



ADDENDUM NO. 2

FROM: Barganier Davis Sims Architects Associated
624 South McDonough Street
Montgomery, Alabama 36104

TO: Plan Holders

RE: Goodwill Hall – Renovation & Band Rehearsal Hall Addition
For Auburn University
AU Project No: 15-255
ABC Job No: 2016 – 111

GENERAL

1. Attached are notes from the pre-construction conference held July 17, 2017 at Auburn Facilities, and shall be included as part of this addendum.

CHANGES TO SPECIFICATIONS:

1. Refer to advertisement for bid and addendum No.1. The bid date shall be revised to August 1, 2017. Time and location shall remain unchanged.
2. Refer to SECTION 012300 – ALTERNATES. Refer to 2.1, Schedule of Alternates. For Alternate No. 2, please note that two (2) of the clerestory windows on the east wall are eliminated as part of this alternate.
3. Refer to SECTION 01270 UNIT PRICE SCHEDULE. Delete UNIT PRICE SCHEDULE (page 2 of 2) and insert attached Unit Price Schedule on AU Form C-3C. Note: Unit Price Schedule to be attached to the proposal form.

4. Refer to SECTION 015000 – TEMPORARY FACILITIES AND CONTROLS
 - a. Under paragraph 1.3C Electric Power Service: Remove the word NOT.
 - b. Under paragraph 3.4E Site Enclosure Fence: Delete the 48" high orange fence. See Civil Drawings for fencing.
5. Refer to the INDEX TO SPECIFICATIONS
 - a. Under DIVISION 4 – MASONRY change Section 042000 to Section 04810.
6. Refer to SECTION 04810 – UNIT MASONRY ASSEMBLIES
 - a. Under 2.6 MORTAR AND GROUT MATERIALS and paragraph C. Change bag Allowance from \$13.00 a bag to \$15.00 a bag. TYPE N Mortar to be used for face brick.
7. Refer to SECTION 052100 STEEL JOIST FRAMING
 - a. Refer to paragraph 2.3 K-SERIES STEEL JOISTS and change to LH STEEL JOISTS.
8. Refer to SECTION 054000 COLD FORMED METAL FRAMING
 - a. Under paragraph 2.4 EXTERIOR NON-LOAD BEARING WALL FRAMING and note that these studs and tracks are to be 16 ga. typical.
9. Refer to SECTION 074113- PREFORMED ROOFING – Delete this section in its entirety.
10. Refer to SECTION 055000 METAL FABRICATIONS
 - a. Under 2.7 MISCELLANEOUS FRAMING AND SUPPORTS. Delete paragraph D. In its entirety. No aluminum ladder required.
11. Refer to SECTION 064023 INTERIOR ARCHITECTURAL WOODWORK
 - a. Under PART 2 PRODUCTS add the following:
 1. It will be acceptable to use either custom millwork or manufactured casework on this project.
Approved manufacturers are as follows:
 - a. Columbus Cabinet Company
 - b. Case Systems
 - c. Stevens Industries, Inc.
 - d. LSI Corporation of America
 - e. TMI Systems Corporation
12. Refer to SECTION 07533 THERMOPLASTIC SINGLE-PLY MEMBRANE ROOFING
 - a. Refer to PART 2 PRODUCTS and 2.1 MANUFACTURERS and paragraph B.
 1. Delete Sarnafil Roofing System.
 2. Add GAF as an approved manufacturer.
 3. Add Versico Roofing Systems as an approved manufacturer.

13. Refer to SECTION 078123 INTUMESCENT FIREPROOFING. Delete reference to "Alpha Omicron Pi New Chapter House" at the top of the spec. sheet.
14. Refer to SECTION 095316 CURVED PROFILE SUSPENSION CLOUDS, paragraph 2.1.A. "Curvalon" system as manufactured by Rulon International shall be approved as an equal.
15. Refer to SECTION 098400 FABRIC WRAPPED ACOUSTICAL PANELS, paragraph 1.8.1. "Accutrack Systems, LLC shall be added as an approved manufacturer.
16. Refer to SECTION 098400 FABRIC WRAPPED ACOUSTICAL PANELS
 - a. Under PART 2 – PRODUCTS and 1.9 MANUFACTURED UNITS change 1.9.6 to read as follows: Color: To be selected by architect from manufacturer full range of standard colors.
17. Refer to SECTION 102800 – TOILET AND BATH ACCESSORIES, paragraph 2.2.A.6. Delete this item. No hand dryers are required for this project.
18. Refer to SECTION 105300 ALUMINUM WALKWAY COVER, 3.1.B. Delete item 3.1.B in its entirety.
19. Refer to SECTION 124941 ROLLER SHADES, paragraph 2.1.A. Draper, Inc. shall be added to the list of approved manufacturers.
20. Refer to SECTIONS 210100, 210529, 221113 and 230910. Delete in its entirety.
21. Refer to SECTION 211100 – FIRE PROTECTION SYSTEMS. Delete in its entirety and replace with attached Section 211100.
22. Refer to DIVISION 22. Delete in its entirety and replace with attached Division 22.
23. Refer to DIVISION 23. Delete in its entirety and replaced with attached Division 23.

CHANGES TO DRAWINGS:

1. Refer to Drawing A1.0, General Note No.1. Revise note to read, "See Bollard detail on C7.0."
2. Refer to Drawing A1.0. Delete note in uniform storage 009 which reads "Alternate = 4" metal stud wall w/ 5/8" gypsum board on each side extend to structure above (this wall only)."
3. Refer to attached Drawing A1.0. See revised Finish Schedule on this sheet.

4. Refer to Drawing A1.0, Finish Type 6 on Finish Schedule. Finish for ceiling should be revised to read, "Exposed structure painted above clouds, except that sound boards are prefinished black. Suspended clouds are prefinished.
5. Refer to Drawing A1.0, Finish Schedule. Revise ceiling finish in electrical room 002 from lay-in ceiling to painted gypsum board.
6. Refer to Drawing A1.0. Delete outside grades indicated on north side of building. Refer to civil drawings for finish grade elevations.
7. Refer to Drawing A1.1. Revise note reading "Existing Relocated Transformer", to read "New Transformer".
8. Refer to Drawing A1.1. Contractor to remove and replace doors 105A (added) to mechanical room in existing building doors to be a pair of hollow metal, 3' x 7' galvanized, painted. Reuse and repaint existing frame. Hardware schedule to follow.
9. Refer to Drawing A2.2 Add (2) downspouts and boots on drawing 2/A2.2.
10. Refer to Drawings A2.1, A2.3. See added overflow scuppers. Also, detail 5/A4.1.
11. Refer to Drawings A2.1, A2.2 and A2.3. All masonry control joints indicated shall be 3/4" wide, minimum. See added control joints on these drawing.
12. Refer to Drawing A5.5 for revision to detail 1/A5.5.
13. Refer to Drawing A6.1, toilet accessory index. Items 1, 2 and 3 are owner furnished, owner installed. Spec. of actual accessory is for contractor information only.
14. Refer to Drawing A6.2. There are (4) return air openings indicated (4 locations) in the corners of the Rehearsal Room. See 1 and 2/A6.2. At the location of these return air openings, the Doweled Wood Panel Grille shall be removable for access to the return air grille.
15. Refer to Drawing A6.6. The Vita-Vibe Rail Systems indicated are "Aluminum fixed position sit up bars", model "SB". For each of the two rails (one high and one low) indicated as 16' long, each shall be composed of 3-50" Bars and 1-34" bar for a total of 184" long each. For each of the two rails (one high and one low) indicated as 12' long, each shall be composed of one 50" rail and one 34" rail for a total of 84". Provide bar, mounting brackets and mounting hardware for a complete installation.
16. Refer to attached Drawing A6.9. This drawing shall be included in the construction documents.

17. Refer to Drawing A7.0. Revise ceiling height from 9'-0" to 8'-0" in men's restroom 006, women's restroom 007, janitor 005, vestibule 001 and electrical 002.
18. Refer to Drawing A7.1. The ceiling material between the suspended clouds is exposed sound acoustic board in lieu of what appears to be rendered as gypsum board. Sound boards are factory finished black matte finish. All other ceiling components above the clouds including structure, ductwork, conduits, etc. shall be painted matt black.
19. Refer to Drawing 2/A3.1 and 1/A6.3. Projector screen indicated will be located on the east wall instead of the west wall. See Electrical requirements on drawing E1.2. Projection Screens are (NIC) not in contract.
20. Refer to Drawing AR1.0. Delete note "3" in existing foyer 114. Existing floor shall remain.
21. Refer to attached Drawings AR1.0, AR3.0, AR4.0, AR5.0 and AR6.0 for minor revisions.
22. Refer to Drawing AS1.1, Egress Plan. The temporary exitway indicated shall extend a minimum of 25' to the south of southern face of the new addition.
23. Refer to Drawing C2.0, Surface Demolition Plan. The temporary sidewalk indicated shall be removed prior of project completion.
24. Refer to Drawing C3.0. Eliminate the new "post and chain" indicated along the sidewalk on the south and east side.
25. Refer to Drawing E0.1. See revised Lighting Fixture Schedule and Lighting Controls Detail.
26. Refer to Drawing Sheets E1.0, E1.1, E1.2, E2.2, E3.1 and E5.0 for revisions as indicated on the drawings.
27. Refer to Drawing Sheets FR3.0, for revision as indicated on the drawing.
28. Refer to Drawing Sheets M1.0, M2.1 and M2.2, for revisions as indicated on the drawings.
29. Refer to Drawing Sheets P0.1 and P2.1, for revisions as indicated on the drawings.
30. Refer to Drawing M0.2, Electric Steam Humidifier Schedule. Armstrong Humidifiers shall be listed as an approved manufacturer.

END OF ADDENDUM

STATED ALLOWANCES AND UNIT PRICES
Attachment to ABC Form C-3
Proposal Form

STATED ALLOWANCE AND UNIT PRICES

The following items of work are anticipated during construction of this contract; however the exact quantity of each work item may not be determinable prior to bidding. The Contractor, shall therefore, include in his Lump Sum Base and / or Alternates Bid (as applicable), an allowance for the following items in the quantities indicated: Allowance Unit Prices include all charges for labor, materials and equipment, shoring, layout, supervision (field and home office), general expenses, taxes, insurances, overhead and profit, but not limited to, for accomplishment of the Allowance item(s). Where quantities of same items of work are defined and are quantified in the bid documents, the allowance quantities indicated hereinafter shall be in addition to those which are indicated. (Example: If the site grading plan indicates new and existing grades, the bidder shall compute the quantity of earthwork required and include that quantity of work in the bid the same as if no “allowance quantity were specified. If an additional allowance quantity of earthwork is stipulated, that stipulated allowance quantity of work shall also be included in addition to the quantity computed from the bidders earthwork “takeoff”).

The following Unit Prices Quoted are for increases or decreases in the above quantities included in the Lump Sum Base and/or Alternate Bids. These Unit Prices include all charges for labor, materials and equipment, fee, layout, supervision (field and home office), general expenses, taxes, insurances, overhead and profit, but not limited to, for accomplishment of the Unit Price item(s).

Clarification Note: The Unit Prices quoted by the Contractor shall apply to increases (additive change orders) and to decreases (deductive change orders). This requirement shall supplement the requirements of the General Conditions, and Instructions to Bidders. Changes in the contract amount which are computed using the Stated Allowances and Unit Prices shall be figured at the same unit price whether additive or deductive.

<u>ITEM</u>	<u>ALLOWANCE QUANTITY</u>	<u>ALLOWANCE UNIT PRICE</u>	<u>TOTAL</u>
Excavation and Haul-Off of Unsuitable Soils	20 Cubic Yards	\$ _____ Per CY	
Replacement with Crushed Stone	10 Tons	\$ _____ Per TN	
Replacement with Offsite Suitable Material	20 Cubic Yards	\$ _____ Per CY	

<u>ITEM</u>	<u>ALLOWANCE QUANTITY</u>	<u>ALLOWANCE UNIT PRICE</u>	<u>TOTAL</u>
Surge Material (ALDOT #1 Stone)	10 Tons	\$ _____ Per Ton	
Installation of Stabilization Fabric	10 Square Yards	\$ _____ Per SY	
Tree protection fencing	10 Linear Feet	\$ _____ Per LF	
Silt fencing	10 Linear Feet	\$ _____ Per LF	
Dandy sack inlet protection	1 Each	\$ _____ Per EA	
Silt saver inlet protection	1 Each	\$ _____ Per EA	
Straw Wattle	10 Linear Feet	\$ _____ Per LF	
Gravel Sock	10 Linear Feet	\$ _____ Per LF	
AU Standard Sidewalk (6" concrete with Ochre color including base material)	5 Square Yards	\$ _____ Per SY	
Concrete Paving (6" thick with base and reinforcing per detail)	5 Square Yards	\$ _____ Per SY	
AU Standard Post & Chain	10 Linear Feet	\$ _____ Per LF	
24" Curb and Gutter	10 Linear Feet	\$ _____ Per LF	
6" Direct Buried (Pre-Insulated) Chilled Water Piping		\$ _____ Per 20' Length	
6" Direct Buried Chilled Water Piping 22.5 Degree Elbow	1 Each	\$ _____ Per Elbow	
6" Direct Buried Chilled Water Piping 45 Degree Elbow	1 Each	\$ _____ Per Elbow	
6" Direct Buried Chilled Water Piping 90 Degree Elbow	1 Each	\$ _____ Per Elbow	
6" Direct Buried Chilled Water Valve	1 Each	\$ _____ Per Valve	
10" Direct Buried(Pre-Insulated) Chilled Water Piping		\$ _____ Per 20' Length	

10" Direct Buried Chilled Water Piping 22.5 Degree Elbow	1 Each	\$ _____ Per Elbow	
10" Direct Buried Chilled Water Piping 45 Degree Elbow	1 Each	\$ _____ Per Elbow	
10" Direct Buried Chilled Water Piping 90 Degree Elbow	1 Each	\$ _____ Per Elbow	
10" Direct Buried Chilled Water Valve	1 Each	\$ _____ Per Valve	
8" Direct Buried (Pre-Insulated) Hot Water Piping		\$ _____ Per 20' Length	
8" Direct Buried Hot Water Piping 22.5 Degree Elbow	1 Each	\$ _____ Per Elbow	
8" Direct Buried Hot Water Piping 45 Degree Elbow	1 Each	\$ _____ Per Elbow	
8" Direct Buried Hot Water Piping 90 Degree Elbow	1 Each	\$ _____ Per Elbow	
8" Direct Buried Hot Water Valve	1 Each	\$ _____ Per Valve	
½" Domestic Water Piping		\$ _____ Per 10' Length	
¾" Domestic Water Piping		\$ _____ Per 10' Length	
1" Domestic Water Piping		\$ _____ Per 10' Length	
1 ½" Domestic Water Piping		\$ _____ Per 10' Length	
2" Domestic Water Piping		\$ _____ Per 10' Length	
½" Domestic Isolation Ball Valve	1 Each	\$ _____ Per Valve	
¾" Domestic Ball Valve	1 Each	\$ _____ Per Valve	
1" Domestic Ball Valve	1 Each	\$ _____ Per Valve	
2" Domestic Ball Valve	1 Each	\$ _____ Per Valve	

TOTAL VALUE INCLUDED IN BASE BID	\$
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Legal Name of Bidder: _____

Mailing Address: _____

*By (Legal Signature) _____

*Name (type or print) _____ (Seal)

*Title _____

Telephone Number _____



Auburn University

Design Services

Facilities Management

PRE-BID CONFERENCE

Date: July 7, 2017, 9:00 AM, followed by a site visit

Location: Facilities Management One, Training Room 1103A

Project Name: Goodwin Hall - Renovation & Band Rehearsal Hall Addition

Project Number: 15-255

Bid Opening Date and Time: July 18, 2017, 3:00 PM, local time

Bid Opening Location: Facilities Management, Building One, Training Room 1103A

ATTENDEES:

Circulate Sign-in Sheet; copies available at conclusion of meeting and will be distributed via addendum

I. Introductions and Opening Remarks by AU

- a. Owner (AU)
 - i. Campus Architect-Design Lead: David Bess
 - ii. Construction Project Manager: Josh Conradson
- b. Architect/Engineers: Barganier Davis and Sims, Blackburn Daniels O'barr, LBYD, Conway and Owens
- c. Bid Documents and Bid Schedule
 - i. Documents available on LPW Bid Calendar on AU website

II. Project Safety Overview

- a. Auburn University considers safety to be a high priority on Design & Construction projects. This will be evident through our demonstrated focus and attention to safety through many avenues such as:
 - i. Prequalification
 - ii. Contract requirements
 - iii. Pre-construction meeting
 - iv. Project meetings
 - v. Architect and AU Representative's focus and requirements
 - vi. Contractor's written requirements regarding submittals, processes, and/or procedures demonstrating that they are complying in full with OSHA and AU Safety Specification requirements.
- b. It is the Contractor's inherent, important, and sole responsibility to be certain that they comply with the AU Safety Specification and ALL applicable OSHA standards in every case. This compliance shall be demonstrated to the Architect and AU Construction Representative as required by the AU Safety Specification and OSHA or in such a way that this compliance is evident (in writing).
- c. **Competent Person** – Per the AU Safety Specification and OSHA requirements, Contractor shall maintain a "Competent" person(s) at the Project Site at all times this particular activity is underway. Contractor shall inform Architect and AU Construction Representative as to the identity of this (these) individual(s). This shall be kept current at all times.
- d. Refer to and review **ALL** attachments to the Construction Contract – Health and Safety.
- e. The apparent low bidding contractor(s) will have 10 days from the date of notification (letter of intent) that they are the low bidder to submit a site specific safety plan as noted in the project manual.

III. Schedule Control:

- a. Contract Time – 345 calendar days

IV. Cost Control:

- a. Lump Sum bid (with Additive Alternates and Unit prices)
- b. Schedule of Values 24 hours after bid opening

V. Quality Assurance / Quality Control:

- a. Prequalification required of General Contractors
- b. Submit list of major subcontractors and major materials suppliers within 24 Hours after receiving bids.

1161 West Samford Ave.
Auburn, University,
Alabama 36849

Telephone:
334-844-9450

Fax:
334-844-9458

- c. Construction observation by AU (various groups – Design Services, Maintenance and Operations, Risk Management) and Architects/Engineers

VI. Discussion of Bid Requirements by AU:

- a. Sealed Envelope
- b. License # on Envelope
- c. Sign Notes on Envelope
- d. Sign Proposal ABC Form C-3
- e. Accounting of Sales Tax, ABC Form C-3A
- f. Proposal Form Attachment C-3C – Stated Allowances & Unit Prices
- g. Certification of Compliance C-3D
- h. Bid Bond ABC Form C-4 with Power of Attorney
- i. State of Alabama Disclosure Statement – (For Proposal)

VII. Post Bid:

- a. Auburn University Design Lead will notify low bidder in writing of receipt of certified bid tabulation from AU procurement department.
- b. Apparent Low Bidder submits AU Form C-3B 24 hours after bid opening.
- c. Apparent Low Bidder submits schedule of values twenty-four hours after bid opening.
- d. Approved Insurance Certificate – 48 hours after bid opening.
- e. Resumes of Superintendent and Project Manager – 5 days
- f. Low bidder will have 10 days to submit a site specific safety plan after receiving LOI
- g. Contractor to return executed contract and attachments (listed below)
 - i. ABC Form C-6 Performance Bond
 - ii. ABC Form C-7 Payment Bond
 - iii. ABC Form C-8 General Conditions
 - iv. ABC Form C-8S Supplement to the General Conditions of the Contract
 - v. ABC Form C-8 Attachment B
 - vi. Certificate of Compliance with Act 2012-491, State Department of Finance
 - vii. Disclosure Statement (Contract box should be checked)
 - viii. AU Form C-3B List of Subcontractors and Major Suppliers
 - ix. Approved Insurance Certificate
 - x. Proposal Documents submitted on Bid Day
 - xi. Specifications
 - xii. Drawings
- h. Low bidder will have 15 days to submit a Construction Schedule after receiving LOI.
- i. See project specifications for other required submittals.

VIII. Description of Project Work by Architect/Engineers:

- a. General
- b. Demolition
 - i. Hazardous Materials – Contractor is responsible for proper removal and disposal of hazardous materials
- c. Utility Work- Schedule with Auburn Facilities
- d. Work Restrictions
 - i. Staging area, fencing, deliveries. Contractor is responsible for other security measures as defined by ABC form C-8.
 - ii. Parking will be allowed as defined by the contract documents.
 - iii. Landscaped and paved areas should be protected.
 - iv. Special delivery hours.
- e. Rain Days- Per specifications, Class III

IX. Description of Bid Alternates by Architect/Engineers:

- Alternate 1 – Renovate Existing Building
- Alternate 2 – Acoustical Curtains
- Alternate 3 - Construct 4 offices in Basement
- Alternate 4 – Carpet/Wall – storage 008

SECTION 21 11 00 – FIRE PROTECTION SYSTEMS

1.1 GENERAL

A. Summary

1. Furnish and install all components of the fire protection system

B. Description of Work

1. Provide a complete fire protection standpipe system and sprinkler system, including pipe, tube fittings, fire and jockey pumps, and appurtenances as indicated, in compliance with these Specifications and as required by local code agencies.
2. Related work
3. Applications
 - a. Supply mains, valves, risers, and drains.
 - b. Standard pattern Siamese connections per local Fire Department Regulations.
 - c. Fire hose stairway valves.
 - d. Flow switches.
 - e. Fire pump, controllers, and accessories.
 - f. Jockey fire pump, controllers, and accessories.
 - g. Dry-pipe air compressor and valves.
 - h. Hydraulically designed sprinkler system.

C. Quality Assurance

1. Materials shall be installed in accordance with NFPA 13 and NFPA 14
2. Coordination Drawings
3. Acceptable Manufacturers
 - a. Sprinkler Equipment: Viking Corporation, Tyco Fire Protection Products, Victaulic Corporation, Reliable Automatic Sprinkler Company
 - b. Fire Hose Equipment: Potter Roemer, Inc., Elkhart Brass Company, Badger Powhatten, Croker
4. Pipe and Hanger Supports

D. Combination Standpipe System

1. Install a dry pipe sprinkler system for sprinkler piping installed outside of the building insulation envelope and in unheated to provide complete coverage.
2. Install combination standpipe system in the building consisting of risers extended up from the lowest level with 2 1/2" hose valves on each floor in stairwells and a wet pipe sprinkler system to provide complete coverage on each floor.
3. Install a sprinkler system in all elevator shafts and spaces housing elevator machinery or controls.
4. System piping shall be hydraulically designed throughout areas in accordance with the rules and regulations of NFPA 13, using design densities of:
 - a. Light hazard areas: 0.10 gpm per 1,500 square feet with maximum Sprinkler head spacing of 225 square feet per sprinkler head.
 - b. All ordinary hazard areas: 0.20 gpm per 1,500 square feet with maximum sprinkler head spacing of 130 square feet.
5. Sprinkler heads, valves, alarms, and similar items shall be as manufactured by Viking, Grinnell, or other approved manufacturer.

E. Valves

1. Valves shall be UL listed and FM approved for the pressures at which they are installed.
2. Supervised valves shall include valve tamper switches.

1.2 PRODUCTS

A. Piping

1. Standpipe and sprinkler piping shall be ASTM A135, Schedule 40 black steel.
2. Dry system piping shall be galvanized steel.

B. Equipment

1. Fire Hose Valves
2. Fire Department Connection
3. Roof Manifold
4. Water Flow Switch
5. Sight Flow Connection.
6. Sprinkler Heads
7. Dry Pipe Valve
8. Accelerator
9. Alarm Bell

1.3 EXECUTION

A. Installation of piping Systems

B. Protection during Construction

Goodwin-Hall Renovation and
Band Rehearsal Hall Additions
AU Project No. 15-255

- C. Inspections and Tests
- D. Underground Piping

END OF SECTION

SECTION 22 01 00 – GENERAL PLUMBING REQUIREMENTS

1.1 GENERAL

A. Summary

1. The plumbing system will be fully coordinated with all disciplines.

B. Reference Standards

1. Work shall comply with latest codes.

C. Existing Conditions

1. Work in existing areas will be field coordinated.

D. Definitions

1.2 PRODUCTS

A. Manufacturer's

1. All bids shall be based on material specified.

B. Basis of Design

C. Shop Drawings and Product data

1. Shop drawings will be provided by the contractor prior to any work on site.

D. As-Built Drawings

1. The Contractor shall maintain on a daily basis at the Project site a complete set of "Record Drawings".

1.3 EXECUTION

A. Installation

B. Structural Fittings

1. Furnish and install the necessary sleeves, inserts, hangers, anchor bolts, and related structural items.
2. Cutting and Patching

C. Weatherproof Equipment

D. Cleaning

E. Tests & Demonstrations

1. All systems shall be tested in the presence of the Owner or an Owner designated representative upon completion of the Work and demonstrates that the installation is in accordance with the Contract Documents.

F. Warranties

1. The warranty period for all systems, equipment, components, work, etc. shall be no less than one (1) year, unless specified otherwise hereinafter. The warranty shall include parts and labor.

END OF SECTION

SECTION 22 05 29 - HANGERS & SUPPORTS FOR PLUMBING PIPING & EQUIPMENT

1.1 GENERAL

A. Related Documents

B. Description of Work

1. Provide pipe hangers, supports, and required appurtenances as specified and indicated

C. Quality Assurance

1. Acceptable Manufacturers: ITT Grinnell Corporation, Fee and Mason, Central Iron Manufacturing Company, F& S Manufacturing Company, Anvil International & B-Line.

1.2 PRODUCTS

A. Pipe Hangers and Supports

1. Inserts: Provide Universal Concrete Insert No. 282 for concrete construction.
2. Piping in Multiple Parallel Runs: Provide Grinnell No. 45 or No. 50 with Grinnell No. 137 U-bolt pipe clamps or structural channels or angles with U-bolt clamps, supported as trapeze hangers where multiple parallel runs of piping are shown.
3. Piping in Single Runs: Provide Fee and Mason Fig. 239 or Grinnell No. 260 clevis hanger.
4. Hanger Rods
5. Riser Clamps
6. Saddles & Shields
7. Piping on Roof

1.3 EXECUTION

A. Installation

1. Provisions for Movement
2. Insulated piping
3. Spacing of hangers per code.
4. Saddles
5. Guides
6. Anchors
7. Leveling
8. Vibration Isolation
9. Riser Supports

END OF SECTION

SECTION 22 05 53 – IDENTIFICATION FOR PLUMBING PIPING & EQUIPMENT

1.1 GENERAL

A. Summary

1. This section describes the basic materials and installation methods for the identification of equipment and piping for plumbing systems.

B. Description of Work

1. Identification of plumbing equipment shall consist of equipment labeling, pipe marking, and valve tagging.
 - a. In general, all equipment shall be labeled.
 - b. Pipe markings shall be applied to all piping.
 - c. Each valve shall be identified with a stamped tag.
 - d. Labels, tags, and markers shall comply with ANSI A13.1 and other applicable state and local standards for lettering size, colors, and length of color field.

C. Acceptable Manufacturers

1. Labels, markings, and tags shall be manufactured by W.H. Brady, Seton, Allen, or Industrial Safety Supply.

1.2 PRODUCTS

A. Equipment Labeling

1. Permanently Attached
2. Stencil Painted

B. Pipe Markings

1. On piping less than 6" diameter, install plastic semi-rigid snap-on type.
2. On piping and insulation 6" and greater diameter, full band as specified above or strip-type markers fastened to the pipe.
3. Provide arrows for direction of flow.

C. Valve Tags

1. Valve tags shall be polished brass or plastic laminate with solid brass S hook and chain.
2. Valve Schedule

1.3 EXECUTION

Goodwin-Hall Renovation and
Band Rehearsal Hall Additions
AU Project No. 15-255

A. General

1. Provide after insulation is complete.
2. Coordination
3. Unit Designation
4. Placement of Markers
5. Placement of Valve Tags

END OF SECTION

SECTION 22 07 00 – PLUMBING INSULATION

1.1 GENERAL

A. Summary

1. This section describes the basic materials and installation methods for the insulation of plumbing piping and equipment.

B. Quality Assurance

1. Approved manufacturers are Armstrong, Calsite, Cell-U-Foam Corp, Ceelco, Certainteed Corp, Dow Chemical Company, Forrest Mfg Co, Foster / Chilers, Gemco, Johns Manville, Knauf Fiberglass, Midwest Fastners, Owens Corning Fiberglass, Pittsburg Corning Fiberglass, Rubatex, Trymer, and Venture Tape.

C. Submittals

1. Product Data
 - a. Type A Insulation
 - b. Type B Insulation
 - c. Type C Insulation
 - d. Type D Insulation
 - e. Type E Insulation
 - f. Type F Insulation
 - g. Type G Insulation
 - h. Vinyl Lacquer Paint for Type B Insulation
 - i. Metal Jacket

D. Definitions

1.2 PRODUCTS

A. Piping Insulation

1. Type A – Fiberglass (indoor)
2. Type B – Closed Cell (indoor)
3. Type C – Polyisocyanurate (outdoor)
4. Type Da – Cellular glass

B. Equipment Insulation

1. Type Dh – Fiberglass Board (Hot Equipment)

- C. Metal Jacket
- D. Insulation Accessories

1.3 EXECUTION

A. Insulation Applicability

1. Condensate Drains (except in plenums and fire partitions/floors) – Type B insulation, ½ inch thick for all pipe sizes.
2. Condensate Drains (inside plenums and fire partitions/floors) – Type A insulation ½ inch thick for pipes up to 1 inch, and ¾ inch thick for all pipes larger than 1 inch.
3. Horizontal storm leaders, roof drain bodies, and underside of drains receiving condensate from cooling coils – Type F insulation 2 inches thick for all pipe sizes.
4. Horizontal waste piping from electrical water coolers – Type A insulation ½ inch thick for all pipe sizes.
5. Domestic Cold Water – Type A insulation 1 inch thick for all pipe sizes.
6. Domestic Hot Water and Tempered water – Type A insulation 1 inch thick for all pipe sizes.
7. Hot equipment – Type Dh insulation, minimum of 2 inches thick.

B. Piping Insulation General Requirements

1. Preparation
2. Application
3. Application at Fittings

C. Type A Installation

1. Cold Piping
2. Hot Piping
3. Exterior Piping

D. Type B Installation

E. Type C Installation

1. Exterior

F. Type D and E Installation

1. Equipment Insulation Application
2. Hot Equipment
3. Roof Drain Bodies

G. Metal Jacket Installation

H. Hangers

I. Pipe Sleeves

END OF SECTION

SECTION 22 10 00 – PLUMBING PIPING

1.1 GENERAL

A. Summary

1. This section describes the basic materials and installation methods for the plumbing piping systems.

B. Description of Work

C. Quality Assurance

1. Qualify welding procedures, welders, and operators in accordance with ANSI B31.1, Paragraph 127.5, for shop and job site welding of piping work.

1.2 PRODUCTS

A. Piping Materials

B. Pipe/Tube Fittings

1.3 EXECUTION

A. Piping Installation

1. General
2. Steel Pipe
3. Copper Pipe
4. Excavation, Installation, and Backfill for Underground Pipe
5. Anchors
6. Backfill
7. Existing Surfaces
8. Safety

B. Plumbing Services

C. Make-Up Water Piping Systems

D. Domestic Hot and Cold Water Piping Systems

1. Interior Hot and Cold Water Piping
 - a. Piping 3” and smaller, Type L copper tubing with wrought copper solder end fittings.
 - b. Piping 4” and larger, Schedule 40, galvanized steel pipe, ASTM A120 with galvanized malleable iron fittings, or galvanized cast iron flanged fittings.
2. Air Chambers

- E. Underground Domestic Water Service & Fire Protection Piping
 - 1. Piping 2 ½” and smaller, Type K, copper tubing with wrought copper brazed end fittings.
 - 2. Piping 3” and larger, ductile iron bell and spigot, push-on joint, pressure water pipe.

- F. Storm and Sanitary Drainage Piping Systems
 - 1. Soil, Waste, and Vent piping underground.
Service weight cast iron soil pipe and fittings with lead and oakum joints or neoprene gasket joints made up with “Lubrifest” joining material.
 - 2. Storm Drainage piping underground.
 - a. Same as soil, waste, and vent piping underground.
 - 3. Soil, Waste, and Vent Piping above ground.
 - a. Service weight cast iron soil pipe and fittings with neoprene gasket joints or hub-less cast iron pipe and fittings with coupling assembly.
 - 4. Storm Piping above ground.
 - a. Service weight cast iron soil pipe and fittings with neoprene gasketed joints or Schedule 40, service weight hub-less cast iron soil pipe and fittings with coupling assembly.
 - 5. Pump Discharge Piping
 - a. Schedule 40 galvanized steel cast iron drainage fittings.
 - 6. Cleanouts
 - a. Finished Floor: Jay R. Smith No. 4434, cast iron adjustable assembly with nickel bronze cover and tapered thread bronze plug
 - b. Unfinished Areas: Jay R. Smith No. 4434 cleanout with cadmium-plated, cast iron plug.
 - c. Walls: Jay R. Smith No. 4434, cast iron with nickel bronze, square, smooth, access cover, vandal-proof screws.
 - d. Outside: Jay R. Smith No. 4434, non-slip, vandal-proof cover.

- G. Natural Gas Piping System
 - 1. Gas Piping intended for pressures of 5 psig or greater: ASTM A53, Schedule 40, black steel joined by Schedule 40, black welding fittings
 - 2. Gas Piping intended for pressures less than 5 psig: ASTM A53, Schedule 40, black steel joined by Schedule 40, black welded fittings or Class 150 pounds, banded, black malleable iron, threaded fittings.

- H. Cleaning, Flushing, Testing, and Inspecting

END OF SECTION

22 40 00 - PLUMBING FIXTURES

PART 1 - GENERAL

1.1 SUMMARY

- A. The General Provisions, Supplemental General Provisions, section 22 01 00, Division 1 Specifications and Special Provisions apply to all Work specified in this Section.
- B. This section describes the basic materials and installation methods for the water source heat pump systems. Comply with other Division 22 sections and drawings as applicable. Refer to other divisions for coordination of work.
- C. Furnish and install all components of the water source heat pump systems specified herein, as indicated on the drawings, and as required to provide complete and operating systems.

1.2 DESCRIPTION OF WORK

- A. Acceptable Manufacturers: The model numbers listed in the Specifications establish a level of quality and material. The following manufacturers are acceptable subject to compliance with the requirements of these Specifications.
 - 1. Fixtures
 - a. Zurn Industries, Inc.
 - b. American Standard
 - c. Kohler Company
 - d. Crane Company
 - e. Toto
 - 2. Faucets
 - a. Chicago Faucet Company
 - b. Speakman Company
 - c. T & S Brass and Bronze Works, Inc.
 - d. Delta
 - e. Zurn Industries, Inc.
 - 3. Flush Valves
 - a. Sloan Valve Company
 - b. Delany Flush Valves
 - c. Zurn Industries, Inc.
 - 4. Seats
 - a. Church Products, Forbes-Wright Ind., Inc.
 - b. Olsonite Corporation
 - c. Beneke Corporation
 - d. Bemis
 - 5. Carriers
 - a. Zurn Industries, Inc.
 - b. J. R. Smith Mfg. Co.
 - c. Wade Div./Tyler Pipe
 - 6. Drinking Fountains
 - a. Halsey Taylor - Div. Household Int. Co.
 - b. Elkay Mfg. Company

- c. Ebco/Oasis
- 7. Stainless Steel Sinks
 - a. Elkay Mfg. Company
 - b. Just Mfg. Company

PART 2 - PRODUCTS

See drawings for Fixture Schedule

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Heights: Set fixtures at heights as shown on the Architect's Drawings.
- B. Caulking: This Contractor shall caulk the joint between the finished wall surface and all plumbing fixtures. Verify colors with the Architect. Caulking material shall comply with the appropriate section of these Specifications.
- ~~C. **Emergency Shower: Install an emergency shower and eye wash adjacent to the chemical treatment feeder system, and in other locations as required by code or as indicated on the drawings. Pipe domestic cold water to shower.**~~
- D. Each fixture shall be provided with a shut-off valve for each supply line. All exposed lines shall be chromium-plated.

END OF SECTION

SECTION 23 01 00 - GENERAL MECHANICAL REQUIREMENTS

1.1 GENERAL

A. Summary

1. Elements of the Scope of Work include, but are not limited to, labor, materials, equipment, supplies, storage, transportation and all required permits, fees and licenses.

B. Reference Standards

1. A. All work shall comply with the most recently revised versions of all local, state and federal codes, ordinances of the authority having jurisdiction, laws, rules and regulations.

C. Existing Conditions

1. Work in existing areas will be field coordinated.

D. Definitions

1.2 PRODUCTS

A. Manufacturer's

1. All bids shall be based on material specified.

B. Basis of Design

C. Shop Drawings and Product data

1. Shop drawings will be provided by the contractor prior to any work on site.

D. As-Built Drawings

1. The Contractor shall maintain on a daily basis at the Project site a complete set of "Record Drawings".

1.3 EXECUTION

A. Installation

B. Structural Fittings

1. Furnish and install the necessary sleeves, inserts, hangers, anchor bolts, and related structural items.
2. Flashing
3. Cutting and Patching

C. Weatherproof Equipment

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D. Cleaning

E. Tests & Demonstrations

1. All systems shall be tested in the presence of the Owner or an Owner designated representative upon completion of the Work and demonstrates that the installation is in accordance with the Contract Documents.

F. Warranties

1. The warranty period for all systems, equipment, components, work, etc. shall be no less than one (1) year, unless specified otherwise hereinafter. The warranty shall include parts and labor.

END OF SECTION

SECTION 23 05 29 – HANGERS & SUPPORTS FOR HVAC PIPING AND EQUIPMENT

1.1 GENERAL

A. Related Documents

B. Description of Work

1. Provide pipe hangers, supports, and required appurtenances as specified and indicated

C. Quality Assurance

1. Acceptable Manufacturers: ITT Grinnell Corporation, Fee and Mason, Central Iron Manufacturing Company, F& S Manufacturing Company, Anvil International & B-Line.

1.2 PRODUCTS

A. Pipe Hangers and Supports

1. Inserts: Provide Grinnell No. 282 for concrete construction.
2. Piping in Multiple Parallel Runs: Provide Grinnell No. 45 or No. 50 with Grinnell No. 137 U-bolt pipe clamps or structural channels or angles with U-bolt clamps, supported as trapeze hangers where multiple parallel runs of piping are shown.
3. Piping in Single Runs: Provide Fee and Mason Fig. 239 or Grinnell No. 260 clevis hanger.
4. Hanger Rods
5. Riser Clamps
6. Saddles & Shields
7. Piping on Roof

1.3 EXECUTION

A. Installation

1. Independent Support
2. Provisions for Movement
3. Insulated piping
4. Spacing of hangers per code.
5. Saddles
6. Guides
7. Anchors
8. Leveling
9. Vibration Isolation
10. Riser Supports

END OF SECTION

SECTION 23 05 48 – VIBRATION ISOLATION

1.1 GENERAL

A. Summary

1. This section describes the basic materials and installation methods for the vibration isolation systems.

B. Description of Work

1. Provide vibration isolation work as specified and indicated.

C. Quality Assurance

1. Acceptable Manufacturers: Amber-Booth, Vibrations Mounting and Controls, Inc., Korfund Dynamics Corporation, Consolidated Kinetics Corporation.

1.2 PRODUCTS

A. Materials

1. Chilled, Condenser and Heating Hot Water Pumps
2. Suspended Fans
3. Cooling Towers
4. Fluid Cooler Mounted on Ground
5. Suspended Heat Pump Units
6. Suspended Fan & Coil Units
7. Flexible Pipe Connections at Cooling Tower
8. Flexible Pipe Connections at Rotating Equipment
9. Flexible Ductwork Connections to Equipment
10. Roof Mounted Air Handling Units

1.3 EXECUTION

A. Isolator Performance

1. Comply with the minimum static deflections recommended by the American Society of Heating, Refrigerating and Air Conditioning Engineers.

B. Related Work Examination

1. Installer of vibration isolation work shall observe the installation of other work related to and connected to vibration isolation work.

C. Equal Loading

END OF SECTION

SECTION 23 05 53 – HVAC EQUIPMENT AND PIPING IDENTIFICATION

1.1 GENERAL

A. Summary

1. This section describes the basic materials and installation methods for the identification of equipment and piping.

B. Description of Work

1. Identification of mechanical equipment shall consist of equipment labeling, pipe marking, and valve tagging as specified hereinafter.
 - a. In general, all equipment shall be labeled.
 - b. Pipe markings shall be applied to all piping.
 - c. Each valve shall be identified with a stamped tag.
 - d. Labels, tags, and markers shall comply with ANSI A13.1 and other applicable state and local standards for lettering size, colors, and length of color field.

C. Acceptable Manufacturers

1. Labels, markings, and tags shall be manufactured by W.H. Brady, Seton, Allen, or Industrial Safety Supply.

1.2 PRODUCTS

A. Equipment Labeling

1. Permanently Attached
2. Stencil Painted

B. Pipe Markings

1. On piping less than 6" diameter, install plastic semi-rigid snap-on type.
2. On piping and insulation 6" and greater diameter, full band as specified above or strip-type markers fastened to the pipe.
3. Provide arrows for direction of flow.

C. Valve Tags

1. Valve tags shall be polished brass or plastic laminate with solid brass S hook and chain.
2. Valve Schedule

1.3 EXECUTION

A. General

1. Provide after insulation is complete.
2. Coordination
3. Unit Designation
4. Placement of Markers
5. Placement of Valve Tags

END OF SECTION

SECTION 23 05 93 – TESTING, ADJUSTING, AND BALANCING

1.1 GENERAL

A. Summary

1. This section describes the basic materials and installation methods for the testing, adjusting, and balancing of HVAC systems.

B. Description of Work

1. All air and water systems shall be tested, adjusted, and balanced to optimize operating and comfort conditions Acceptable Manufacturers.

C. Quality Assurance

1.2 PRODUCTS

Not Applicable.

1.3 EXECUTION

A. Test Data

1. Record test data after balancing has been completed and deliver recorded data to the Engineer for review and evaluation.

B. Calibration Test

C. Preliminary Air Testing

1. Preliminary air tests shall be performed before duct work or equipment is enclosed in walls, floors, ceilings, chases, or in any other way concealed from view.

D. Final Air Balance

1. Verify correct rotation of rotating equipment.
2. Check air filters or filter media.
3. Airflow at each unit.
4. Water flow at each unit.
5. Coil Temperatures.
6. Outlet Airflow.

END OF SECTION

SECTION 23 07 00 – HVAC INSULATION

1.1 GENERAL

A. Summary

1. This section describes the basic materials and installation methods for the insulation of HVAC and Plumbing piping, duct, and equipment.

B. Quality Assurance

1. Approved Manufacturers are Armstrong, Calsite, Cell-U-Foam Corp, Ceelco, Certainteed Corp, Dow Chemical Company, Forrest Mfg Co, Foster / Chilers, Gemco, Johns Manville, Knauf Fiberglass, Midwest Fastners, Owens Corning Fiberglass, Pittsburg Corning Fiberglass, Rubatex, Trymer, and Venture Tape.

C. Submittals

1. Product Data

- a. Type A Insulation
- b. Type B Insulation
- c. Type C Insulation
- d. Type D Insulation
- e. Type E Insulation
- f. Type F Insulation
- g. Type G Insulation
- h. Vinyl Lacquer Paint for Type B Insulation
- i. Metal Jacket

D. Definitions

1.2 PRODUCTS

A. Piping Insulation

1. Type A – Fiberglass (indoor)
2. Type B – Closed Cell (indoor)
3. Type C – Polyisocyanurate (outdoor)
4. Type Da – Cellular glass

B. Equipment Insulation

1. Type Dh – Fiberglass Board (Hot Equipment)

2. Type Dc – Foamed Plastic (Cold Equipment)
3. Type E – Calcium Silicate

C. Ductwork Installation

1. Type F – Duct Wrap
2. Type G – Duct Liner

D. Metal Jacket

E. Insulation Accessories

1.3 EXECUTION

A. Insulation Applicability

1. Interior Chilled Water – Type Da insulation 1-1/2 inches thick for pipe sizes up to 1-1/4 inch, and 2 inch thick insulation for pipe sizes 1-1/2 inches and up.
2. Interior Hot Water and Steam – Type A insulation 1-1/2 inches thick for pipes up to 1-1/2 inches, 2 inch thick insulation for pipes 3 inches and up.
3. Condensate Drains (except in plenums and fire partitions/floors) – Type B insulation ½ inch thick for all pipe sizes.
4. Condensate Drains (inside plenums and fire partitions/floors) – Type A insulation ½ inch thick for pipes up to 1 inch, ¾ inch thick insulation for pipes 1-1/4 inch and up.
5. Refrigerant Suction Lines & Valves (except in plenums and fire partitions/floors) – Type B insulation 1 inch thick for all pipe sizes.
6. Refrigerant Suction Lines & Valves (in plenums and fire partitions/floors) and hot gas bypass piping – Type A insulation 1 inch thick for all pipe sizes.
7. Medium Pressure Supply Ducts – Type F insulation 2 inches thick for all pipe sizes.
8. Low Pressure Supply Ducts – Type F insulation 2 inches thick for all pipe sizes.
9. Outside Air Ductwork – No insulation required.
10. Cold Equipment – Type Dc insulation, minimum of ½ inch.
11. Hot Equipment – Type Dh insulation, minimum of 2 inches.

B. Piping Insulation General Requirements

1. Preparation
2. Application
3. Application at Fittings

C. Type A Installation

D. Type B Installation

E. Type C Installation

F. Type D and E Installation

G. Type F Installation

H. Type G Installation

I. Metal Jacket Installation

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J. Hangers

K. Pipe Sleeves

END OF SECTION

SECTION 23 09 00 – DIRECT DIGITAL CONTROLS

1.1 GENERAL

A. Related Documents

1. The work of this Division shall be scheduled, coordinated, and interfaced with the associated work of other trades.

B. Definitions

C. BMS Description

D. Quality Assurance

1. The BMS Contractor shall be a recognized national manufacturer, installer and service provider of BMS.

E. References

F. Submittals

G. Record Documentation

H. Warranty

1. If within twelve (12) months from the date of acceptance of product, upon written notice from the owner, it is found to be defective in operation, workmanship or materials, it shall be replaced, repaired or adjusted at the option of the BMS Contractor at the cost of the BMS Contractor.

