TYPE	MARK					VOLTAGE	PHASE	DRIVE	HP	
REF	01	GREENHECK	VEKTOR-MD-22-9-100-LV-HPW	9,840 CFM	1.65 in-wg	480 V	3	BELT	7.5	1725
REF	02	GREENHECK	VEKTOR-MD-22-9-100-LV-HPW	9,925 CFM	1.65 in-wg	480 V	3	BELT	7.5	1725

**ROOFTOP LAB EXHAUST FAN NOTES:**

PROVIDE EXHAUST FAN WITH THE FOLLOWING:

- BYPASS AIR PLENUM - DOUBLE WALL, 316 SS
- SIDE EXHAUST INTAKE COATED WITH LABCOAT, RAL7023, ENTIRE UNIT
- SWITCH - NEMA-3R, TOGGLE, FOR INDOOR OR OUTDOOR USE, MOUNTED AND WIRED
- UL/CUL-705 - "POWER VENTILATORS" LISTED
- SHAFT MATERIAL - TURNED AND POLISHED STEEL WITH PROTECTIVE COATING
- FAN PANEL MATERIAL - COATED STEEL
- ACOUSTICAL BYPASS DAMPER - HCD-130-LE, GALVANIZED, MILL FINISH, 10 IN. X 10 IN., QTY: 2
- BYPASS DAMPER ACT. - ELECTRIC, MODULATING, W/O TRANSFORMER, 24 VAC, MODEL: NFB24-SR-S, QTY: 2
- ISOLATION DAMPER - HCD-130-LE, GALVANEAL, COATED, 34 IN. X 32 IN., PARALLEL BLADES, MOUNTED IN BAP, ONE PER FAN
- ISOLATION DAMPER ACT. - ELECTRIC, 24 VAC, 2 POS., SR, W/END SWITCH, W/TRANSFORMER, MODEL: AFBUP-S, QTY: 2
- SURE-AIRE FLOW STATION (NO ELECTRONICS), QTY: 2
- FACTORY VIBRATION TEST, 0.10 IN/SEC, PEAK, FILTER-IN AS MEASURED AT THE FAN RPM
- EXTENDED LUBE LINES - BRAIDED STAINLESS
- MOTOR COVER - WITH HINGED REMOVABLE ACCESS PANEL
- WIND SPEED LEVEL 125 MPH WITHOUT GUY WIRES
- STANDARD WEATHERHOOD OVER BYPASS DAMPER WITH INLET SCREEN
- ACOUSTICAL NOZZLE.

**AMBIENT DESIGN CONDITIONS:**

HEATING: 13.0°F DB (5-YEAR RETURN PERIOD OF EXTREME TEMPERATURE)  
COOLING: 98.4°F DB (0.4%)/ 77.4°F WB (MCWB)

**INDOOR DESIGN CONDITIONS:**

**LAB/100% OA ZONES**

TEMPERATURE/RELATIVE HUMIDITY  
SUMMER: 73°F +/-2°F 50% +/- 5% RH  
WINTER: 70°F +/-2°F 30%

**ADMINISTRATIVE AREAS/OFFICES/CONFERENCE**

OCCUPIED TEMPERATURE/RELATIVE HUMIDITY  
SUMMER: 75°F +/-2°F  
WINTER: 70°F +/-2°F

UNOCCUPIED TEMPERATURE/RELATIVE HUMIDITY  
SUMMER: 78°F +/-2°F  
WINTER: 68°F +/-2°F

**HVAC -- BOILER SCHEDULE**

DESIGNATION		Manufacturer	Model	Description	INPUT BTUH (EACH BOILER)	OUTPUT BTUH (EACH BOILER)	ELECTRICAL REQUIREMENTS	
Type	Mark				VOLTAGE	PHASE		
B	1	Raypak	XVERS H1007	Xvers KOR Type H Boiler, 1007-4007	999,000 Btu/h	952,000 Btu/h	480 V	3
B	2	Raypak	XVERS H1007	Xvers KOR Type H Boiler, 1007-4007	999,000 Btu/h	952,000 Btu/h	480 V	3
B	3	Raypak	XVERS H1007	Xvers KOR Type H Boiler, 1007-4007	999,000 Btu/h	952,000 Btu/h	480 V	3