1.2 PRODUCTS

A. General Description

B. BMS Architecture

C. User Interface

D. Network Automation Engines

E. DDC System Controllers

F. Field Devices

G. System Tools

H. Input Devices

I. Output Devices

J. Miscellaneous Devices

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1.3 EXECUTION

- A. Factory Testing
- B. Field Quality Control
- C. Local Control Panels

1.4 PERFORMANCE/ EXECUTION

- A. BMS Specific Requirements
- B. Installation Practices
- C. Training
- D. Commissioning

END OF SECTION

23 09 00 - DIRECT DIGITAL CONTROLS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. All work of this Division shall be coordinated and provided by the single Building Management System (BMS) Contractor.
- B. The work of this Division shall be scheduled, coordinated, and interfaced with the associated work of other trades. Reference the Division 15 Sections for details.
- C. The work of this Division shall be as required by the Specifications, Point Schedules and Drawings.
- D. If the BMS Contractor believes there are conflicts or missing information in the project documents, the Contractor shall promptly request clarification and instruction from the design team.

1.2 DEFINITIONS

- A. Analog: A continuously variable system or value not having discrete levels. Typically exists within a defined range of limiting values.
- B. Binary: A two-state system where an "ON" condition is represented by one discrete signal level and an "OFF" condition is represented by a second discrete signal level.
- C. Building Management System (BMS): The total integrated system of fully operational and functional elements, including equipment, software, programming, and associated materials, to be provided by this Division BMS Contractor and to be interfaced to the associated work of other related trades.
- D. BMS Contractor: The single Contractor to provide the work of this Division. This Contractor shall be the primary manufacturer, installer, commissioner and ongoing service provider for the BMS work.
- E. Control Sequence: An BMS pre-programmed arrangement of software algorithms, logical computation, target values and limits as required to attain the defined operational control objectives.
- F. Direct Digital Control: The digital algorithms and pre-defined arrangements included in the BMS software to provide direct closed-loop control for the designated equipment and controlled variables. Inclusive of Proportional, Derivative and Integral control algorithms together with target values, limits, logical functions, arithmetic functions, constant values, timing considerations and the like.
- G. BMS Network: The total digital on-line real-time interconnected configuration of BMS digital processing units, workstations, panels, sub-panels, controllers, devices and associated elements individually known as network nodes. May exist as one or more fully interfaced and integrated sub-networks, LAN, WAN or the like.
- H. Node: A digitally programmable entity existing on the BMS network.
- I. BMS Integration: The complete functional and operational interconnection and interfacing of all BMS work elements and nodes in compliance with all applicable

codes, standards and ordinances so as to provide a single coherent BMS as required by this Division.

- J. Provide: The term "Provide" and its derivatives when used in this Division shall mean to furnish, install in place, connect, calibrate, test, commission, warrant, document and supply the associated required services ready for operation.
- K. PC: IBM-compatible Personal Computer from a recognized major manufacturer
- L. Furnish: The term "Furnish" and its derivatives when used in this Division shall mean supply at the BMS Contractor's cost to the designated third party trade contractor for installation. BMS Contractor shall connect furnished items to the BMS, calibrate, test, commission, warrant and document.
- M. Wiring: The term "Wiring" and its derivatives when used in this Division shall mean provide the BMS wiring and terminations.
- N. Install: The term "Install" and its derivatives when used in this Division shall mean receive at the jobsite and mount.
- O. Protocol: The term "protocol" and its derivatives when used in this Division shall mean a defined set of rules and standards governing the on-line exchange of data between BMS network nodes.
- P. Software: The term "software" and its derivatives when used in this Division shall mean all of programmed digital processor software, preprogrammed firmware and project specific digital process programming and database entries and definitions as generally understood in the BMS industry for real-time, on-line, integrated BMS configurations.
- Q. The use of words in the singular in these Division documents shall not be considered as limiting when other indications in these documents denote that more than one such item is being referenced.
- R. Headings, paragraph numbers, titles, shading, bolding, underscores, clouds and other symbolic interpretation aids included in the Division documents are for general information only and are to assist in the reading and interpretation of these Documents.
- S. The following abbreviations and acronyms may be used in describing the work of this Division:

ADC	-	Analog to Digital Converter
AI	-	Analog Input
AN	-	Application Node
ANSI	-	American National Standards Institute
AO	-	Analog Output
ASCII	-	American Standard Code for Information Interchange
ASHRAE		American Society of Heating, Refrigeration and Air Conditioning Engineers
AWG	-	American Wire Gauge
CPU	-	Central Processing Unit
CRT	-	Cathode Ray Tube
DAC	-	Digital to Analog Converter
DDC	-	Direct Digital Control
DI	-	Digital Input
DO	-	Digital Output
EEPROM	-	Electrically Erasable Programmable Read Only Memory

EMI	-	Electromagnetic Interference
FAS	-	Fire Alarm Detection and Annunciation System
GUI	-	Graphical User Interface
HOA	-	Hand-Off-Auto
ID	-	Identification
IEEE	-	Institute of Electrical and Electronics Engineers
I/O	-	Input/Output
LAN	-	Local Area Network
LCD	-	Liquid Crystal Display
LED	-	Light Emitting Diode
MCC	-	Motor Control Center
NC	-	Normally Closed
NIC	-	Not In Contract
NO	-	Normally Open
OWS	-	Operator Workstation
OAT	-	Outdoor Air Temperature
PC	-	Personal Computer
RAM	-	Random Access Memory
RF	-	Radio Frequency
RFI	-	Radio Frequency Interference
RH	-	Relative Humidity
ROM	-	Read Only Memory
RTD	-	Resistance Temperature Device
SPDT	-	Single Pole Double Throw
SPST	-	Single Pole Single Throw
XVGA	-	Extended Video Graphics Adapter
TBA	-	To Be Advised
TCP/IP	-	Transmission Control Protocol/Internet Protocol
TTD	-	Thermistor Temperature Device
UPS	-	Uninterruptible Power Supply
VAC	-	Volts, Alternating Current
VAV	-	Variable Air Volume
VDC	-	Volts, Direct Current
WAN	-	Wide Area Network

1.3 BMS DESCRIPTION

- A. The Building Management System (BMS) shall be a complete system designed for use with the enterprise IT systems. This functionality shall extend into the equipment rooms. Devices residing on the automation network located in equipment rooms and similar shall be Johnson Controls fully compatible existing devices that mount and communicate directly Auburn IT infrastructure across campus for uploading and downloading of controller are required, alarming, metering and energy management. Contractor shall be responsible for coordination with the owner's IT staff to ensure that the FMS will perform in the owner's environment without disruption to any of the other activities taking place on that LAN.
- B. All points of user interface are existing and shall be on standard PCs that do not require the purchase of any special software from the BMS manufacturer for use as a building operations terminal. The primary point of interface on these PCs will be a standard Web Browser.
- C. The work of the single BMS Contractor shall be as defined individually and collectively in all Sections of this Division specifications together with the associated Point Sheets

and Drawings and the associated interfacing work as referenced in the related documents.

- D. The BMS work shall consist of the provision of all labor, materials, tools, equipment, software, software licenses, software configurations and database entries, interfaces, wiring, tubing, installation, labeling, engineering, calibration, documentation, samples, submittals, testing, commissioning, training services, permits and licenses, transportation, shipping, handling, administration, supervision, management, insurance, temporary protection, cleaning, cutting and patching, warranties, services, and items, even though these may not be specifically mentioned in these Division documents which are required for the complete, fully functional and commissioned BMS.
- E. Provide a complete, neat and workmanlike installation. Use only manufacturer employees who are skilled, experienced, trained, and familiar with the specific equipment, software, standards and configurations to be provided for this Project.
- F. Manage and coordinate the BMS work in a timely manner in consideration of the Project schedules. Coordinate with the associated work of other trades so as to not impede or delay the work of associated trades.
- G. The BMS as provided shall incorporate, at minimum, the following integrated features, functions and services:
 - 1. Operator information, alarm management and control functions.
 - 2. Enterprise-level information and control access.
 - 3. Information management including monitoring, transmission, archiving, retrieval, and reporting functions.
 - 4. Diagnostic monitoring and reporting of BMS functions.
 - 5. Offsite monitoring and management access.
 - 6. Energy management
 - 7. Standard applications for terminal HVAC systems.

1.4 QUALITY ASSURANCE

- A. General
 - 1. The Building Management System Contractor shall be the primary manufacturer-owned branch office that is regularly engaged in the engineering, programming, installation and service of total integrated Building Management Systems.
 - 2. The BMS Contractor shall be a recognized national manufacturer, installer and service provider of BMS.
 - 3. As evidence and assurance of the contractor's ability to support the Owner's system with service and parts, the contractor must have been in the BMS business for at least the last ten (10) years and have successfully completed total projects of at least 10 times the value of this contract in each of the preceding five years.
 - 4. The Building Management System architecture shall consist of the products of a manufacturer regularly engaged in the production of Building Management Systems, and shall be the manufacturer's latest standard of design at the time of bid.
- B. Workplace Safety And Hazardous Materials
 - 1. Provide a safety program in compliance with the Contract Documents.

2. The FMS Contractor shall have a corporately certified comprehensive Safety Certification Manual and a designated Safety Supervisor for the Project.
3. The Contractor and its employees and subtrades comply with federal, state and local safety regulations.
4. The Contractor shall ensure that all subcontractors and employees have written safety programs in place that covers their scope of work, and that their employees receive the training required by the OSHA have jurisdiction for at least each topic listed in the Safety Certification Manual.
5. Hazards created by the Contractor or its subcontractors shall be eliminated before any further work proceeds.
6. Hazards observed but not created by the Contractor or its subcontractors shall be reported to either the General Contractor or the Owner within the same day. The Contractor shall be required to avoid the hazard area until the hazard has been eliminated.
7. The Contractor shall sign and date a safety certification form prior to any work being performed, stating that the Contractors' company is in full compliance with the Project safety requirements.
8. The Contractor's safety program shall include written policy and arrangements for the handling, storage and management of all hazardous materials to be used in the work in compliance with the requirements of the AHJ at the Project site.
9. The Contractor's employees and subcontractor's staff shall have received training as applicable in the use of hazardous materials and shall govern their actions accordingly.

C. QUALITY MANAGEMENT PROGRAM

1. Designate a competent and experienced employee to provide BMS Project Management. The designated Project Manger shall be empowered to make technical, scheduling and related decisions on behalf of the BMS Contractor. At minimum, the Project Manager shall:
 - a. Manage the scheduling of the work to ensure that adequate materials, labor and other resources are available as needed.
 - b. Manage the financial aspects of the BMS Contract.
 - c. Coordinate as necessary with other trades.
 - d. Be responsible for the work and actions of the BMS workforce on site.

1.5 REFERENCES

- A. All work shall conform to the following Codes and Standards, as applicable:
 1. National Fire Protection Association (NFPA) Standards.
 2. National Electric Code (NEC) and applicable local Electric Code.
 3. Underwriters Laboratories (UL) listing and labels.

4. UL 864 UUKL Smoke Control
 5. UL 268 Smoke Detectors.
 6. UL 916 Energy Management
 7. NFPA 70 - National Electrical Code.
 8. NFPA 90A - Standard For The Installation Of Air Conditioning And Ventilating Systems.
 9. NFPA 92A and 92B Smoke Purge/Control Equipment.
 10. Factory Mutual (FM).
 11. American National Standards Institute (ANSI).
 12. National Electric Manufacturer's Association (NEMA).
 13. American Society of Mechanical Engineers (ASME).
 14. American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE) [user note: add ASHRAE 62 IAQ as applicable].
 15. Air Movement and Control Association (AMCA).
 16. Institute of Electrical and Electronic Engineers (IEEE).
 17. American Standard Code for Information Interchange (ASCII).
 18. Electronics Industries Association (EIA).
 19. Occupational Safety and Health Administration (OSHA).
 20. American Society for Testing and Materials (ASTM).
 21. Federal Communications Commission (FCC) including Part 15, Radio Frequency Devices.
 22. Americans Disability Act (ADA)
 23. ANSI/EIA 909.1-A-1999 (LonWorks)
 24. ANSI/ASHRAE Standard 195-2004 (BACnet)
- B. In the case of conflicts or discrepancies, the more stringent regulation shall apply.
- C. All work shall meet the approval of the Authorities Having Jurisdiction at the project site.

1.6 SUBMITTALS

- A. Shop Drawings, Product Data, and Samples
1. The BMS contractor shall submit a list of all shop drawings with submittals dates within 30 days of contract award.
 2. Submittals shall be in defined packages. Each package shall be complete and shall only reference itself and previously submitted packages. The packages shall be as approved by the Architect and Engineer for Contract compliance.
 3. Allow 15 working days for the review of each package by the Architect and Engineer in the scheduling of the total BMS work.
 4. Equipment and systems requiring approval of local authorities must comply with such regulations and be approved. Filing shall be at the expense of the BMS Contractor where filing is necessary. Provide a copy of all related correspondence and permits to the Owner.

5. Prepare an index of all submittals and shop drawings for the installation. Index shall include a shop drawing identification number, Contract Documents reference and item description.
6. The BMS Contractor shall correct any errors or omissions noted in the first review.
7. At a minimum, submit the following:
 - a. BMS network architecture diagrams including all nodes and interconnections.
 - b. Systems schematics, sequences and flow diagrams.
 - c. Points schedule for each point in the BMS, including: Point Type, Object Name, Expanded ID, Display Units, Controller type, and Address.
 - d. Samples of Graphic Display screen types and associated menus.
 - e. Detailed Bill of Material list for each system or application, identifying quantities, part numbers, descriptions, and optional features.
 - f. Control Damper Schedule including a separate line for each damper provided under this section and a column for each of the damper attributes, including: Code Number, Fail Position, Damper Type, Damper Operator, Duct Size, Damper Size, Mounting, and Actuator Type.
 - ~~g.~~ Control Valve Schedules including a separate line for each valve provided under this section and a column for each of the valve attributes: Code Number, Configuration, Fail Position, Pipe Size, Valve Size, Body Configuration, Close off Pressure, Capacity, Valve CV, Design Pressure, and Actuator Type.
 - ~~h.~~ Room Schedule including a separate line for each VAV box and/or terminal unit indicating location and address
 - i. Details of all BMS interfaces and connections to the work of other trades.
 - j. Product data sheets or marked catalog pages including part number, photo and description for all products including software.

1.7 RECORD DOCUMENTATION

- A. Operation and Maintenance Manuals
 1. Three (3) copies of the Operation and Maintenance Manuals shall be provided to the Owner's Representative upon completion of the project. The entire Operation and Maintenance Manual shall be furnished on Compact Disc media, and include the following for the BMS provided:
 - a. Table of contents.
 - b. As-built system record drawings. Computer Aided Drawings (CAD) record drawings shall represent the as-built condition of the system and incorporate all information supplied with the approved submittal.
 - c. Manufacturers product data sheets or catalog pages for all products including software.
 - d. System Operator's manuals.
 - e. Archive copy of all site-specific databases and sequences.
 - f. BMS network diagrams.
 - g. Interfaces to all third-party products and work by other trades.

2. The Operation and Maintenance Manual CD shall be self-contained, and include all necessary software required to access the product data sheets. A logically organized table of contents shall provide dynamic links to view and print all product data sheets. Viewer software shall provide the ability to display, zoom, and search all documents.

1.8 WARRANTY

- A. Standard Material and Labor Warranty:
 1. Provide a one-year labor and material warranty on the BMS.
 2. If within twelve (12) months from the date of acceptance of product, upon written notice from the owner, it is found to be defective in operation, workmanship or materials, it shall be replaced, repaired or adjusted at the option of the BMS Contractor at the cost of the BMS Contractor.
 3. Maintain an adequate supply of materials within 100 miles of the Project site such that replacement of key parts and labor support, including programming. Warranty work shall be done during BMS Contractor's normal business hours.

PART 2 – PRODUCTS

2.1 GENERAL DESCRIPTION

- A. The Building Management System (BMS) shall use an open architecture and fully support a multi-vendor environment. To accomplish this effectively, the BMS shall support open communication protocol standards and integrate a wide variety of third-party devices and applications. The system shall be designed for use on the Internet, or intranets using off the shelf, industry standard technology compatible with other owner provided networks.
- B. The Building Management System shall consist of the following:
 1. Standalone Network Automation Engine(s)
 2. Field Equipment Controller(s)
 3. Input/Output Module(s)
 4. Local Display Device(s)
 5. Portable Operator's Terminal(s)
 6. Distributed User Interface(s)
 7. Network processing, data storage and communications equipment
 8. Other components required for a complete and working BMS
- C. The system shall be modular in nature, and shall permit expansion of both capacity and functionality through the addition of sensors, actuators, controllers and operator devices, while re-using existing controls equipment.
- D. System architectural design shall eliminate dependence upon any single device for alarm reporting and control execution.
 1. The failure of any single component or network connection shall not interrupt the execution of control strategies at other operational devices.

2. The System shall maintain all settings and overrides through a system reboot.
- E. System architectural design shall eliminate dependence upon any single device for alarm reporting and control execution.
1. The System shall comply with the following International Code Council (ICC) Codes:
 - a. Building Officials and code Administrators International (BOMA) model code
 - b. International Conference of Building Officials (ICBO) model code
 - c. Southern Building Code Congress International (SBCCI) regulations
- F. Acceptable Manufacturers
1. Johnson Controls, Metasys

2.2 BMS ARCHITECTURE

- A. Automation Network
1. The automation network shall be based on a PC industry standard of Ethernet TCP/IP. Where used, LAN controller cards shall be standard “off the shelf” products available through normal PC vendor channels.
 2. The automation network shall be capable of operating at a communication speed of 100 Mbps, with full peer-to-peer network communication.
 3. Network Automation Engines (NAE) shall reside on the automation network.
 4. The automation network will be compatible with other enterprise-wide networks. Where indicated, the automation network shall be connected to the enterprise network and share resources with it by way of standard networking devices and practices.
- B. Control Network
1. Network Automation Engines (NAE) shall provide supervisory control over the control network and shall support the following communication protocols:
 - a. BACnet Standard MS/TP Bus Protocol ASHRAE SSPC-135, Clause 9
 - ◇ The NAE shall be BACnet Testing Labs (BTL) certified and carry the BTL Label.
 - ◇ The NAE shall be tested and certified as a BACnet Building Controller (B-BC).
 - b. The Johnson Controls N2 Field Bus.
 2. Control networks shall provide either “Peer-to-Peer,” Master-Slave, or Supervised Token Passing communications, and shall operate at a minimum communication speed of 9600 baud.
 3. DDC Controllers shall reside on the control network.
 4. Control network communication protocol shall be BACnet Standard MS/TP Bus Protocol ASHRAE SSPC-135.
 5. A BACnet Protocol Implementation Conformance Statement (PICS) shall be provided for each controller device (master or slave) that will communicate on the BACnet MS/TP Bus.
 6. The PICS shall be submitted 10 days prior to bidding.

2.3 USER INTERFACE

- A. Dedicated Web Based User Interface
 - 1. Where indicated on plans the BMS Contractor shall provide and install a personal computer for command entry, information management, network alarm management, and database management functions. All real-time control functions, including scheduling, history collection and alarming, shall be resident in the BMS Network Automation Engines to facilitate greater fault tolerance and reliability.
 - 2. Dedicated User Interface Architecture – The architecture of the computer shall be implemented to conform to industry standards, so that it can accommodate applications provided by the BMS Contractor and by other third party applications suppliers, including but not limited to Microsoft Office Applications. Specifically it must be implemented to conform to the following interface standards.
 - a. Microsoft Internet Explorer for user interface functions
 - b. Microsoft Office Professional for creation, modification and maintenance of reports, sequences other necessary building management functions
 - c. Microsoft Outlook or other e-mail program for supplemental alarm functionality and communication of system events, and reports
 - d. Required network operating system for exchange of data and network functions such as printing of reports, trends and specific system summaries
 - 3. (EXISTING NOT REQUIRED) PC Hardware – The personal computer(s) shall be configured as follows:
 - 4. Operating System Software
 - a. Windows XP Professional
 - b. Where user interface is not provided via browser, provide complete operator workstation software package, including any hardware or software keys. Include the original installation disks and licenses for all included software, device drivers, and peripherals.
 - c. Provide software registration cards to the Owner for all included software.
- B. Distributed Web Based User Interface
 - 1. All features and functions of the dedicated user interface previously defined in this document shall be available on any computer connected directly or via a wide area or virtual private network (WAN/VPN) to the automation network and conforming to the following specifications.
 - 2. The software shall run on the Microsoft Internet Explorer (6.0 or higher) browser.
- C. User Interface Application Components
 - 1. Operator Interface
 - a. An integrated browser based client application shall be used as the user operator interface program.
 - b. The System shall employ an event-driven rather than a device polling methodology to dynamically capture and present new data to the user.
 - c. All Inputs, Outputs, Setpoints, and all other parameters as defined within Part 3, shown on the design drawings, or required as part of the system software, shall be displayed for operator viewing and modification from the operator interface software.

- d. The user interface software shall provide help menus and instructions for each operation and/or application.
 - e. The system shall support customization of the UI configuration and a home page display for each operator.
 - f. The system shall support user preferences in the following screen presentations:
 - ◇ Alarm
 - ◇ Trend
 - ◇ Display
 - ◇ Applications
 - g. All controller software operating parameters shall be displayed for the operator to view/modify from the user interface. These include: setpoints, alarm limits, time delays, PID tuning constants, run-times, point statistics, schedules, and so forth.
 - h. The Operator Interface shall incorporate comprehensive support for functions including, but not necessarily limited to, the following:
 - ◇ User access for selective information retrieval and control command execution
 - ◇ Monitoring and reporting
 - ◇ Alarm, non-normal, and return to normal condition annunciation
 - ◇ Selective operator override and other control actions
 - ◇ Information archiving, manipulation, formatting, display and reporting
 - ◇ FMS internal performance supervision and diagnostics
 - ◇ On-line access to user HELP menus
 - ◇ On-line access to current FMS as-built records and documentation
 - ◇ Means for the controlled re-programming, re-configuration of FMS operation and for the manipulation of FMS database information in compliance with the prevailing codes, approvals and regulations for individual FMS applications
 - i. The system shall support a list of application programs configured by the users that are called up by the following means:
 - ◇ The Tools Menu
 - ◇ Hyperlinks within the graphics displays
 - ◇ Key sequences
 - j. The operation of the control system shall be independent of the user interface, which shall be used for operator communications only. Systems that rely on an operator workstation to provide supervisory control over controller execution of the sequences of operations or system communications shall not be acceptable.
2. Navigation Trees
- a. The system will have the capability to display multiple navigation trees that will aid the operator in navigating throughout all systems and points connected. At minimum provide a tree that identifies all systems on the networks.

- b. Provide the ability for the operator to add custom trees. The operator will be able to define any logical grouping of systems or points and arrange them on the tree in any order. It shall be possible to nest groups within other groups. Provide at minimum 5 levels of nesting.
 - c. The navigation trees shall be “dockable” to other displays in the user interface such as graphics. This means that the trees will appear as part of the display, but can be detached and then minimized to the Windows task bar or closed altogether. A simple keystroke will reattach the navigation to the primary display of the user interface.
3. Alarms
- a. Alarms shall be routed directly from Network Automation Engines to PCs and servers. It shall be possible for specific alarms from specific points to be routed to specific PCs and servers. The alarm management portion of the user interface shall, at the minimum, provide the following functions:
 - ◇ Log date and time of alarm occurrence.
 - ◇ Generate a “Pop-Up” window, with audible alarm, informing a user that an alarm has been received.
 - ◇ Allow a user, with the appropriate security level, to acknowledge, temporarily silence, or discard an alarm.
 - ◇ Provide an audit trail on hard drive for alarms by recording user acknowledgment, deletion, or disabling of an alarm. The audit trail shall include the name of the user, the alarm, the action taken on the alarm, and a time/date stamp.
 - ◇ Provide the ability to direct alarms to an e-mail address or alphanumeric pager. This must be provided in addition to the pop up window described above. Systems that use e-mail and pagers as the exclusive means of annunciating alarms are not acceptable.
 - ◇ Any attribute of any object in the system may be designated to report an alarm.
 - b. The FMS shall annunciate diagnostic alarms indicating system failures and non-normal operating conditions.
 - c. The FMS shall allow a minimum of 4 categories of alarm sounds customizable through user defined wav.files.
 - d. The FMS shall annunciate application alarms at minimum, as required by Part 3.
4. Reports and Summaries
- a. Reports and Summaries shall be generated and directed to the user interface displays, with subsequent assignment to printers, or disk. As a minimum, the system shall provide the following reports:
 - ◇ All points in the BMS
 - ◇ All points in each BMS application
 - ◇ All points in a specific controller
 - ◇ All points in a user-defined group of points
 - ◇ All points currently in alarm
 - ◇ All points locked out
 - ◇ All BMS schedules

- ◇ All user defined and adjustable variables, schedules, interlocks and the like.
 - b. Summaries and Reports shall be accessible via standard UI functions and not dependent upon custom programming or user defined HTML pages.
 - c. Selection of a single menu item, tool bar item, or tool bar button shall print any displayed report or summary on the system printer for use as a building management and diagnostics tool.
 - d. The system shall allow for the creation of custom reports and queries via a standard web services XML interface and commercial off-the-shelf software such as Microsoft Access, Microsoft Excel, or Crystal Reports.
5. Schedules
- a. A graphical display for time-of-day scheduling and override scheduling of building operations shall be provided. At a minimum, the following functions shall be provided:
 - ◇ Weekly schedules
 - ◇ Exception Schedules
 - ◇ Monthly calendars
 - b. Weekly schedules shall be provided for each group of equipment with a specific time use schedule.
 - c. It shall be possible to define one or more exception schedules for each schedule including references to calendars
 - d. Monthly calendars shall be provided that allow for simplified scheduling of holidays and special days for a minimum of five years in advance. Holidays and special days shall be user-selected with the pointing device or keyboard, and shall automatically reschedule equipment operation as previously defined on the exception schedules.
 - e. Changes to schedules made from the User Interface shall directly modify the Network Automation Engine schedule database.
 - f. Schedules and Calendars shall comply with ASHRAE SP135/2003 BACnet Standard.
 - g. Selection of a single menu item or tool bar button shall print any displayed schedule on the system printer for use as a building management and diagnostics tool.
6. Password
- a. Multiple-level password access protection shall be provided to allow the user/manager to user interface control, display, and database manipulation capabilities deemed appropriate for each user, based on an assigned password.
 - b. Each user shall have the following: a user name (24 characters minimum), a password (12 characters minimum), and access levels.
 - c. The system shall allow each user to change his or her password at will.
 - d. When entering or editing passwords, the system shall not echo the actual characters for display on the monitor.
 - e. A minimum of five levels of access shall be supported individually or in any combination as follows:
 - ◇ Level 1 = View Data
 - ◇ Level 2 = Command

- ◇ Level 3 = Operator Overrides
 - ◇ Level 4 = Database Modification
 - ◇ Level 5 = Database Configuration
 - ◇ Level 6 = All privileges, including Password Add/Modify
- f. A minimum of 100 unique passwords shall be supported.
- g. Operators shall be able to perform only those commands available for their respective passwords. Display of menu selections shall be limited to only those items defined for the access level of the password used to log-on.
- h. The system shall automatically generate a report of log-on/log-off and system activity for each user. Any action that results in a change in the operation or configuration of the control system shall be recorded, including: modification of point values, schedules or history collection parameters, and all changes to the alarm management system, including the acknowledgment and deletion of alarms.
7. Screen Manager
- a. The User Interface shall be provided with screen management capabilities that allow the user to activate, close, and simultaneously manipulate a minimum of 4 active display windows plus a network or user defined navigation tree.
8. Dynamic Color Graphics
- a. The graphics application program shall be supplied as an integral part of the User Interface. Browser or Workstation applications that rely only upon HTML pages shall not be acceptable.
- b. The graphics applications shall include a create/edit function and a runtime function. The system architecture shall support an unlimited number of graphics documents (graphic definition files) to be generated and executed.

The graphics shall be able to display and provide animation based on real-time data that is acquired, derived, or entered.

- c. Graphics runtime functions – A maximum of 16 graphic applications shall be able to execute at any one time on a user interface or workstation with 4 visible to the user. Each graphic application shall be capable of the following functions:
- ◇ All graphics shall be fully scalable
 - ◇ The graphics shall support a maintained aspect ratio.
 - ◇ Multiple fonts shall be supported.
 - ◇ Unique background shall be assignable on a per graphic basis.
 - ◇ The color of all animations and values on displays shall indicate if the status of the object attribute.
- d. Operation from graphics – It shall be possible to change values (setpoints) and states in system controlled equipment by using drop-down windows accessible via the pointing device
- e. Graphic editing tool – A graphic editing tool shall be provided that allows for the creation and editing of graphic files. The graphic editor shall be capable of performing/defining all animations, and defining all runtime binding.

- ◇ The graphic editing tool shall in general provide for the creation and positioning of point objects by dragging from tool bars or drop-downs and positioning where required.
 - ◇ In addition, the graphic editing tool shall be able to add additional content to any graphic by importing backgrounds in the SVG, BMP or JPG file formats.
 - f. Aliasing – Many graphic displays representing part of a building and various building components are exact duplicates, with the exception that the various variables are bound to different field values. Consequently, it shall be possible to bind the value of a graphic display to aliases, as opposed to the physical field tags.
- 9. Historical trending and data collection
 - a. Each Automation Engine shall store trend and point history data for all analog and digital inputs and outputs, as follows:
 - ◇ Any point, physical or calculated, may be designated for trending. Three methods of collection shall be allowed: Defined time interval
Upon a change of value
 - ◇ Each Automation Engine shall have the capability to store multiple samples for each physical point and software variable based upon available memory, including an individual sample time/date stamp. Points may be assigned to multiple history trends with different collection parameters.
- 10. Trend data viewing and analysis
 - a. Provide a trend viewing utility that shall have access to all database points.
 - b. It shall be possible to retrieve any historical database point for use in displays and reports by specifying the point name and associated trend name.
 - c. The trend viewing utility shall have the capability to define trend study displays to include multiple trends
 - d. Displays shall be able to be single or stacked graphs with on-line selectable display characteristics, such as ranging, color, and plot style.
 - e. Display magnitude and units shall both be selectable by the operator at any time without reconfiguring the processing or collection of data. This is a zoom capability.
 - f. Display magnitude shall automatically be scaled to show full graphic resolution of the data being displayed.
 - g. Trend studies shall be capable of calculating and displaying calculated variables including highest value, lowest value and time based accumulation.
 - h. The Display shall support the user's ability to change colors, sample sizes, and types of markers.
- 11. Database Management
 - a. The System shall provide a Database Manager that separates the database monitoring and managing functions by supporting two separate windows.
 - b. Database secure access shall be accomplished using standard SQL authentication including the ability to access data for use outside of the Building Automation application.
 - c. The database managing function shall include summarized information on trend, alarm, event, and audit for the following database management actions:

- ◇ Backup
 - ◇ Purge
 - ◇ Restore
- d. The Database Manager shall support four tabs:
- ◇ Statistics – shall display Database Server information and Trend, Alarm (Event), and Audit information on the Metasys Databases.
 - ◇ Maintenance – shall provide an easy method of purging records from the Metasys Server trend, alarm (event), and audit databases by supporting separate screens for creating a backup prior to purging, selecting the database, and allowing for the retention of a selected number of day's data.
 - ◇ Backup – Shall provide the means to create a database backup file and select a storage location.
 - ◇ Restore – shall provide a restricted means of restoring a database by requiring the user to log into an Expert Mode in order to view the Restore screen.
- e. The Status Bar shall appear at the bottom of all Metasys Database Manager Tabs and shall provide information on the current database activity. The following icons shall be provided:
- ◇ Ready
 - ◇ Purging Record from a database
 - ◇ Action Failed
 - ◇ Refreshing Statistics
 - ◇ Restoring database
 - ◇ Shrinking a database
 - ◇ Backing up a database
 - ◇ Resetting internet information Services
 - ◇ Starting the Metasys Device Manager
 - ◇ Shutting down the Metasys Device Manager
 - ◇ Action successful
- f. The Database Manager monitoring functions shall be accessed through the Monitoring Settings window and shall continuously read database information once the user has logged in.
- g. The System shall provide user notification via taskbar icons and e-mail messages when a database value has exceeded a warning or alarm limit.
- h. The Monitoring Settings window shall have the following sections:
- ◇ General – Shall allow the user to set and review scan intervals and start times.
 - ◇ Email – Shall allow the user to create and review e-mail and phone text messages to be delivered when a Warning or Alarm is generated.
 - ◇ Warning – shall allow the user to define the Warning limit parameters, set the Reminder Frequency, and link the e-mail message.

- ◇ Alarm – shall allow the user to define the Alarm limit parameters, set the Reminder Frequency, and link the e-mail message.
 - ◇ Database login – Shall protect the system from unauthorized database manipulation by creating a Read Access and a Write Access for each of the Trend, Alarm (Event) and Audit databases as well as an Expert Mode required to restore a database.
- i. The Monitoring Settings Taskbar shall provide the following informational icons:
- ◇ Normal – Indicates by color and size that all databases are within their limits.
 - ◇ Warning - Indicates by color and size that one or more databases have exceeded their Warning limit.
 - ◇ Alarm - Indicates by color and size that one or more databases have exceeded their Alarm limit.
- j. The System shall provide user notification via Taskbar icons and e-mail messages when a database value has exceeded a warning or alarm limit.

2.4 NETWORK AUTOMATION ENGINES (NAE)

- A. Network Automation Engine (NAE 35XX)
1. The Network Automation Engine (NAE) shall be a fully user-programmable, supervisory controller. The NAE shall monitor the network of distributed application-specific controllers, provide global strategy and direction, and communicate on a peer-to-peer basis with other Network Automation Engines.
 2. Automation network – The NAE shall reside on the automation network and shall support a subnet of system controllers.
 3. User Interface – Each NAE shall have the ability to deliver a web based User Interface (UI) as previously described. All computers connected physically or virtually to the automation network shall have access to the web based UI.
 - a. The web based UI software shall be imbedded in the NAE. Systems that require a local copy of the system database on the user's personal computer are not acceptable.
 - b. The NAE shall support a minimum of two (2) concurrent users.
 - c. The web based user shall have the capability to access all system data through one NAE.
 - d. Remote users connected to the network through an Internet Service Provider (ISP) or telephone dial up shall also have total system access through one NAE.
 - e. Systems that require the user to address more than one NAE to access all system information are not acceptable.
 - f. The NAE shall have the capability of generating web based UI graphics. The graphics capability shall be imbedded in the NAE.
 - g. Systems that support UI Graphics from a central database or require the graphics to reside on the user's personal computer are not acceptable.
 - h. The web based UI shall support the following functions using a standard version of Microsoft Internet Explorer:

- ◇ Configuration
 - ◇ Commissioning
 - ◇ Data Archiving
 - ◇ Monitoring
 - ◇ Commanding
 - ◇ System Diagnostics
- i. Systems that require workstation software or modified web browsers are not acceptable.
 - j. The NAE shall allow temporary use of portable devices without interrupting the normal operation of permanently connected modems.
4. Processor – The NAE shall be microprocessor-based with a minimum word size of 32 bits. The NAE shall be a multi-tasking, multi-user, and real-time digital control processor. Standard operating systems shall be employed. NAE size and capability shall be sufficient to fully meet the requirements of this Specification.
 5. Memory – Each NAE shall have sufficient memory to support its own operating system, databases, and control programs, and to provide supervisory control for all control level devices.
 6. Hardware Real Time Clock – The NAE shall include an integrated, hardware-Based, real-time clock.
 7. The NAE shall include troubleshooting LED indicators to identify the following conditions:
 - a. Power - On/Off
 - b. Ethernet Traffic – Ethernet Traffic/No Ethernet Traffic
 - c. Ethernet Connection Speed – 10 Mbps/100 Mbps
 - d. FC Bus – Normal Communications/No Field Communications
 - e. Peer Communication – Data Traffic between NAE Devices
 - f. Run – NAE Running/NAE in Startup/NAE Shutting Down/Software Not Running
 - g. Bat Fault – Battery Defective, Data Protection Battery Not Installed
 - h. Fault – General Fault
 - i. Modem RX – NAE Modem Receiving Data
 - j. Modem TX – NAE Modem Transmitting Data
 8. Communications Ports – The NAE shall provide the following ports for operation of operator Input/Output (I/O) devices, such as industry-standard computers, modems, and portable operator’s terminals.
 - a. USB port
 - b. URS-232 serial data communication port
 - c. RS-485 port
 - d. Ethernet port
 9. Diagnostics – The NAE shall continuously perform self-diagnostics, communication diagnosis, and diagnosis of all panel components. The Network Automation Engine shall provide both local and remote annunciation of any detected component failures, low battery conditions, or repeated failures to establish communication.
 10. Power Failure – In the event of the loss of normal power, The NAE shall continue to operate for a user adjustable period of up to 10 minutes after which

there shall be an orderly shutdown of all programs to prevent the loss of database or operating system software.

- a. During a loss of normal power, the control sequences shall go to the normal system shutdown conditions. All critical configuration data shall be saved into Flash memory.
 - b. Upon restoration of normal power and after a minimum off-time delay, the controller shall automatically resume full operation without manual intervention through a normal soft-start sequence.
11. Certification – The NAE shall be listed by Underwriters Laboratories (UL).
 12. Controller network – The NAE shall support the following communication protocols on the controller network:
 - a. The NAE shall support BACnet Standard MS/TP Bus Protocol ASHRAE SSPC-135, Clause 9 on the controller network.
 - ◇ The NAE shall be BACnet Testing Labs (BTL) certified and carry the BTL Label.
 - ◇ The NAE shall be tested and certified as a BACnet Building Controller (B-BC).
 - ◇ A BACnet Protocol Implementation Conformance Statement shall be provided for the NAE.
 - ◇ The Conformance Statements shall be submitted 10 days prior to bidding.
 - ◇ The NAE shall support a minimum of 50 control devices.

2.5 DDC SYSTEM CONTROLLERS

- A. Field Equipment Controller (FEC X610)
 1. The Field Equipment Controller (FEC) shall be a fully user-programmable, digital controller that communicates via BACnet MS/TP protocol.
 - a. The FEC shall support BACnet Standard MS/TP Bus Protocol ASHRAE SSPC-135, Clause 9 on the controller network.
 - ◇ The FEC shall be BACnet Testing Labs (BTL) certified and carry the BTL Label.
 - ◇ The FEC shall be tested and certified as a BACnet Application Specific Controller (B-ASC).
 - ◇ A BACnet Protocol Implementation Conformance Statement shall be provided for the FEC.
 - ◇ The Conformance Statement shall be submitted 10 days prior to bidding.
 2. The FEC shall employ a finite state control engine to eliminate unnecessary conflicts between control functions at crossover points in their operational sequences. Suppliers using non-state based DDC shall provide separate control strategy diagrams for all controlled functions in their submittals.
 3. Controllers shall be factory programmed with a continuous adaptive tuning algorithm that senses changes in the physical environment and continually adjusts loop tuning parameters appropriately. Controllers that require manual tuning of loops or perform automatic tuning on command only shall not be acceptable.
 4. The FEC shall be assembled in a plenum-rated plastic housing with flammability rated to UL94-5VB.

5. The FEC shall include a removable base to allow pre-wiring without the controller.
6. The FEC shall include troubleshooting LED indicators to identify the following conditions:
 - a. Power On
 - b. Power Off
 - c. Download or Startup in progress, not ready for normal operation
 - d. No Faults
 - e. Device Fault
 - f. Field Controller Bus - Normal Data Transmission
 - g. Field Controller Bus - No Data Transmission
 - h. Field Controller Bus - No Communication
 - i. Sensor-Actuator Bus - Normal Data Transmission
 - j. Sensor-Actuator Bus - No Data Transmission
 - k. Sensor-Actuator Bus - No Communication
7. The FEC shall accommodate the direct wiring of analog and binary I/O field points.
8. The FEC shall support the following types of inputs and outputs:
 - a. Universal Inputs - shall be configured to monitor any of the following:
 - ◇ Analog Input, Voltage Mode
 - ◇ Analog Input, Current Mode
 - ◇ Analog Input, Resistive Mode
 - ◇ Binary Input, Dry Contact Maintained Mode
 - ◇ Binary Input, Pulse Counter Mode
 - b. Binary Inputs - shall be configured to monitor either of the following:
 - ◇ Dry Contact Maintained Mode
 - ◇ Pulse Counter Mode
 - c. Analog Outputs - shall be configured to output either of the following:
 - ◇ Analog Output, Voltage Mode
 - ◇ Analog Output, current Mode
 - d. Binary Outputs - shall output the following:
 - ◇ 24 VAC Triac
 - e. Configurable Outputs - shall be capable of the following:
 - ◇ Analog Output, Voltage Mode
 - ◇ Binary Output Mode
9. The FEC shall have the ability to reside on a Field Controller Bus (FC Bus).
 - a. The FC Bus shall be a Master-Slave/Token-Passing (MS/TP) Bus supporting BACnet Standard protocol SSPC-135, Clause 9.
 - b. The FC Bus shall support communications between the FECs and the NAE.
 - c. The FC Bus shall also support Input/Output Module (IOM) communications with the FEC and with the NAE.
 - d. The FC Bus shall support a minimum of 100 IOMs and FECs in any combination.
 - e. The FC Bus shall operate at a maximum distance of 15,000 Ft. between the FEC and the furthest connected device.
 - f.
10. The FEC shall have the ability to monitor and control a network of sensors and actuators over a Sensor-Actuator Bus (SA Bus).

- a. The SA Bus shall be a Master-Slave/Token-Passing (MS/TP) Bus supporting BACnet Standard Protocol SSPC-135, Clause 9.
 - b. The SA Bus shall support a minimum of 10 devices per trunk.
 - c. The SA Bus shall operate at a maximum distance of 1,200 Ft. between the FEC and the furthest connected device.
11. The FEC shall have the capability to execute complex control sequences involving direct wired I/O points as well as input and output devices communicating over the FC Bus or the SA Bus.
12. The FEC shall support, but not be limited to, the following:
- a. Hot water, chilled water/central plant applications
 - b. Built-up air handling units for special applications
- C. Terminal units
- c. Special programs as required for systems control

2.6 FIELD DEVICES

- A. Input/Output Module (IOM X710)
- 1. The Input/Output Module (IOM) provides additional inputs and outputs for use in the FEC.
 - 2. The IOM shall communicate with the FEC over the FC Bus or the SA Bus.
 - 3. The IOM shall support BACnet Standard MS/TP Bus Protocol ASHRAE SSPC-135, Clause 9 on the controller network.
 - a. The IOM shall be BACnet Testing Labs (BTL) certified and carry the BTL Label.
 - b. The IOM shall be tested and certified as a BACnet Application Specific Controller (B-ASC).
 - c. A BACnet Protocol Implementation Conformance Statement shall be provided for the FEC.
 - d. The Conformance Statement shall be submitted 10 days prior to bidding.
 - 4. The IOM shall be assembled in a plenum-rated plastic housing with flammability rated to UL94-5VB.
 - 5. The IOM shall have a minimum of 4 points to a maximum of 17 points.
 - 6. The IOM shall support the following types of inputs and outputs:
 - a. Universal Inputs - shall be configured to monitor any of the following:
 - ◇ Analog Input, Voltage Mode
 - ◇ Analog Input, Current Mode
 - ◇ Analog Input, Resistive Mode
 - ◇ Binary Input, Dry Contact Maintained Mode
 - ◇ Binary Input, Pulse Counter Mode
 - b. Binary Inputs - shall be configured to monitor either of the following:
 - ◇ Dry Contact Maintained Mode
 - ◇ Pulse Counter Mode
 - c. Analog Outputs - shall be configured to output either of the following:
 - ◇ Analog Output, Voltage Mode
 - ◇ Analog Output, current Mode
 - d. Binary Outputs - shall output the following:
 - ◇ 24 VAC Triac
 - e. Configurable Outputs - shall be capable of the following:

- ◇ Analog Output, Voltage Mode
- ◇ Binary Output Mode
- 7. The IOM shall include troubleshooting LED indicators to identify the following conditions:
 - a. Power On
 - b. Power Off
 - c. Download or Startup in progress, not ready for normal operation
 - d. No Faults
 - e. Device Fault
 - f. Normal Data Transmission
 - g. No Data Transmission
 - h. No Communication
- B. Network Sensors (NS-XXX700X)
 - 1. The Network Sensors (NS) shall have the ability to monitor the following variables as required by the systems sequence of operations:
 - a. Zone Temperature
 - b. Zone Humidity
 - c. Zone Setpoint
 - d. Discharge Air Temperature
 - 2. The NS shall transmit the information back to the controller on the Sensor-Actuator Bus (SA Bus) using BACnet Standard protocol SSPC-135, Clause 9.
 - 3. The NS shall be BACnet Testing Labs (BTL) certified and carry the BTL Label.
 - a. The NS shall be tested and certified as a BACnet Smart Sensors (B-SS).
 - b. A BACnet Protocol Implementation Conformance Statement shall be provided for the NS.
 - c. The Conformance Statement shall be submitted 10 days prior to bidding.
 - 4. The Network Zone Sensors shall include the following items:
 - a. A backlit Liquid Crystal Display (LCD) to indicate the Temperature, Humidity and Setpoint
 - b. An LED to indicate the status of the Override feature
 - c. A button to toggle the temperature display between Fahrenheit and Celsius
 - d. A button to initiate a timed override command
 - e. Available in either surface mount or wall mount
 - f. Available with either screw terminals or phone jack
 - 5. The Network Discharge Air Sensors shall include the following:
 - a. 4 inch or 8 inch duct insertion probe
 - b. 10 foot pigtail lead
 - c. Dip Switches for programmable address selection
 - d. Ability to provide an averaging temperature from multiple locations
 - e. Ability to provide a selectable temperature from multiple locations

2.7 SYSTEM TOOLS

- A. System Configuration Tool (SCT)
 - 1. The Configuration Tool shall be a software package enabling a computer platform to be used as a stand-alone engineering configuration tool for a Network Automation Engine (NAE) or a Network Integration Engine (NIE).