**BOILER SCHEDULE NOTES:**

- PROVIDE THREE (3) GAS-FIRED CONDENSING BOILERS, WITH MAX OF TWO IN OPERATION AT PEAK LOAD FOR N+1 REDUNDANCY.
- BOILERS SHALL BE UTILIZED IN A PRIMARY / SECONDARY HEATING WATER SYSTEM.
- HEATING WATER SUPPLY AND RETURN DESIGN TEMPERATURE SHALL BE AT 130/100°F.
- THE BOILER AND HEATING HOT WATER PUMP SEQUENCES OF OPERATION SHALL ALTERNATE THE LEAD PUMPS AND LEAD BOILER SO THAT ALL EQUIPMENT WILL HAVE SIMILAR RUN TIMES.
- PROVIDE BOILER RATED AND TESTED FOR 160 PSI MAX.
- PROVIDE EACH BOILER WITH MANUFACTURER RECOMMENDED INLET SUCTION DIFFUSER.
- PROVIDE EACH BOILER WITH MANUFACTURER RECOMMENDED SS FLUE EXHAUST VENT TERMINATION.
- REFER TO DETAILS FOR FURTHER REQUIREMENTS.

**HVAC -- PUMP SCHEDULE**

DESIGNATION	MANUFACTURER	MODEL	MOTOR HORSEPOWER	NOMINAL FLOW	NOMINAL TOTAL HEAD	VOLTAGE	PHASE	POWER
BP	1	TACO	VR15M-SF	0.6	65 GPM	0.85 ftH2O	120 V	1 0.50 kVA
BP	2	TACO	VR15M-SF	0.6	65 GPM	0.85 ftH2O	120 V	1 0.50 kVA
BP	3	TACO	VR15M-SF	0.6	65 GPM	0.85 ftH2O	120 V	1 0.50 kVA
HWP	1	BELL & GOSSETT	BG-E1510-2BD-SS-213T-S	7.5	215 GPM	70.00 ftH2O	480 V	3 9.15 kVA
HWP	2	BELL & GOSSETT	BG-E1510-2BD-SS-213T-S	7.5	215 GPM	70.00 ftH2O	480 V	3 9.15 kVA

**PUMP SCHEDULE NOTES:**

- PROVIDE WITH WALL-MOUNTED VFD AND SUCTION DIFFUSER TO MATCH PUMP INLET SIZE. REFER TO PUMP CONTROLS AND DETAIL.
- PROVIDE BOILER CIRCULATOR PUMPS, BP, AS STAINLESS STEEL.
- THE BOILER AND HEATING HOT WATER PUMP SEQUENCES OF OPERATION SHALL ALTERNATE THE LEAD PUMPS AND LEAD BOILER SO THAT ALL EQUIPMENT WILL HAVE SIMILAR RUN TIMES.
- THE PRIMARY BOILER PUMPS (BP) SHALL BE DEDICATED TO EACH BOILER WITH THE SECONDARY HEATING WATER PUMPS (HWP) HEADERED FOR REDUNDANCY.

**REVISIONS:**

1 ADDENDUM 1 11/7/24

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**HVAC CONTROLS GENERAL NOTES:**

CONTRACTOR SHALL FURNISH AND INSTALL BUILDING AUTOMATION SYSTEM (BAS) AS FOLLOWS:

- WEB ENABLED NATIVE BACNET BUILDING CONTROLLER AND EQUIPMENT CONTROLLERS CAPABLE OF ALL HVAC SYSTEMS INTEGRATION AND MONITORING AS SHOWN. REFER TO SPECIFICATIONS.
- GENERAL CONTRACTOR SHALL PROVIDE ALLOWANCE FOR INTEGRATION OF BUILDING CONTROLLER INTO EXISTING SEIMENS CAMPUS FRONT END (BY POWERS OF ARKANSAS).