2. The configuration tool shall provide an archive database for the configuration and application data.
3. The configuration tool shall have the same look-and-feel at the User Interface (UI) regardless of whether the configuration is being done online or offline.
4. The configuration tool shall include the following features:
 - a. Basic system navigation tree for connected networks
 - b. Integration of Metasys N1, LonWorks, and BACnet enabled devices
 - c. Customized user navigation trees
 - d. Point naming operating parameter setting
 - e. Graphic diagram configuration
 - f. Alarm and event message routing
 - g. Graphical logic connector tool for custom programming
 - h. Downloading, uploading, and archiving databases
5. The configuration tool shall have the capability to automatically discover field devices on connected buses and networks. Automatic discovery shall be available for the following field devices:
 - a. BACnet Devices
 - b. LonWorks devices
 - c. N2 Bus devices
 - d. Metasys N1 networks
6. The configuration tool shall be capable of programming the Field Equipment Controllers.
 - a. The configuration tool shall provide the capability to configure, simulate, and commission the Field Equipment Controllers.
 - b. The configuration tool shall allow the FECs to be run in Simulation Mode to verify the applications.
 - c. The configuration tool shall contain a library of standard applications to be used for configuration.
7. The configuration tool shall be capable of programming the field devices.
 - a. The configuration tool shall provide the capability to configure, simulate, and commission the field devices.
 - b. The configuration tool shall allow the field devices to be run in Simulation Mode to verify the applications.
 - c. The configuration tool shall contain a library of standard applications to be used for configuration
8. A wireless access point shall allow a wireless enabled portable PC to make a temporary Ethernet connection to the automation network.
 - a. The wireless connection shall allow the PC to access configuration tool through the web browser using the User Interface (UI).
 - b. The wireless use of configuration tool shall be the same as a wired connection in every respect.
 - c. The wireless connection shall use the Bluetooth Wireless Technology.

2.8 INPUT DEVICES

- A. General Requirements

1. Installation, testing, and calibration of all sensors, transmitters, and other input devices shall be provided to meet the system requirements.

B. Temperature Sensors

1. General Requirements:

- a. Sensors and transmitters shall be provided, as outlined in the input/output summary and sequence of operations.
- b. The temperature sensor shall be of the resistance type, and shall be either two-wire 1000 ohm nickel RTD, or two-wire 1000 ohm platinum RTD.
- c. The following point types (and the accuracy of each) are required, and their associated accuracy values include errors associated with the sensor, lead wire, and A to D conversion:

Point Type	Accuracy
Chilled Water	$\pm .5^{\circ}\text{F}$.
Room Temp	$\pm .5^{\circ}\text{F}$.
Duct Temperature	$\pm .5^{\circ}\text{F}$.
All Others	$\pm .75^{\circ}\text{F}$.

2. Room Temperature Sensors

- a. Room sensors shall be constructed for either surface or wall box mounting.
- b. Room sensors shall have the following options when specified:
 - ◇ Setpoint reset slide switch providing a ± 3 degree (adjustable) range.
 - ◇ Individual heating/cooling setpoint slide switches.
 - ◇ A momentary override request push button for activation of after-hours operation.
 - ◇ Analog thermometer.

3. Room Temperature Sensors with Integral Display

- a. Room sensors shall be constructed for either surface or wall box mounting.
- b. Room sensors shall have an integral LCD display and four button keypad with the following capabilities:
 - ◇ Display room and outside air temperatures.
 - ◇ Display and adjust room comfort setpoint.
 - ◇ Display and adjust fan operation status.
 - ◇ Timed override request push button with LED status for activation of after-hours operation.
 - ◇ Display controller mode.
 - ◇ Password selectable adjustment of setpoint and override modes.

4. Thermo wells

- a. When thermo wells are required, the sensor and well shall be supplied as a complete assembly, including wellhead and Greenfield fitting.
- b. Thermo wells shall be pressure rated and constructed in accordance with the system working pressure.
- c. Thermo wells and sensors shall be mounted in a threadolet or 1/2" NPT saddle and allow easy access to the sensor for repair or replacement.
- d. Thermo wells shall be constructed of 316 stainless steel.

5. Outside Air Sensors
 - a. Outside air sensors shall be designed to withstand the environmental conditions to which they will be exposed. They shall also be provided with a solar shield.
 - b. Sensors exposed to wind velocity pressures shall be shielded by a perforated plate that surrounds the sensor element.
 - c. Temperature transmitters shall be of NEMA 3R construction and rated for ambient temperatures.
 6. Duct Mount Sensors
 - a. Duct mount sensors shall mount in an electrical box through a hole in the duct, and be positioned so as to be easily accessible for repair or replacement.
 - b. Duct sensors shall be insertion type and constructed as a complete assembly, including lock nut and mounting plate.
 - c. For outdoor air duct applications, a weatherproof mounting box with weatherproof cover and gasket shall be used.
 7. Averaging Sensors
 - a. For ductwork greater in any dimension than 48 inches and/or where air temperature stratification exists, an averaging sensor with multiple sensing points shall be used.
 - b. For plenum applications, such as mixed air temperature measurements, a string of sensors mounted across the plenum shall be used to account for stratification and/or air turbulence. The averaging string shall have a minimum of 4 sensing points per 12-foot long segment.
 - c. Capillary supports at the sides of the duct shall be provided to support the sensing string.
 8. Acceptable Manufacturers: Johnson Controls, Setra.
- C. Humidity Sensors
1. The sensor shall be a solid-state type, relative humidity sensor of the Bulk Polymer Design. The sensor element shall resist service contamination.
 2. The humidity transmitter shall be equipped with non-interactive span and zero adjustments, a 2-wire isolated loop powered, 4-20 mA, 0-100% linear proportional output.
 3. The humidity transmitter shall meet the following overall accuracy, including lead loss and Analog to Digital conversion. 3% between 20% and 80% RH @ 77 Deg F unless specified elsewhere.
 4. Outside air relative humidity sensors shall be installed with a rain proof, perforated cover. The transmitter shall be installed in a NEMA 3R enclosure with sealtite fittings and stainless steel bushings.
 5. A single point humidity calibrator shall be provided, if required, for field calibration. Transmitters shall be shipped factory pre-calibrated.
 6. Duct type sensing probes shall be constructed of 304 stainless steel, and shall be equipped with a neoprene grommet, bushings, and a mounting bracket.
 7. Acceptable Manufacturers: Johnson Controls, Veris Industries, and Mamac.
- D. Differential Pressure Transmitters
1. General Air and Water Pressure Transmitter Requirements:

- a. Pressure transmitters shall be constructed to withstand 100% pressure over-range without damage, and to hold calibrated accuracy when subject to a momentary 40% over-range input.
 - b. Pressure transmitters shall transmit a 0 to 5 VDC, 0 to 10 VDC, or 4 to 20 mA output signal.
 - c. Differential pressure transmitters used for flow measurement shall be sized to the flow sensing device, and shall be supplied with Tee fittings and shut-off valves in the high and low sensing pick-up lines to allow the balancing Contractor and Owner permanent, easy-to-use connection.
 - d. A minimum of a NEMA 1 housing shall be provided for the transmitter. Transmitters shall be located in accessible local control panels wherever possible.
2. Low Differential Water Pressure Applications (0" - 20" w.c.)
- a. The differential pressure transmitter shall be of industrial quality and transmit a linear, 4 to 20 mA output in response to variation of flow meter differential pressure or water pressure sensing points.
 - b. The differential pressure transmitter shall have non-interactive zero and span adjustments that are adjustable from the outside cover and meet the following performance specifications:
 - ◇ .01-20" w.c. input differential pressure range.
 - ◇ 4-20 mA output.
 - ◇ Maintain accuracy up to 20 to 1 ratio turndown.
 - ◇ Reference Accuracy: +0.2% of full span.
 - c. Acceptable Manufacturers: Setra and Mamac.
3. Medium to High Differential Water Pressure Applications (Over 21" w.c.)
- a. The differential pressure transmitter shall meet the low pressure transmitter specifications with the following exceptions:
 - ◇ Differential pressure range 10" w.c. to 300 PSI.
 - ◇ Reference Accuracy: $\pm 1\%$ of full span (includes non-linearity, hysteresis, and repeatability).
 - b. Standalone pressure transmitters shall be mounted in a bypass valve assembly panel. The panel shall be constructed to NEMA 1 standards. The transmitter shall be installed in the panel with high and low connections piped and valved. Air bleed units, bypass valves, and compression fittings shall be provided.
 - c. Acceptable Manufacturers: Setra and Mamac.
4. Building Differential Air Pressure Applications (-1" to +1" w.c.)
- a. The differential pressure transmitter shall be of industrial quality and transmit a linear, 4 to 20 mA output in response to variation of differential pressure or air pressure sensing points.
 - b. The differential pressure transmitter shall have non-interactive zero and span adjustments that are adjustable from the outside cover and meet the following performance specifications:
 - ◇ -1.00 to +1.00 w.c. input differential pressure ranges. (Select range appropriate for system application)
 - ◇ 4-20 mA output.
 - ◇ Maintain accuracy up to 20 to 1 ratio turndown.
 - ◇ Reference Accuracy: +0.2% of full span.
 - c. Acceptable Manufacturers: Johnson Controls and Setra.
5. Low Differential Air Pressure Applications (0" to 5" w.c.)

- a. The differential pressure transmitter shall be of industrial quality and transmit a linear, 4 to 20 mA output in response to variation of differential pressure or air pressure sensing points.
 - b. The differential pressure transmitter shall have non-interactive zero and span adjustments that are adjustable from the outside cover and meet the following performance specifications:
 - ◇ (0.00 - 1.00" to 5.00") w.c. input differential pressure ranges. (Select range appropriate for system application.)
 - ◇ 4-20 mA output.
 - ◇ Maintain accuracy up to 20 to 1 ratio turndown.
 - ◇ Reference Accuracy: +0.2% of full span.
 - c. Acceptable Manufacturers: Johnson Controls and Setra.
6. Medium Differential Air Pressure Applications (5" to 21" w.c.)
- a. The pressure transmitter shall be similar to the Low Air Pressure Transmitter, except that the performance specifications are not as severe. Differential pressure transmitters shall be provided that meet the following performance requirements:
 - ◇ Zero & span: (c/o F.S./Deg. F): .04% including linearity, hysteresis and repeatability.
 - ◇ Accuracy: 1% F.S. (best straight line) Static Pressure Effect: 0.5% F.S. (to 100 PSIG.
 - ◇ Thermal Effects: <+.033 F.S./Deg. F. over 40°F. to 100°F. (calibrated at 70°F.).
 - b. Standalone pressure transmitters shall be mounted in a bypass valve assembly panel. The panel shall be constructed to NEMA 1 standards. The transmitter shall be installed in the panel with high and low connections piped and valved. Air bleed units, bypass valves, and compression fittings shall be provided.
 - c. Acceptable manufacturers: Johnson Controls and Setra.
7. Water Flow Switches
- a. Water flow switches shall be equal to the Johnson Controls P74.
8. Low Temperature Limit Switches
- a. The low temperature limit switch shall be of the manual reset type with Double Pole/Single Throw snap acting contacts rated for 16 amps at 120VAC.
 - b. The sensing element shall be a minimum of 15 feet in length and shall react to the coldest 18-inch section. Element shall be mounted horizontally across duct in accordance with manufacturers recommended installation procedures.
 - c. For large duct areas where the sensing element does not provide full coverage of the air stream, additional switches shall be provided as required to provide full protection of the air stream.
 - d. The low temperature limit switch shall be equal to Johnson Controls A70.

2.9 OUTPUT DEVICES

A. Actuators

1. General Requirements
 - a. Damper and valve actuators shall be electronic and/or pneumatic, as specified in the System Description section.
2. Electronic Damper Actuators

- a. Electronic damper actuators shall be direct shaft mount.
 - b. Modulating and two-position actuators shall be provided as required by the sequence of operations. Damper sections shall be sized Based on actuator manufacturer's recommendations for face velocity, differential pressure and damper type. The actuator mounting arrangement and spring return feature shall permit normally open or normally closed positions of the dampers, as required. All actuators (except terminal units) shall be furnished with mechanical spring return unless otherwise specified in the sequences of operations. All actuators shall have external adjustable stops to limit the travel in either direction, and a gear release to allow manual positioning.
 - c. Modulating actuators shall accept 24 VAC or VDC power supply, consume no more than 15 VA, and be UL listed. The control signal shall be 2-10 VDC or 4-20 mA, and the actuator shall provide a clamp position feedback signal of 2-10 VDC. The feedback signal shall be independent of the input signal and may be used to parallel other actuators and provide true position indication. The feedback signal of one damper actuator for each separately controlled damper shall be wired back to a terminal strip in the control panel for trouble-shooting purposes.
 - d. Two-position or open/closed actuators shall accept 24 or 120 VAC power supply and be UL listed. Isolation, smoke, exhaust fan, and other dampers, as specified in the sequence of operations, shall be furnished with adjustable end switches to indicate open/closed position or be hard wired to start/stop associated fan. Two-position actuators, as specified in sequences of operations as "quick acting," shall move full stroke within 20 seconds. All smoke damper actuators shall be quick acting.
 - e. Acceptable manufacturers: Johnson Controls, Mamac.
3. Electronic Valve Actuators
- a. Electronic valve actuators shall be manufactured by the valve manufacturer.
 - b. Each actuator shall have current limiting circuitry incorporated in its design to prevent damage to the actuator.
 - c. Modulating and two-position actuators shall be provided as required by the sequence of operations. Actuators shall provide the minimum torque required for proper valve close-off against the system pressure for the required application. The valve actuator shall be sized Based on valve manufacturer's recommendations for flow and pressure differential. All actuators shall fail in the last position unless specified with mechanical spring return in the sequence of operations. The spring return feature shall permit normally open or normally closed positions of the valves, as required. All direct shaft mount rotational actuators shall have external adjustable stops to limit the travel in either direction.
 - d. Modulating Actuators shall accept 24 VAC or VDC and 120 VAC power supply and be UL listed. The control signal shall be 2-10 VDC or 4-20 mA and the actuator shall provide a clamp position feedback signal of 2-10 VDC. The feedback signal shall be independent of the input signal, and may be used to parallel other actuators and provide true position indication. The feedback signal of each valve actuator (except terminal valves) shall be wired back to a terminal strip in the control panel for trouble-shooting purposes.
 - e. Two-position or open/closed actuators shall accept 24 or 120 VAC power supply and be UL listed. Butterfly isolation and other valves, as specified in the sequence of operations, shall be furnished with adjustable end

switches to indicate open/closed position or be hard wired to start/stop the associated pump or chiller.

f. Acceptable manufacturers: Johnson Controls

B. Control Dampers

1. The BMS Contractor shall furnish all automatic dampers. All automatic dampers shall be sized for the application by the BMS Contractor or as specifically indicated on the Drawings.
2. All dampers used for throttling airflow shall be of the opposed blade type arranged for normally open or normally closed operation, as required. The damper is to be sized so that, when wide open, the pressure drop is a sufficient amount of its close-off pressure drop to shift the characteristic curve to near linear.
3. All dampers used for two-position, open/close control shall be parallel blade type arranged for normally open or closed operation, as required.
4. Damper frames and blades shall be constructed of either galvanized steel or aluminum. Maximum blade length in any section shall be 60". Damper blades shall be 16-gauge minimum and shall not exceed eight (8) inches in width. Damper frames shall be 16-gauge minimum hat channel type with corner bracing. All damper bearings shall be made of reinforced nylon, stainless steel or oil-impregnated bronze. Dampers shall be tight closing, low leakage type, with synthetic elastomer seals on the blade edges and flexible stainless steel side seals. Dampers of 48"x48" size shall not leak in excess of 8.0 cfm per square foot when closed against 4" w.g. static pressure when tested in accordance with AMCA Std. 500.
5. Airfoil blade dampers of double skin construction with linkage out of the air stream shall be used whenever the damper face velocity exceeds 1500 FPM or system pressure exceeds 2.5" w.g., but no more than 4000 FPM or 6" w.g. Acceptable manufacturers are Johnson Controls D-7250 D-1250 or D-1300, Ruskin CD50, and Vent Products 5650.
6. One piece rolled blade dampers with exposed or concealed linkage may be used with face velocities of 1500 FPM or below. Acceptable manufacturers are: Johnson Controls D-1600, Ruskin CD36, and Vent Products 5800.
7. Multiple section dampers may be jack-shafted to allow mounting of piston pneumatic actuators and direct connect electronic actuators. Each end of the jackshaft shall receive at least one actuator to reduce jackshaft twist.

C. Control Relays

1. Control Pilot Relays
 - a. Control pilot relays shall be of a modular plug-in design with retaining springs or clips.
 - b. Mounting Bases shall be snap-mount.
 - c. DPDT, 3PDT, or 4PDT relays shall be provided, as appropriate for application.
 - d. Contacts shall be rated for 10 amps at 120VAC.
 - e. Relays shall have an integral indicator light and check button.
 - f. Acceptable manufacturers: Johnson Controls, Lectro

D. Control Valves

1. All automatic control valves shall be fully proportioning and provide near linear heat transfer control. The valves shall be quiet in operation and fail-safe open,

closed, or in their last position. All valves shall operate in sequence with another valve when required by the sequence of operations. All control valves shall be sized by the control manufacturer, and shall be guaranteed to meet the heating and cooling loads, as specified. All control valves shall be suitable for the system flow conditions and close against the differential pressures involved. Body pressure rating and connection type (sweat, screwed, or flanged) shall conform to the pipe schedule elsewhere in this Specification.

2. Chilled water control valves shall be modulating plug, ball, and/or butterfly, as required by the specific application. Modulating water valves shall be sized per manufacturer's recommendations for the given application. In general, valves (2 or 3-way) serving variable flow air handling unit coils shall be sized for a pressure drop equal to the actual coil pressure drop, but no less than 5 PSI. Valves (3-way) serving constant flow air handling unit coils with secondary circuit pumps shall be sized for a pressure drop equal to 25% the actual coil pressure drop, but no less than 2 PSI. Mixing valves (3-way) serving secondary water circuits shall be sized for a pressure drop of no less than 5 PSI. Valves for terminal reheat coils shall be sized for a 2 PSIG pressure drop, but no more than a 5 PSI drop.
3. Ball valves shall be used for hot and chilled water applications, water terminal reheat coils, radiant panels, unit heaters, package air conditioning units, and fan coil units except those described hereinafter.
4. Modulating plug water valves of the single-seat type with equal percentage flow characteristics shall be used for all special applications as indicated on the valve schedule. Valve discs shall be composition type. Valve stems shall be stainless steel.
5. Butterfly valves shall be acceptable for modulating large flow applications greater than modulating plug valves, and for all two-position, open/close applications. In-line and/or three-way butterfly valves shall be heavy-duty pattern with a body rating comparable to the pipe rating, replaceable lining suitable for temperature of system, and a stainless steel vane. Valves for modulating service shall be sized and travel limited to 50 degrees of full open. Valves for isolation service shall be the same as the pipe. Valves in the closed position shall be bubble-tight.
6. Acceptable manufacturers: Johnson Controls

2.10 MISCELLANEOUS DEVICES

- E. Variable Frequency Motor Speed Control Drives
Danfoss FC100, Nema12, No Bypass, Rated for Motor being controlled.

2.11 SCOPE

- A. This specification describes the electrical, mechanical, environmental, agency and reliability requirements for three phase, adjustable frequency drives as specified herein and as shown on the contract drawings.

2.12 REFERENCES

- A. The adjustable frequency drives and all components shall be designed, manufactured and tested in accordance with the latest applicable standards.

1. Institute of Electrical and Electronic Engineers (IEEE)
 - a. IEEE 519-1992: Guide for harmonic content and control
 2. Underwriters Laboratories (UL508C: Power Conversion Equipment)
 - a. UL
 - b. cUL
 3. National Electrical Manufacturer's Association (NEMA)
 - a. ICS 7.0: Industrial Controls & Systems for AFDs.
 4. IEC 61800-2 and -3. EN 50082-1 and -2
 - a. Fulfill all EMC immunity requirements
- B. In case of conflict between the requirements of this section and those of the listed documents, the requirements of this section shall prevail.

2.13 SUBMITTALS

2.13.1 SUBMITTAL FOR REVIEW / APPROVAL

- A. The following information shall be submitted to the Engineer.
1. Dimensioned outline drawing.
 2. Control Schematic diagram.
 3. Power and control connection diagram(s)
- B. Submit four (4) copies of the above information.

2.13.2 SUBMITTAL FOR INFORMATION

- A. When requested by the Engineer the following product information shall be submitted:
1. Product bulletins
 2. Technical product data sheets
 3. Harmonic analysis result

2.13.3 SUBMITTAL FOR CLOSE-OUT

- A. The following information shall be submitted for record purposes prior to final payment.
1. Final as-built drawings and information for items listed section in 1.04.1.
 2. Installation information.

2.14 QUALIFICATIONS

- A. The supplier of the assembly shall be the manufacturer of the electromechanical power components used within the assembly, such as bypass contactors, power distribution circuit breakers, when specified. These parts, when specified, shall have a commonality with other manufacturer's products.
- B. For the equipment specified herein, the manufacturer shall be ISO 9002 certified.
- C. The supplier of this equipment shall have produced similar electrical equipment for a minimum period of ten (10) years. When requested by the Engineer, an acceptable list of installations with similar equipment shall be provided demonstrating compliance with this requirement.
- D. Adjustable Frequency Drives shall be on the basis of Danfoss FC1000 for function and quality.

2.15 DELIVERY, STORAGE, AND HANDLING

- A. Equipment shall be handled and stored in accordance with manufacturer's instructions. One (1) copy of these instructions shall be included with the equipment at time of shipment.

2.16 FIELD MEASUREMENTS

2.17 OPERATION AND MAINTENANCE MANUALS

- A. Five (5) copies of the equipment operation and maintenance manuals shall be provided.
- B. Operation and maintenance manuals shall include the following information:
 - 1. Instruction books
 - 2. Recommended renewal parts list.
 - 3. Drawings and information required by section 1.04.3

PART 3: PRODUCTS

3.1 ADJUSTABLE FREQUENCY DRIVES (AFD)

- A. Where shown on the drawings, adjustable frequency drives 1 through 250 HP shall have the following features:
 - 1. The AFDs shall be rated for 480 Vac (optional input voltages of 208, 240 Vac through 100 HP). The AFD shall provide microprocessor based control for three-phase induction motors. The controller's full load output current rating shall be based on variable torque application at 40° C ambient and 1-16 kHz switching frequency below 50 HP and 1-10 kHz 50 HP and above to reduce motor noise and avoid increased motor losses.
 - 2. The AFDs shall be of the Pulse Width Modulated (PWM) design converting the utility input voltage and frequency to a variable voltage and frequency output via

a two-step operation. Adjustable Current Source AFDs are not accepted. Insulated Gate Bipolar Transistors (IGBTs) shall be used in the inverter section. Bipolar Junction Transistors, GTOs or SCRs are not accepted. The AFD shall run at the above listed switching frequencies.

3. The AFDs shall have efficiency at full load and speed that exceeds 95% for AFDs below 15 HP and 97% for drives 15 HP and above. The efficiency shall exceed 90% at 50% speed and load.
4. The AFDs shall maintain a minimum line side displacement power factor of 0.96, regardless of speed and load.
5. The AFDs shall have a one (1) minute overload current rating of 110% for variable torque applications.
6. The AFDs shall be capable of operating any NEMA design B squirrel cage induction motor, regardless of manufacturer, with a horsepower and current rating within the capacity of the AFD.
7. The AFDs shall have an integral EMI/RFI filter as standard.
8. The AFDs shall limit harmonic distortion reflected onto the utility system to voltage and current levels as defined by IEEE 519-1992 for general systems applications, by utilizing the standard 3% nominal impedance integral ac three-phase line reactor. DC link chokes are not accepted.
9. Any harmonic calculations shall be done based on the kVA capacity, X/R ratio and the impedance of the utility transformer feeding the installation, as noted on the drawings, and the total system load. The calculations shall be made with the point of common coupling (PCC) being the point where the utility feeds multiple customers.
10. The system containing the AFDs shall comply with the 5% level of total harmonic distortion of line voltage and the line current limits as defined in IEEE 519-1992. If the system cannot meet the harmonic levels with the AFDs provided with the standard input line reactor or optional input isolation transformer, the AFD manufacturer shall supply an eighteen pulse, multiple bridge rectifier ac to dc conversion section with phase shifting transformer for all drives above 75 HP. This eighteen pulse rectifier converter shall result in a multiple pulse current waveform that will more nearly approximate a true sine wave to reduce voltage harmonic content on the utility line. The phase shifting transformer shall be of a single winding type to optimize its KVA rating and harmonic cancellation capability.

Harmonic filters are not accepted above 75 HP.

11. The AFDs shall be able to start into a spinning motor. The AFDs shall be able to determine the motor speed in any direction and resume operation without tripping. If the motor is spinning in the reverse direction, the AFDs shall start into the motor in the reverse direction, bring the motor to a controlled stop, and then accelerate the motor to the preset speed.

Standard operating conditions shall be:¹

- A. Incoming Power: Three-phase, 208 / 240 / 480 (+10% to -15%) and 50/60 Hz (+/-5 Hz) power to a fixed potential DC bus level.
- B. Frequency stability of +/-0.05% for 24 hours with voltage regulation of +/-1% of maximum rated output voltage.
- C. Speed regulation of +/- 0.5% of base speed.
- D. Load inertia dependant carryover (ride through) during utility loss.
- E. Insensitive to input line rotation.
- F. Humidity: 0 to 95% (non-condensing and non-corrosive).
- G. Altitude: 0 to 3,300 feet (1000 meters) above sea level.
- H. Ambient Temperature: -10 to 40 °C (VT).
- I. Storage Temperature: -40 to 70 °C.

13. Control Functions

- A. Frequently accessed AFD programmable parameters shall be adjustable from a digital operator keypad located on the front of the AFD. The AFDs shall have a 3 line alphanumeric programmable display with status indicators. Keypads must use plain English words for parameters, status, and diagnostic messages. Keypads that are difficult to read or understand are not accepted, and particularly those that use alphanumeric code and tables. Keypads shall be adjustable for contrast with large characters easily visible in normal ambient light.
- B. The keypad shall include a Hand-Off-Auto membrane selection and an Inverter/Bypass membrane selection. When in "Hand" the AFD will be started and the speed will be controlled from the up/down arrows. When in "Off", the AFD will be stopped. In "Auto", the AFD will start via an external contact closure or a communication network and the AFD speed will be controlled via an external speed reference.
- C. The keypad shall have copy / paste capability.
- D. Upon initial power up of the AFD, the keypad shall display a start up guide that will sequence all the necessary parameter adjustments for general start up.
- E. Standard advanced programming and trouble-shooting functions shall be available by using a personal computer's RS-232 port and Windows™ based software. In addition the software shall

permit control and monitoring via the AFD's RS232 port. The manufacturer shall supply a diskette with the required software. An easily understood instruction manual and software help screens shall also be provided. The computer software shall be used for modifying the drive setup and reviewing diagnostic and trend information as outlined in this section through section 18.

- F. The operator shall be able to scroll through the keypad menu to choose between the following:
 - 1. Parameter Menu
 - 2. Keypad Control
 - 3. System Menu
 - 4. Expander Boards
 - 5. Monitoring Menu
 - 6. Operate Menu

- G. The following setups and adjustments, at a minimum, are to be available:
 - 1. Start command from keypad, remote or communications port
 - 2. Speed command from keypad, remote or communications port
 - 3. Motor direction selection
 - 4. Maximum and minimum speed limits
 - 5. Acceleration and deceleration times, two settable ranges
 - 6. Critical (skip) frequency avoidance
 - 7. Torque limit
 - 8. Multiple attempt restart function
 - 9. Multiple preset speeds adjustment
 - 10. Catch a spinning motor start or normal start selection
 - 11. Programmable analog output

- 14. The AFD shall have the following system interfaces:
 - A. Inputs – A minimum of six (6) programmable digital inputs, two (2) analog inputs and serial communications interface shall be provided with the following available as a minimum:
 - 1. Remote manual/auto
 - 2. Remote start/stop
 - 3. Remote forward/reverse
 - 4. Remote preset speeds
 - 5. Remote external trip
 - 6. Remote fault reset
 - 7. Process control speed reference interface, 4-20mA dc
 - 8. Potentiometer or process control speed reference interface, 0 -10Vdc
 - 9. RS232 programming and operation interface port

 - B. Outputs – A minimum of two (2) discrete programmable digital outputs, one (1) programmable open collector output, and one

(1) programmable analog output shall be provided, with the following available at minimum.

1. Programmable relay outputs with one (1) set of Form C contacts for each, selectable with the following available at minimum:

- a. Fault
- b. Run
- c. Ready
- d. Reversing
- e. Jogging
- f. At speed
- g. In torque limit
- h. Motor rotation direction opposite of commanded
- i. Over temperature

2. Programmable open collector output with available 24Vdc power supply and selectable with the following available at minimum:

- a. Fault
- b. Run
- c. Ready
- d. Reversing
- e. Jogging
- f. At speed
- g. In torque limit
- h. Motor rotation direction opposite of commanded
- i. Over temperature

3. Programmable analog output signal, selectable with the following available at minimum:

- a. Output frequency
- b. Frequency reference
- c. Motor speed
- d. Output current
- e. Motor torque
- f. Motor power
- g. Motor voltage
- h. DC link voltage
- i. PID controller reference value
- j. PID controller actual value 1
- k. PID controller actual value 2
- l. PID controller error value
- m. PID controller output

C. Capability of two additional expandable I/O interface cards. Upon installation, software shall automatically identify the interface card and activate the appropriate parameters. This should be done without adding any new software.

15. Monitoring and Displays

- A. The AFD's display shall be a LCD type capable of displaying three (3) lines of text and the following thirteen (13) status indicators:

1. Run
2. Forward
3. Reverse
4. Stop
5. Ready
6. Alarm
7. Fault
8. I/O Terminal
9. Keypad
10. Bus/comm
11. Hand
12. Auto
13. Off

- B. The AFD's keypad shall be capable of displaying the following monitoring functions at a minimum:

1. Motor Speed (RPM and %)
2. Frequency reference
3. Output frequency
4. Motor current
5. Motor torque
6. Motor power
7. Motor voltage
8. DC-link voltage
9. Heat sink temperature
10. Motor run time (resetable)
11. Total operating days counter
12. Operating hours (resetable)
13. Total megawatt hours
14. Megawatt hours (resetable)
15. Voltage level of analog input
16. Current level of analog input
17. Digital inputs status
18. Digital and relay outputs status
19. Motor temperature rise
20. PID references

16. Protective Functions

- A. The AFD shall include the following protective features at minimum:

1. Over current
2. Over voltage
3. System fault
4. Under voltage
5. Input line supervision

6. Output phase supervision
7. Under temperature
8. Over temperature
9. Motor stalled
10. Motor over temperature
11. Motor under load
12. Logic voltage failure
13. Microprocessor failure
14. Brake chopper supervision
15. DC Injection braking

- B. The AFD shall provide ground fault protection during power-up, starting, and running. AFD's with no ground fault protection during running are not accepted.

17. Diagnostic Features

A. Active Faults

1. The last 10 faults shall be recorded and stored in sequential order
2. Fault code and description of fault shall be displayed on the keypad.
3. Fault or alarm LED shall blink
4. Display drive data at time of fault
5. In the event several faults occur simultaneously, the sequence of active faults shall be viewable.
6. During a fault, the drive must be able to identify the following:
 - Drive Speed
 - Running hours
 - Running Days
 - Amps during fault
 - Motor Power
 - Motor Torque
 - DC bus Voltage
 - Drive Temperature

B. Fault History

1. The last 30 faults shall be recorded and stored in sequential order.
2. Display drive data at time of fault

18. Additional features included in the AFDs:

- A. The following indicating lights shall be provided on the keypad. .
1. Drive Ready
 2. Drive Run
 3. Drive Fault
- B. The current withstand rating of the drive shall be 100,000 AIC. .
- C. Communication card for interface with Johnson Controls Metasys control system.

- D. The AFD shall have a cooling fan that is field replaceable using non-screw accessibility.

19. Enclosure

- A. The AFD shall be designed in a NEMA Type 12 enclosure.
- B. The AFD shall have complete front accessibility with easily removable assemblies.
- C. Cable entry shall be bottom entry.

20. The AFD manufacturer shall maintain, as part of a national network, engineering service facilities within 250 miles of project to provide start-up service, emergency service calls, repair work, service contracts, maintenance and training of customer personnel.

PART 4: EXECUTION

4.1 FACTORY TESTING

- A. The following standard factory tests shall be performed on the equipment provided under this section. All tests shall be in accordance with the latest version of UL and NEMA standards.
 - 1. All printed circuit boards shall be functionally tested via automatic test equipment prior to unit installation.
 - 2. All final assemblies shall be tested at full load with application of line-to-line and line-to-ground bolted faults. The Adjustable Frequency Drive shall trip electronically without device failure.
 - 3. After all tests have been performed; each AFD shall undergo a burn-in test. The drive shall be burned in at 100% inductive or motor load without an unscheduled shutdown.
 - 4. After the burn-in cycle is complete, each AFD shall be put through a motor load test before inspection and shipping.
- B. All testing and manufacturing procedures shall be ISO 9001 certified.

4.2 FIELD QUALITY CONTROL

- A. Provide the services of a qualified manufacturer's employed Field Service Engineer or authorized service representative to assist the Contractor in installation and start-up of the equipment specified under this section. Field Service personnel shall be factory trained with periodic updates and have experience with the same model of AFD's on the job site. Sales representatives will not be accepted to perform this work. The manufacturer's service representative shall provide technical direction and assistance to

the Contractor in general assembly of the equipment, installation as specified in manufacturer's installation instructions, wiring, application dependant adjustments, and verification of proper AFD operation.

- B. The following minimum work shall be performed by the Contractor under the technical direction of the manufacturer's service representative.
 - 1. Inspection and final adjustments.
 - 2. Operational and functional checks of AFDs and spare parts.
 - 3. The contractor shall certify that he has read the drive manufacturer's installation instructions and has installed the AFD in accordance with those instructions.

4.3 MAINTNANCE / WARRANTY SERVICE

- A. Standard warranty is twenty-four (24) months from the date of shipment and covers the factory repair or replacement of the defective unit.

4.4 LOCAL CONTROL PANELS

- A. All control panels shall be factory constructed, incorporating the BMS manufacturer's standard designs and layouts. All control panels shall be UL inspected and listed as an assembly and carry a UL 508 label listing compliance. Control panels shall be fully enclosed, with perforated sub-panel, hinged door, and slotted flush latch.
- B. In general, the control panels shall consist of the DDC controller(s), display module as specified and indicated on the plans, and I/O devices—such as relays, transducers, and so forth—that are not required to be located external to the control panel due to function. Where specified the display module shall be flush mounted in the panel face unless otherwise noted.
- C. All I/O connections on the DDC controller shall be provide via removable or fixed screw terminals.
- D. Low and line voltage wiring shall be segregated. All provided terminal strips and wiring shall be UL listed, 300-volt service and provide adequate clearance for field wiring.
- E. All wiring shall be neatly installed in plastic trays or tie-wrapped.
- F. A convenience 120 VAC duplex receptacle shall be provided in each enclosure, fused on/off power switch, and required transformers.

4.5 POWER SUPPLIES

- A. DC power supplies shall be sized for the connected device load. Total rated load shall not exceed 75% of the rated capacity of the power supply.
- B. Input: 120 VAC +10%, 60Hz.
- C. Output: 24 VDC.
- D. Line Regulation: +0.05% for 10% line change.
- E. Load Regulation: +0.05% for 50% load change.
- F. Ripple and Noise: 1 mV rms, 5 mV peak to peak.
- G. An appropriately sized fuse and fuse block shall be provided and located next to the power supply.

- H. A power disconnect switch shall be provided next to the power supply.
- F. Thermostats
 - 1. Electric room thermostats of the heavy-duty type shall be provided for unit heaters, cabinet unit heaters, and ventilation fans, where required. All these items shall be provided with concealed adjustment. Finish of covers for all room-type instruments shall match and, unless otherwise indicated or specified, covers shall be manufacturer's standard finish.

PART 5 – PERFORMANCE / EXECUTION

5.1 BMS SPECIFIC REQUIREMENTS

- A. Graphic Displays
 - 1. Provide a color graphic system flow diagram display for each system with all points as indicated on the point list. All terminal unit graphic displays shall be from a standard design library.
 - 2. User shall access the various system schematics via a graphical penetration scheme and/or menu selection. .
- B. Custom Reports:
 - 1. Provide custom reports as required for this project:
- C. Actuation / Control Type
 - 1. Primary Equipment
 - a. Controls shall be provided by equipment manufacturer as specified herein.
 - b. All damper and valve actuation shall be electric.
 - 2. Air Handling Equipment
 - a. All air handlers shall be controlled with a HVAC-DDC Controller
 - b. All damper and valve actuation shall be electric.

5.2 INSTALLATION PRACTICES

- A. BMS Wiring
 - 1. All conduit, wiring, accessories and wiring connections required for the installation of the Building Management System, as herein specified, shall be provided by the BMS Contractor unless specifically shown on the Electrical Drawings under Division 16 Electrical. All wiring shall comply with the requirements of applicable portions of Division 16 and all local and national electric codes, unless specified otherwise in this section.
 - 2. All BMS wiring materials and installation methods shall comply with BMS manufacturer recommendations.
 - 3. The sizing, type and provision of cable, conduit, cable trays, and raceways shall be the design responsibility of the BMS Contractor. If complications arise, however, due to the incorrect selection of cable, cable trays, raceways and/or conduit by the BMS Contractor, the Contractor shall be responsible for all costs incurred in replacing the selected components.
 - 4. Class 2 Wiring

- a. All Class 2 (24VAC or less) wiring shall be installed in conduit unless otherwise specified.
 - b. Conduit is not required for Class 2 wiring in concealed accessible locations. Class 2 wiring not installed in conduit shall be supported every 5' from the building structure utilizing metal hangers designed for this application. Wiring shall be installed parallel to the building structural lines. All wiring shall be installed in accordance with local code requirements.
5. Class 2 signal wiring and 24VAC power can be run in the same conduit. Power wiring 120VAC and greater cannot share the same conduit with Class 2 signal wiring.
 6. Provide for complete grounding of all applicable signal and communications cables, panels and equipment so as to ensure system integrity of operation. Ground cabling and conduit at the panel terminations. Avoid grounding loops.
- B. BMS Line Voltage Power Source
1. 120-volt AC circuits used for the Building Management System shall be taken from panel boards and circuit breakers provided by Division 16.
 2. Circuits used for the BMS shall be dedicated to the BMS and shall not be used for any other purposes.
 3. DDC terminal unit controllers may use AC power from motor power circuits.
- C. BMS Raceway
1. All wiring shall be installed in conduit or raceway except as noted elsewhere in this specification. Minimum control wiring conduit size 1/2".
 2. Where it is not possible to conceal raceways in finished locations, surface raceway (Wiremold) may be used as approved by the Architect.
 3. All conduits and raceways shall be installed level, plumb, at right angles to the building lines and shall follow the contours of the surface to which they are attached.
 4. Flexible Metal Conduit shall be used for vibration isolation and shall be limited to 3 feet in length when terminating to vibrating equipment. Flexible Metal Conduit may be used within partition walls. Flexible Metal Conduit shall be UL listed.
- D. Penetrations
1. Provide fire stopping for all penetrations used by dedicated BMS conduits and raceways.
 2. All openings in fire proofed or fire stopped components shall be closed by using approved fire resistive sealant.
 3. All wiring passing through penetrations, including walls shall be in conduit or enclosed raceway.
 4. Penetrations of floor slabs shall be by core drilling. All penetrations shall be plumb, true, and square.

.BMS Identification Standards

5. Node Identification. All nodes shall be identified by a permanent label fastened to the enclosure. Labels shall be suitable for the node location.

Cable types specified in Item A shall be color coded for easy identification and troubleshooting.

E. BMS Panel Installation

1. The BMS panels and cabinets shall be located as indicated at an elevation of not less than 2 feet from the bottom edge of the panel to the finished floor. Each cabinet shall be anchored per the manufacturer's recommendations.
2. The BMS contractor shall be responsible for coordinating panel locations with other trades and electrical and mechanical contractors.

F. Input Devices

1. All Input devices shall be installed per the manufacturer recommendation
2. Locate components of the BMS in accessible local control panels wherever possible.

G. HVAC Input Devices – General

1. All Input devices shall be installed per the manufacturer recommendation
2. Locate components of the BMS in accessible local control panels wherever possible.
3. The mechanical contractor shall install all in-line devices such as temperature wells, pressure taps, airflow stations, etc.
4. Input Flow Measuring Devices shall be installed in strict compliance with ASME guidelines affecting non-standard approach conditions.
5. Outside Air Sensors
 - a. Sensors shall be mounted on the North wall to minimize solar radiant heat impact or located in a continuous intake flow adequate to monitor outside air conditions accurately.
 - b. Sensors shall be installed with a rain proof, perforated cover.
6. Water Differential Pressure Sensors
 - a. Differential pressure transmitters used for flow measurement shall be sized to the flow-sensing device.
 - b. Differential pressure transmitters shall be supplied with tee fittings and shut-off valves in the high and low sensing pick-up lines.
 - c. The transmitters shall be installed in an accessible location wherever possible.
7. Medium to High Differential Water Pressure Applications (Over 21" w.c.):
 - a. Air bleed units, bypass valves and compression fittings shall be provided.
8. Building Differential Air Pressure Applications (-1" to +1" w.c.):
 - a. Transmitters exterior sensing tip shall be installed with a shielded static air probe to reduce pressure fluctuations caused by wind.
 - b. The interior tip shall be inconspicuous and located as shown on the drawings.
9. Duct Temperature Sensors:

- a. Duct mount sensors shall mount in an electrical box through a hole in the duct and be positioned so as to be easily accessible for repair or replacement.
 - b. The sensors shall be insertion type and constructed as a complete assembly including lock nut and mounting plate.
 - c. For ductwork greater in any dimension than 48 inches or where air temperature stratification exists such as a mixed air plenum, utilize an averaging sensor.
 - d. The sensor shall be mounted to suitable supports using factory approved element holders.
10. Space Sensors:
- a. Shall be mounted per ADA requirements.
 - b. Provide lockable tamper-proof covers in public areas and/or where indicated on the plans.
11. Low Temperature Limit Switches:
- a. Install on the discharge side of the first water or steam coil in the air stream.
 - b. Mount element horizontally across duct in a serpentine pattern insuring each square foot of coil is protected by 1 foot of sensor.
 - c. For large duct areas where the sensing element does not provide full coverage of the air stream, provide additional switches as required to provide full protection of the air stream.
- H. HVAC Output Devices
1. All output devices shall be installed per the manufacturers recommendation. The mechanical contractor shall install all in-line devices such as control valves, dampers, airflow stations, pressure wells, etc.
 2. Actuators: All control actuators shall be sized capable of closing against the maximum system shut-off pressure. The actuator shall modulate in a smooth fashion through the entire stroke. When any pneumatic actuator is sequenced with another device, pilot positioners shall be installed to allow for proper sequencing.
 3. Control Dampers: Shall be opposed blade for modulating control of airflow. Parallel blade dampers shall be installed for two position applications.
 4. Control Valves: Shall be sized for proper flow control with equal percentage valve plugs. The maximum pressure drop for water applications shall be 5 PSI. The maximum pressure drop for steam applications shall be 7 PSI.
 5. Electronic Signal Isolation Transducers: Whenever an analog output signal from the Building Management System is to be connected to an external control system as an input (such as a chiller control panel), or is to receive as an input a signal from a remote system, provide a signal isolation transducer. Signal isolation transducer shall provide ground plane isolation between systems. Signals shall provide optical isolation between systems

5.2 TRAINING

- A. The BMS contractor shall provide the following training services:

1. One day of on-site orientation by a system technician who is fully knowledgeable of the specific installation details of the project. This orientation shall, at a minimum, consist of a review of the project as-built drawings, the BMS software layout and naming conventions, and a walk through of the facility to identify panel and device locations.

5.3 COMMISSIONING

- A. Fully commission all aspects of the Building Management System work.
- B. Acceptance Check Sheet
 1. Prepare a check sheet that includes all points for all functions of the BMS as indicated on the point list included in this specification.
 2. Submit the check sheet to the Engineer for approval
 3. The Engineer will use the check sheet as the basis for acceptance with the BMS Contractor.
- C. Promptly rectify all listed deficiencies and submit to the Engineer that this has been done.

END OF SECTION

SECTION 23 21 13 – HVAC PIPING

1.1 GENERAL

A. Summary

1. This section describes the basic materials and installation methods for the HVAC piping systems.

B. Description of Work

C. Quality Assurance

1. Qualify welding procedures, welders, and operators in accordance with ANSI B31.1, Paragraph 127.5, for shop and job site welding of piping work.

1.2 PRODUCTS

A. Piping Materials

B. Pipe/Tube Fittings

1.3 EXECUTION

A. Piping Installation

1. General
2. Steel Pipe
3. Copper Pipe
4. Final Connections to Equipment Furnished by Owner
5. Excavation, Installation, and Backfill for Underground Pipe

B. Chilled Water & Heating Water Piping

1. Piping

- a. Above ground piping 5” and larger: Black steel, ASTM A53, Schedule 40; 4” and smaller: Copper type “L”.
- b. Underground piping 5” and larger: 5” and larger: Black steel, ASTM A53, Schedule 40; 4” and smaller: Copper type “L”.

2. Fittings
3. Cold-springing
4. Automatic Air Vents

C. Condensate Drainage

1. Provide a condensate drain pipe to connect each cooling unit drain pan or funnel and to extend to and discharge into an open type drain in the sanitary plumbing system.

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- D. Chemical Treatment Piping for Open and Closed Loops System
- E. Cleaning, Flushing, Testing, and Inspecting

END OF SECTION

SECTION 23 21 14 – VALVES

1.1 GENERAL

A. Summary

1. This section describes the basic materials and installation methods for the valves associated with the piping systems.

B. Description of Work

C. Quality Assurance

1. Acceptable Manufacturers

- a. General Valves: Jenkins Bros. Valves, Crane Company, Stockham Valves and Fittings, Walworth Company, Kennedy Valve, Kitz, Nibco, or approved equal
- b. Ball Valves: Jenkins Bros. Valves, Jamesbury Corporation, Nibco, Stockham Valves and Fittings, Apollo, Kitz, approved equal.
- c. Backflow Preventers: Watts Regulator Company, Febco, Hersey Products, Inc., Wilkins, or approved equal.
- d. Refrigerant Valves: Mueller Brass Company, Henry Valve Company, Superior Valve Company, approved equal.
- e. Check Valves: Jenkins Bros. Valves, Crane Company, Muesco, Inc., APCO/Valve & Primer Corporation, Williams-Hager, Clow Pipeline Products, Valve Division, Nibco, Crane, Stockham, Milwaukee, Kitz, or approved equal.
- f. Butterfly Valves: Jenkins Bros. Valves, Jamesbury Corporation, Nibco, Stockham Valves and Fittings, Apollo, Keystone, Demco, Grinnell, Centerline, Kitz, or approved equal.

1.2 PRODUCTS

A. Materials

1. General
2. Refrigerant Valves
3. Butterfly Valves
4. Ball Valves
5. Gate Valves

B. Valves

1. Valves for service at or less than 150 psig.
2. Valves for service over 150 psig.
3. Check valves.
4. Valves for Water Make Up connections.
5. Relief Valve
6. Combination Pressure Reducing and Relief Valve for Make Up Water

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7. Reduced Pressure Backflow Preventer
8. Domestic Water Pressure Reducing Valves
9. Valves for Gas Connections

C. Fire Protection Valves

1. Check Valves
2. OS&Y Valves

1.3 Execution

A. Installation

1. Ball Valves
2. Valve Stems
3. Chain Operators
4. Swing Check Valves
5. Unions and Companion Flanges
6. Access Doors and Panels

END OF SECTION

SECTION 23 21 23 – HVAC PUMPS

1.1 GENERAL

A. Summary

1. This section describes the basic materials and installation methods for the water source heat pump systems.

B. Description of Work

1. Provide pumps as specified and indicated.

C. Quality Assurance

1. Acceptable Manufacturers: Bell and Gossett, Armstrong, Aurora, TACO, Myers, Patterson, PACO, Weil, and Worthington
2. Electrical Standards

- a. Provide electric motors and products which have been listed and labeled by Underwriters' Laboratories, Inc. (UL) and comply with National Electrical Manufacturers' Association (NEMA) Standards.

3. Certification, Pump Performance

1.2 PRODUCTS

A. Chilled, Condenser, and Heating Hot Water Pumps

1. Horizontal Split Case Pumps
2. End Suction Base-mounted Pumps

B. Circulating Pumps

1.3 EXECUTION

A. Inspection

B. Pump Installation

C. Electrical Connections

1. Provide positive electrical pump and motor grounding in accordance with applicable requirements of the NEC.

D. Field Quality Control

E. Split Case and End Suction Pumps.

END OF SECTION

SECTION 23 25 00 – WATER TREATMENT SYSTEMS

1.1 GENERAL

A. Summary

1. This section describes the basic materials and installation methods for the water treatment systems.

B. Description of Work

1. Chemicals
2. Testing Equipment and Reagents
3. Service Representative
4. Replacement and Rework

C. Quality Assurance

1. Qualifications
2. Packaging and Labeling
3. Electrical Standards
4. Chemical Standards

D. Submittals

1.2 PRODUCTS

A. General

1. Water Analysis
2. Pre-treatment
3. Cooling tower Blow-down
4. Governing Laws

B. Closed Loop Systems

C. Open Loop Systems

1.3 EXECUTION

A. Piping System Preparation.

B. Flushing

C. Open Loop System

D. Personnel Training

END OF SECTION

23 30 00 - DUCTWORK

PART 1 - GENERAL

1.1 SUMMARY

- A. The General Provisions, Supplemental General Provisions, section 23 01 00, Division 1 Specifications and Special Provisions apply to all Work specified in this Section.
- B. This section describes the basic materials and installation methods for the duct systems. Comply with other Division 23 sections and drawings as applicable. Refer to other divisions for coordination of work.
- C. Furnish and install all components of the duct systems specified herein, as indicated on the drawings, and as required to provide complete and operating systems.

1.2 DESCRIPTION OF WORK

- A. Work Included:
 - 1. Provide sheet metal ductwork as specified herein.
- B. Types: The types of ductwork specified in this Section include, but are not necessarily limited to the following:
 - 1. Air conditioning cooling and/or heating supply and return air systems
 - 2. Outdoor air supply systems
 - 3. Mechanical exhaust systems
 - 4. Air relief systems
 - 5. Kitchen exhaust systems
 - 6. Boiler breeching and boiler flue
- C. Supply Air Ductwork Downstream of Heat Pumps: Ductwork shall be sheet metal designed for velocities up to 1,500 fpm or a friction rate of 0.10 inches water column per 100 feet of duct, whichever is most stringent. The ductwork shall meet the latest SMACNA Standards for construction and stiffening based on the maximum pressure in the ductwork. Ductwork shall be 1" W.C. pressure class.
- D. VAV Supply Air Ductwork Upstream of Terminal Units (round or flat oval): Ductwork shall be sheet metal designed for velocities up to 2,800 fpm. The ductwork shall meet the latest SMACNA Standards for construction and stiffening based on the maximum pressure in the ductwork. Ductwork shall be 3" W.C. pressure class.
- E. VAV Supply Air Ductwork Upstream of Terminal Units (rectangular): Ductwork shall be sheet metal designed for velocities up to 2,300 fpm. The ductwork shall meet the latest SMACNA Standards for construction and stiffening based on the maximum pressure in the ductwork. Ductwork shall be 3" W.C. pressure class.
- F. Supply Air Ductwork Downstream of Terminal Units: Ductwork shall be sheet metal ductwork designed for velocities up to 1,500 fpm or a friction rate of 0.10 inches water column per 100 feet of duct, whichever is most stringent. The ductwork shall meet the latest SMACNA Standards for construction and stiffening based on the maximum pressure in the ductwork. Ductwork shall be 1" W.C. pressure class.

- G. Outside Air Ductwork (fan forced): Ductwork shall be sheet metal ductwork designed for velocities up to 2,500 fpm. The ductwork shall meet the latest SMACNA Standards for construction and stiffening based on the maximum pressure in the ductwork. Ductwork shall be 1" W.C. pressure class.
- H. Outside Air Ductwork (passive): Ductwork shall be sheet metal ductwork designed for velocities up to 1,000 fpm. The ductwork shall meet the latest SMACNA Standards for construction and stiffening based on the maximum pressure in the ductwork.
- ~~I. **Stairwell Pressurization Ductwork: Ductwork shall be sheet metal ductwork designed for velocities up to 3,000 fpm. The ductwork shall meet the latest SMACNA Standards for construction and stiffening based on the maximum pressure in the ductwork.**~~
- J. Restroom and General Exhaust Ductwork: Ductwork shall be sheet metal ductwork designed for velocities up to 1,500 fpm. The ductwork shall meet the latest SMACNA Standards for construction and stiffening based on the maximum pressure in the ductwork. Ductwork shall be 1" W.C. pressure class.
- ~~K. **Smoke Exhaust and Relief Air Ductwork: Ductwork shall be sheet metal ductwork designed for velocities up to 3,000 fpm. The ductwork shall meet the latest SMACNA Standards for construction and stiffening based on the maximum pressure in the ductwork.**~~
- ~~L. **Grease exhaust ductwork shall be designed for velocities up to 2,500 FPM. The ductwork shall meet the latest SMACNA standards for construction and stiffening based on the maximum pressure in the ductwork. Grease exhaust duct material and installation shall meet the requirements of NFPA 96 and shall be either 16 GA black carbon steel or 18 GA stainless steel, sloping at a minimum of 1/4" / foot back toward the hood. All grease exhaust duct shall be welded and leak tested. Cleanouts should be provided at least every 12 feet and at each change in direction.**~~
- M. Flexible Ductwork: Ductwork connections to HVAC terminal units and air devices shall be made with flexible ductwork connection where shown on the Drawings. Additional connections may be made using flexible ductwork at the Contractors opinion, where approved in writing, in advance, by the Engineer.
- N. Ductwork Insulation: Refer to section 23 07 00, "HVAC Insulation", for duct insulation.
- O. Ductwork Accessories: Refer to Section 23 33 00, "Ductwork Accessories", for accessories and specialties related to ductwork systems and installation.

1.3 QUALITY ASSURANCE

- A. Design and Installation Standards:
1. SMACNA HVAC Duct Construction Standards, latest edition.
 2. ASHRAE Standards: Comply with American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE 70-72) , Method of Testing for Rating the air flow performance of outlets and inlets.
 3. ADC Standard 1062R2, Air Diffusing Equipment Test Code.
 4. AMCA Standard 210, Test Code for Air Moving Devices.

5. NFPA 90-A, Standard for the Installation of Air Conditioning and Ventilating Systems, 2002 edition.

- B. Fire and Smoke Rating Test Standards: ASTM E84, NFPA 255 and UL 723.

1.4 SUBMITTALS

- A. Shop Drawings: Submit dimensioned layouts of ductwork showing both the accurately scaled ductwork and its relation to space enclosure. Show modifications of indicated requirements, made to conform to local shop practice and how those modifications ensure that the free area, materials, and weights are not reduced. The shop drawings must be submitted at ¼" = 1'-0" or larger scale and shall include all equipment connected to the duct systems, drawn to scale, based on the equipment submittals. All ductwork and equipment must indicate bottom elevations, referenced to finished floor below (bottom of duct = X'-Y" AFF, e.g.)

PART 2 - PRODUCTS

2.1 DUCTWORK MATERIALS

- A. Exposed Ductwork Materials: Where ductwork is indicated to be exposed to view in occupied spaces, provide materials which are free from visual imperfections including pitting, seam marks, roller marks, oil canning, stains, discolorations, and other imperfections, including those which would impair painting.
- B. Gauges, Rectangular Ductwork: Fabricate galvanized steel ductwork from the minimum gauges for sizes up to the corresponding maximum long-side dimensions as indicated in SMACNA Duct Construction Standards.
- C. Gauges, Round Ductwork: Fabricate lock-form quality galvanized steel ductwork from the minimum gauges for diameters up to the corresponding maximum dimensions as indicated in SMACNA Duct Construction Standards.
- D. Fiberglass Duct board: Fiberglass duct board is NOT an acceptable means of air transport.

2.2 MISCELLANEOUS DUCT MATERIALS

- A. General: Provide miscellaneous materials and products of the 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. Duct Sealant: Provide non-hardening, non-migrating mastic or liquid elastic sealant (type applicable for the fabrication/installation detail) as compounded and recommended by the manufacturer specifically for sealing joints and seams in ductwork.
- C. Ductwork Support Materials: Except as otherwise indicated, provide hot-dipped galvanized steel fasteners, anchors, rods, straps, trim, and angles for support of ductwork.
- D. Duct Liner Adhesive: Comply with ASC-A-7001 by The Adhesive and Sealant Council, Inc. (per SMACNA standards).

- E. Duct Liner Fasteners: Comply with SMACNA.
- F. Flexible Ductwork: Insulated flexible ductwork shall be Wiremold Type VTCK. Approved equal flexible ductwork by Certainteed Corporation, Flexaust Company, Genflex or Owens-Corning Fiberglass will be acceptable. Provide either 45 degree angle taps with manual volume dampers or "spin-in" taps with manual volume dampers at main duct tap as shown on Drawings.

PART 3 - EXECUTION

3.1 GENERAL REQUIREMENTS

- A. Standards: Round and rectangular sheet metal ductwork shall be constructed in accordance with SMACNA "HVAC Duct Constructions Standards", latest Edition, ASHRAE Guide and Data Book, "Handbook of Fundamentals", latest edition, specifically Chapter 25 and NFPA Standard 90-A, "Standard for the Installation of Air Conditioning and Ventilating Systems".
- B. All ductwork required for the heating, ventilating and air conditioning systems shall be constructed and erected in a first class workmanlike manner. This work shall be guaranteed for a period of one year from and after the date of acceptance of the job against noise, chatter, whistling, vibration, and free from pulsation under all conditions of operation.
- C. The interior surface of all ductwork shall be smooth with no parts projecting into the air stream unless specified to do so. All seams and joints shall be external. The inside of all ductwork shall be thoroughly cleaned and all fans operated to remove any debris prior to connection of air devices.
- D. All holes in ducts for damper rods and other necessary devices shall be either drilled or machine punched (not pin punched), and shall not be any larger than necessary. All duct openings shall be provided with sheet metal caps if the openings are to be left unconnected for any length of time.
- E. Where ducts, exposed to view (including equipment rooms), pass through walls, floors or ceilings, furnish and install sheet metal collars around the duct.
- F. Sheet metal plenums shall be constructed and reinforced in accordance with SMACNA standards. Where plenums are connected to louvers, the plenum bottom shall be sloped to drain to the louver.
- G. Ductwork which is exposed to weather shall have soldered joints and seams and shall be painted with a suitable epoxy coating. In lieu of solder joints, the use of duct-mate or TDC manufactured flanges are acceptable.

3.2 COORDINATION

- A. Prior to submitting ductwork shop drawings, the Division 23 Contractor shall fully coordinate the routing and height of all ductwork with all other trades and with ceiling heights, lighting fixtures and building construction.

3.3 GENERAL DUCTWORK FABRICATION

- A. Duct Gauge and Reinforcing:

1. Rectangular Ductwork: Minimum metal gauges and reinforcement shall be in accordance with SMACNA HVAC Duct Construction Standards (SDCS) Tables 1-3 through 1-13. Minimum aluminum gauges and reinforcement shall be in accordance with SDCS Tables 1-14 through 1-16. Reinforcing shall be installed per SDCS Fig. 1-9 through 1-12.
2. Round Ductwork: Minimum metal gauges for longitudinal and spiral seam round ductwork shall be in accordance with SDCS Table 3-2. Minimum aluminum gauges for longitudinal and spiral seam round ductwork shall be in accordance with SDCS Table 3-3. Longitudinal seam ductwork larger than 12" diameter shall not be permitted unless welded seams are used.
3. Cross-breaking: Cross-break or transverse bead all flat surfaces which are more than 12" wide. Transverse beading shall be on 12" centers and shall be a minimum of 1/8" deep at the center of the bead and 3/8" wide at the base of the bead.
4. Minimum Gauges: The metal gauges listed in the SDCS for round and rectangular ductwork are the minimum recommended. It shall be the Contractor's responsibility to select a metal gauge heavy enough to withstand the physical abuse of installation.

B. Duct Joints And Seams:

1. General: Make all joints airtight. The distance between transverse joints on any size duct shall not exceed 5'.
2. Rectangular Ductwork: Transverse joints and longitudinal seams in ductwork shall be constructed in accordance with SDCS Fig. 1-4 and 1-5. Drive slips may be used on rectangular ductwork on short sides only, up to 18" maximum. Gauge of drive slips shall be at least as heavy as ductwork on which they are installed. Bend drive slips over at least 3/4" at corners. Corner closures shall be in accordance with SDCS Fig. 1-13 through 1-18. All longitudinal seams shall be "Pittsburgh Lock" or button punch snap lock at corner seams and grooved seam or seam welded in sides between corners, in accordance with SDCS Fig. 1-5. At the Contractor's option, transverse joints may be transverse duct flange joints or Ductmate EP12/11 prefabricated galvanized "Ductmate" sections. The proposed gasket material, flange, corner piece and Ductmate details shall be submitted for approval.
3. Round Ductwork: Transverse joints for round ductwork shall be beaded sleeve type constructed in accordance with SDCS Fig. 3-2, properly secured and sealed. Draw bands shall not be used on round ductwork. Longitudinal and spiral seams shall be constructed in accordance with SDCS Fig. 3-1.
4. Ductwork Sealing: Seal all longitudinal and transverse ductwork joints and seams using SMACNA ductwork sealant and 3" wide open weave tape to provide positive seal. Sufficient sealant shall be used to completely imbed the cloth.

C. Connections and Take-offs:

1. Rectangular Ductwork: Parallel flow branches shall be constructed using radius elbow take-offs in accordance with SDCS Fig. 2-7. Branch duct connections shall be 45 degree entry expanded taps constructed in accordance with SDCS Fig. 2-8. Duct-mounted coil connections shall be constructed in accordance with SDCS Fig. 2-11.
2. Round Ductwork: Connections and takeoffs shall be made using 90 degree conical taps, 45 degree lateral taps or wye fittings constructed in accordance with SDCS Fig. 3-4 and 3-5. Use of 90 degree tees shall not be allowed.
3. Spin-in Fittings: Spin-in fittings may be used for duct taps to air supply and exhaust devices and shall include quadrant dampers even though a volume damper may be

specified for the air device. Spin-in fittings shall be sealed at the duct tap with a gasket and compression fit or sealed with duct sealant. The location of spin-in fittings in the ducts shall be determined after terminal units are hung and the location of the light fixtures is known so as to minimize flexible duct lengths and sharp bends. Spin-ins shall be installed with their damper axis parallel to airflow. A minimum of 18" must be provided between fittings.

4. Flexible Joints In Ductwork: Provide flexible connections where ductwork connects to air-handling units, fans, and similar powered equipment items and where required for expansion and contraction of the ductwork or the building structure. A minimum of one inch (1") slack shall be provided in all flexible connection to insure vibration isolation. Flexible joints are not required where equipment is connected with flexible duct. Flexible connections shall be rigidly connected to metal work on each side and shall be airtight. Bond flanges of flexible duct connectors to ducts and housings to provide airtight connections. Seal seams and penetrations to prevent air leakage.

D. Elbows and Tees:

1. Rectangular Ductwork: Provide radius or square elbows in ductwork, where shown on the Drawings. Where radius elbows are shown, radius elbows must be provided. Where square elbows are shown, square or radius elbows may be provided, at the Contractor's option. Elbows shall be constructed in accordance with SDCS Fig. 2-2. Turning vanes are required in all square elbows of 46 degrees or greater angle. Turning vanes are not required in radius elbows. Turning vanes shall be single vane type without a trailing edge and shall be constructed and installed in accordance with SDCS Fig. 2-3 and 2-4.
2. Round Ductwork: Provide radius elbows of the stamped or segmented type constructed in accordance with SDCS Fig. 3-3. Segmented elbows shall have a minimum of three segments for 45 degree elbows and five segments for 90 degree elbows.

- E. Offsets and Transitions: Where duct width increases, maximum angle of slope shall be 20 degrees (one inch (1") in 2.7"). Where duct width decreases, maximum angle of slope shall be 30 degrees (one inch (1") in 1.7"). Offsets and transitions shall be constructed in accordance with SDCS Fig. 2-9 and 2-10.

- F. Air Device Connections: Make connections to air devices and fabricate air device plenums as detailed on the Drawings and in accordance with SDCS Fig. 2-16 through 2-18.

3.4 DUCTLINER

- A. General: Ductliner shall only be used at unit discharge. All other areas shall utilize wrapped duct insulation. The liner shall be applied to the inside of the duct with heavy density side to the air stream and shall be secured in the duct with adhesive, completely coating the clean sheet metal. All joints in the insulation shall be "battered" and firmly butted tightly to the adjoining liner using fireproof adhesive. Where a cut is made for duct taps, etc., the raw edge shall be accurately and evenly cut and shall be thoroughly coated with fireproof adhesive. On ducts over 24" in width or depth, the liner shall be further secured with mechanical fasteners. The fasteners shall be A.J. Gerrard Company pronged straps, or approved equal, secured to the ducts by fireproof adhesive. The clips shall be 18" maximum spacing and shall be pointed up with fireproof adhesive. Liner shall be accurately cut and ends thoroughly coated with fireproof adhesive so that when the duct section is installed, the liner shall make a firmly butted and tightly sealed joint. Where ducts are lined exterior insulation will not be needed unless otherwise noted,

except that the two insulations shall lap not less than 24". Ductliner for velocities over 2,000 fpm shall be as specified except a perforated metal liner shall be used over ductliner for securement, in lieu of fasteners. Ductliner installation and fasteners shall comply with SDCS Fig. 2-22 through 2-25.

3.5 DUCTWORK INSTALLATION

- A. General: Assemble and install ductwork in accordance with recognized industry practices which will achieve airtight and noiseless systems, capable of performing each indicated service. Install each run with a 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 the type which will hold ducts true-to-shape and prevent buckling.
- B. Inserts: Install concrete inserts for support of ductwork in coordination with formwork, as required to avoid delays in the work.
- C. Completion: Complete fabrication of work at the project as necessary to match shop-fabricated work and accommodate installation requirements.
- D. Run Location: Locate ductwork runs, except as otherwise indicated, vertically and horizontally and avoid diagonal runs wherever possible. Locate runs as indicated by diagrams, grams, details, and notations or, if not otherwise indicated, run ductwork in the shortest route which does not obstruct usable space or block access for servicing the building and its equipment.

Hold ducts close to walls, overhead construction, columns, and other structural and permanent-enclosure elements of the building. Limit clearance to 0.5" where furring is shown for enclosure or concealment of ducts, but allow for insulation thickness, if any. Where possible, locate insulated ductwork to assure 1.0" clearance of insulation. Wherever 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 the layout with suspended ceiling and lighting layouts and similar finished work.

- E. Coordination: Coordinate duct installation with installation of accessories, dampers, coil frames, equipment, controls, and other associated work of the ductwork system.
- F. Hangers and Supports:
 - 1. General: All ductwork supports shall be per Section IV of the SMACNA "HVAC Duct Construction Standards - First Edition" with all supports directly anchored to the building structure. Supports shall be on maximum 8'-0" centers with additional supports as required to prevent sagging.
 - 2. Attachment to Structure: Provide hanger attachment to the building structure as specified in Section 15100, "Basic Materials and Methods", and in accordance with SDCS Fig. 4-1 through 4-3.
 - 3. Hangers: Hangers shall be strap or rod sized in accordance with SDCS Table 4-1 and 4-2. Strap hanger attachment to rectangular duct shall consist of a turning strap under the duct a minimum of one inch (1") and securing the strap with one screw into the bottom of the duct and one screw to the side of the duct. Rectangular duct supported on trapeze hangers shall be attached to the trapeze. Round duct attachments shall be constructed in accordance with SDCS Fig. 4-4.

4. Horizontal Ducts: Ducts larger than 50" in their greatest dimension shall be supported by means of hanger rods bolted to angle iron or half round trapeze hangers. Duct shall have at least one pair of supports 8'-0" on centers according to the following:

<u>Angle Length</u>	<u>Angle</u>	<u>Rod Diameter</u>
4'-0"	1-1/2" x 1-1/2" x 1/8"	1/4"
6'-0"	1-1/2" x 1-1/2" x 1/8"	1/4"
8'-0"	2" x 2" x 1/8"	5/16"
10'-0"	3" x 3" x 1/8"	3/8"

5. Vertical Ducts: Ducts shall be supported where they pass through the floor lines with 1-1/2" x 1-1/2" x 1/4" angles for ducts up to 60". Above 60", the angles must be increased in strength and sized on an individual basis considering space requirements.

G. Flexible Ductwork:

1. General: Flexible ductwork shall be provided as shown on Drawings. Flexible ducts shall be installed in a fully extended condition free of sags and kinks, using only the minimum length required to make the connection, subject to the maximum lengths herein and below. Bends in any length of flexible duct shall not exceed 45 degrees for HVAC terminal unit connections or 135 degrees for air device connections and shall not exceed that recommended by the flexible ductwork manufacturer. Unless otherwise shown on the Drawings, the length of any one run of flexible ductwork shall not exceed 2 feet to terminal units or 6 feet to air devices.
2. Supports: Where flexible duct extension exceeds 48", horizontally, a support shall be provided. Duct shall be suspended on 48" centers with a minimum two inch (2") wide flat banding material. Refer to SDCS Fig. 3-9 and 3-10 and Page 3-17 for additional requirements.
3. Terminal Unit Flexible Duct Connections: The terminal ends of the duct core shall be secured by stainless steel worm gear type clamps. The fittings on terminal units and on sheet metal duct shall be coated with sealant, then the flexible duct core slipped over duct and the clamp tightened, and the connections shall be sealed with duct sealant. Insulation of flexible duct shall be slipped over connection to point where insulation abuts terminal unit or insulation on duct and attached with self-locking nylon straps. The insulation connections shall then be sealed using foil duct tape to provide vapor barrier. Refer to SDCS Page 3-13 and 3-15 for additional requirements.
4. Air Device Flexible Duct Connections: All joints and connections shall be made by turning back the insulation and securing the inner liner with self-locking nylon straps and sealing with two wraps of duct tape. The insulation shall then be placed over the joint, attached with a self-locking nylon strap and sealed on the exterior with an approved foil duct tape. Refer to SDCS Page 3-13 and 3-15 for additional requirements.

H. Duct Mounted Devices:

1. Install duct mounted sensors and control devices furnished under Section 23 09 00, "Building Controls". Provide access doors at each duct mounted control device. Coordinate location of devices and installation requirements with the Section 23 09 00 Contractor.
2. Install duct type smoke detectors furnished under Division 26. Provide access doors at each sampling tube assembly. Coordinate location of detectors and installation requirements with Division 26.

3. Provide duct test ports in ductwork as required to properly balance all air systems. Test ports shall be located per ANSI/ASHRAE Standard III to allow accurate pitot-tube traverse measurements in ductwork.

3.6 CLEANING AND PROTECTION

- A. General: Clean ductwork internally, section-by-section of dust and debris as it is installed. Clean external surfaces of foreign substances which might cause corrosive deterioration of the metal or, where ductwork is to be painted, might interfere with painting or cause paint damage.
- B. Repairs: Strip protective paper from stainless ductwork surfaces and repair finish or replace ductwork portion wherever it has been damaged.
- C. Temporary Closure: At ends of ducts which are not connected to equipment or air distribution devices at the time of ductwork installation, provide temporary closure of polyethylene film or other covering which will prevent the entrance of dust and debris until such time that connections are to be completed.

END OF SECTION

SECTION 23 33 00 – DUCTWORK ACCESSORIES

1.1 GENERAL

A. Summary

1. This section describes the basic materials and installation methods for the registers, grilles, and diffusers.

B. Description of Work

1. Provide ductwork accessories for the project including the following:
 - a. Extractors
 - b. Turning vanes
 - c. Monitors
 - d. Splitter Dampers
 - e. Access Doors
 - f. Straightening Grids
 - g. Fire Dampers

C. Quality Assurance

D. Submittals

1.2 PRODUCTS

A. Ductwork accessories, fabrication, and materials

B. Flexible Connections

1. Flexible connections shall be UL labeled, 30 ounces glass fabric-lined with insulation and coated on both sides with neoprene, complete with attachment accessories, "Vent-Glass" by Vent-Fabrics, Inc. or approved equal.

C. Ductwork Hardware

1. Damper Operators shall be Young Regulator as noted, or an approved equal unit by Duo-Dyne or Vent Fabrics, Inc.

D. Directional, volume control, and fire dampers

1. Provide all direction and volume control and fire dampers shown or noted on Drawings.

E. Flashing and counter-flashing

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- F. Duct access doors
- G. Miscellaneous ductwork materials
- H. Turning vanes

1.3 EXECUTION

- A. Installation
- B. Testing

END OF SECTION

23 34 00 - FANS AND HOODS

PART 1 - GENERAL

1.1 SUMMARY

- A. The General Provisions, Supplemental General Provisions, section 23 01 00, Division 1 Specifications and Special Provisions apply to all Work specified in this Section.
- B. This section describes the basic materials and installation methods for the fan and hood systems. Comply with other Division 23 sections and drawings as applicable. Refer to other divisions for coordination of work.
- C. Furnish and install all components of the fan and hood systems specified herein, as indicated on the drawings, and as required to provide complete and operating systems.

1.2 DESCRIPTION OF WORK

- A. Work Included: Provide U.L. listed fans and ventilators as required by code and as specified.

1.3 QUALITY ASSURANCE

- A. Basis of design is Cook. Other acceptable manufacturers are ACME, Broan, Buffalo, Carnes, Greenheck, Penn, and Woods.

PART 2 - PRODUCTS

2.1 PRODUCT REQUIREMENTS

- A. Ratings: Fans shall be licensed to bear the AMCA certified ratings seal. Ratings of fans shall be based on 70°F and 29.92" of Hg atmospheric pressure. Air handling equipment shall be sized in conformance with applicable codes and good engineering practice. Roof-mounted units shall be located in coordination with the Architect to ensure proper sight lines.
- B. Construction: Fan construction shall be in accordance with AMCA classes of construction for the intended duty. Fan wheels, shafts, and drives shall be statically and dynamically balanced at the factory as a unit. Balance reports shall be factory-certified to the Construction Manger.
- C. Drives: Provide drives with a minimum belt horsepower capacity of 120% of the motor nameplate horsepower.
- D. Motor Sheaves: Motor sheaves shall be Browning Type, MVP, or approved equal, adjustable type with double-locking feature. Motor sheaves shall be selected for the

rated fan rpm and shall be adjustable to as close as 10% above and below the rated fan speed.

- E. Fan Sheaves: Provide adjustable or nonadjustable sheaves with removable machined bushings. Sheaves shall be machined on surfaces. Sheaves with over three grooves shall be dynamically balanced and the manufacturer shall so designate on each sheave. Fan sheaves with three grooves or less shall be statically balanced and weights required for balancing shall be welded to the sheaves. Manufacturers shall be Browning, Eaton, Yale, Towne, Dodge Manufacturing Company, or Fort Worth Steel and Machinery Company.
- F. Belts: Provide standard "V-groove" belts suitable for the service intended with the required capacities. The belts shall be closely matched and tagged prior to delivery to the job site. If the belts do not appear to be properly matched during operation, they shall be rechecked and, if necessary, replaced. Belts shall be as manufactured by Gates, Durkee-Atwood, Goodyear, Browning, or Uniroyal.
- G. Bearings: Provide SKF, Sealmaster, Timken, or Fafnir externally or internally-mounted, grease-lubricated, self-aligning ball bearings. Bearings shall have grease type zerk fittings.
- H. Motor Mount: Motors shall be mounted on an adjustable base rigidly supported on the fan and shall have extended shaft to accommodate the adjustable pitch sheave.

2.2 CENTRIFUGAL FANS

- A. General: Provide centrifugal fans of the single-width, single-inlet type with either forward or backward curved fan blades, and adjustable belt drives.
- B. Motors: Provide standard drip-proof motors. Provide cast iron housings for motors larger than 10 hp, riveted or spot-weld wheels with steel rims and hub plates.
- C. Fan: Blades shall be die cut, die-formed, and hubs shall be machined close-grained cast iron. Steel housings shall have lock-seam construction with discharge reinforcement and shall be adjustable with continuous inlet collars. Provide weatherproof enclosure for motors and drive, if units are exposed to weather.

2.3 CEILING EXHAUST FANS

- A. General: Provide direct driven ceiling exhaust fans as required. Fan shall be acoustically insulated and have a maximum sound level rating as scheduled.
- B. Motor: Motor shall be suitably grounded and mounted on rubber-in-shear vibration isolators and speeds shall not exceed that scheduled.
- C. Accessories:
 - 1. Provide totally noise-free, integral back draft damper, with no metal to metal contact.
 - 2. Inlet grille shall be white molded plastic with egg-crate or perforated shape and provide 85% free open area.
 - 3. Provide terminal box on the housing with cord, plug, and receptacle inside the housing.

2.4 — GREASE EXHAUST FANS

- ~~A. General: Fan shall be a spun aluminum, roof mounted, belt driven, upblast centrifugal exhaust ventilator, specifically designed and tested for use in applications requiring the exhaust of grease laden air.~~
- ~~B. Certifications: Fan shall be manufactured at an ISO 9001 certified facility. Fan shall be listed by Underwriters Laboratories (UL 705) and UL listed for Canada (cUL 705). Fan shall bear the AMCA certified ratings seal for sound and air performance.~~
- ~~C. Construction: The fan shall be of bolted and welded construction utilizing corrosion resistant fasteners. The spun aluminum structural components shall be constructed of minimum 16 gauge marine alloy aluminum, bolted to a rigid aluminum support structure. The aluminum base shall have a one piece inlet spinning and continuously welded curb cap corners for maximum leak protection. The windband shall have a rolled bead for added strength. A two piece top cap shall have stainless steel quick release latches to provide access into the motor compartment without the use of tools. An integral conduit chase shall be provided into the motor compartment to facilitate wiring connections. The motor, bearings and drives shall be mounted on a minimum 14 gauge steel power assembly, isolated from the unit structure with rubber vibration isolators. These components shall be enclosed in a weather-tight compartment, separated from the exhaust airstream. Lifting lugs shall be provided to help prevent damage from improper lifting. Unit shall bear an engraved aluminum nameplate. Nameplate shall indicate design CFM, static pressure, and maximum fan RPM. Unit shall be shipped in ISTA certified transit tested packaging.~~
- ~~D. Wheel: Wheel shall be centrifugal backward inclined, constructed of 100 percent aluminum, including a precision machined cast aluminum hub. Wheel inlet shall overlap an aerodynamic aluminum inlet cone to provide maximum performance and efficiency. Wheel shall be balanced in accordance with AMCA Standard 204-96, Balance Quality and Vibration Levels for Fans.~~
- ~~E. Motor: Motor shall be heavy duty type with permanently lubricated sealed ball bearings and furnished at the specified voltage, phase and enclosure.~~
- ~~F. Bearings: Bearings shall be designed and individually tested specifically for use in air handling applications. Construction shall be heavy duty re-greasable ball type in a cast iron pillow block housing selected for a minimum L50 life in excess of 200,000 hours at maximum cataloged operating speed.~~
- ~~G. Belts & Drives: Belts shall be oil and heat resistant, non-static type. Drives shall be precision machined cast iron type, keyed and securely attached to the wheel and motor shafts. Drives shall be sized for 150 percent of the installed motor horsepower. The variable pitch motor drive must be factory set to the specified fan RPM.~~
- ~~H. Grease Capture: Provide with grease capture and containment system.~~

2.5 — ROOF MOUNTED SMOKE EXHAUST FANS

- ~~A. General: Provide belt driven, axial type up-blast propeller roof exhaust fan, UL 705 listed.~~

- ~~1. The fan construction shall meet the specification for U.L. Listed "Power Ventilators for Smoke Control Systems". This includes the IRI requirements of 500 °F air for a minimum of 4 hours, the SBCCI "Standard Fire Prevention Code" requirements of 1000 °F air for a minimum of 15 minutes, and the Snow Load Test for butterfly dampers in UL 793.~~
- ~~B. Motor: Motors shall be permanently lubricated, heavy-duty type, and located outside of the air stream.~~
- ~~C. Fan: Propellers shall be constructed of fabricated steel, fabricated aluminum or cast aluminum blades and hubs. Propellers shall be securely fastened to fan shaft. Propellers shall be statically and dynamically balanced.~~
- ~~D. Curb: The fan shall be furnished with a 14" high, insulated curb.~~
- ~~E. Options and Accessories: Outlet screen to prevent debris from getting inside discharge and dampers, butterfly dampers with weather tight gaskets, 165 °F fusible link damper lifters, magnetic damper latches, belt tube with heat shields, high temperature bearings and extended lubrication lines.~~

PART 3 - EXECUTION

3.1 VENTILATION AND EXHAUST FANS

- A. General: Ventilating and exhaust fans not having integral vibration isolation shall be mounted on or suspended by vibration isolators as specified under Section 23 05 48. Where ductwork is connected to fans, Contractor shall provide UL labeled flexible duct connections.
- B. Curbs: Factory-fabricated roof curbs, caps, and similar items, shall be supplied and installed by Mechanical Contractor. Coordinate installation with Roofing Contractor.

3.2 SYSTEMS

- A. Refer to Section 23 05 53, "Mechanical Identification" for applicable painting, nameplate, and labeling requirements.
- B. Placement of fans and noise levels generated by the fans shall be taken into consideration. Refer to specification 23 34 00 for additional information.

END OF SECTION

SECTION 23 37 00 – REGISTERS, GRILLES, AND DIFFUSERS

1.1 GENERAL

A. Summary

1. This section describes the basic materials and installation methods for the registers, grilles, and diffusers.

B. Description of Work

1. Provide air outlets and inlets as required for the finished or non-tenant areas of the project including the following:
 - a. Ceiling air registers, grilles, diffusers
 - b. Wall mounted registers and grilles
 - c. Linear lay-in slot diffusers
 - d. Architectural linear diffusers

C. Quality Assurance

1. Acceptable Manufacturers: Titus, Krueger, Anemostat, Cames, Metal Aire, Price, and Tuttle & Bailey.

1.2 PRODUCTS

A. Air Outlets and Inlets

1. General

- a. Provide air outlets and inlets of the size, shape, and type, constructed of materials and components, and with finishes as required.

2. Ceiling Diffusers

- a. Provide diffusers with corrosion resistant treated surfaces and finished in baked enamel unless otherwise required.

3. Registers and Grilles

- a. Provide registers that contain a key-operated multi-louvered opposed blade damper operable from the face side.

4. Supply Linear Diffusers

- a. The diffuser shall be designed, tested, and constructed in a manner so as to comply with the performance criteria and sound level requirements specified elsewhere in these Specifications.

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1.3 EXECUTION

- A. Installation
- B. Field Control Quality Control

END OF SECTION

SECTION 23 57 19 – PLATE AND FRAME HEAT EXCHANGERS

1.1 GENERAL

A. Summary

1. This section describes the basic materials and installation methods for the heat exchanger system.

1.2 PRODUCTS

A. Quality Assurance

1. Acceptable Manufacturers: Alfa Laval, Bell and Gossett, Mueller, Tranter, and SONDEX.

B. Heat Exchanger System

1. Plate and frame heat exchangers shall be designed, fabricated and tested for operation in accordance with the A.S.M.E. Unfired Pressure Vessel Code, Section VIII, Division 1, including latest addendum and code stamped where required.
2. Fixed and movable end frames shall be reinforced, flat plate SA-516-70 carbon steel design.
3. Tightening bolts shall be SA-193-B7 zinc plated carbon steel with fixed SA-194-2H carbon steel nut.
4. Free nuts shall be heavy SA-194-2H carbon steel with heavy-duty carbon steel washers.
5. Plates shall be fabricated of 304 stainless steel.
6. Gaskets shall be molded one piece, nitrile rubber, securely cemented into the continuous groove in each plate.
7. All exterior steel surfaces shall be sharp steel shot blasted to SSPC-S-6-63 followed by one coat of two part epoxy spray enamel baked at 250°F.

1.3 EXECUTION

A. Installation

B. Start-Up

C. Testing and Adjusting and Cleaning

END OF SECTION

23 73 00 - CHILLED WATER AIR HANDLING UNITS

1.0 GENERAL

1.01 SUMMARY

- A. The General Provisions, Supplemental General Provisions, section 23 01 00, Division 1 Specifications and Special Provisions apply to all Work specified in this Section.
- B. This section describes the basic materials and installation methods for the boiler system. Comply with other Division 23 sections and drawings as applicable. Refer to other divisions for coordination of work.
- C. Furnish and install all components of the air handling unit system specified herein, as indicated on the drawings, and as required to provide complete and operating systems.
- D. Refer to Section 23 25 00, "HVAC Water Treatment", for information regarding required chemicals, etc.

1.02 DESCRIPTION OF WORK

- A. Provide variable air volume chilled water air handling unit and all associated components and specialties as specified herein, on the drawings, or as otherwise required to maintain the design chilled water supply conditions.

1.03 QUALITY ASSURANCE

- A. Manufacturer: Basis of design is Trane. Approved alternate manufacturers are Carrier, McQuay, or Johnson Controls, Inc.
- B. Submittals must be provided including equipment dimensions, installation, clearance, performance at specified conditions, etc.

2.0 PRODUCTS

2.01 AIR HANDLING UNITS

- A. Units shall consist of the components listed below and shall perform in accord with capacities as scheduled on the drawings.
- B. Casing: Includes all sections of air handling unit: coil section, fan sections, access sections, sections of blow through units downstream of cooling coils, etc. Refer to SECTION 23 30 00 for discharge plenums which attach to air handling unit vertical discharge opening.
 - 1. Wall and roof panels shall be minimum 2" thick acoustical type constructed of minimum solid galvanized exterior panel (min. 16 ga.) and a solid interior panel (min. 20 ga). Acoustical fill shall be glass fiber insulation, 1.5 pounds per cubic foot minimum density. Fill shall comply with the following U.L. Fire Resistance Ratings:

Flame Spread	10 - 20
Fuel Contributed	10 - 15

Smoke Developed 0 – 20

2. Floor construction shall be structural longitudinal and perimeter base rail with 20 gage solid galvanized inner and 16 gage galvanized outer panels.
 3. Access door panels shall be constructed identically to the wall panels. Doors shall be of gasketed to provide an airtight perimeter of the door. The latches shall be wedge lever type, minimum 2 per door. The door hinges shall be lift off type.
 4. Air Handler shall be double wall construction with no through metal in the casings or doors.
- C. Fans:
1. Fans shall deliver the scheduled capacities. Fans shall be airfoil type. Fans shall be furnished complete including: motor, motor mount, inlet bells (if applicable), 2" deflection spring type vibration isolation, discharge section (if applicable), drive mechanisms and all other accessories required and/or specified to produce the intended result.
 2. Fans shall be forward curved type with variable speed drive.
- D. Water coil(s) shall be constructed in accordance with ARI Standard 410-87. Coils shall have aluminum fins mechanically bonded to seamless copper tubes with copper headers and return bends. Coils shall be leak tested under water at 350 PSI of dry air.
- E. Drain pan(s) shall be #304 stainless steel. Drain pans shall form positive built-in slope of the trough to the drain connection. Drain pan shall drain dry to preclude the buildup of microbial slime or fungus. Each cooling coil shall have a drain pan under the entire coil extended at least 6" past the leaving air side of the coil and minimum of 2 1/2" deep. When air handling units are furnished with stacked coils, upper drain pans shall have a minimum of two 1" drain connections piped to the lower pan and secured to prevent vibration. All condensate piping shall be of hard drawn copper tubing.
- F. Filter section and frame shall accommodate high efficiency filters. Filter section shall have full height hinged access doors and holding frames shall be welded in place. Frames shall include spring clips for filter retention.
- G. Each air handling unit shall be constructed and shall operate for all conditions of air flow to provide acceptable an NC levels (max NC 35) in the occupied tenant space immediately adjacent to the fan room.
- H. The unit manufacturer shall submit sound power levels of each air handling unit. Acoustic performance shall be based on data obtained in accordance with ANSI Standard SI-32, for discharge sound power levels and radiated sound power levels. Aerodynamic performance data shall be in accordance with ARI Standard 430. Maximum sound power levels shall not exceed:

	<u>63</u>	<u>125</u>	<u>250</u>	<u>500</u>	<u>1k</u>	<u>2k</u>	<u>4k</u>
Discharge PWL's (re.10 ⁻¹² W)	88	88	87	86	85	85	85
Inlet/cabinet PWL's	88	85	85	84	83	81	81

3.0 INSTALLATION

3.01 AIR HANDLING UNITS

- A. Install the air handling unit(s) where indicated on the drawings, observing required clearances. See related specification sections concerning ductwork, piping and electrical work to assure proper connection of services to the unit. Follow the manufacturer's written instructions concerning start-up and installation. The unit shall not be started or run without filters in place.
- B. Contractor shall arrange piping to units so as to provide required access to equipment.
- C. Install clean filters in unit at time of air balance. Provide temporary filters during construction.

END OF SECTION 23 73 00

SECTION 23 82 19 – FAN COIL UNITS

1.1 GENERAL

A. Summary

1. This Section includes fan coil units and accessories.

B. Submittals

C. Quality Assurance

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

1.2 PRODUCTS

A. Acceptable Manufacturers: Trane Co. (The); Unitary Products Group, Carrier Corporation, A United Technologies Company, and Daikin McQuay.

B. Fan Coil Units

1. Coil Section Insulation: 1 inch thick, [coated glass fiber] [foil-covered, closed-cell foam] [matte finish, closed cell foam] complying with ASTM C 1071 and attached with adhesive complying with ASTM C 916.
2. Main and Auxiliary Drain Pans: Stainless steel, insulated galvanized steel with plastic liner formed to slope from all directions to the drain connection as required by ASHRAE 62.
3. Chassis: Galvanized steel where exposed to moisture.
4. Cabinet: Steel with baked enamel finish in manufacturer's standard paint color as selected by Owner.
5. Filters: Minimum arrestance according to ASHRAE 52.1, and a minimum efficiency reporting value (MERV) according to ASHRAE 52.2.
6. Hydronic Coils: Copper tube, with mechanically bonded aluminum fins spaced no closer than 0.1 inch, rated for a minimum working pressure of 200 psig and a maximum entering-water temperature of 220 deg F.
7. Fan and Motor Board: Removable
 - a. Fan: Forward curved, double width, centrifugal; directly connected to motor.
 - b. Motor: Permanently lubricated, multispeed; resiliently mounted on motor board.
8. Factory, Hydronic Piping Package: ASTM B 88, Type L copper tube with wrought-copper fittings and brazed joints.
9. Electrical Connection

C. Ducted Fan Coil Units

1. Coil Section Insulation: 1 inch thick coated, foil faced, glass fiber complying with ASTM C 1071 and attached with adhesive complying with ASTM C 916.
2. Drain Pans: Stainless steel, galvanized steel with plastic liner, formed to slope from all directions to the drain connection as required by ASHRAE 62.1.