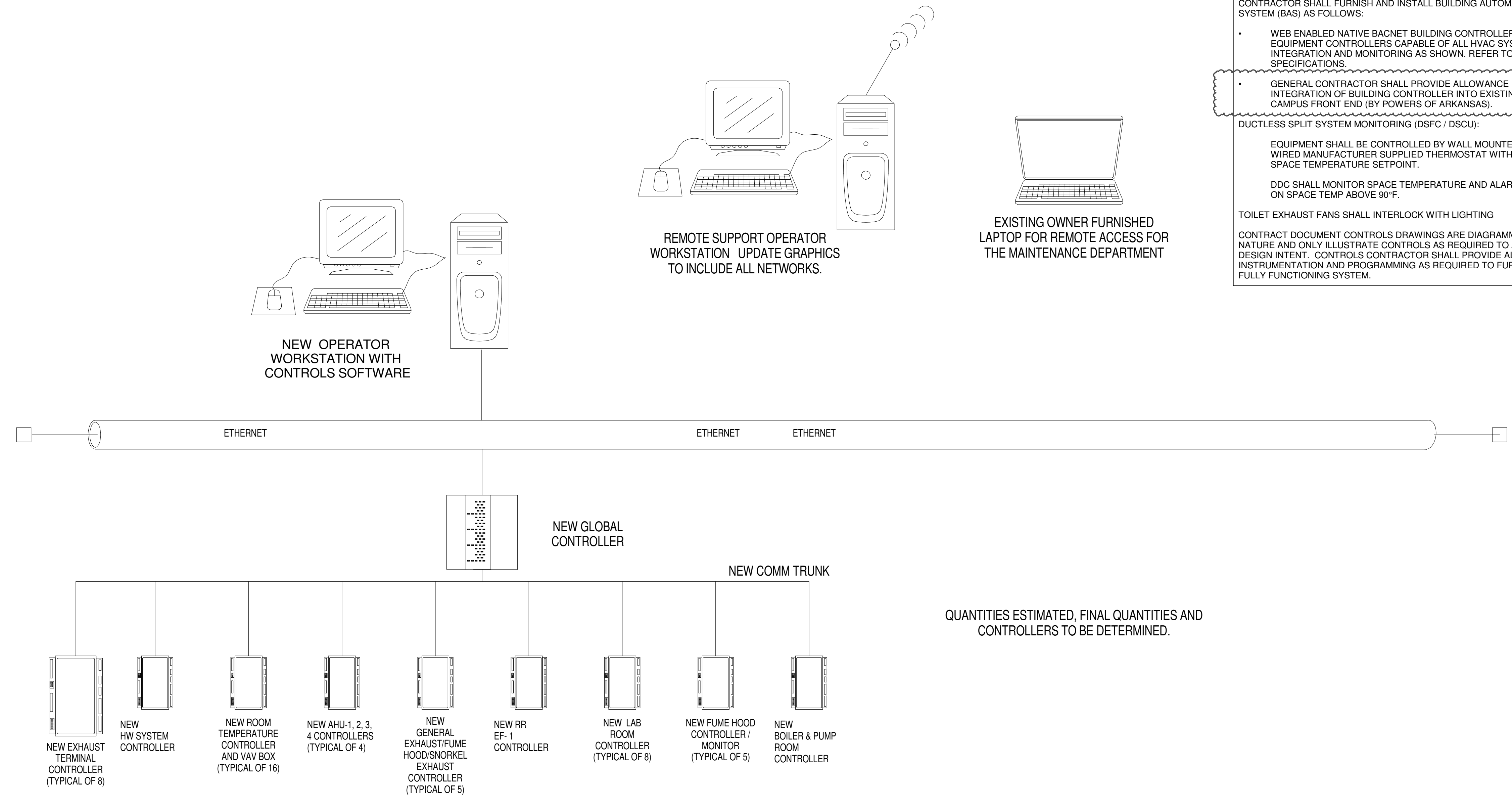
DUCTLESS SPLIT SYSTEM MONITORING (DSFC / DSCU):

EQUIPMENT SHALL BE CONTROLLED BY WALL MOUNTED, HARD-WIRED MANUFACTURER SUPPLIED THERMOSTAT WITH 78 DEG SPACE TEMPERATURE SETPOINT.

DDC SHALL MONITOR SPACE TEMPERATURE AND ALARM ON SPACE TEMP ABOVE 90°F.

TOILET EXHAUST FANS SHALL INTERLOCK WITH LIGHTING

CONTRACT DOCUMENT CONTROLS DRAWINGS ARE DIAGRAMMATIC IN NATURE AND ONLY ILLUSTRATE CONTROLS AS REQUIRED TO ACHIEVE DESIGN INTENT. CONTROLS CONTRACTOR SHALL PROVIDE ALL INSTRUMENTATION AND PROGRAMMING AS REQUIRED TO FURNISH A FULLY FUNCTIONING SYSTEM.



**1 UAM FOREST HEALTH RESEARCH SYSTEM ARCHITECTURE**  
NTS

ARKANSAS FOREST HEALTH  
RESEARCH CENTER  
UNIVERSITY OF ARKANSAS AT MONTICELLO  
MONTICELLO, AR

REVISIONS:

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CONTROLS I -  
SYSTEM  
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