3. Chassis: Galvanized steel where exposed to moisture, with baked enamel finish and removable access panels.
4. Cabinets: Steel with baked enamel finish in manufacturer's standard paint color.
 - a. Supply Air Plenum: Sheet metal plenum finished and insulated to match the chassis with mill finish, aluminum, double deflection grille.
 - b. Return Air Plenum: Sheet metal plenum finished to match the chassis.
 - c. Mixing Plenum: Sheet metal plenum finished and insulated to match the chassis with outdoor and return air, formed steel dampers.
 - d. Dampers: Galvanized steel with extruded vinyl blade seals, flexible metal jamb seals, and interlocking linkage.
5. Filters: Minimum arrestance according to ASHRAE 52.1, and a minimum efficiency reporting value (MERV) according to ASHRAE 52.2.
6. Hydronic Coils: Copper tube, with mechanically bonded aluminum fins spaced no closer than 0.1 inch, rated for a minimum working pressure of 200 psig and a maximum entering water temperature of 220 deg F.
7. Belt-Driven Fans: Double width, forward curved, centrifugal; with permanently lubricated, single speed motor installed on an adjustable fan base resiliently mounted in the cabinet.
8. Factory, Hydronic Piping Package: ASTM B 88, Type L copper tube with wrought-copper fittings and brazed joints.
9. Electrical Connection

1.3 EXECUTION

- A. Installation
- B. Field Quality Control

END OF SECTION

SECTION 28 31 00 - LIFE SAFETY SYSTEM

PART 1 – GENERAL

1.1 SUMMARY

- A. This Section covers fire alarm systems, including initiating devices, notification appliances, controls, and supervisory devices.
- B. Work covered by this section includes the furnishing of labor, equipment, and materials for installation of the fire alarm system as indicated on the drawings and specifications
- C. The Fire Alarm System shall consist of all necessary hardware equipment and software programming to perform the following functions:
 - 1. Fire alarm and detection operations
 - 2. Control and monitoring of elevators, smoke control equipment, door hold-open devices, fire suppression systems, emergency power systems, and other equipment as indicated in the drawings and specifications.
 - 3. One-way supervised automatic voice alarm operations for the purpose of fire alarm evacuation and emergency communication of other life safety emergencies. The system will provide both live messaging and a minimum of eight pre-recorded messages.
 - 4. Interface with PA system to shut down PA during alarm.
 - 5. Interface with access control door lock power supply per 16400.
 - 6. Provide programming and accessories necessary to provide mass notification/ amber alert.
 - 7. Smoke detection and power supplies for all smoke dampers
 - 8. Monitoring of site back flow preventers and PIV valves as indicated on the Civil Drawings.

1.2 ACCEPTABLE MANUFACTURERS

- A. Manufacturers: The equipment and service described in this specification are those supplied and supported by SimplexGrinnell or Auburn University pre-approved equal. All equipment must be 100% compatible with the existing Auburn University fire alarm network.
- B. The Manufacturer shall be a nationally recognized company specializing in fire alarm and detection systems. This organization shall employ factory trained and NICET certified technicians, and shall maintain a service organization within 100 miles of this project location. The Manufacturer and service organization shall have a minimum of 10 years experience in the fire protective signaling systems industry. The organization must be certified as a fire alarm contractor in the state of Alabama. Technicians terminating control panels, programming the system or otherwise commissioning this project must be a minimum of NICET Level II certified.

1.3 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this section.
- B. The work covered by this section is to be coordinated with related work as specified elsewhere in the specifications. Requirements of the following sections apply:
 - 1. Division 16: "Basic Electrical Materials and Methods."
 - 2. Division 16: "Wiring Methods."
 - 3. Division 13: "Fire Suppression"
 - 4. Division 15: "Fire Protection"
 - 5. Division 15: "HVAC Systems"

6. Division 13: "Building Automation and Control"

C. The system and all associated operations shall be in accordance with the following:

1. Guidelines of the following Building Code: IBC
2. NFPA 72, National Fire Alarm Code
3. NFPA 70, National Electrical Code
4. NFPA 101, Life Safety Code
5. NFPA 90A, Standard for the Installation of Air Conditioning and Ventilating Systems
6. Other applicable NFPA standards
7. Local Jurisdictional Adopted Codes and Standards
8. ADA Accessibility Guidelines

1.4 SYSTEM DESCRIPTION

- A. General: Provide a complete, non-coded, addressable, microprocessor-based fire alarm system with initiating devices, notification appliances (speakers and strobes), and monitoring and control devices as indicated on the drawings and as specified herein.
- B. Software: The fire alarm system shall allow for loading and editing instructions and operating sequences as necessary. The system shall be capable of on-site programming to accommodate system expansion and facilitate changes in operation. All software operations shall be stored in a non-volatile programmable memory within the fire alarm control unit. Loss of primary and secondary power shall not erase the instructions stored in memory. System shall be capable of storing dual configuration programs with one active and one in reserve. Panel shall be capable of full system operation during a new configuration download.
- C. History Logs: The system shall provide a means to recall alarms and trouble conditions in chronological order for the purpose of recreating an event history. A separate alarm and trouble log shall be provided.
- D. Wiring/Signal Transmission:
1. System connections for initiating (signaling) circuits and notification appliance circuits shall be Class B.
 2. Circuit Supervision: Circuit faults shall be indicated by a trouble signal at the FACP. Provide a distinctive indicating audible tone and alphanumeric annunciation.
- E. Remote Access:
1. FACP shall have the capability to provide Remote Access through a Dial-Up Service Modem using the public switched telephone system of a private switched telephone system.
 2. A personal computer or technician's laptop, configured with terminal emulation software shall have the ability to access the FACP for diagnostics, maintenance reporting and information gathering.
 3. FACP shall have the capability to provide Remote Access through a listed Internet Interface via a standard web browser user interface.
- F. Required Functions: The following are required system functions and operating features:
1. Priority of Signals: Alarm events have highest priority. Subsequent alarm events are queued in the order received and do not affect existing alarm conditions. Priority Two, Supervisory and Trouble events have second-, third-, and fourth-level priority respectively. Signals of a higher-level priority take precedence over signals of lower priority even though the lower-priority condition occurred first. Annunciate all events regardless of priority or order received. Priority of mass notification messages will be determined by Auburn University. Provide the Auburn University standard digital message set.
 2. Noninterfering: The activation of an addressable device does not prevent the receipt of signals

- from subsequent activations.
3. Annunciation: Operation of alarm and supervisory initiating devices shall be annunciated at the FACP, the remote annunciator, and at campus graphical command centers (True Site Workstations). In addition, alarm signals shall be annunciated at the City of Auburn 911 center network display unit (NDU) which is a node on the fire alarm network.
 4. General Alarm: A system general alarm shall include:
 - a. Indication of alarm condition at the FACP and annunciator(s).
 - b. Identification of the device or zone that is the source of the alarm at the FACP.
 - c. Operation of audible and visible notification devices throughout the building until silenced at FACP.
 - d. Closing doors normally held open by magnetic door holders.
 - e. Unlocking designated doors.
 - f. Shutting down supply and return fans serving zone where alarm is initiated.
 - g. Closing smoke dampers on system serving zone where alarm is initiated.
 - h. Initiation of smoke control sequence through the building temperature control system.
 - i. Notifying the local fire department via the campus fire alarm network.
 5. Supervisory Operations: Upon activation of a supervisory device such as fire pump power failure, low air pressure switch, and tamper switch, the system shall operate as follows:
 - a. Activate the system supervisory service audible signal and illuminate the LED at the control unit and the graphic annunciator.
 - b. Pressing the Supervisory Acknowledge Key will silence the supervisory audible signal while maintaining the Supervisory LED "on" indicating off-normal condition.
 - c. Record the event in the FACP historical log.
 - d. Transmission of supervisory signal to remote central station.
 - e. Restoring the condition shall cause the Supervisory LED to clear and restore the system to normal.
 6. Alarm Silencing: If the "Alarm Silence" button is pressed, all audible alarm signals shall cease operation.
 7. System Reset
 - a. The "System Reset" button shall be used to return the system to its normal state. Display messages shall provide operator assurance of the sequential steps ("IN PROGRESS", "RESET COMPLETED") as they occur. The system shall verify all circuits or devices are restored prior to resetting the system to avoid the potential for re-arming the system. The display message shall indicate "ALARM PRESENT, SYSTEM RESET ABORTED."
 - b. Should an alarm condition continue, the system will remain in an alarmed state.
 8. A manual evacuation (drill) switch shall be provided to operate the notification appliances without causing other control circuits to be activated.
 9. WALKTEST: The system shall have the capacity of 8 programmable passcode protected one person testing groups, such that only a portion of the system need be disabled during testing. The actuation of the "enable one person test" program at the control unit shall activate the "One Person Testing" mode of the system as follows:
 - a. The city circuit connection and suppression release circuits shall be bypassed for the testing group.
 - b. Control relay functions associated to one of the 8 testing groups shall be bypassed.
 - c. The control unit shall indicate a trouble condition.
 - d. The alarm activation of any initiation device in the testing group shall cause the audible notification appliances to sound a voice announcement to identify the device or zone.
 - e. The unit shall automatically reset itself after signaling is complete.

- f. Any momentary opening of an initiating or notification appliance circuit wiring shall cause the audible signals to voice announce the trouble condition.

G. Analog Smoke Sensors:

1. Monitoring: FACP shall individually monitor sensors for calibration, sensitivity, and alarm condition, and shall individually adjust for sensitivity. The control unit shall determine the condition of each sensor by comparing the sensor value to the stored values.
2. Environmental Compensation: The FACP shall maintain a moving average of the sensor's smoke chamber value to automatically compensate for dust, dirt, and other conditions that could affect detection operations.
3. Programmable Sensitivity: Photoelectric Smoke Sensors shall have 7 sensitivity levels ranging from 0.2% to 3.7%, programmed and monitored from the FACP.
4. Sensitivity Testing Reports: The FACP shall provide sensor reports that meet NFPA 72 calibrated test method requirements. The reports shall be viewed on a CRT Display or printed for annual recording and logging of the calibration maintenance schedule.
5. The FACP shall automatically indicate when an individual sensor needs cleaning. The system shall provide a means to indicate that a sensor requires cleaning. When a sensor's average value reaches a predetermined value, (3) progressive levels of reporting are provided. The first level shall indicate that a sensor is close to a trouble reporting condition and will be indicated on the FACP as "ALMOST DIRTY." This condition provides a means to alert maintenance staff of a dirty sensor without creating a trouble in the system. If this indicator is ignored, a second level "DIRTY SENSOR" condition shall be indicated at the FACP and subsequently a system trouble is reported. The sensor base LED shall glow steady giving a visible indication at the sensor location. The "DIRTY SENSOR" condition shall not affect the sensitivity level required to alarm the sensor. If a "DIRTY SENSOR" is left unattended, and its average value increases to a third predetermined value, an "EXCESSIVELY DIRTY SENSOR" trouble condition shall be indicated at the control unit.
6. The FACP shall continuously perform an automatic self-test on each sensor which will check sensor electronics and ensure the accuracy of the values being transmitted. Any sensor that fails this test shall indicate a "SELF TEST ABNORMAL" trouble condition.
7. Multi-Sensors shall combine photoelectric smoke sensing and heat sensing technologies. An alarm shall be determined by either smoke detection, with selectable sensitivity from 0.2 to 3.7 %/ft obscuration; or heat detection, selectable as fixed temperature or fixed with selectable rate-of-rise; or based on an analysis of the combination of smoke and heat activity.
8. Programmable bases. It shall be possible to program relay and sounder bases to operate independently of their associated sensor.
9. Magnet test activation of smoke sensors shall be distinguished by its label and history log entry as being activated by a magnet.

H. Audible Alarm Notification: By voice evacuation and tone signals on loudspeakers in areas as indicated on drawings.

1. Automatic Voice Evacuation Sequence:
 - a. The audio alarm signal shall consist of an alarm tone for a maximum of five seconds followed by an automatic digital voice message. At the end of the voice message, the alarm tone shall resume. This sequence shall sound continuously until the "Alarm Silence" switch is activated.
 - b. All audio operations shall be activated by the system software so that any required future changes can be facilitated by authorized personnel without any component rewiring or hardware additions.

I. Speaker: Speaker notification appliances shall be listed to UL 1480.

1. The speaker shall operate on a standard 25VRMS or 70.7VRMS NAC using twisted/shielded wire.
2. The following taps are available: 0.25W, 0.50W, 1.0W and 2.0W. At the 1.0W tap, the speaker has minimum UL rated sound pressure level of 84dBA at 10 feet.

3. The speaker shall have a frequency response of 400 to 4000 Hz for Fire Alarm and 125 to 12kHz for General Signaling.
- J. Manual Voice Paging
1. The system shall be configured to allow voice paging. Upon activation of any speaker manual control switch, the alarm tone shall be sounded over all speakers in that group.
 2. The control panel operator shall be able to make announcements via the push-to-talk paging microphone over the pre-selected speakers.
 3. Facility for total building paging shall be accomplished by the means of an "All Call" switch.
- K. Fire Suppression Monitoring:
1. Water flow: Activation of a water flow switch shall initiate general alarm operations.
 2. Sprinkler valve tamper switch: The activation of any valve tamper switch shall activate system supervisory operations.
 3. WSO: Water flow switch and sprinkler valve tamper switch shall be capable of existing on the same initiating zone. Activation of either device shall distinctly report which device is in alarm on the initiating zone.
- L. Power Requirements
1. The control unit shall receive AC power via a dedicated fused disconnect circuit.
 2. The system shall be provided with sufficient battery capacity to operate the entire system upon loss of normal AC power in a normal supervisory mode for a period of 24 hours with 15 minutes of alarm operation at the end of this period. The system shall automatically transfer to battery standby upon power failure. All battery charging and recharging operations shall be automatic.
 3. All circuits requiring system-operating power shall be 24 VDC and shall be individually fused at the control unit.
 4. The incoming power to the system shall be supervised so that any power failure will be indicated at the control unit. A green "power on" LED shall be displayed continuously while incoming power is present.
 5. The system batteries shall be supervised so that a low battery or depleted battery condition or disconnection of the battery shall be indicated at the control unit and displayed for the specific fault type.
 6. The system shall support NAC Lockout feature to prevent subsequent activation of Notification Appliance Circuits after a Depleted Battery condition occurs in order to make use of battery reserve for front panel annunciation and control
 7. The system shall support 100% of addressable devices in alarm or operated at the same time, under both primary(AC) and secondary (battery) power conditions.]
 8. Loss of primary power shall sound a trouble signal at the FACP. FACP shall indicate when the system is operating on an alternate power supply.

1.5 SUBMITTALS

- A. General: Submit the following according to Conditions of Contract and Division 1 Specification Sections.
1. Product data sheets for system components highlighted to indicate the specific products, features, or functions required to meet this specification. Alternate or as-equal products submitted under this contract must provide a detailed line-by-line comparison of how the submitted product meets, exceeds, or does not comply with this specification.
 2. Wiring diagrams from manufacturer.
 3. Shop drawings showing system details including location of FACP, all devices, circuiting and details of graphic annunciator.
 4. System Power and battery charts with performance graphs and voltage drop calculations to assure that the system will operate per the prescribed backup time periods and under all voltage conditions per UL and NFPA standards.

5. System operation description including method of operation and supervision of each type of circuit and sequence of operations for all manually and automatically initiated system inputs and outputs. A list of all input and output points in the system shall be provided with a label indicating location or use of IDC, NAC, relay, sensor, and auxiliary control circuits.
 6. Operating instructions for FACP.
 7. Operation and maintenance data for inclusion in Operating and Maintenance Manual. Include data for each type product, including all features and operating sequences, both automatic and manual. Provide the names, addresses, and telephone numbers of service organizations.
 8. Product certification signed by the manufacturer of the fire alarm system components certifying that their products comply with indicated requirements.
 9. Record of field tests of system.
- B. Submission to Authority Having Jurisdiction: In addition to routine submission of the above material, make an identical submission to the authority having jurisdiction. Include copies of shop drawings as required to depict component locations to facilitate review. Upon receipt of comments from the Authority, make resubmissions if required to make clarifications or revisions to obtain approval.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: A factory authorized installer is to perform the work of this section.
- B. Each and all items of the Fire Alarm System shall be listed as a product of a single fire alarm system manufacturer under the appropriate category by Underwriters Laboratories, Inc. (UL), and shall bear the "UL" label.

2.0 PRODUCTS

2.1 FIRE ALARM CONTROL PANEL (FACP)

- A. General: Comply with UL 864, "Control Units for Fire-Protective Signaling Systems."
- B. The following FACP hardware shall be provided:
 1. Power Limited base panel with beige cabinet and door, 120 VAC input power.
 2. 2,000 point capacity where (1) point equals (1) monitor (input) or (1) control (output).
 3. 2,000 points of Network Annunciation at FACP Display when applied as a Network Node
 4. 2000 points of annunciation where one (1) point of annunciation equals:
 - a. 1 LED driver output on a graphic driver or 1 switch input on a graphic switch input module.
 - b. 1 LED on panel or 1 switch on panel.
 5. From all battery charging circuits in the system provide battery voltage and ammeter readouts on the FCP LCD Display.
 6. One Auxiliary Relay, SPDT 2A @32VDC, programmable as a trouble relay, either as normally energized or de-energized, or as an auxiliary control.
 7. Power Supplies with integral intelligent Notification Appliance Circuit Class B for system expansion.
 8. The FACP shall support (6) RS-232-C ports and one service port.
 9. Remote Unit Interface: supervised serial communication channel for control and monitoring of remotely located annunciators and I/O panels.
- C. Cabinet: Lockable steel enclosure. Arrange unit so all operations required for testing or for normal care and maintenance of the system are performed from the front of the enclosure. If more than a

- single unit is required to form a complete control unit, provide exactly matching modular unit enclosures.
- D. Alphanumeric Display and System Controls: Panel shall include an 80 character LCD display to indicate alarm, supervisory, and component status messages and shall include a keypad for use in entering and executing control commands.
 - E. Voice Alarm: Provide an emergency communication system, integral with the FACP, including voice alarm system components, microphones, amplifiers, and tone generators. Features include:
 - 1. Amplifiers comply with UL 1711, "Amplifiers for Fire Protective Signaling Systems." Amplifiers shall provide an onboard local mode temporal coded horn tone as a default backup tone. Test switches on the amplifier shall be provided to test and observe amplifier backup switchover. Each amplifier shall communicate to the host panel amplifier and NAC circuit voltage and current levels for display on the user interface. Provide Simplex 4100-1327 "flex 50" dual channel amplifiers.
 - 2. All announcements are made over dedicated, supervised communication lines. All risers shall support Class B wiring for each audio channel.
 - 3. Emergency voice communication audio controller module shall provide up to 32 minutes of message memory for digitally stored messages. Provide supervised connections for master microphone and remote microphones.
 - 4. Status annunciator indicating the status of the various voice alarm speaker zones.
 - F. Distributed Module Operation: FACP shall be capable of allowing remote location of the following modules; interface of such modules shall be through a Style 7, Class A supervised serial communications channel (SLC):
 - 1. Amplifiers, voice and telephone control circuits
 - 2. Addressable Signaling Line Circuits
 - 3. Initiating Device Circuits
 - 4. Notification Appliance Circuits
 - 5. Auxiliary Control Circuits

2.2 REMOTE LCD ANNUNCIATOR

- A. Provide Remote LCD Annunciator with the same "look and feel" as the FACP operator interface. The Remote LCD Annunciator shall use the same Primary Acknowledge, Silence, and Reset Keys, Status LEDs and LCD Display as the FACP.
- B. Annunciator shall have super-twist LCD display with two lines of 40 characters each. Annunciator shall be provided with four (4) programmable control switches and associated LEDs.
- C. Under normal conditions the LCD shall display a "SYSTEM IS NORMAL" message and the current time and date.
- D. Should an abnormal condition be detected the appropriate LED (Alarm, Supervisory or Trouble) shall flash. The unit audible signal shall pulse for alarm conditions and sound steady for trouble and supervisory conditions.
- E. The LCD shall display the following information relative to the abnormal condition of a point in the system:
 - 1. 40 character custom location label.
 - 2. Type of device (e.g., smoke, pull station, waterflow).
 - 3. Point status (e.g., alarm, trouble).
- F. Operator keys shall be key switch enabled to prevent unauthorized use. The key shall only be removable in the disabled position. Acknowledge, Silence and Reset operation shall be the same

as the FACP.

2.3 EMERGENCY POWER SUPPLY

- A. General: Components include battery, charger, and an automatic transfer switch.
- B. Battery: Sealed lead-acid. Provide sufficient capacity to operate the complete alarm system in normal or supervisory (non-alarm) mode for a period of 24 hours. Following this period of operation on battery power, the battery shall have sufficient capacity to operate all components of the system, including all alarm indicating devices in alarm or supervisory mode for a period of 15 minutes.

2.4 ADDRESSABLE MANUAL PULL STATIONS

- A. Description: Addressable single- action type, red LEXAN, with molded, raised-letter operating instructions of contrasting color. Station will mechanically latch upon operation and remain so until manually reset by opening with a key common with the control units.

2.5 SMOKE SENSORS

- A. General: Comply with UL 268, "Smoke Detectors for Fire Protective Signaling Systems." Include the following features:
 - 1. Factory Nameplate: Serial number and type identification.
 - 2. Operating Voltage: 24 VDC, nominal.
 - 3. Self-Restoring: Detectors do not require resetting or readjustment after actuation to restore normal operation.
 - 4. Plug-In Arrangement: Sensor and associated electronic components are mounted in a module that connects to a fixed base with a twist-locking plug connection. Base shall provide break-off plastic tab that can be removed to engage the head/base locking mechanism. No special tools shall be required to remove head once it has been locked. Removal of the detector head shall interrupt the supervisory circuit of the fire alarm detection loop and cause a trouble signal at the control unit.
 - 5. Each sensor base shall contain an LED that will flash each time it is scanned by the Control Unit (once every 4 seconds). In alarm condition, the sensor base LED shall be on steady.
 - 6. Each sensor base shall contain a magnetically actuated test switch to provide for easy alarm testing at the sensor location.
 - 7. Each sensor shall be scanned by the Control Unit for its type identification to prevent inadvertent substitution of another sensor type. Upon detection of a "wrong device", the control unit shall operate with the installed device at the default alarm settings for that sensor; 2.5% obscuration for photoelectric sensor, 135-deg F and 15-deg F rate-of-rise for the heat sensor, but shall indicate a "Wrong Device" trouble condition.
 - 8. The sensor's electronics shall be immune from false alarms caused by EMI and RFI.
 - 9. Sensors include a communication transmitter and receiver in the mounting base having a unique identification and capability for status reporting to the FACP. Sensor address shall be located in base to eliminate false addressing when replacing sensors.
 - 10. Removal of the sensor head for cleaning shall not require the setting of addresses.
- B. Type: Smoke sensors shall be of the photoelectric or combination photoelectric / heat type. Where acceptable per manufacturer specifications, ionization type sensors may be used.
- C. Bases: Relay output, sounder and isolator bases shall be supported alternatives to the standard base.
- D. Provide duct smoke detectors or in-duct smoke detectors as applicable for all smoke damper

locations. Coordinate quantity and locations with the mechanical drawings. Provide 120V power supply to each smoke damper.

- E. Duct Smoke Sensor: Photoelectric type, with sampling tube of design and dimensions as recommended by the manufacturer for the specific duct size and installation conditions where applied. Sensor includes relay as required for fan shutdown.
 - 1. Environmental compensation, programmable sensitivity settings, status testing, and monitoring of sensor dirt accumulation for the duct sensor shall be provided by the FACP.
 - 2. The Duct Housing shall provide a supervised relay driver circuit for driving up to 15 relays with a single "Form C" contact rated at 7A@ 28VDC or 10A@ 120VAC. This auxiliary relay output shall be fully programmable. Relay shall be mounted within 3 feet of HVAC control circuit.
 - 3. Duct Housing shall provide a relay control trouble indicator Yellow LED.
 - 4. Compact Duct Housing shall have a transparent cover to monitor for the presence of smoke. Cover shall secure to housing by means of four (4) captive fastening screws.
 - 5. Duct Housing shall provide two (2) Test Ports for measuring airflow and for testing. These ports will allow aerosol injection in order to test the activation of the duct smoke sensor.
 - 6. Duct Housing shall provide a magnetic test area and Red sensor status LED.
 - 7. For maintenance purposes, it shall be possible to clean the duct housing sampling tubes by accessing them through the duct housing front cover.
 - 8. Each duct sensor shall have a Remote Test Station with an alarm LED and test switch.
 - 9. Where indicated a NEMA 4X weatherproof duct housing enclosure shall provide for the circulation of conditioned air around the internally mounted addressable duct sensor housing to maintain the sensor housing at its rated temperature range. The housing shall be UL Listed to Standard 268A.

2.6 HEAT SENSORS

- A. Thermal Sensor: Combination fixed-temperature and rate-of-rise unit with plug-in base and alarm indication lamp; 135-deg F fixed-temperature setting except as indicated.
- B. Thermal sensor shall be of the epoxy encapsulated electronic design. It shall be thermistor-based, rate-compensated, self-restoring and shall not be affected by thermal lag.
- C. Sensor fixed temperature sensing shall be independent of rate-of-rise sensing and] programmable to operate at 135-deg F or 155-deg F. Sensor rate-of-rise temperature detection shall be selectable at the FACP for either 15-deg F or 20-deg F per minute.
- D. Sensor shall have the capability to be programmed as a utility monitoring device to monitor for temperature extremes in the range from 32-deg F to 155-deg F.

2.7 ADDRESSABLE CIRCUIT INTERFACE MODULES

- A. Addressable Circuit Interface Modules: Arrange to monitor one or more system components that are not otherwise equipped for addressable communication. Modules shall be used for monitoring of waterflow, valve tamper, non-addressable devices, and for control of evacuation indicating appliances and AHU systems.
- B. Addressable Circuit Interface Modules will be capable of mounting in a standard electric outlet box. Modules will include cover plates to allow surface or flush mounting. Modules will receive their operating power from the signaling line or a separate two wire pair running from an appropriate power supply as required.
- C. There shall be the following types of modules:

1. Type 1: Monitor Circuit Interface Module:
 - a. For conventional 2-wire smoke detector and/or contact device monitoring with Class B or Class A wiring supervision. The supervision of the zone wiring will be Class B. This module will communicate status (normal, alarm, trouble) to the FACP.
 - b. For conventional 4-wire smoke detector with Class B wiring supervision. The module will provide detector reset capability and over-current power protection for the 4-wire detector. This module will communicate status (normal, alarm, trouble) to the FACP.
 2. Type 2: Line Powered Monitor Circuit Interface Module
 - a. This type of module is an individually addressable module that has both its power and its communications supplied by the two wire multiplexing signaling line circuit. It provides location specific addressability to an initiating device by monitoring normally open dry contacts. This module shall have the capability of communicating four zone status conditions (normal, alarm, current limited, trouble) to the FACP.
 - b. This module shall provide location specific addressability for up to five initiating devices by monitoring normally closed or normally open dry contact security devices. The module shall communicate four zone status conditions (open, normal, abnormal, and short). The two-wire signaling line circuit shall supply power and communications to the module.
 3. Type 3: Single Address Multi-Point Interface Modules
 - a. This multipoint module shall provide location specific addressability for four initiating circuits and control two output relays from a single address. Inputs shall provide supervised monitoring of normally open, dry contacts and be capable of communicating four zone status conditions (normal, open, current limited, and short). The input circuits and output relay operation shall be controlled independently and disabled separately.
 - b. This dual point module shall provide a supervised multi-state input and a relay output, using a single address. The input shall provide supervised monitoring of two normally open, dry contacts with a single point and be capable of communicating four zone status conditions (normal, open, current limited, and short). The two-wire signaling line circuit shall supply power and communications to the module.
 - c. This dual point module shall monitor an unsupervised normally open, dry contact with one point and control an output relay with the other point, using a single address. The two-wire signaling line circuit shall supply power and communications to the module.
- D. All Circuit Interface Modules shall be supervised and uniquely identified by the control unit. Module identification shall be transmitted to the control unit for processing according to the program instructions. Modules shall have an on-board LED to provide an indication that the module is powered and communicating with the FACP. The LEDs shall provide a troubleshooting aid since the LED blinks on poll whenever the peripheral is powered and communicating.

2.8 MAGNETIC DOOR HOLDERS

- A. Description: Units shall be listed to UL 228. Units are equipped for wall or floor mounting as indicated and are complete with matching door plate. Unit shall operate from a 120VAC, a 24VAC or a 24VDC source, and develops a minimum of 25 lbs. holding force.
- B. Material and Finish: Match door hardware.

2.9 ADDRESSABLE ALARM NOTIFICATION APPLIANCES

- A. Addressable Notification Appliances: The Contractor shall furnish and install Addressable Notification Appliances and accessories to operate on compatible signaling line circuits (SLC).
 1. Addressable Notification appliance operation shall provide power, supervision and separate

- control of horns and strobes over a single pair of wires. The controlling channel (SLC) digitally communicates with each appliance and receives a response to verify the appliance's presence on the channel. The channel provides a digital command to control appliance operation. SLC channel wiring shall be unshielded twisted pair (UTP), with a capacitance rating of less than 60pf/ft and a minimum 3 twists (turns) per foot.
2. Class B (Style 4) notification appliances shall be wired without requiring traditional in/out wiring methods; addressable "T" Tapping shall be permitted. Up to 63 appliances can be supported on a single channel.
 3. Each Addressable notification appliance shall contain an electronic module and a selectable address setting to allow it to occupy a unique location on the channel. This on-board module shall also allow the channel to perform appliance diagnostics that assist with installation and subsequent test operations. A visible LED on each appliance shall provide verification of communications and shall flash with the appliances address setting when locally requested using a magnetic test tool.
- B. Addressable Controller: Addressable Controller shall supervise Channel (SLC) wiring, communicate with and control addressable notification appliances. It shall be possible to program the High/Lo setting of the audible (horn) appliances by channel from the addressable controller.
- C. Visible/Only: Addressable strobe shall be listed to UL 1971. The V/O shall consist of a xenon flash tube and associated lens/reflector system. The V/O enclosure shall mount directly to standard single gang, double gang or 4" square electrical box, without the use of special adapters or trim rings. Appliances shall be wired with UTP conductors, having a minimum of 3 twists per foot. V/O appliances shall be provided with different minimum flash intensities of 15cd, 75cd and 110cd. Provide a label inside the strobe lens to indicate the listed candela rating of the specific Visible/Only appliance. The candela rating of individual strobe appliances shall be capable of being set by the 4100U fire alarm control panel. Provide Simplex model 4906-9201 strobe with clear lens for fire notification and Simplex model 4906-9205 with amber lens for mass notification. White Finish.
- D. Speaker/Visible: Combination Speaker/Visible (S/V) units combine the speaker and visible functions into a common housing. The S/V shall be listed to UL 1971 and UL 1480. Addressable functionality controls visible operation, while the speaker operates on a 25VRMS or 70.7VRMS NAC. Where combination speaker visual device is used, provide separate amber visual device to signal that a mass notification message is being played. Speaker Visual: Simplex model 4906-9251. White Finish.
1. Twisted/shielded wire is required for speaker connections on a standard 25VRMS or 70.7VRMS NAC using and UTP conductors, having a minimum of 3 twists per foot is required for addressable strobe connections.
 2. The following taps are available: 0.25W, 0.50W, 1.0W and 2.0W. At the 1.0W tap, the speaker has minimum UL rated sound pressure level of 84dBA at 10 feet.
 3. The S/V shall have a frequency response of 400 to 4000 Hz for Fire Alarm and 125 to 12kHz for General Signaling.
 4. The S/V installs directly to a 4" square, 1 1/2 in. deep electrical box with 1 1/2" extension
- E. Accessories: The contractor shall furnish the necessary accessories.

3.0 EXECUTION

3.1 INSTALLATION, GENERAL

- A. Install system components and all associated devices in accordance with applicable NFPA Standards and manufacturer's recommendations.

- B. Installation personnel shall be supervised by persons who are qualified and experienced in the installation, inspection, and testing of fire alarm systems. Examples of qualified personnel shall include, but not be limited to, the following:
 - 1. Factory trained and certified personnel.
 - 2. National Institute of Certification in Engineering Technologies (NICET) fire alarm level II certified personnel.
 - 3. Personnel licensed or certified by state or local authority.

3.2 EQUIPMENT INSTALLATION

- A. Furnish and install a complete Fire Alarm System as described herein and as shown on the plans. Include sufficient control unit(s), annunciator(s), manual stations, automatic fire detectors, smoke detectors, audible and visible notification appliances, wiring, terminations, electrical boxes, and all other necessary material for a complete operating system.
- B. Water-Flow and Valve Supervisory Switches: Connect for each sprinkler valve required to be supervised.

3.3 WIRING INSTALLATION

- A. System Wiring: Wire and cable shall be a type listed for its intended use by an approval agency acceptable to the Authority Having Jurisdiction (AH) and shall be installed in accordance with the appropriate articles from the current approved edition of NFPA 70: National Electric Code (NEC).
- B. Contractor shall obtain from the Fire Alarm System Manufacturer written instruction regarding the appropriate wire/cable to be used for this installation. No deviation from the written instruction shall be made by the Contractor without the prior written approval of the Fire Alarm System Manufacturer.
- C. Color Coding: Color-code fire alarm conductors differently from the normal building power wiring. Use one color code for alarm initiating device circuits wiring and a different color code for supervisory circuits. Color-code notification appliance circuits differently from alarm-initiating circuits. Paint fire alarm system junction boxes and covers red.

3.4 FIELD QUALITY CONTROL

- A. Manufacturer's Field Services: Provide services of a factory-authorized service representative to supervise the field assembly and connection of components and the pretesting, testing, and adjustment of the system.
- B. Service personnel shall be qualified and experienced in the inspection, testing, and maintenance of fire alarm systems. Examples of qualified personnel shall be permitted to include, but shall not be limited to, individuals with the following qualifications:
 - 1. Factory trained and certified.
 - 2. National Institute for Certification in Engineering Technologies (NICET) fire alarm certified.
 - 3. Certified by a state or local authority.
 - 4. Trained and qualified personnel employed by an organization listed by a national testing laboratory for the servicing of fire alarm systems.
- C. Pretesting: Determine, through pretesting, the conformance of the system to the requirements of the Drawings and Specifications. Correct deficiencies observed in pretesting. Replace malfunctioning or damaged items with new and retest until satisfactory performance and conditions are achieved.
- D. Final Test Notice: Provide a 10-day minimum notice in writing when the system is ready for final

acceptance testing.

- E. Minimum System Tests: Test the system according to the procedures outlined in NFPA 72.
- F. Retesting: Correct deficiencies indicated by tests and completely retest work affected by such deficiencies. Verify by the system test that the total system meets the Specifications and complies with applicable standards.
- G. Report of Tests and Inspections: Provide a written record of inspections, tests, and detailed test results in the form of a test log.
- H. Final Test, Certificate of Completion, and Certificate of Occupancy:
 - 1. Test the system as required by the Authority Having Jurisdiction in order to obtain a certificate of occupancy.

3.5 TRAINING

- A. Provide the services of a factory-authorized service representative to demonstrate the system and train Owner's maintenance personnel as specified below.
 - 1. Train Owner's maintenance personnel in the procedures and schedules involved in operating, troubleshooting, servicing, and preventive maintaining of the system. Provide a minimum of 8 hours' training.
 - 2. Schedule training with the Owner at least seven days in advance.

END OF SECTION 28 31 00

LIFE SAFETY AND CODE REQUIREMENTS

OCCUPANCY CLASSIFICATION

INTERNATIONAL BUILDING CODE 2015 - MIXED OCCUPANCY, MULTISTORY, SEPARATED ASSEMBLY A-3, STORAGE GROUP S-1 AND STORAGE GROUP S-2

ALLOWABLE HEIGHT AND AREA

IBC TABLE 504.3 AND TABLE 504.4

CONSTRUCTION - TYPE II B	ALLOWABLE HEIGHT	ALLOWABLE AREA	ACTUAL AREA/HEIGHT
GROUP A-3 (MOST RESTRICTIVE)	3 STORIES/55 FT.	32,702 S.F.	15,195 S.F./52'-4"

TYPE OF CONSTRUCTION

INTERNATIONAL BUILDING CODE 2015: TYPE II B
REQUIRED FIRE-RESISTANCE RATINGS FOR BUILDING ELEMENTS (IBC TABLE 601)

	TYPE II B
STRUCTURAL FRAME	0
BEARING WALLS	
EXTERIOR	0
INTERIOR	0
NON BEARING WALLS AND PARTITIONS	
EXTERIOR	0
INTERIOR	0
FLOOR CONSTRUCTION	0
ROOF CONSTRUCTION	0

FIRE SEPARATION AND RESISTANCE RATINGS

NEW BUILDING OCCUPANCY SEPARATION FROM EXISTING STRUCTURE - 2 HOUR FIRE WALL ASSEMBLY SPRINKLER AND S-2 SEPARATIONS AS PER TABLE 706.4
EXTERIOR WALL FIRE RESISTANCE RATING BASED ON FIRE SEPARATION DISTANCE - 1 HOUR ASSEMBLY AND S-2 SEPARATIONS AS PER TABLE 602, MORE THAN 5 FT TO LESS THAN 10 FT.
PERCENTAGE OF OPENINGS IN RATED EXTERIOR WALLS = 25% AS PER TABLE 705.8
OCCUPANCY SEPARATION REQUIREMENTS A-3 TO S-2; NO SEPARATION, S-1 TO S-2; 1 HOUR

PLUMBING FIXTURES

AS PER TABLE 2902.1 - IBC 2015

GROUP CLASSIFICATION	WATER CLOSETS SEE SECTION 419.2 OF THE IPC FOR URINALS REQUIRED	WATER CLOSETS SUPPLIED		URINALS SUPPLIED	LAVATORIES REQUIRED		LAVATORIES SUPPLIED		BATHS OR SHOWERS REQUIRED	BATHS OR SHOWERS SUPPLIED	DRINKING FOUNTAINS REQUIRED	DRINKING FOUNTAINS SUPPLIED	OTHER REQUIRED	OTHER SUPPLIED		
		MALE	FEMALE		MALE	FEMALE	MALE	FEMALE								
ASSEMBLY GROUP A-3	802 PERSONS	4	7	4	7	4	3	3	3	3	0	0	2	2	1 SERV SINK	1 SERV SINK

INTERIOR FINISHES

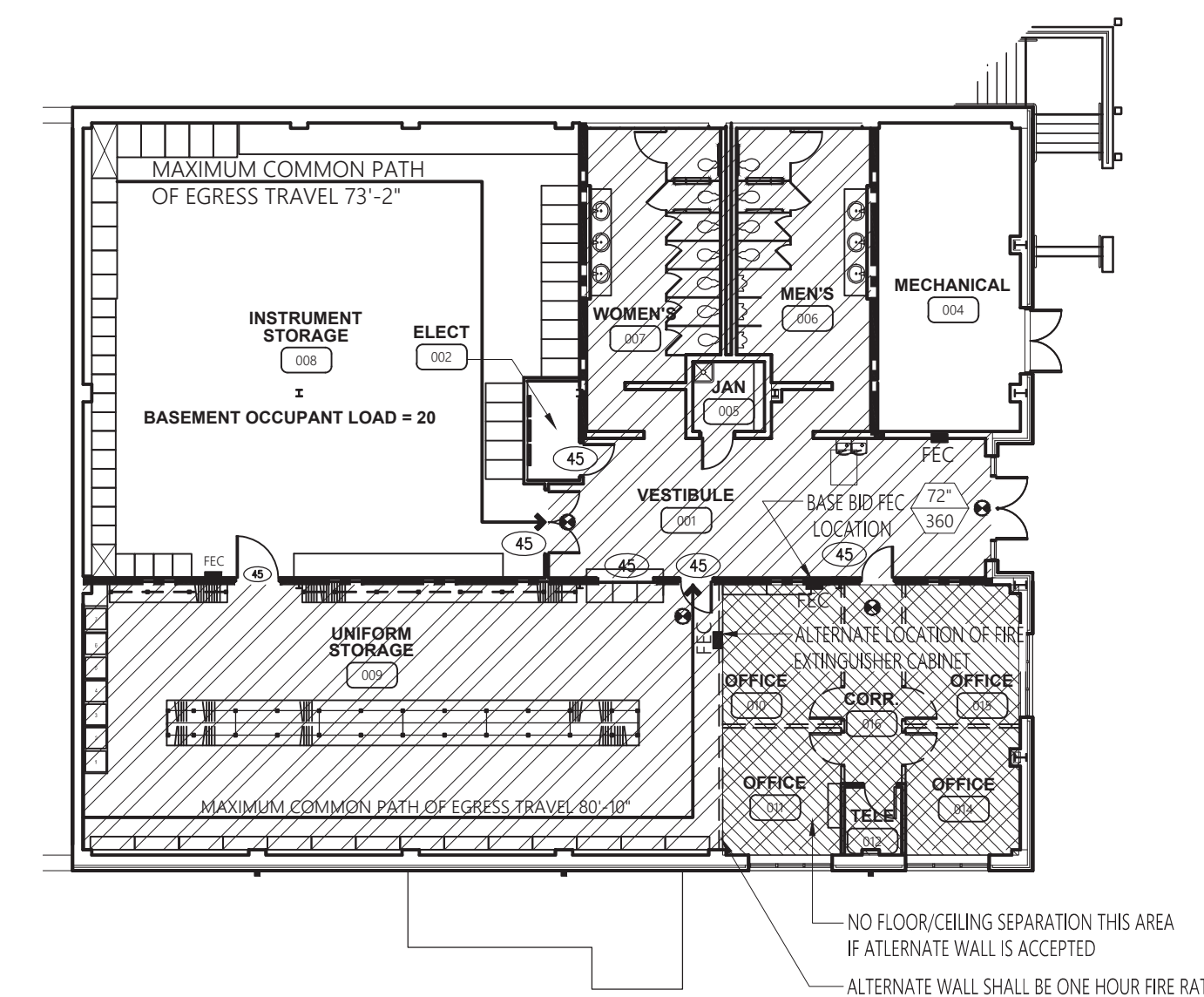
IBC TABLE 803.11 CEILING AND WALL FINISHES

GROUP	SPRINKLERED		
	EXIT ENCL. & PASSAGEWAYS	CORRIDORS	ROOMS AND ENCL. SPACES
GROUP A	B	B	C
GROUP S	C	C	C
GROUP B	B	C	C

IBC SECTION 804 - FLOOR FINISHES SHALL BE NOT LESS THAN TYPE II IN ALL AREAS IN AN UNSPRINKLERED BUILDING FOR GROUP A, B AND S OCCUPANCY.

CODE REFERENCES

INTERNATIONAL BUILDING CODE, BUILDING (IBC-B)	2015 EDITION
INTERNATIONAL BUILDING CODE, MECHANICAL (IBC-M)	2015 EDITION
INTERNATIONAL BUILDING CODE, FUEL GAS (IBC-FG)	2015 EDITION
INTERNATIONAL BUILDING CODE, PLUMBING (IBC-P)	2015 EDITION
NATIONAL FIRE ALARM AND SIGNALING CODE NFPA 72	2013 EDITION
NATIONAL ELECTRICAL CODE (NEC)	2014 EDITION
AMERICANS WITH DISABILITIES ACT	2010 EDITION
ANSI/ASHRAE/IESNA STANDARD 90.1	2013 EDITION



1 BASEMENT FLOOR LIFE SAFETY PLAN
LS.1 SCALE: 1/16" = 1'-0"

FIRE PROTECTION SYSTEMS

AUTOMATIC FIRE SPRINKLER PROTECTION IS REQUIRED, PER IBC SECTION 903.2.1.3 CONDITION 2.
MANUAL FIRE ALARM SHALL BE REQUIRED IF FIRE SPRINKLER DOES NOT ACTIVATE OCCUPANT NOTIFICATION APPLIANCES ON SPRINKLER FLOW. (IBC 907.2.1, EXCEPTION 1)

DESIGN OCCUPANT LOAD

OCCUPANT LOAD FACTORS (IBC TABLE 1004.1.2) :

BUSINESS GROUP B..... 100 G.S.F./PERSON ASSEMBLY GROUP A..... 7 N.S.F./PERSON
STORAGE GROUP S..... 300 G.S.F./PERSON

AREA	LOAD FACTOR	PERSONS
OFFICE	570 G.S.F. /100 G.S.F.	6
STORAGE/MECH.	5,612 G.S.F. /300 G.S.F.	19
ASSEMBLY CONCENTRATED	4,641 N.S.F. /7 N.S.F.	663
ASSEMBLY FIXED SEATING		114
TOTAL PERSONS		802

NUMBER OF MEANS OF EGRESS

TWO EXITS OR EXIT ACCESS (MEANS OF EGRESS) IS REQUIRED AT FIRST FLOOR OCCUPANCY.

ARRANGEMENT OF MEANS OF EGRESS

THE EXITS ARE ARRANGED SO THAT THEY MEET THE SEPARATE AND REMOTE REQUIREMENTS OF THE IBC.

MARKING OF MEANS OF EGRESS

ALL MEANS OF EGRESS SHALL BE PROVIDED WITH ACCEPTABLE EXIT SIGNS WHICH DESIGNATE THE EXITS AND THE DIRECTION OF TRAVEL TO THE EXITS ACCORDING TO IBC SECTION 1013. RAISED CHARACTER AND BRAILLE EXIT SIGNS PER ICC A117.1 SHALL BE INSTALLED AT EXIT DOORS.

EGRESS WIDTH AND TRAVEL DISTANCE

SECTION 1017 - MAXIMUM EXIT ACCESS DISTANCE IS 250 FEET SPRINKLERED.
MINIMUM CORRIDOR WIDTH IS 44 INCHES.

EMERGENCY LIGHTING

ADEQUATE EMERGENCY LIGHTING IS REQUIRED ACCORDING TO IBC SECTION 1006.

ACCESSIBILITY

ALL AREAS COMPLY WITH ACCESSIBILITY REQUIREMENTS OF THE IBC, AND ADA 2010

UTILITIES

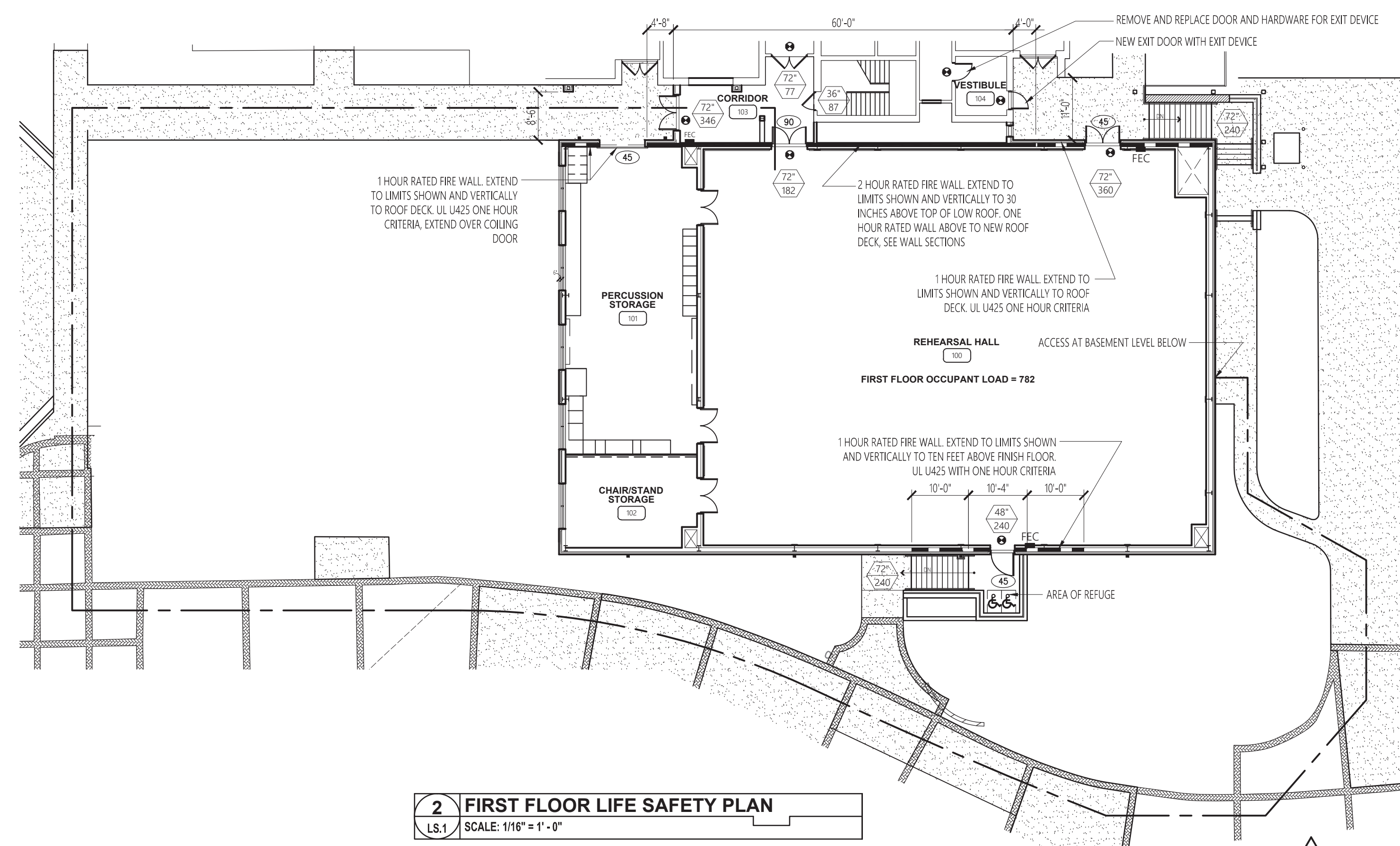
ALL ELECTRICAL SERVICES SHALL COMPLY WITH NFPA 70 - NATIONAL ELECTRICAL CODE. ANY AND ALL NATURAL GAS SERVICE SHALL COMPLY WITH THE 2015 INTERNATIONAL FUEL GAS CODE.
ALL PLUMBING SYSTEM INSTALLATION MUST COMPLY WITH THE PROVISIONS OF THE 2015 INTERNATIONAL PLUMBING CODE.

HEATING, VENTILATING & AIR CONDITIONING EQUIPMENT

ALL HVAC EQUIPMENT SHALL COMPLY WITH THE PROVISIONS OF THE 2015 INTERNATIONAL MECHANICAL CODE FOR INSTALLATION OF AIR CONDITIONING AND VENTILATION SYSTEMS, AND OR INSTALLATION OF WARM AIR HEATING AND AIR CONDITIONING SYSTEMS AS APPLICABLE.

SYMBOLS LEGEND

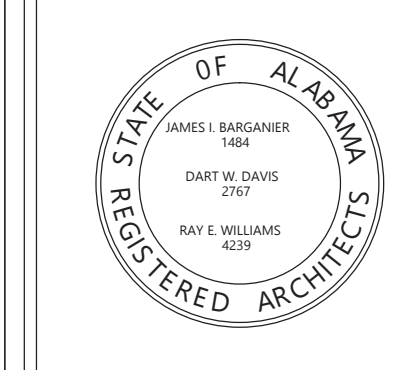
	EXIT SIGN		SEMI-RECESSED FIRE EXTINGUISHER CABINET WITH ABC TYPE EXTINGUISHER
	EXIT WIDTH AND EXIT CAPACITY		ONE HOUR FIRE RATED EXTERIOR WALL
	ONE HOUR FIRE RATED FLOOR/CEILING UL ASSEMBLY D902 WITH INTUMESCENT COATING OPTION 6E OR 6F FOR BEAMS		TWO HOUR FIRE RATED EXTERIOR WALL
			ONE HOUR FIRE RATED INTERIOR BARRIER
			ADA COMPLIANT ACCESSIBLE ROUTE



2 FIRST FLOOR LIFE SAFETY PLAN
LS.1 SCALE: 1/16" = 1'-0"

AUBURN
UNIVERSITY
Facilities Management
1161 West Samford Avenue
Auburn University, AL 36849
Phone: (334) 844-4810
Fax: (334) 844-9458
*Safety is our first priority.
Think Safety. Act Safely.*

No.	Revision	Date



Project Number: 2015-255
Drawn By:
BARGANIER DAVIS SIMS

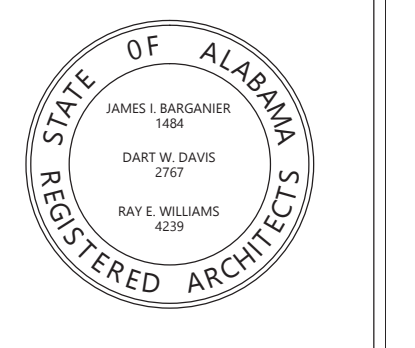
**GOODWIN HALL - RENOVATION
AND
BAND REHEARSAL HALL ADDITION**
Project Number 15-255

SHEET TITLE:
**LIFE SAFETY
PLANS AND
CODE STUDY**

DRAWN BY:
-
CHECKED BY:
-
DATE:
6-14-2017
FILE NUMBER:
-
PROJECT NUMBER:
16-111
SHEET NUMBER:

LS.1

No.	Revision	Date
1	Adm. #2	7-13-17



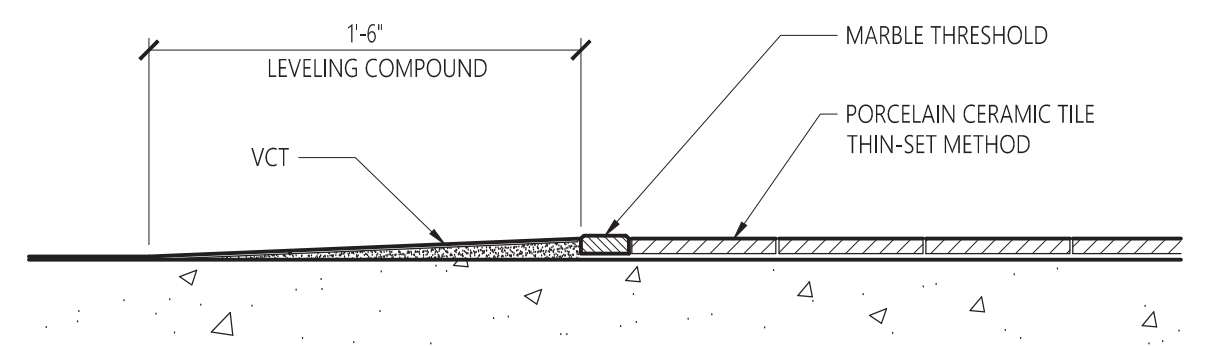
Project Number: 2015-255
BARGANIER DAVIS SIMS
Drawn By:

**GOODWIN HALL - RENOVATION
AND
BAND REHEARSAL HALL ADDITION**
Project Number 15-255

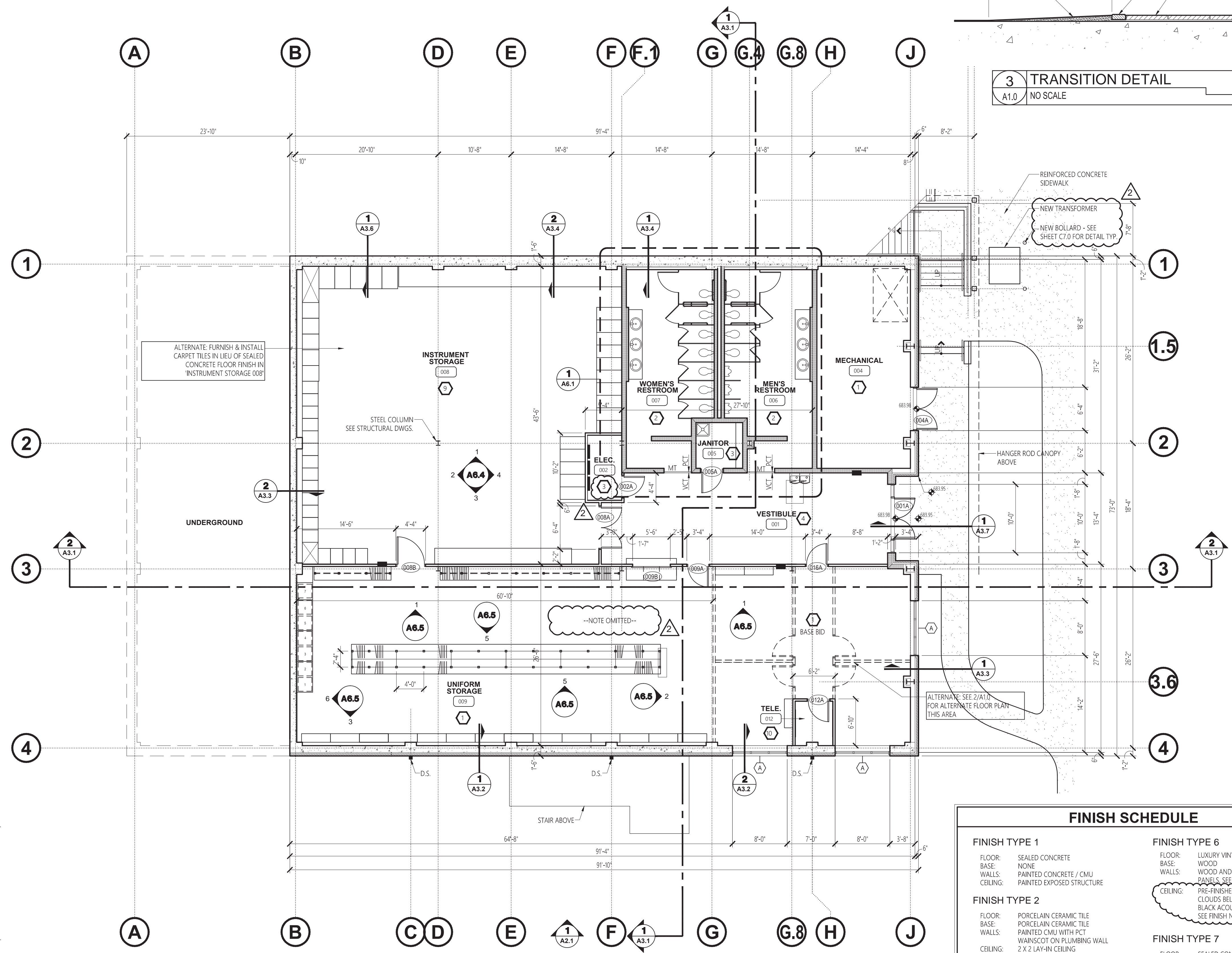
SHEET TITLE:
BASEMENT FLOOR PLAN

DRAWN BY:
-
CHECKED BY:
-
DATE:
6-14-2017
FILE NUMBER:
-
PROJECT NUMBER:
16-111
SHEET NUMBER:

A1.0



3 TRANSITION DETAIL
A1.0 NO SCALE

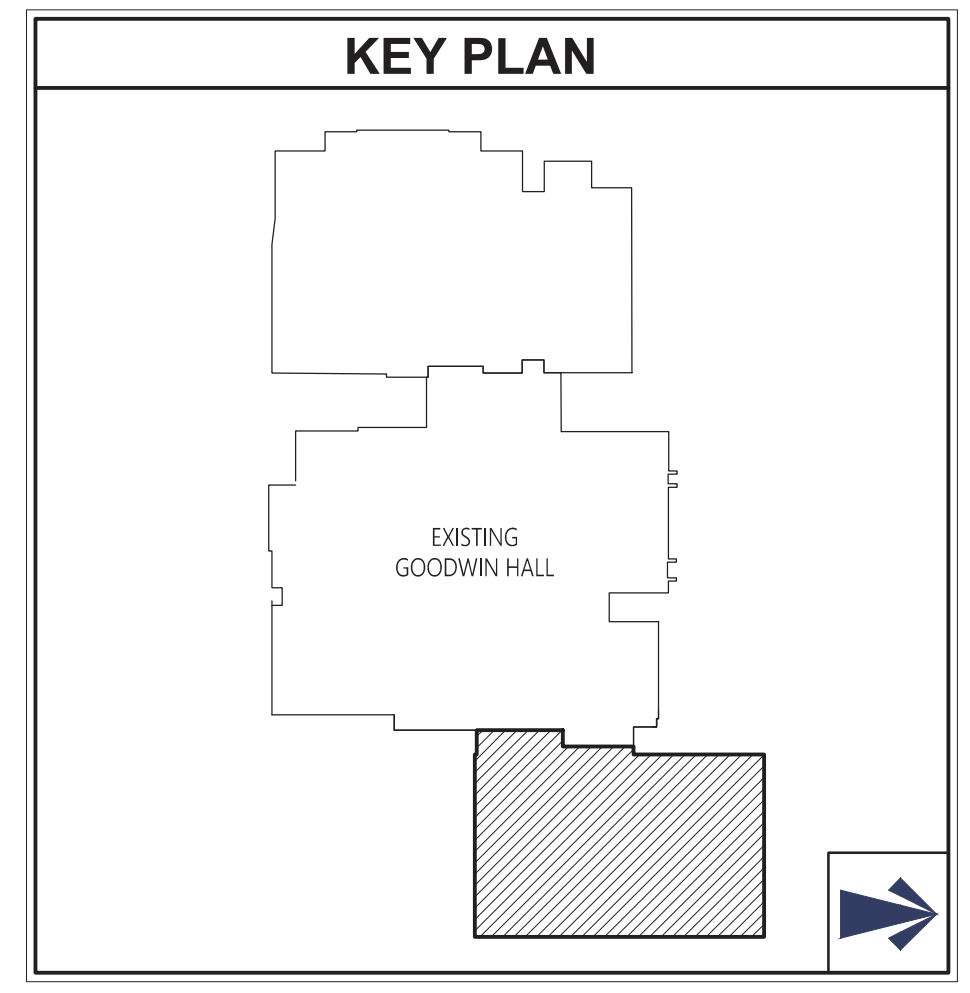


FINISH SCHEDULE	
FINISH TYPE 1 FLOOR: SEALED CONCRETE BASE: NONE WALLS: PAINTED CONCRETE / CMU CEILING: PAINTED EXPOSED STRUCTURE	FINISH TYPE 6 FLOOR: LUXURY VINYL TILE BASE: WOOD WALLS: WOOD AND ACOUSTICAL PANELS. SEE SHEET A6.2 CEILING: PRE-FINISHED SUSPENDED CEILING CLOUDS BELOW PRE-FINISHED BLACK ACOUSTICAL SOUND BOARDS. SEE FINISH NOTE 1, BELOW.
FINISH TYPE 2 FLOOR: PORCELAIN CERAMIC TILE BASE: PORCELAIN CERAMIC TILE WALLS: PAINTED CMU WITH PCT WAINSCOT ON PLUMBING WALL CEILING: 2 X 2 LAY-IN CEILING VINYL CLAD GYPSUM BOARD	FINISH TYPE 7 FLOOR: SEALED CONCRETE BASE: RUBBER WALLS: PAINTED GYPSUM BOARD CEILING: 2 X 2 LAY-IN CEILING
FINISH TYPE 3 FLOOR: SEALED CONCRETE BASE: RUBBER WALLS: PAINTED CONCRETE / GYP. BD. CEILING: PAINTED GYPSUM BOARD	FINISH TYPE 8 FLOOR: SEALED CONCRETE BASE: RUBBER WALLS: SEALED BRICK CEILING: 2 X 2 LAY-IN CEILING
FINISH TYPE 4 FLOOR: VINYL COMPOSITE TILE BASE: RUBBER WALLS: PAINTED CMU CEILING: 2X2 LAY-IN CEILING	FINISH TYPE 9 FLOOR: SEALED CONCRETE(BASE BID) BASE: RUBBER WALLS: PAINTED CONCRETE / CMU CEILING: PAINTED EXPOSED STRUCTURE
FINISH TYPE 5 (ALT.) FLOOR: CARPET BASE: RUBBER WALLS: PAINTED CMU/ GYP. BD. CEILING: 2 X 2 LAY-IN CEILING	FINISH TYPE 10 FLOOR: SEALED CONCRETE BASE: NONE WALLS: PAINTED GYPSUM BOARD CEILING: 3/4" TH. PLYWOOD AT EAST WALL PAINTED GYPSUM BOARD

FINISH NOTE 1:
PAINT FLAT BLACK ALL EXPOSED DUCTWORK, CONDUIT, FRAMING AND ANY OTHER EXPOSED MISC. MATERIALS.

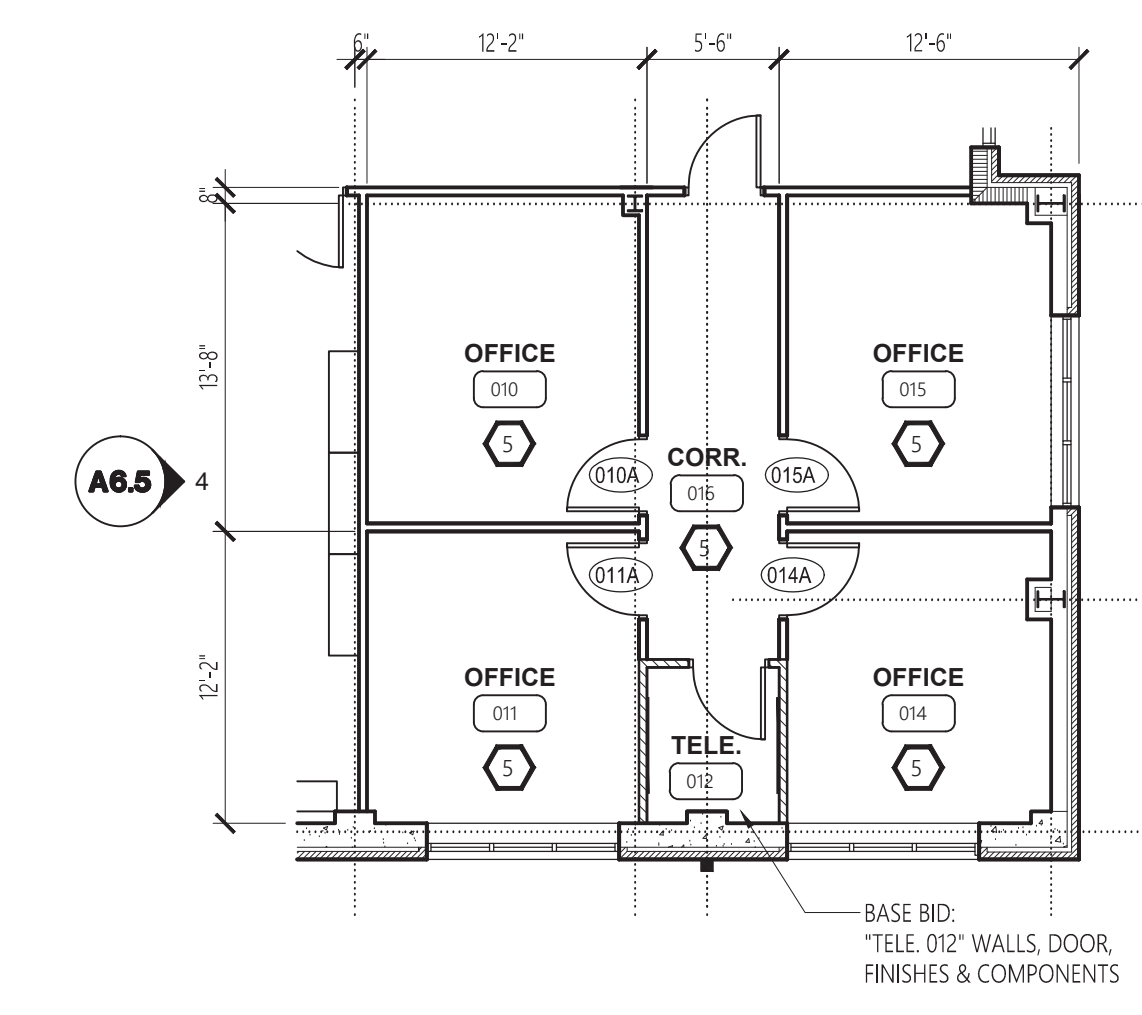
GENERAL NOTES
1. --NOTE OMITTED--

FINISH NOTES
1. HAND-RUBBED CONCRETE FINISH NOT REQUIRED BEHIND CABINETS/CASEWORK.
2. FURNISH & INSTALL MARBLE THRESHOLD TRANSITION BETWEEN VCT & PCT FLOOR FINISHES.
3. "PAINTED EXPOSED STRUCTURE" APPLIES TO STRUCTURAL MEMBERS, MECHANICAL DUCTWORK, CONDUIT AND ALL OTHER COMPONENTS AT THE CEILING. PAINT THE CEILING IN ITS ENTIRETY.



FLOOR PLAN LEGEND

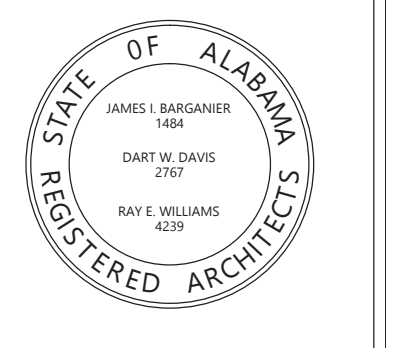
- KEY NOTE SYMBOL - SEE LIST OF KEY NOTES THIS SHEET
- DOOR SYMBOL - SEE DOOR SCHEDULE
- FINISH SYMBOL - SEE FINISH SCHEDULE THIS SHEET
- WINDOW SYMBOL - SEE WINDOW SCHEDULE
- LT LOUVER SYMBOL - SEE SHEET A8.1
- EXISTING WALL - FIELD VERIFY
- 8" REINFORCED CMU WALL
- METAL STUD WALL W/ GYPSUM BD.
- POURED IN PLACE CONCRETE WALL
- NEW WALL CONSTRUCTION - NEW TO MATCH EXISTING MATERIALS. FIELD VERIFY
- D.S. PRE-FINISHED METAL DOWNSPOUT INTO BOOT
- MT 2" MARBLE THRESHOLD WITH 18" WIDE LEVELING COMPOUND STRIP ON VCT SIDE OF MARBLE THRESHOLD - SEE 3/A1.0



1 BASEMENT FLOOR PLAN
A1.0 SCALE: 1/8" = 1'-0"

2 PARTIAL FLOOR PLAN (ALTERNATE)
A1.0 SCALE: 1/8" = 1'-0"

No.	Revision	Date
1	Adm. #2	7-13-17



Project Number: 2015-255
BARGANIER DAVIS SIMS
Drawn By:

**GOODWIN HALL - RENOVATION
AND
BAND REHEARSAL HALL ADDITION**
Project Number 15-255

SHEET TITLE:
FIRST FLOOR PLAN

DRAWN BY:
-

CHECKED BY:
-

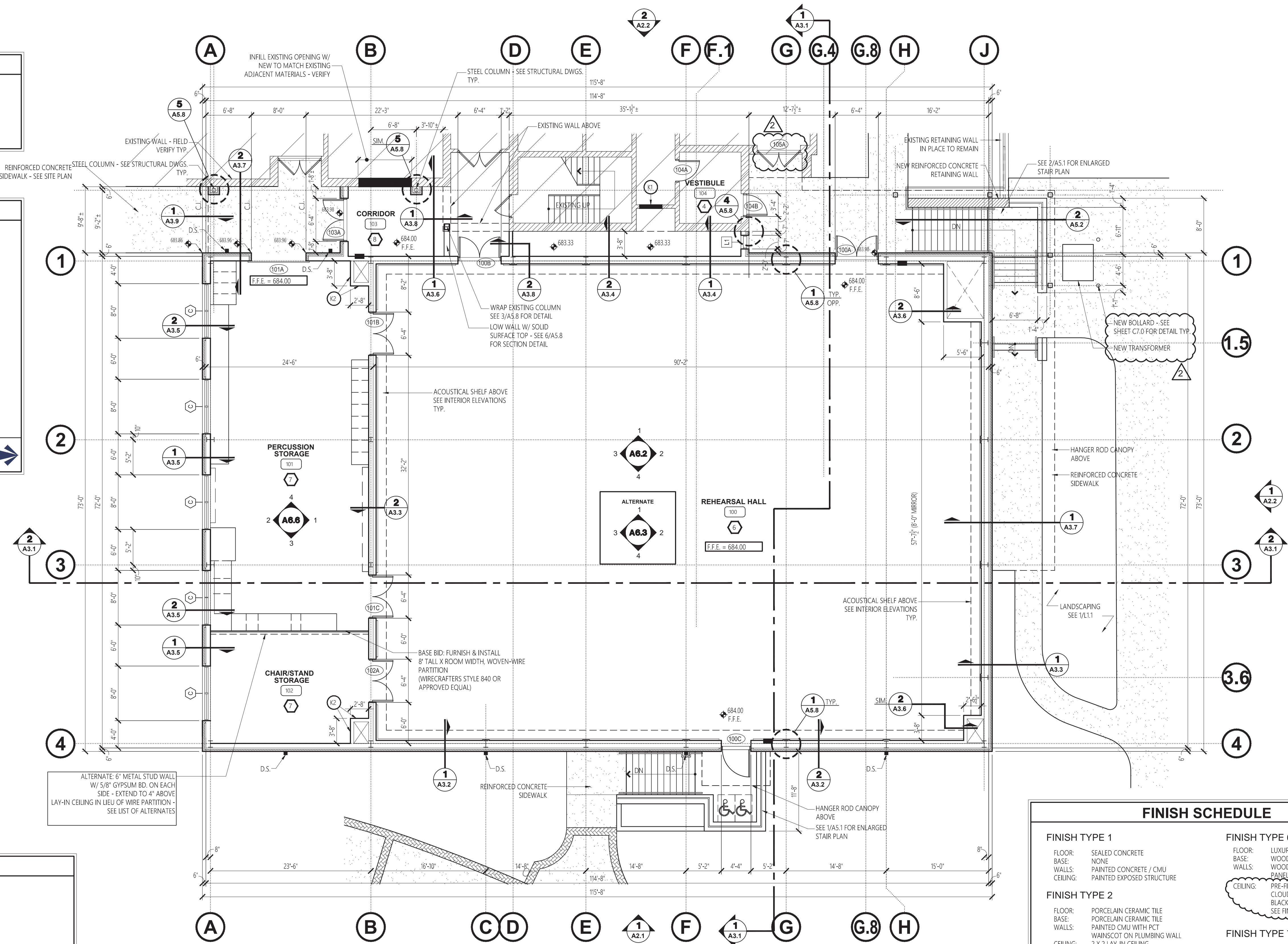
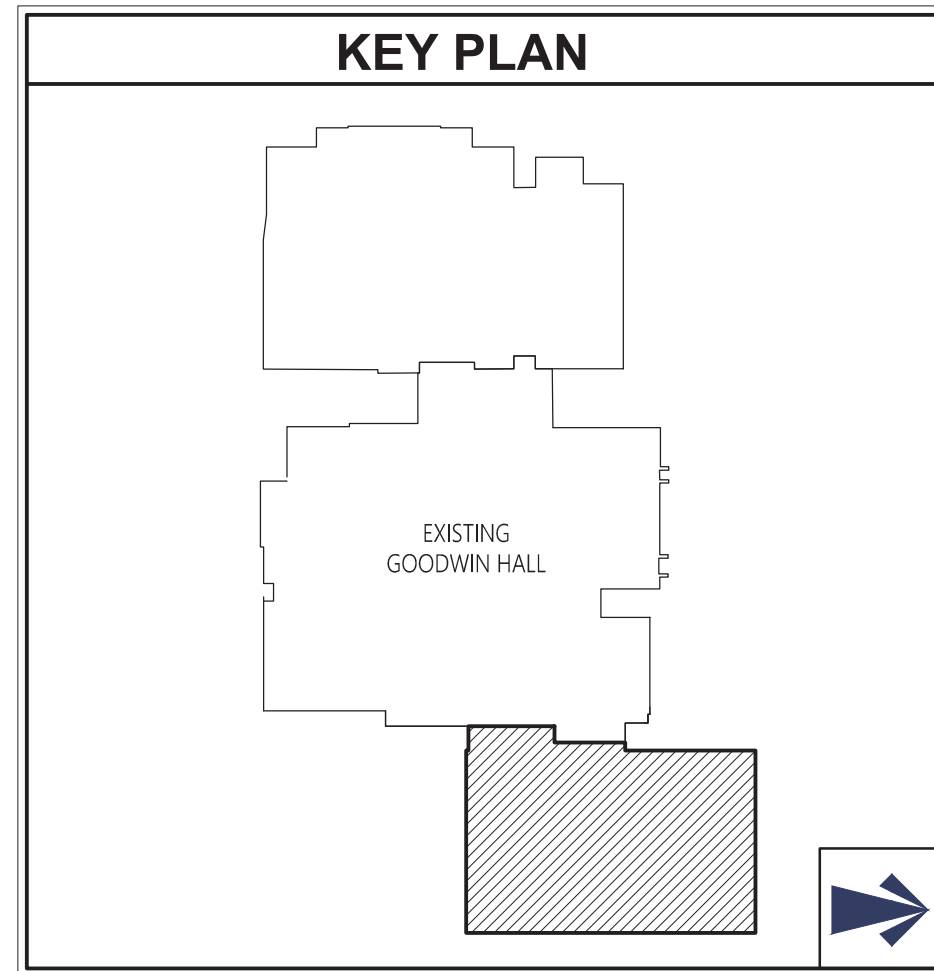
DATE:
6-14-2017

FILE NUMBER:
-

PROJECT NUMBER:
16-111

SHEET NUMBER:
A1.1

- KEY NOTES**
- (1) INFILL EXISTING DOOR OPENING IN MASONRY WALL W/ NEW MATERIALS TO MATCH EXISTING.
 - (2) CHASE WALL: 6" X 18 GA. METAL STUDS AT 16" O.C. W/ (1) LAYER 5/8" TH. GYPSUM BD.



- FLOOR PLAN LEGEND**
- (1) KEY NOTE SYMBOL - SEE LIST OF KEY NOTES THIS SHEET
 - (2) DOOR SYMBOL - SEE DOOR SCHEDULE
 - (3) FINISH SYMBOL - SEE FINISH SCHEDULE THIS SHEET
 - (4) WINDOW SYMBOL - SEE WINDOW SCHEDULE
 - (5) LOUVER SYMBOL - SEE SHEET A8.1
 - (6) EXISTING WALL - FIELD VERIFY
 - (7) 8" REINFORCED CMU WALL
 - (8) METAL STUD WALL W/ GYPSUM BD.
 - (9) POURED IN PLACE CONCRETE WALL
 - (10) NEW WALL CONSTRUCTION - NEW TO MATCH EXISTING MATERIALS FIELD VERIFY
 - (11) D.S. PRE-FINISHED METAL DOWNSPOUT INTO BOOT
 - (12) MT 2" MARBLE THRESHOLD WITH 18" WIDE LEVELING COMPOUND STRIP ON VCT SIDE OF MARBLE THRESHOLD - SEE 3/A1.0

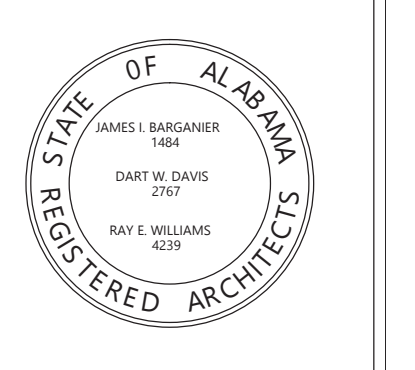
1 FIRST FLOOR PLAN
A1.1 SCALE: 1/8" = 1'-0"

FINISH SCHEDULE

FINISH TYPE 1 FLOOR: SEALED CONCRETE BASE: NONE WALLS: PAINTED CONCRETE / CMU CEILING: PAINTED EXPOSED STRUCTURE	FINISH TYPE 6 FLOOR: LUXURY VINYL TILE BASE: WOOD WALLS: WOOD AND ACOUSTICAL PANELS - SEE SHEET A8.2 CEILING: PRE-FINISHED SUSPENDED CEILING CLOUDS BELOW PRE-FINISHED BLACK ACOUSTICAL SOUND BOARDS. SEE FINISH NOTE 1, BELOW.
FINISH TYPE 2 FLOOR: PORCELAIN CERAMIC TILE BASE: PAINTED CMU WITH PCT WALLS: WAINSCOT ON PLUMBING WALL CEILING: 2 X 2 LAY-IN CEILING VINYL CLAD GYPSUM BOARD	FINISH TYPE 7 FLOOR: SEALED CONCRETE BASE: RUBBER WALLS: PAINTED GYPSUM BOARD CEILING: 2 X 2 LAY-IN CEILING
FINISH TYPE 3 FLOOR: SEALED CONCRETE BASE: RUBBER WALLS: PAINTED CONCRETE / GYP. BD. CEILING: PAINTED GYPSUM BOARD	FINISH TYPE 8 FLOOR: SEALED CONCRETE BASE: RUBBER WALLS: SEALED BRICK CEILING: 2 X 2 LAY-IN CEILING
FINISH TYPE 4 FLOOR: VINYL COMPOSITE TILE BASE: RUBBER WALLS: PAINTED CMU CEILING: 2X2 LAY-IN CEILING	FINISH TYPE 9 FLOOR: SEALED CONCRETE (BASE BID) CARPET TILE (ALTERNATE) BASE: RUBBER WALLS: PAINTED CONCRETE / CMU CEILING: PAINTED EXPOSED STRUCTURE
FINISH TYPE 5 (ALT.) FLOOR: CARPET BASE: RUBBER WALLS: PAINTED CMU / GYP. BD. CEILING: 2 X 2 LAY-IN CEILING	FINISH TYPE 10 FLOOR: SEALED CONCRETE BASE: NONE WALLS: PAINTED GYPSUM BOARD (3/4" TH. PLYWOOD AT EAST WALL) CEILING: PAINTED GYPSUM BOARD

FINISH NOTE 1: PAINT FLAT BLACK ALL EXPOSED DUCTWORK, CONDUIT, FRAMING AND ANY OTHER EXPOSED MISC. MATERIALS.

No.	Revision	Date



Project Number: 2015-255
BARGANIER DAVIS SIMS
 Drawn By:

**GOODWIN HALL - RENOVATION
 AND
 BAND REHEARSAL HALL ADDITION**
 Project Number 15-255

SHEET TITLE:
**WEST & SOUTH
 ELEVATIONS**

DRAWN BY:
 -

CHECKED BY:
 -

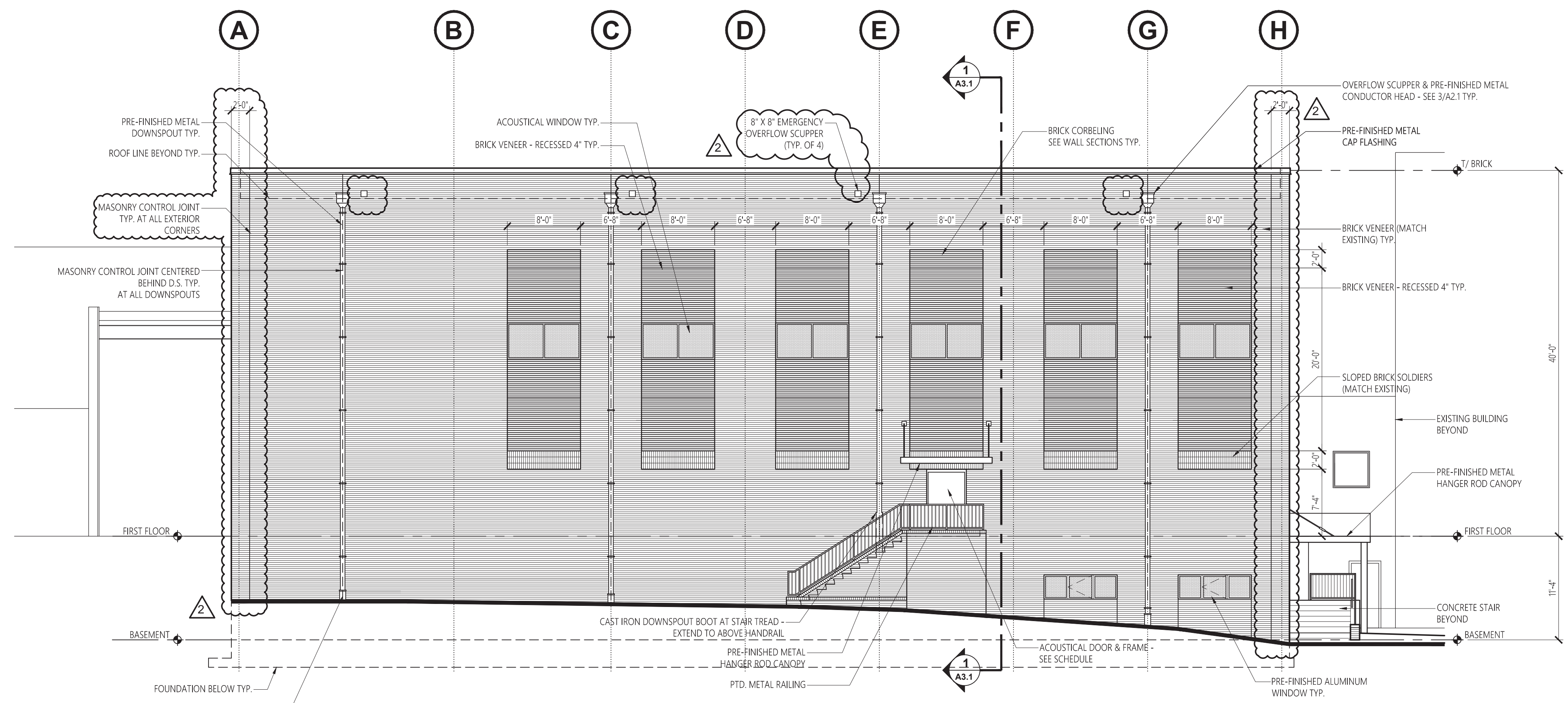
DATE:
 6-14-2017

FILE NUMBER:
 -

PROJECT NUMBER:
 16-111

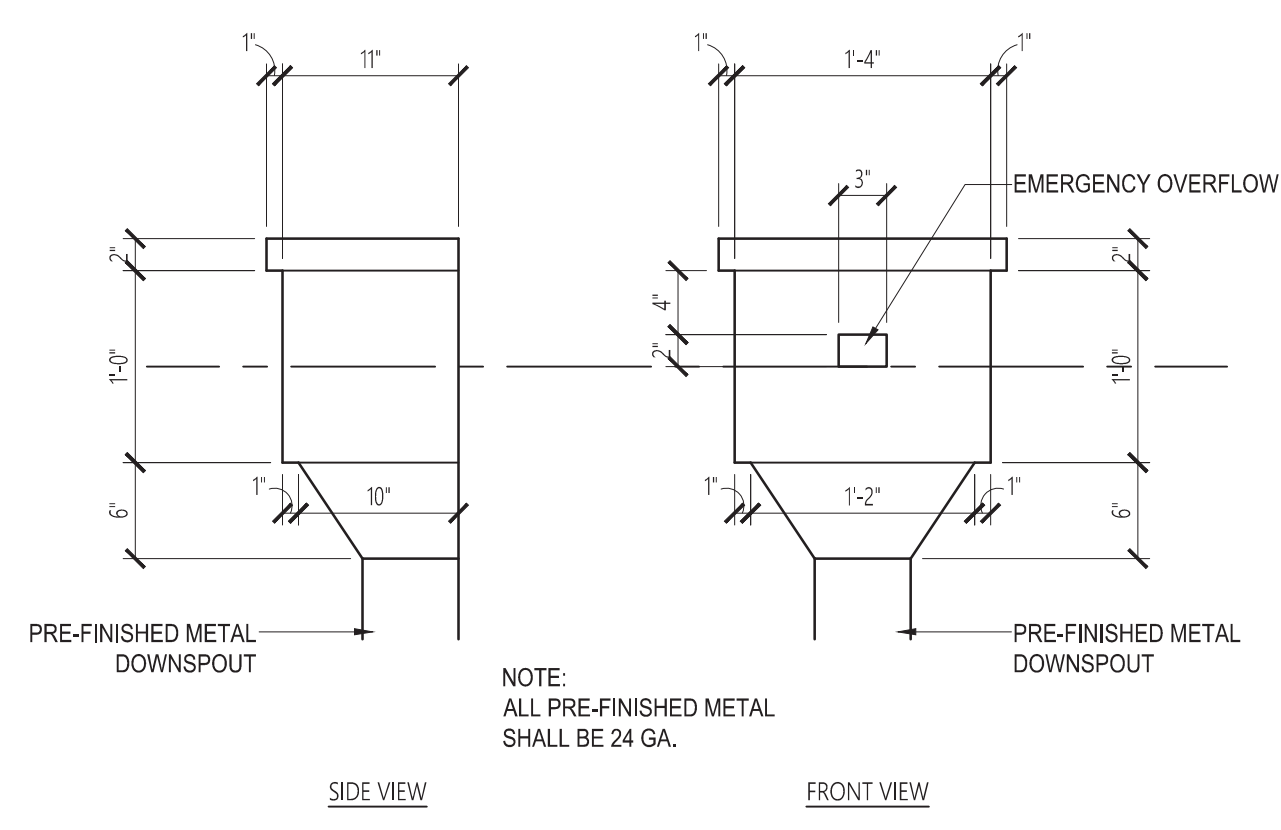
SHEET NUMBER:
 -

A2.1

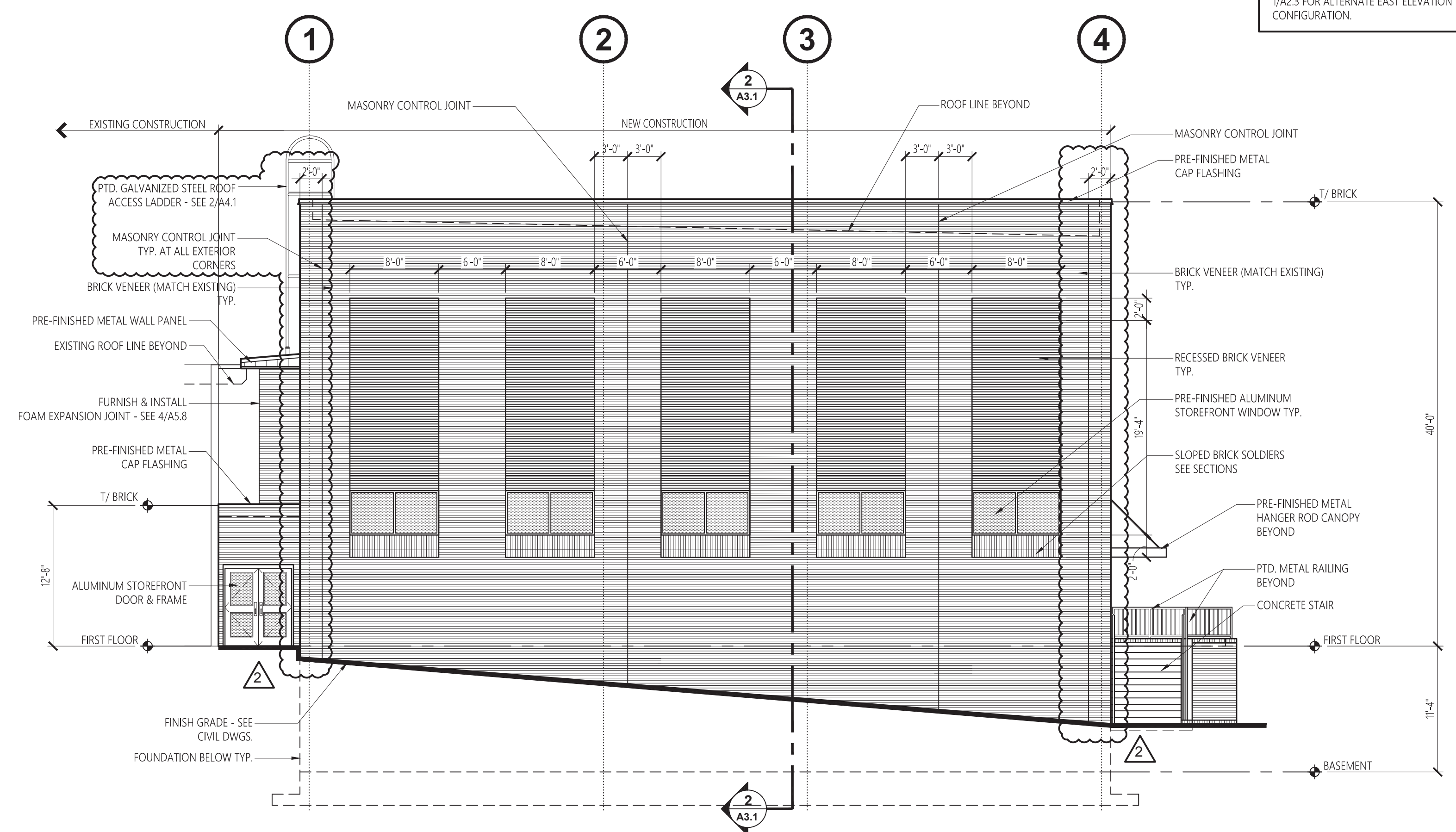


1 EAST ELEVATION (BASE BID)
 A2.1 SCALE: 1/8" = 1'-0"

NOTE:
 BASE BID CONFIGURATION SHOWN. SEE
 1/A2.3 FOR ALTERNATE EAST ELEVATION
 CONFIGURATION.

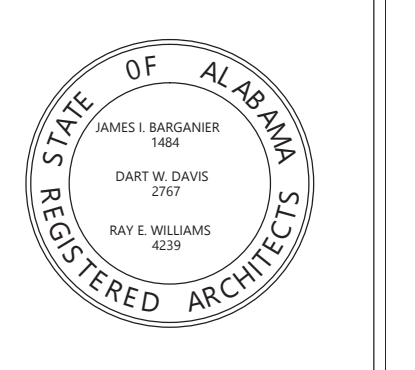


3 CONDUCTOR HEAD DETAIL
 A2.1 SCALE: 1" = 1'-0"



2 SOUTH ELEVATION
 A2.1 SCALE: 1/8" = 1'-0"

No.	Revision	Date



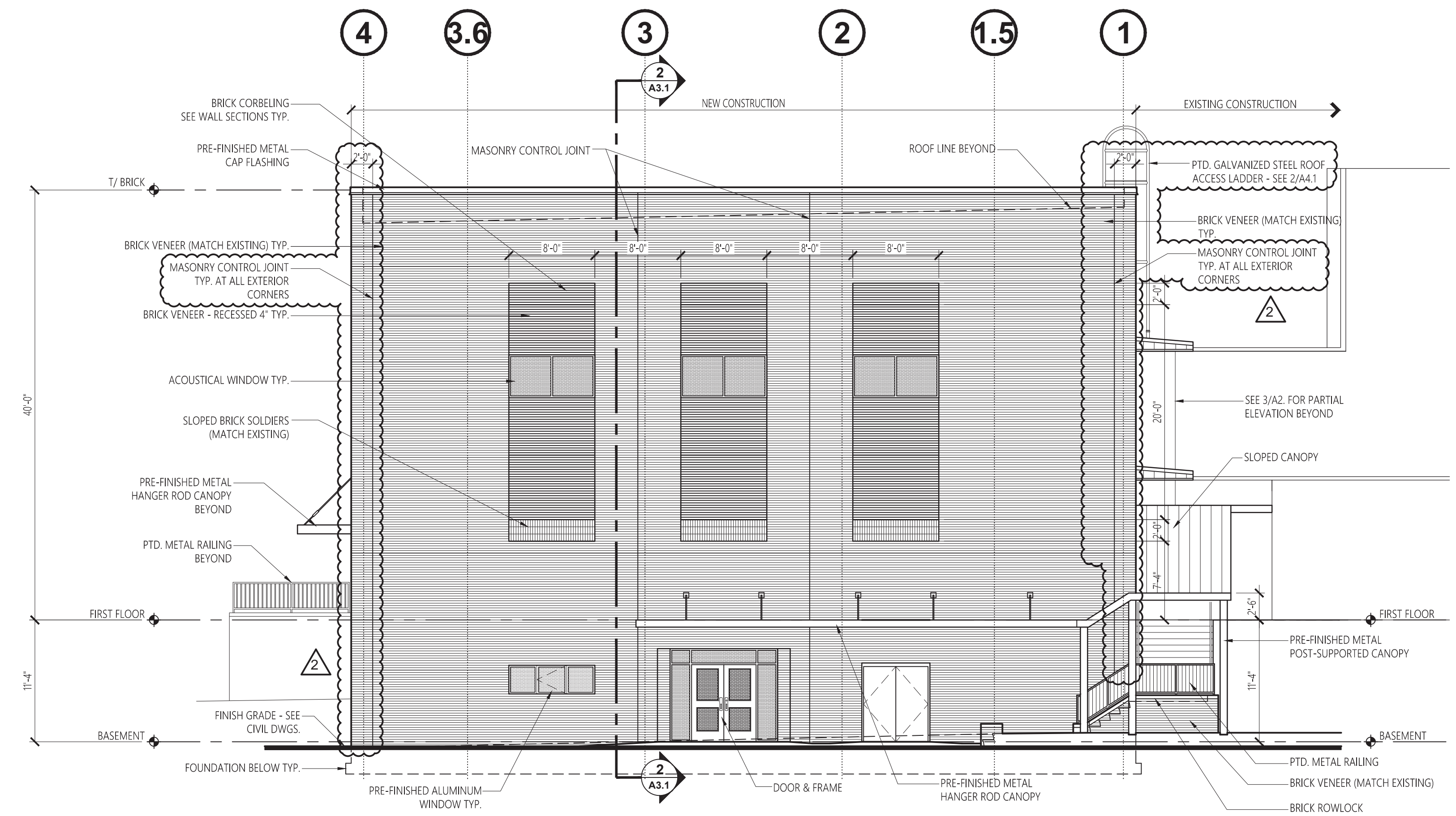
Project Number: 2015-255
BARGANIER DAVIS SIMS
Drawn By:

**GOODWIN HALL - RENOVATION
AND
BAND REHEARSAL HALL ADDITION**
Project Number 15-255

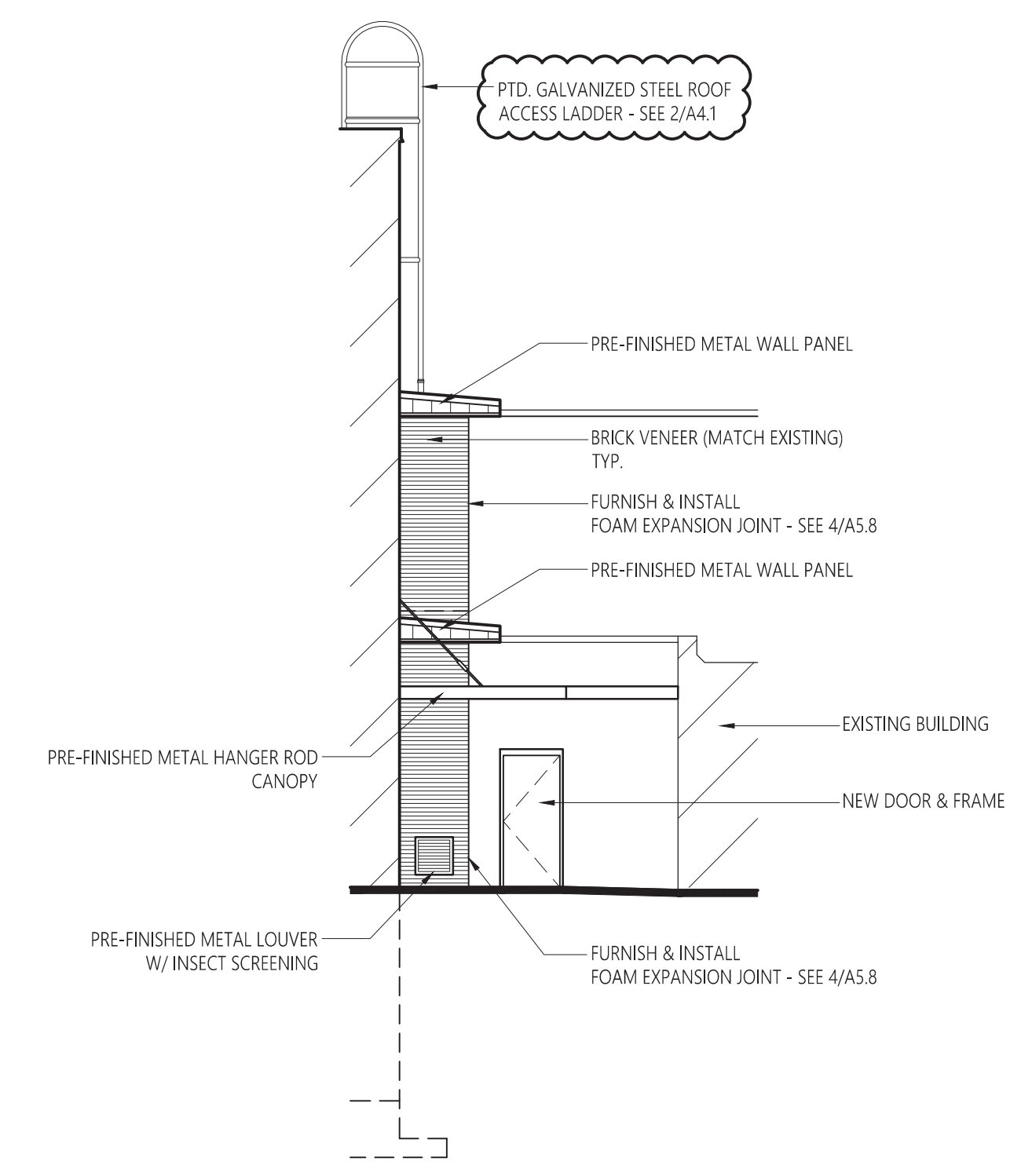
SHEET TITLE:
NORTH ELEVATION

DRAWN BY:
-
CHECKED BY:
-
DATE:
6-14-2017
FILE NUMBER:
-
PROJECT NUMBER:
16-111
SHEET NUMBER:

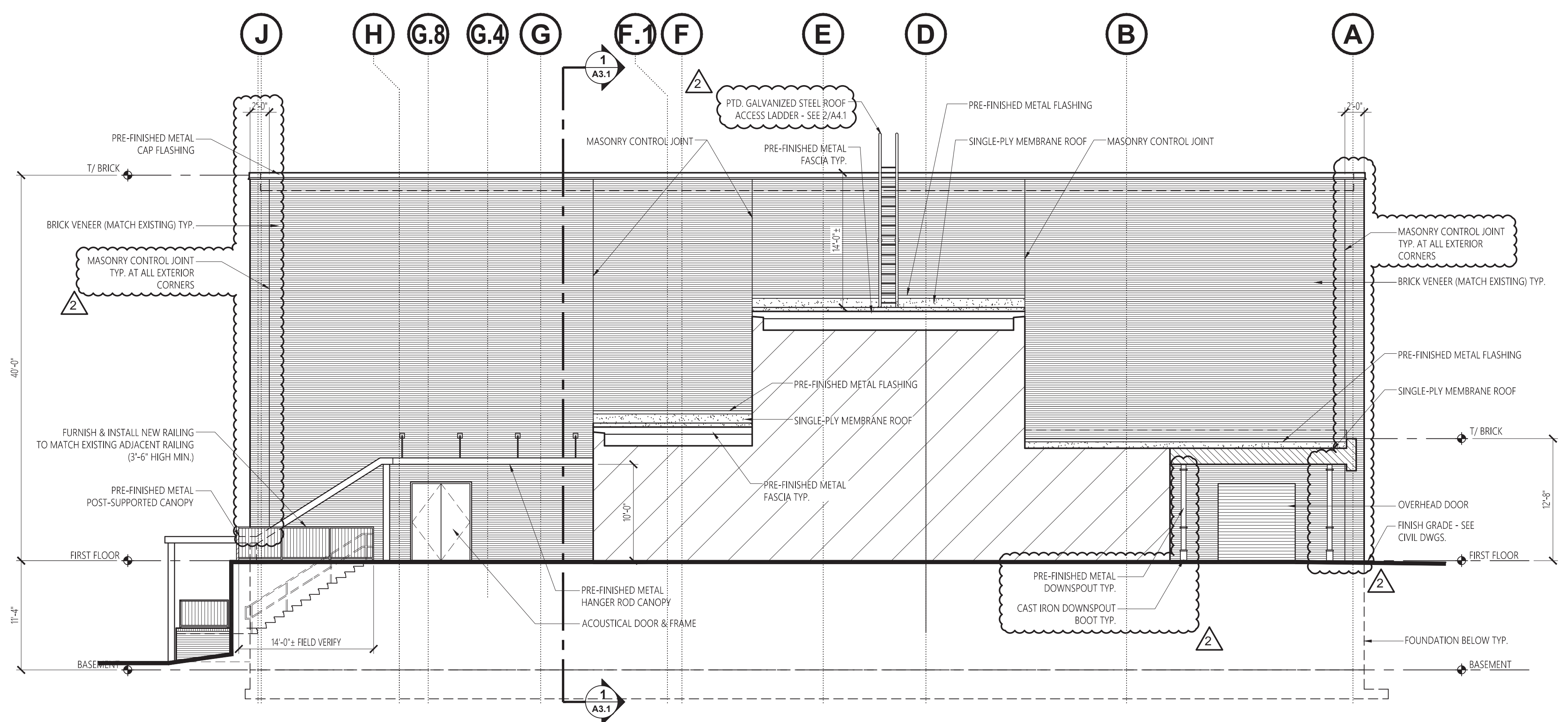
A2.2



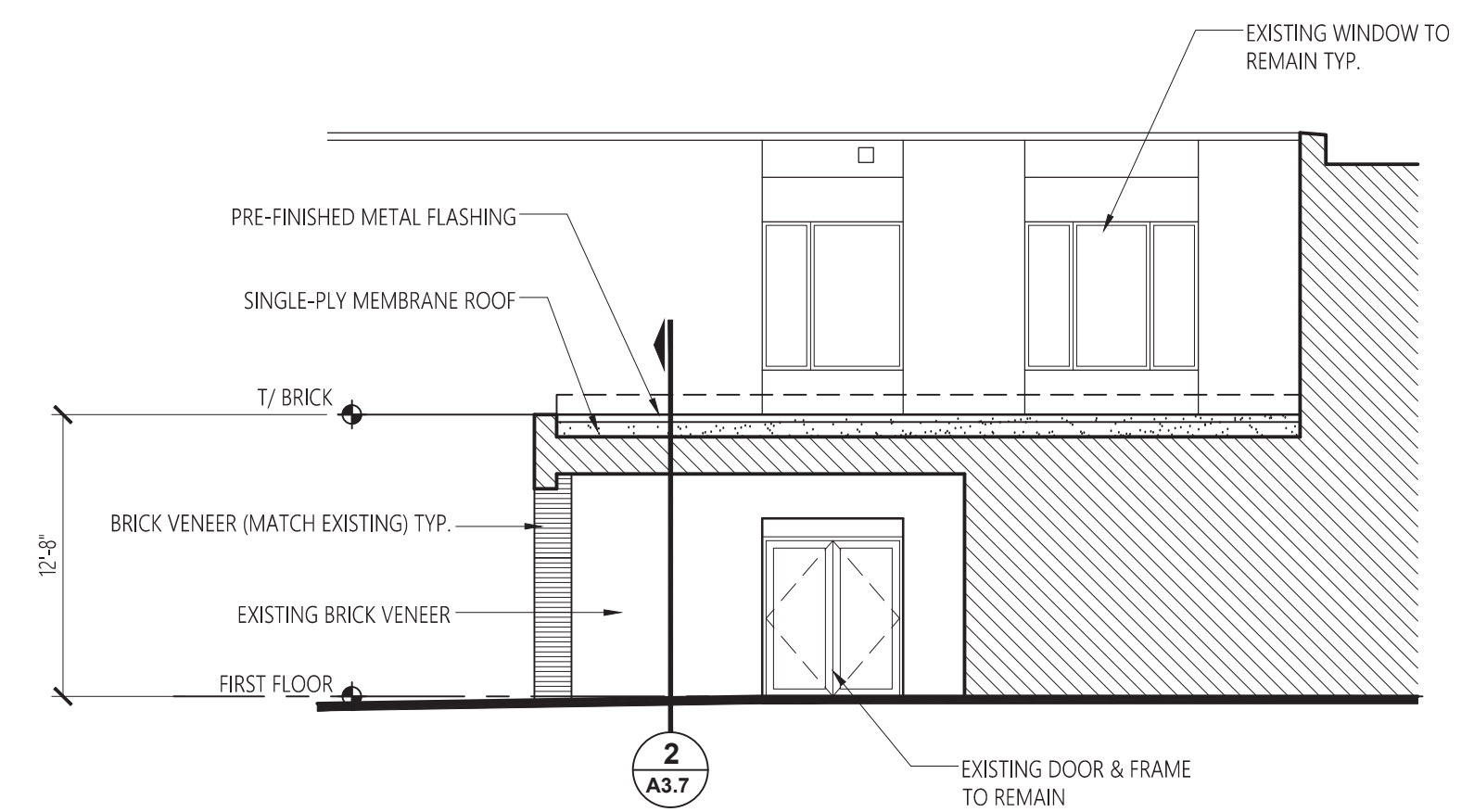
1 NORTH ELEVATION
A2.2 SCALE: 1/8" = 1'-0"



3 PARTIAL NORTH ELEVATION
A2.2 SCALE: 1/8" = 1'-0"

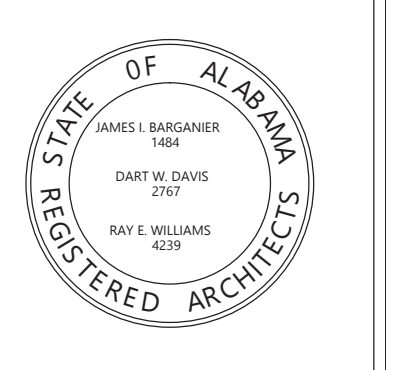


2 WEST ELEVATION
A2.2 SCALE: 1/8" = 1'-0"



4 PARTIAL WEST ELEVATION
A2.2 SCALE: 1/8" = 1'-0"

No.	Revision	Date



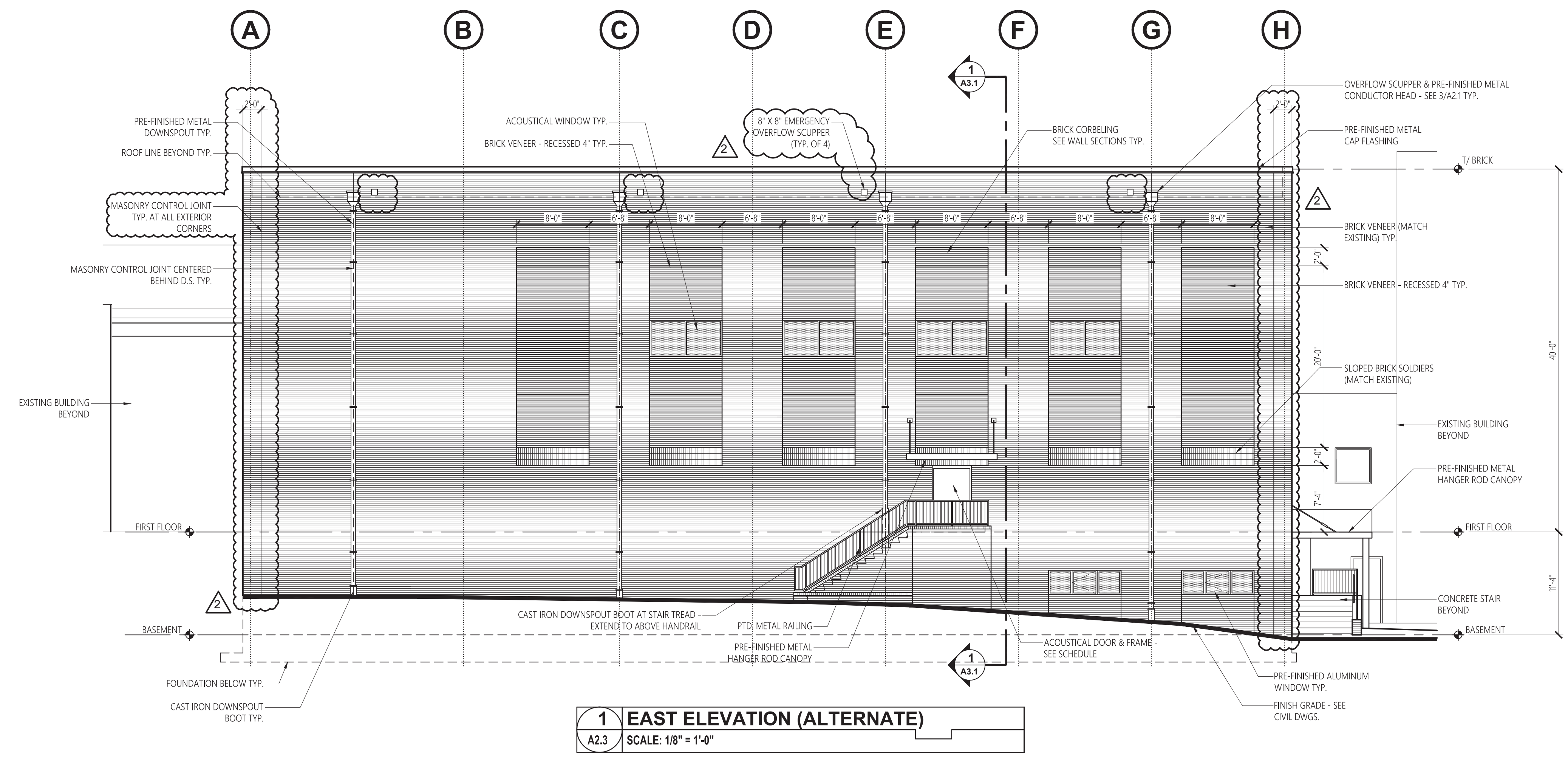
Project Number: 2015-255
BARGANIER DAVIS SIMS
Drawn By:

**GOODWIN HALL - RENOVATION
AND
BAND REHEARSAL HALL ADDITION**
Project Number 15-255

SHEET TITLE:
**EAST ELEVATION
(ALTERNATE)**

DRAWN BY:
-
CHECKED BY:
-
DATE:
6-14-2017
FILE NUMBER:
-
PROJECT NUMBER:
16-111
SHEET NUMBER:

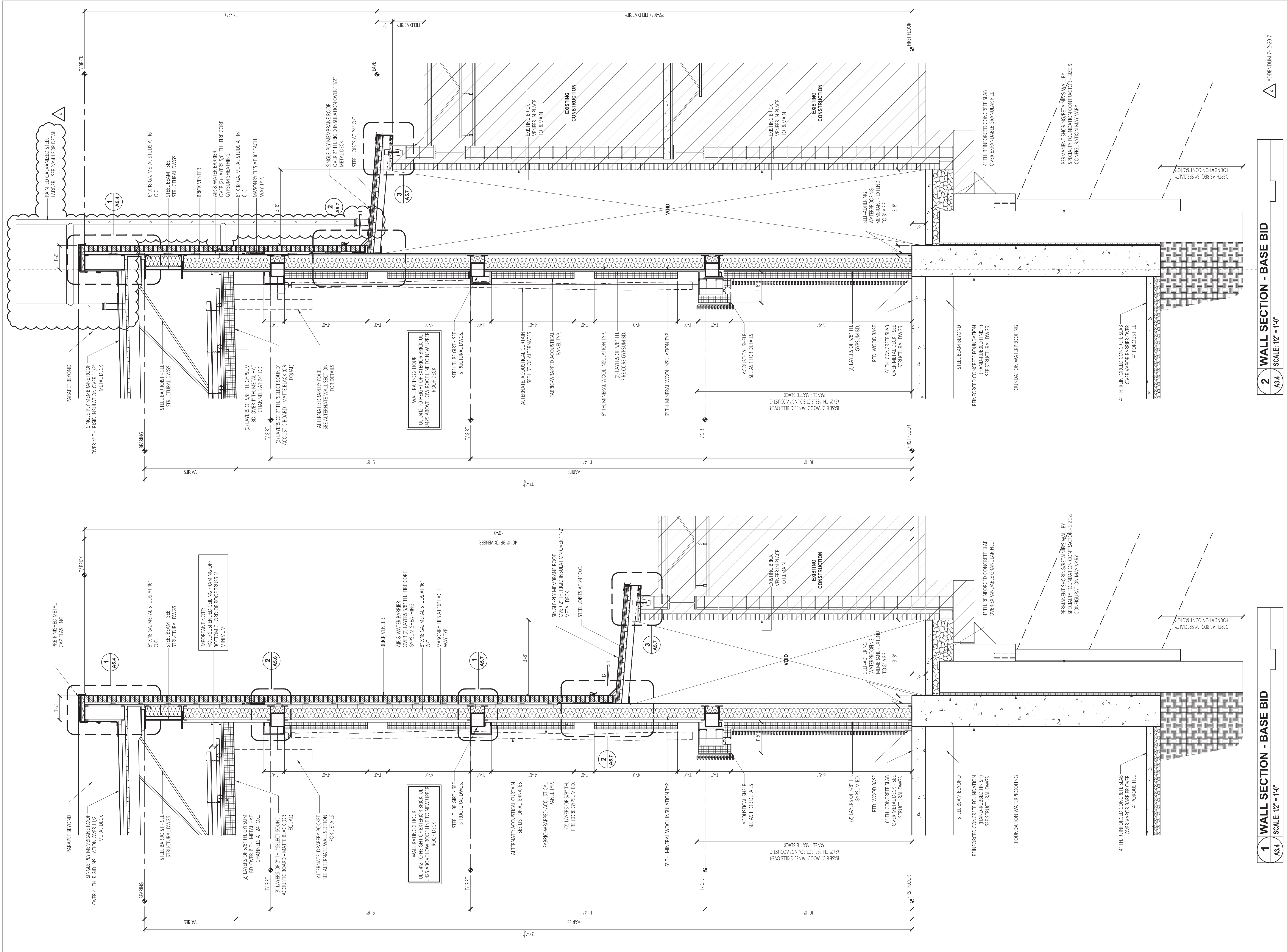
A2.3



ADDENDUM 7-12-2017


GENERAL NOTES

- ALL EXTERIOR STEEL (LINTELS, PIPE SLEEVES, RAILINGS, ETC.) SHALL BE PAINTED, HOT-DIPPED GALVANIZED.



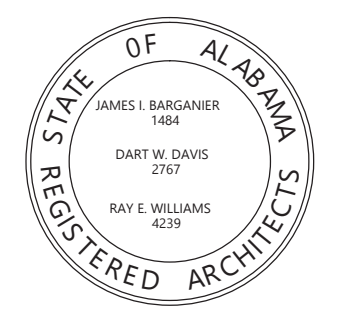
1 WALL SECTION - BASE BID
A3.4 SCALE: 1/2" = 1'-0"

2 WALL SECTION - BASE BID
A3.4 SCALE: 1/2" = 1'-0"



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No.	Revision	Date



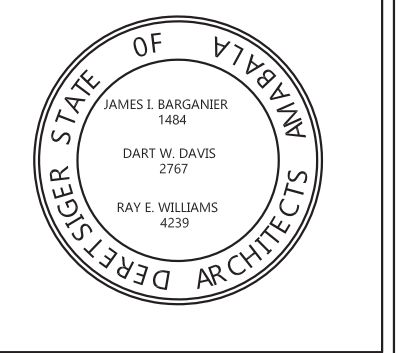
Project Number: 2015-255
BARGANIER DAVIS SIMS
 Drawn By:

**GOODWIN HALL - RENOVATION
 AND
 BAND REHEARSAL HALL ADDITION**
 Project Number 15-255

SHEET TITLE: WALL SECTIONS	
DRAWN BY:	
CHECKED BY:	
DATE:	6-14-2017
FILE NUMBER:	
PROJECT NUMBER:	16-111
SHEET NUMBER:	A3.4

APPENDIX 7-02-2017

No.	Revision	Date



Project Number: 2015-255
BARGANER DAVIS SIMS
 Drawn By:

**GOODWIN HALL - RENOVATION
 AND
 BAND REHEARSAL HALL ADDITION**
 Project Number 15-255

SHEET TITLE:
ROOF PLAN

DRAWN BY:
 -

CHECKED BY:
 -

DATE:
 6-14-2017

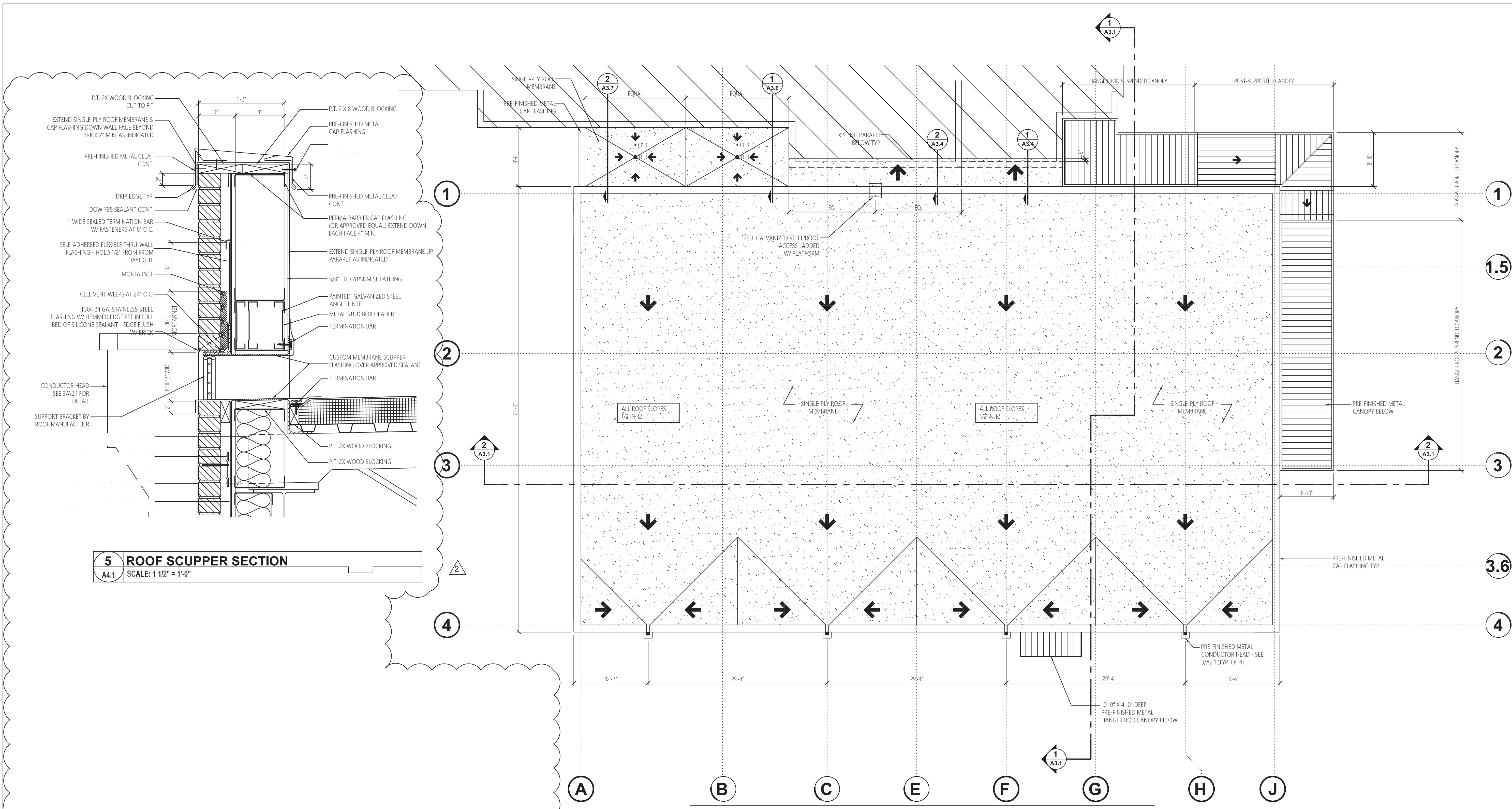
FILE NUMBER:
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PROJECT NUMBER:
 16-111

SHEET NUMBER:

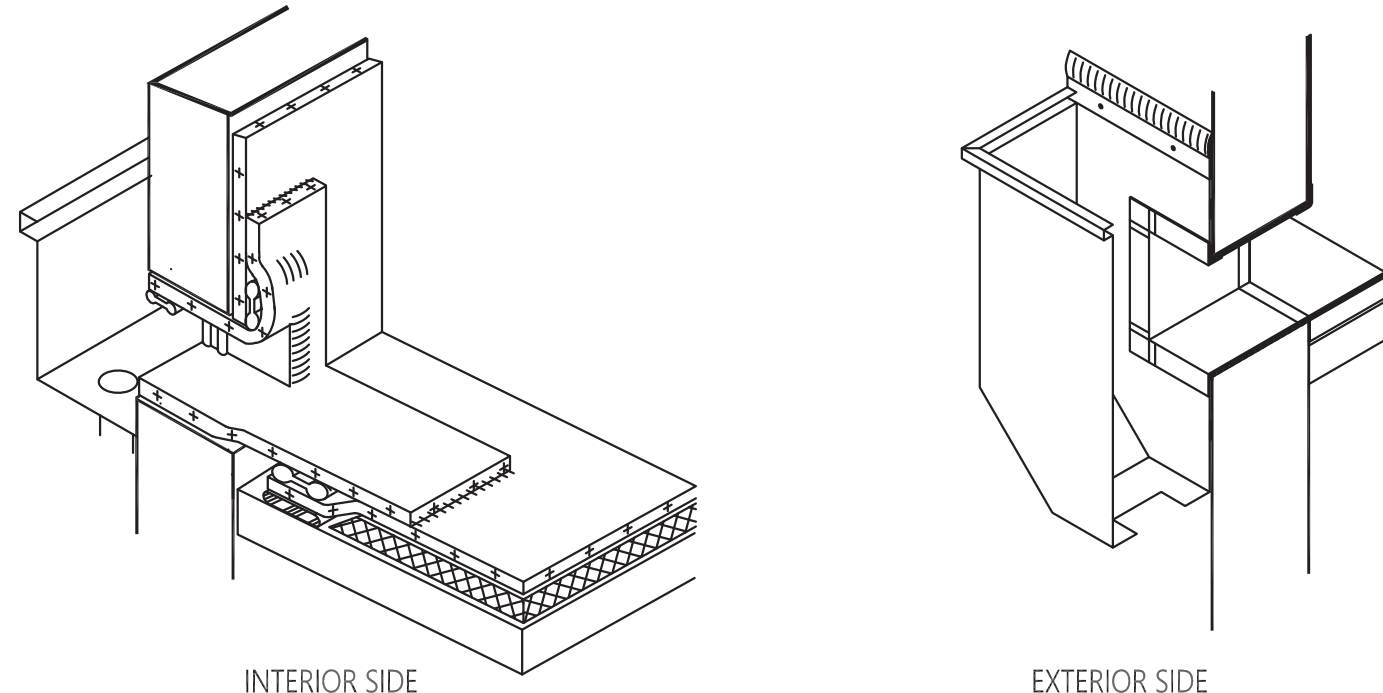
A4.1

2 ADDENDUM 7-12-2017

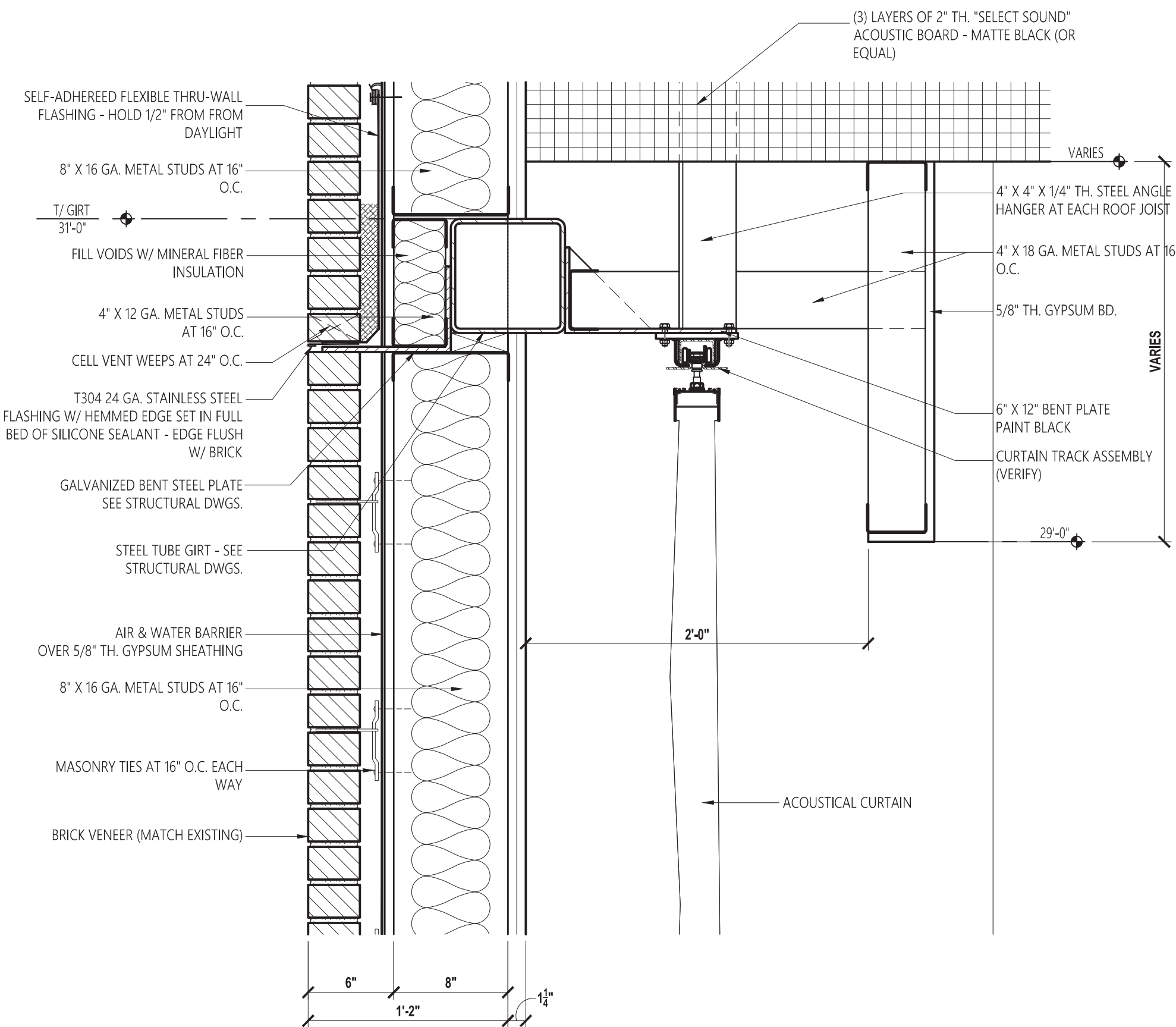


1 ROOF PLAN
 A4.1 SCALE: 1/8" = 1'-0"

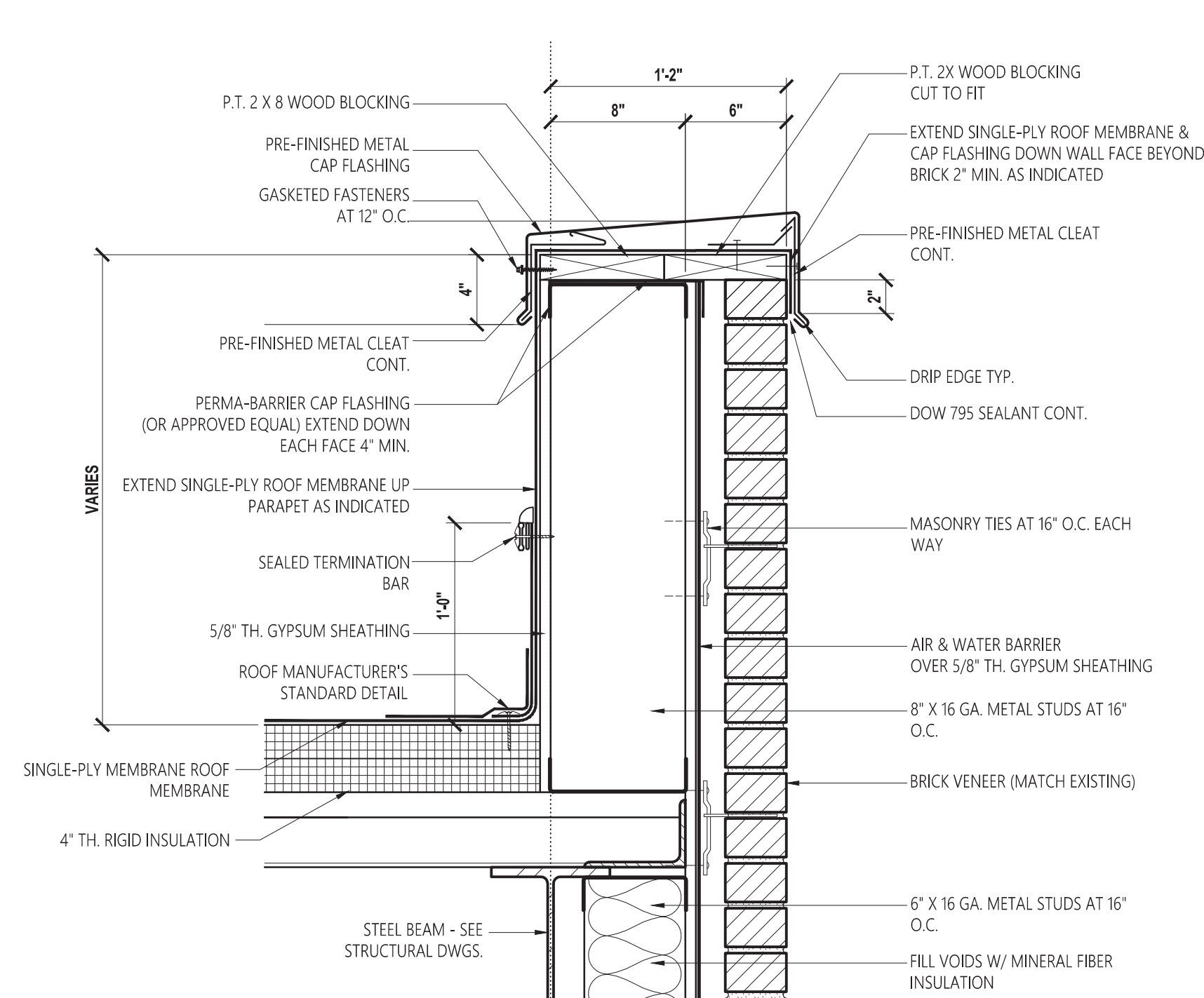
5 ROOF SCUPPER SECTION
 A4.1 SCALE: 1 1/2" = 1'-0"



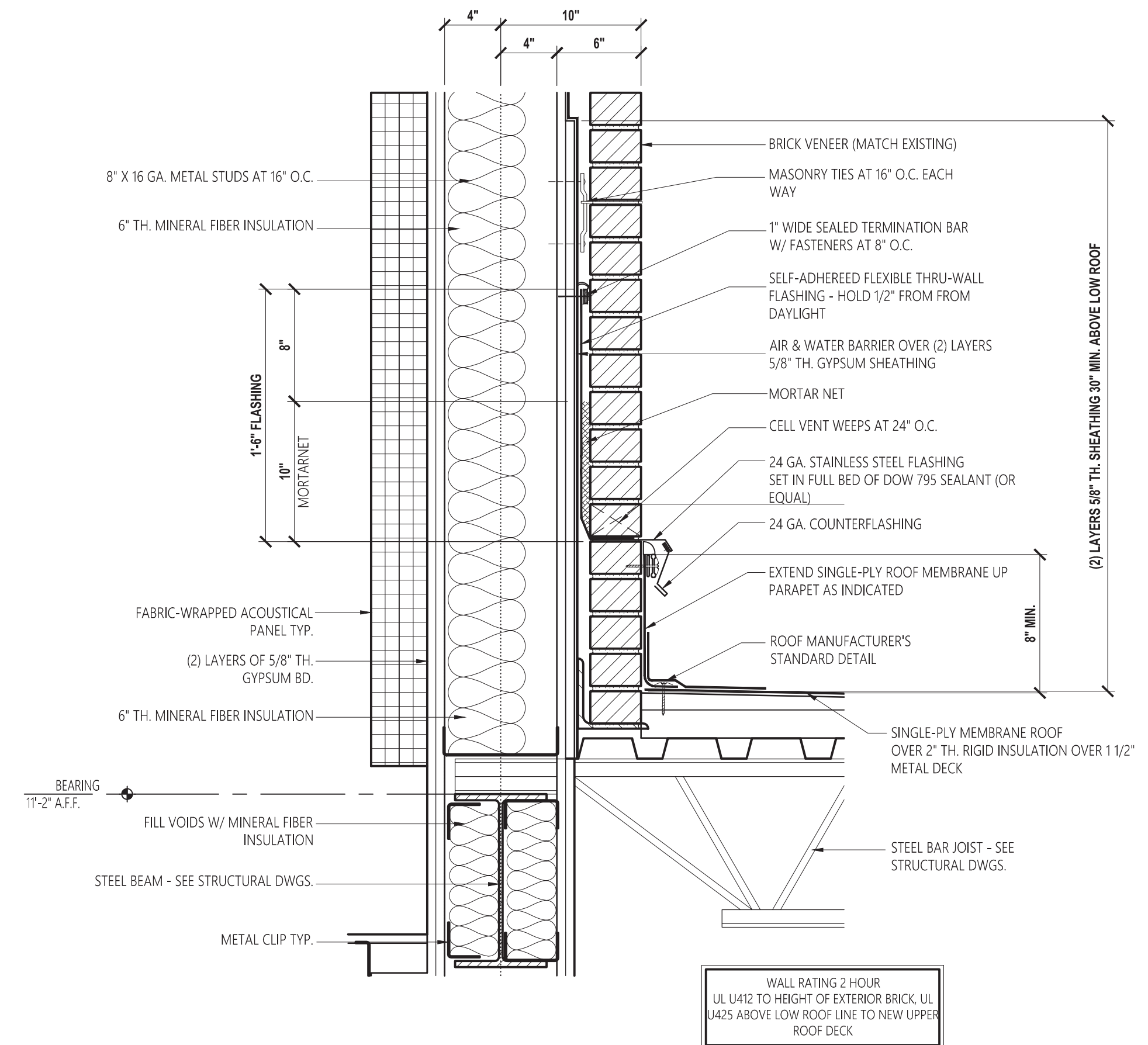
4 ROOF SCUPPER ISOMETRIC
 A4.1 NO SCALE



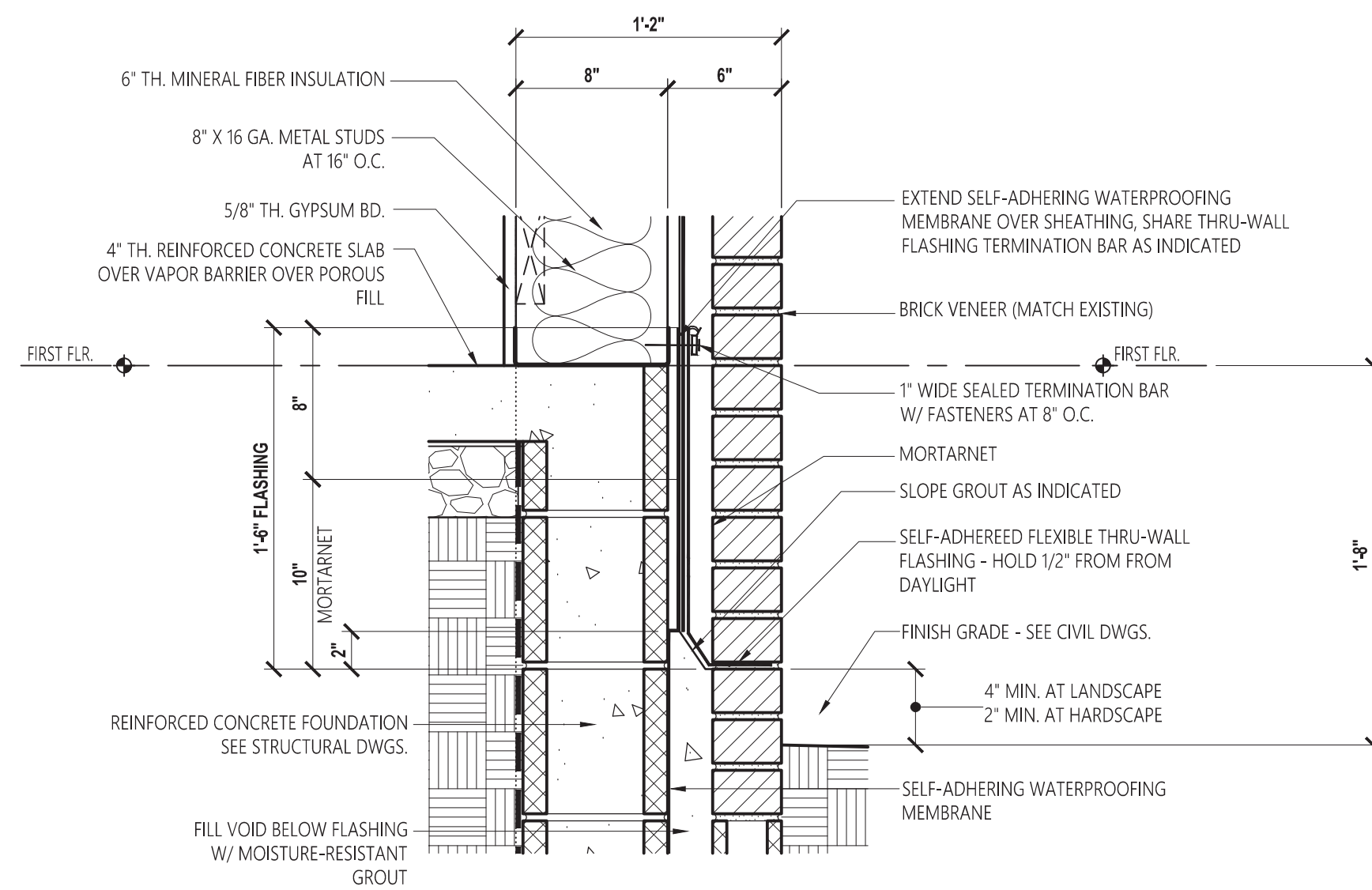
1 SECTION DETAIL (ALTERNATE)
A5.5 SCALE: 1 1/2" = 1'-0"



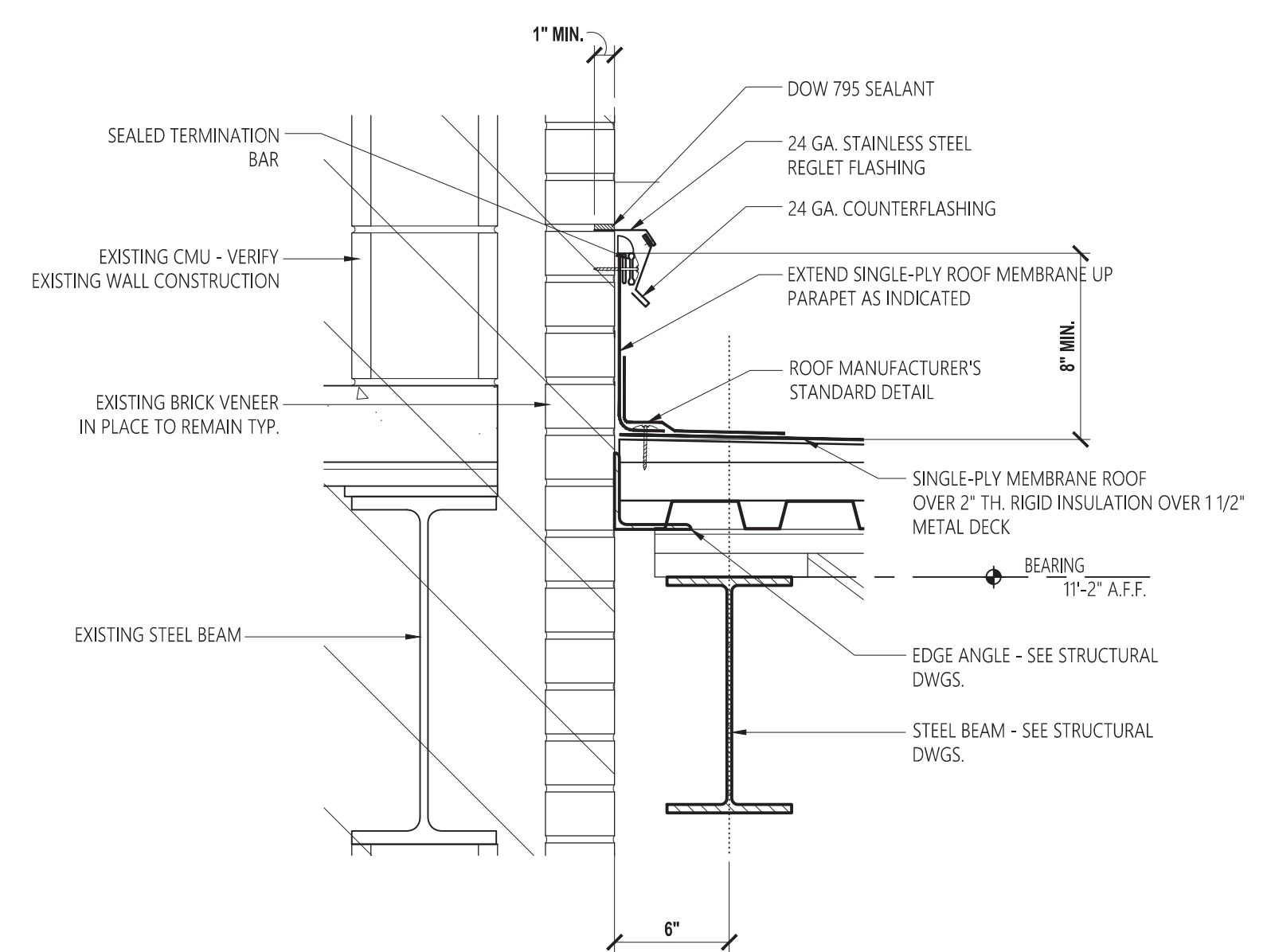
2 SECTION DETAIL
A5.5 SCALE: 1 1/2" = 1'-0"



3 SECTION DETAIL
A5.5 SCALE: 1 1/2" = 1'-0"



5 SECTION DETAIL
A5.5 SCALE: 1 1/2" = 1'-0"



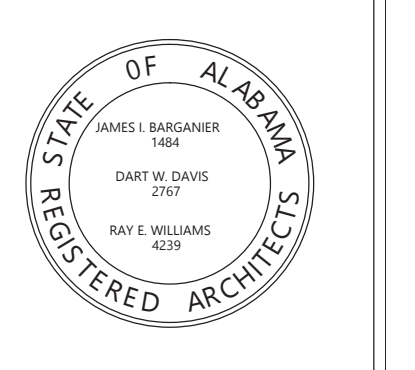
6 SECTION DETAIL
A5.5 SCALE: 1 1/2" = 1'-0"

4 -NOT USED-
A5.5 SCALE: 3" = 1'-0"

2 ADDENDUM 7-12-2017

- GENERAL NOTES**
- ALL MORTARNET SHALL BE 10" TALL MINIMUM.
 - HOLD ALL THRU-WALL FLASHING FROM FACE OF BRICK/DAYLIGHT.
 - ALL THRU-WALL FLASHING SHALL EXTEND 8" MINIMUM ABOVE TOP OF MORTARNET.
 - PROVIDE ALL METAL THRU-WALL FLASHING W/ 2" MIN. EDGE DAMS

No.	Revision	Date



Project Number: 2015-255
BARGANER DAVIS SIMS
Drawn By:

**GOODWIN HALL - RENOVATION
AND
BAND REHEARSAL HALL ADDITION**
Project Number 15-255

SHEET TITLE:
SECTION DETAILS

DRAWN BY:
-
CHECKED BY:
-
DATE:
6-14-2017
FILE NUMBER:
-
PROJECT NUMBER:
16-111
SHEET NUMBER:

A5.5

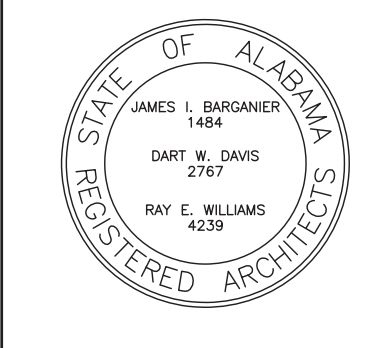


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No.	Revision	Date
1	ADDENDUM	7/13/17



Project Number: 2016-111
BARGANIER DAVIS SIMS
Drawn By:

**GOODWIN HALL - RENOVATION
AND
BAND REHEARSAL HALL ADDITION**
Project Number 15-255

SHEET TITLE:

FIRST AND SECOND
FLOOR GOODWIN
HALL DEMOLITION
PLANS

DRAWN BY:
JBR

CHECKED BY:
-

DATE:
6-14-2017

FILE NUMBER:
-

PROJECT NUMBER:
16-111

SHEET NUMBER:

AR1.0

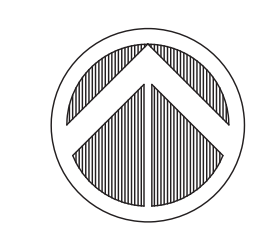
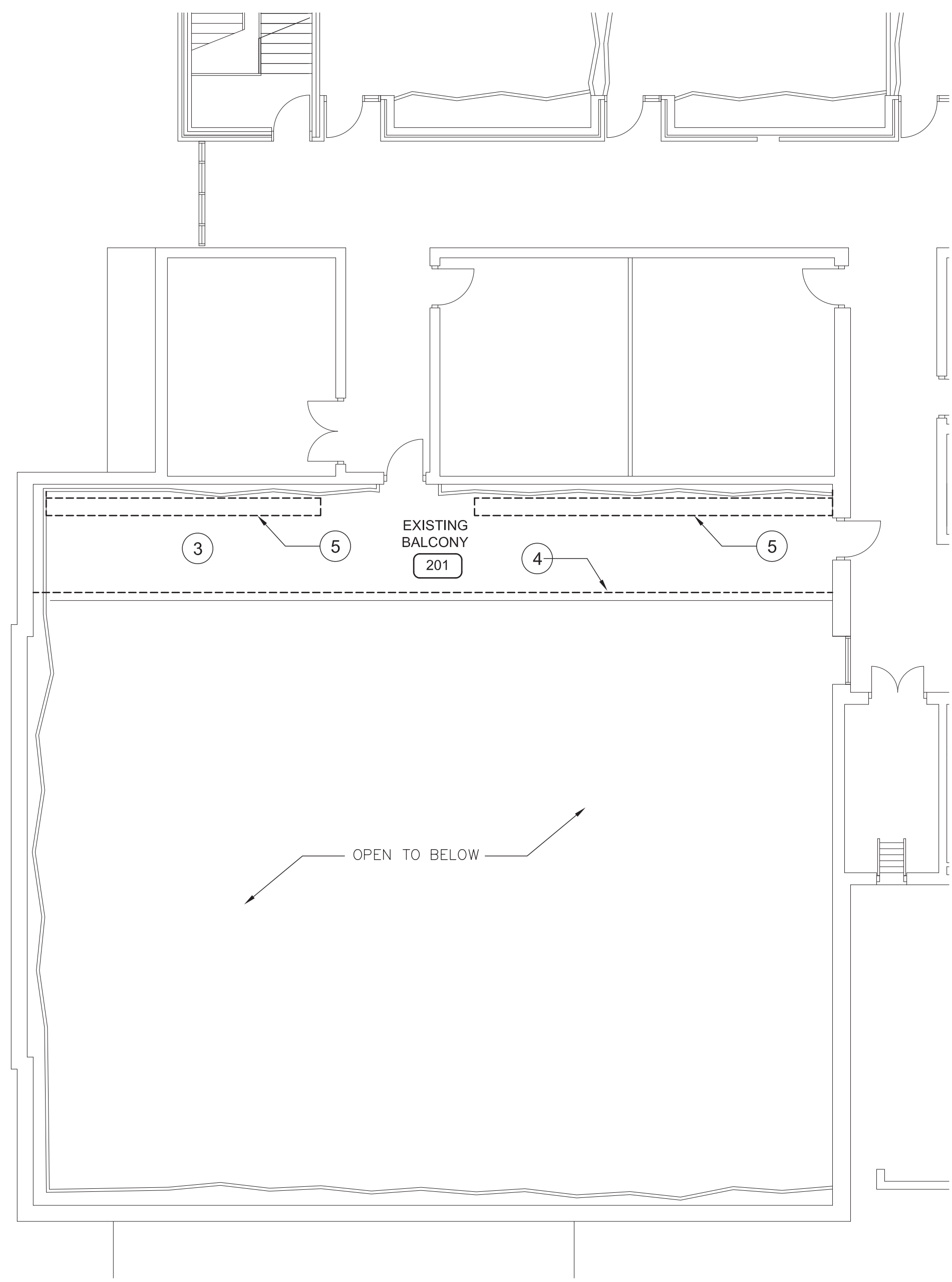
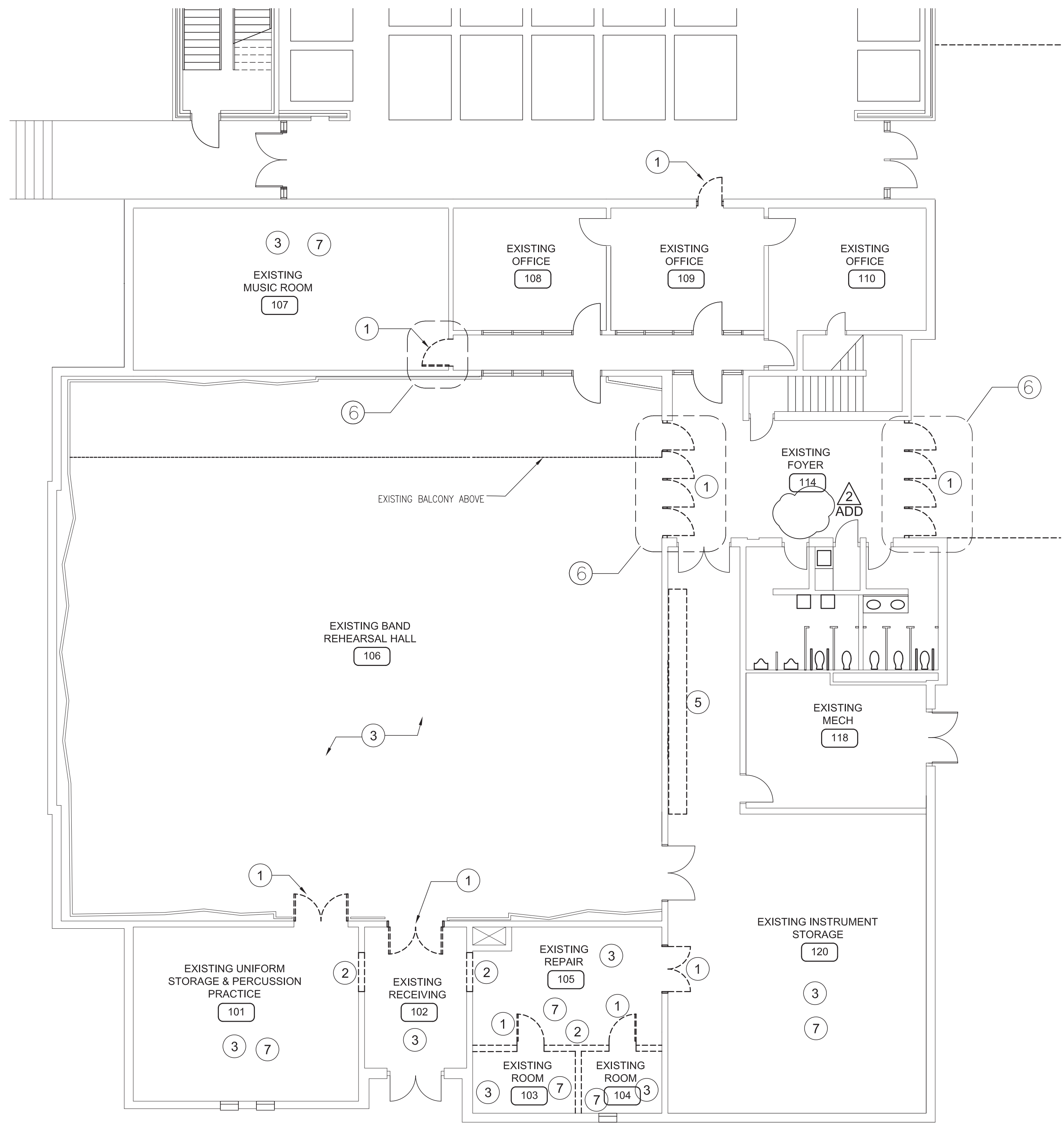
GENERAL NOTES:

- 1) ALL RENOVATION WORK IN EXISTING BUILDING IS PART OF AN ADD ALTERNATE EXCEPT WHERE NOTED OTHERWISE AS BASE BID WORK- SEE ENGINEERING DRAWINGS FOR OTHER RENOVATION WORK IN THE BASE BID.
- 2) ALL BASE BID WORK IN THE EXISTING BUILDING SHALL BE SCHEDULED IN ADVANCE WITH OWNER. THE BUILDING WILL BE OCCUPIED DURING BASE BID WORK.

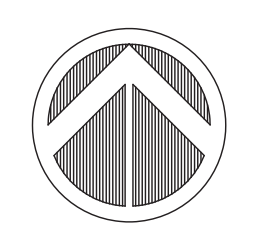
DEMOLITION LEGEND

- 1 REMOVE EXISTING DOOR AND FRAME
- 2 REMOVE EXISTING WALL FOR NEW DOOR/FRAME INSTALLATION
- 3 REMOVE EXISTING FLOOR
- 4 REMOVE GUARD RAILING AT MEZZANINE
- 5 REMOVE EXISTING STORAGE CABINETS AND CUBBIES IN ITS ENTIRETY (SALVAGE FOR OWNER)
- 6 THIS WORK IS PART OF THE BASE BID
- 7 REMOVE EXISTING CEILING

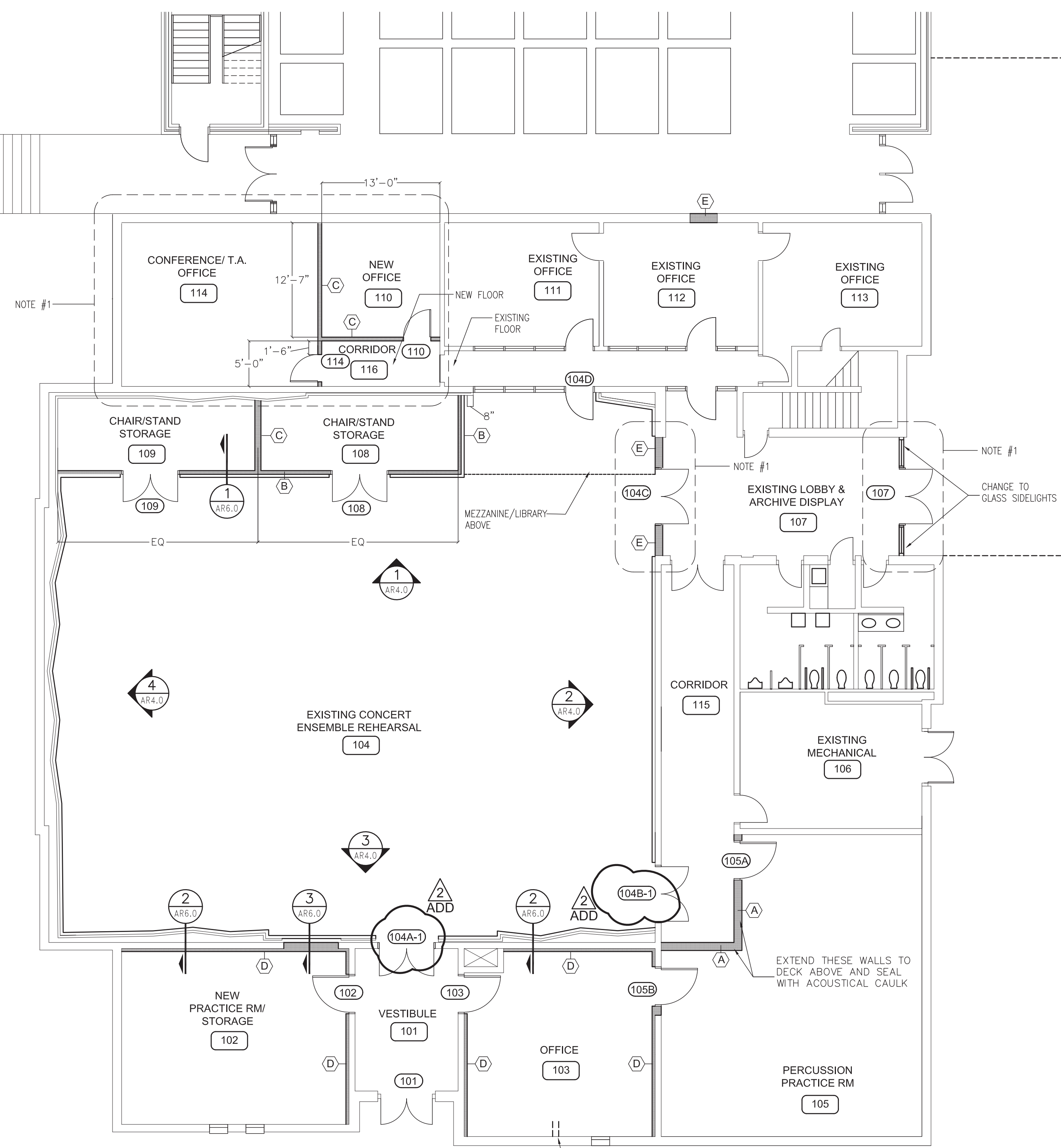
----- WALLS TO BE REMOVED



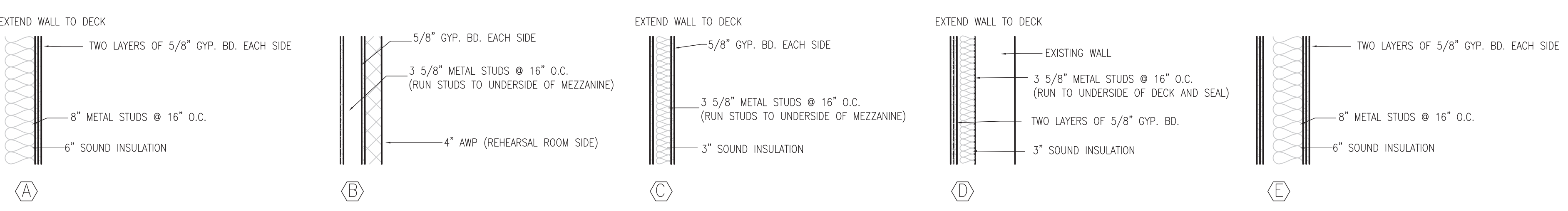
FIRST FLOOR - DEMOLITION PLAN - GOODWIN HALL
SCALE: 1/8"= 1'-0"



SECOND FLOOR - DEMOLITION PLAN - GOODWIN HALL
SCALE: 1/8"= 1'-0"



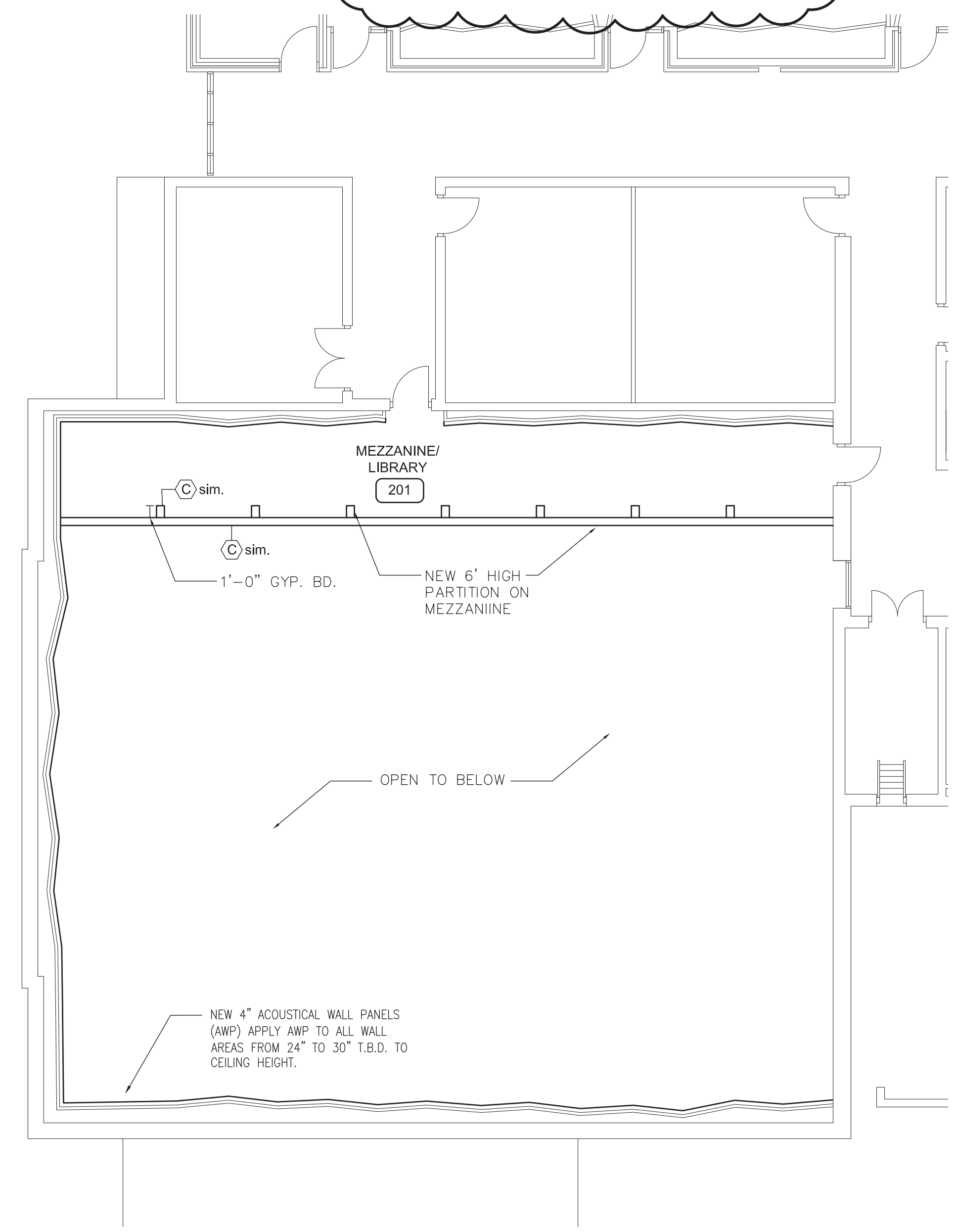
FIRST FLOOR - NEW - GOODWIN HALL
SCALE: 1/8"= 1'-0"



WALL LEGEND
SCALE: 3/4"= 1'-0"

GENERAL NOTES

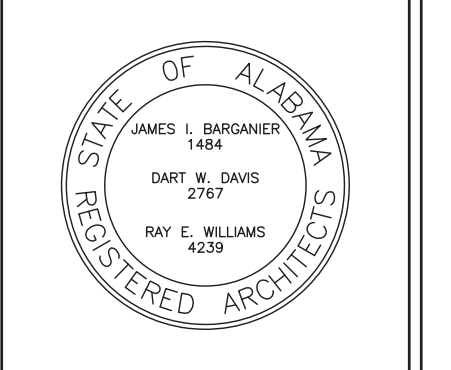
- 1.) THIS WORK SHALL BE PART OF THE BASE BID. ALL OTHER WORK IN EXISTING BUILDING IS PART OF THE ADD ALTERNATE- SEE ENGINEERING DRAWINGS FOR OTHER RENOVATION WORK IN THE BASE BID.
- 2.) SOUND INSULATION NOT REQUIRED IN ROOMS 108, 109, OR 201.
- 3.) PATCH WALLS TO MATCH ADJACENT WALLS AT WALLS TO BE REMOVED. (TYP.)



SECOND FLOOR - NEW - GOODWIN HALL
SCALE: 1/8"= 1'-0"

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No.	Revision	Date
1	ADDENDUM	7/13/17



Project Number: 2016-111
BARGANIER DAVIS SIMS
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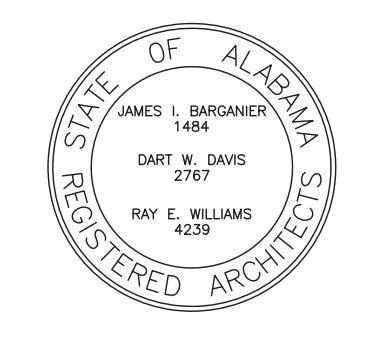
**GOODWIN HALL - RENOVATION
AND
BAND REHEARSAL HALL ADDITION**
Project Number 15-255

SHEET TITLE:
**FIRST AND SECOND
FLOOR GOODWIN
HALL NEW FLOOR
PLANS**

DRAWN BY:
JBR
CHECKED BY:
-
DATE:
6-14-2017
FILE NUMBER:
-
PROJECT NUMBER:
16-111
SHEET NUMBER:

AR3.0

No.	Revision	Date
1	ADDENDUM	7/13/17



Project Number: 2016-111
BARGANER DAVIS SIMS
 Drawn By:

**GOODWIN HALL - RENOVATION
 AND
 BAND REHEARSAL HALL ADDITION**
 Project Number 15-255

SHEET TITLE:
INTERIOR ELEVATIONS

DRAWN BY:
 JBR

CHECKED BY:
 -

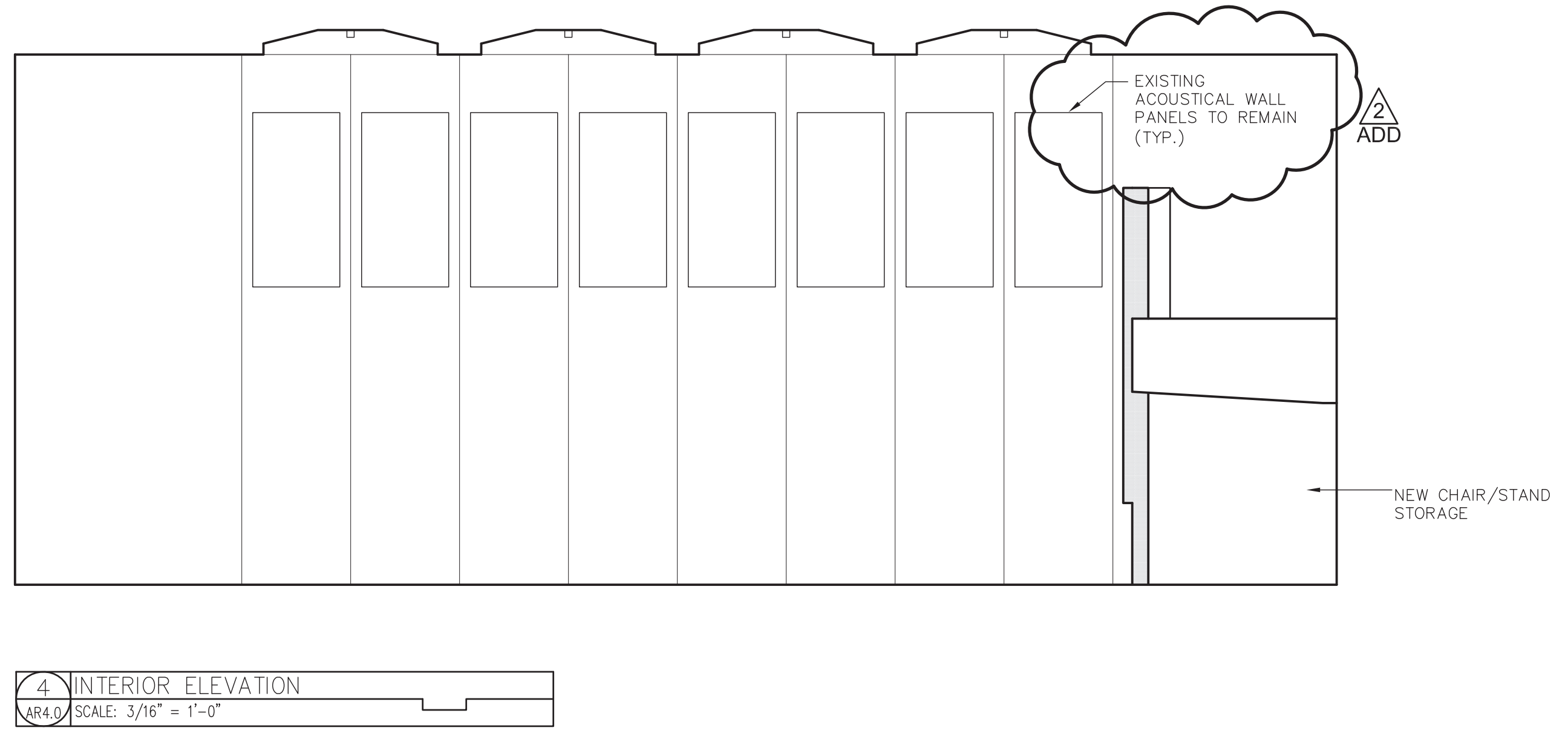
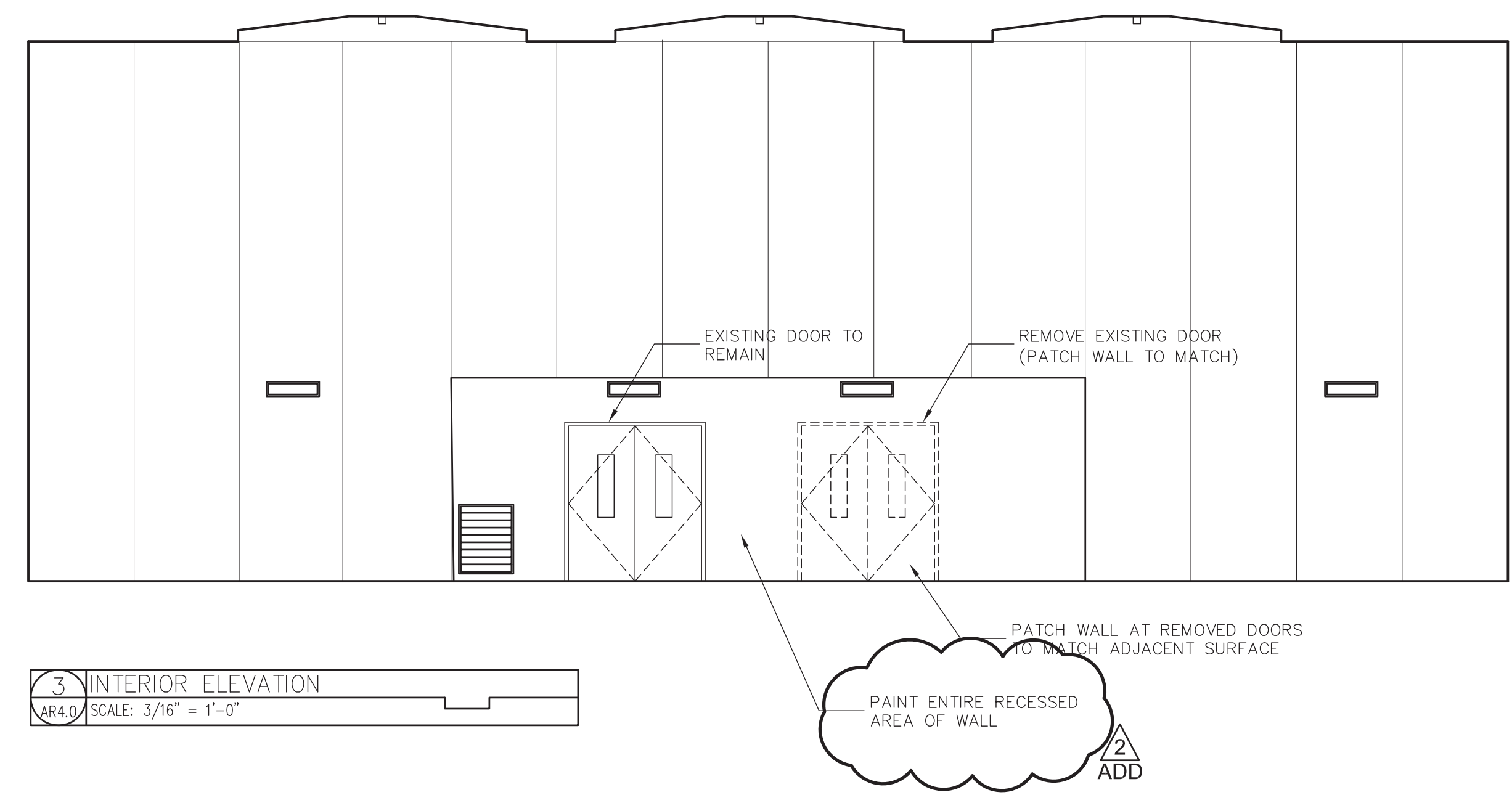
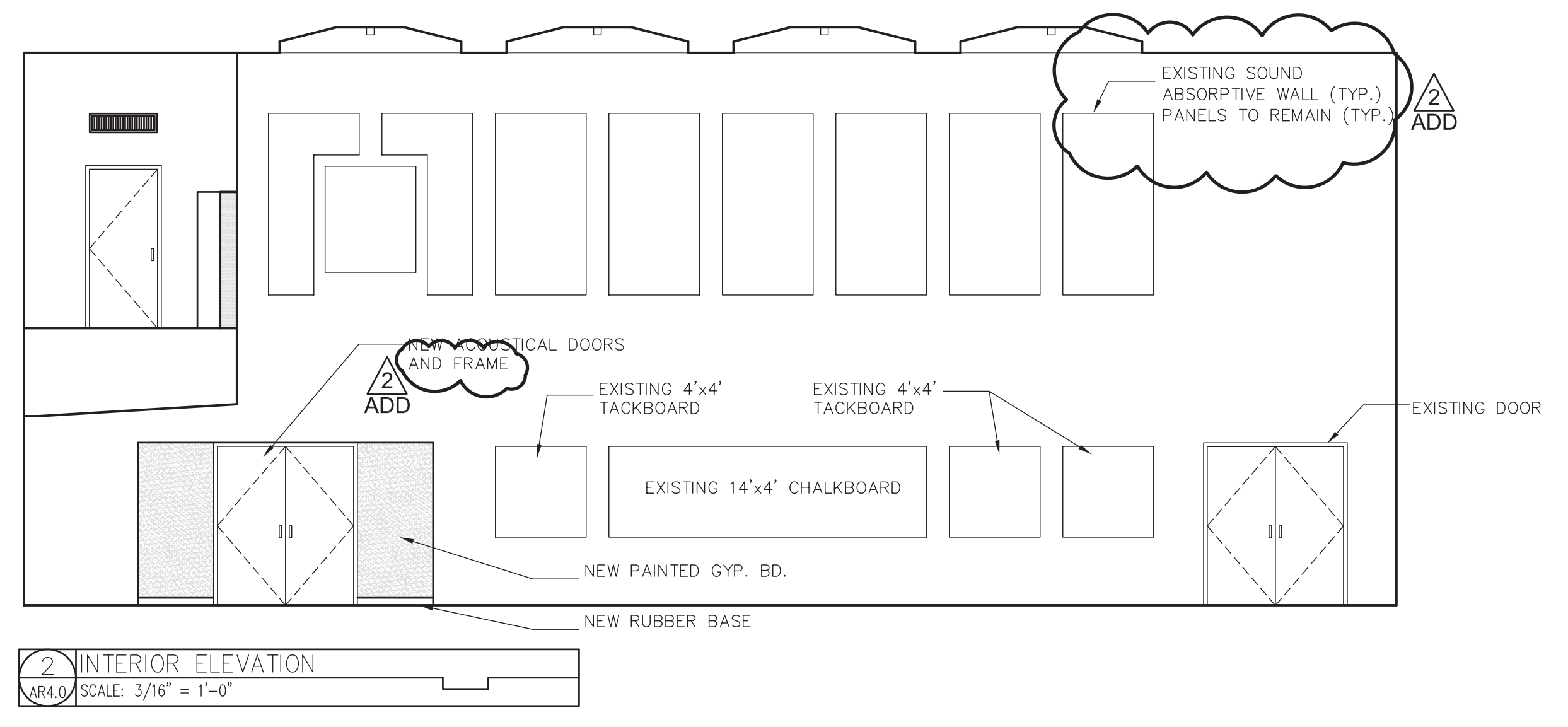
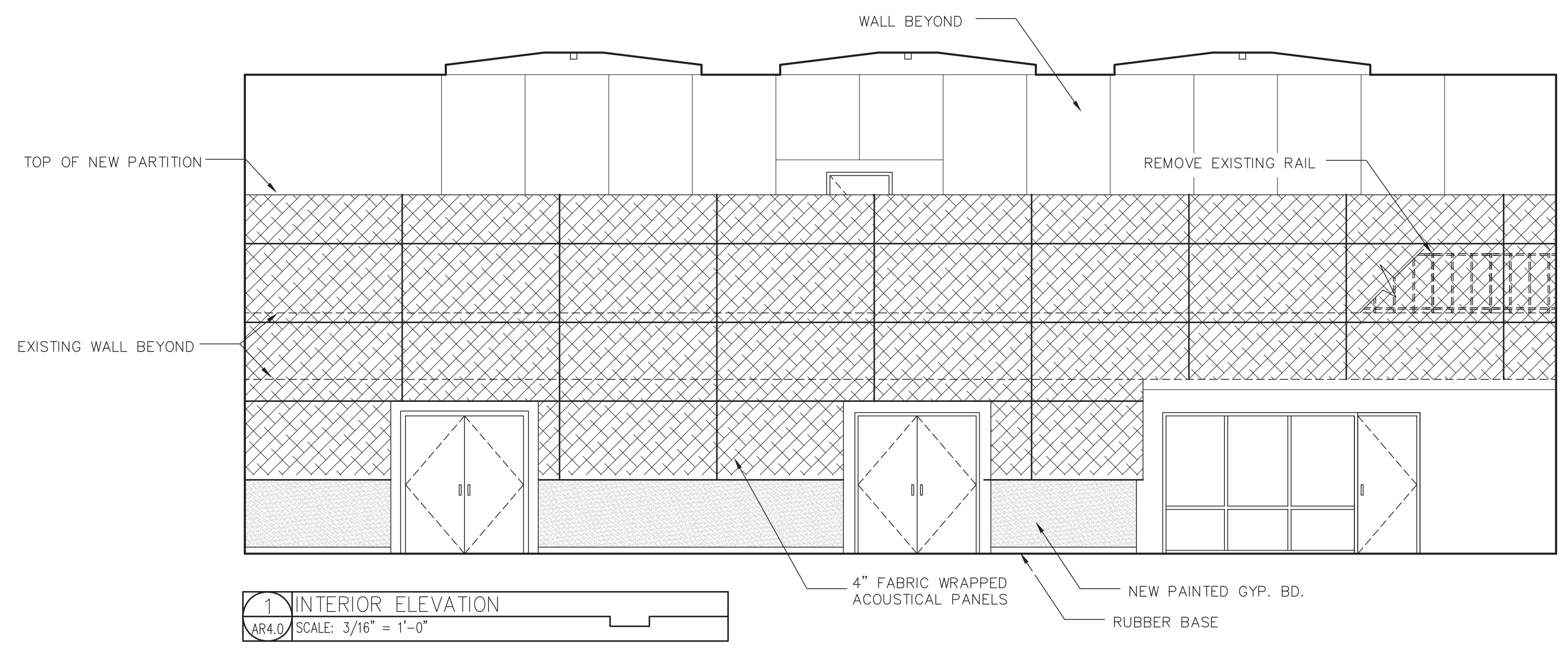
DATE:
 6-14-2017

FILE NUMBER:
 -

PROJECT NUMBER:
 16-111

SHEET NUMBER:

AR4.0



ROOM NUMBER	ROOM NAME	FLOOR	BASE	WALL				CEILING	REMARKS
				NORTH	EAST	SOUTH	WEST		
101	VESTIBULE	VCT	RUBBER	PAINT	PAINT	PAINT	PAINT	-	
102	PRACTICE RM/STORAGE	VCT	RUBBER	PAINT	PAINT	PAINT	PAINT	LAY-IN	
103	OFFICE	CARPET	RUBBER	PAINT	PAINT	PAINT	PAINT	LAY-IN	
104	CONCERT ENSEMBLE REHEARSAL	LVT	RUBBER	-	-	-	-	-	REMOVE EXISTING FLOORING
105	PERCUSSION PRACTICE RM	-	RUBBER	-	-	-	-	LAY-IN	NEW RUBBER BASE AT NEW PARTITION
106	MECHANICAL	-	-	-	-	-	-	-	
107	LOBBY & DISPLAY ARCHIVE	-	-	-	-	-	-	-	PAINT WALLS AT NEW WALLS-NEW RUBBER BASE AT NEW WALL
108	CHAIR/STAND STORAGE	VCT	RUBBER	PAINT	PAINT	PAINT	PAINT	PAINT	CLEAN AND WAX EXISTING FLOOR
109	CHAIR/STAND STORAGE	VCT	RUBBER	PAINT	PAINT	PAINT	PAINT	PAINT	CLEAN AND WAX EXISTING FLOOR
110	NEW OFFICE	CARPET	RUBBER	PAINT	PAINT	PAINT	PAINT	LAY-IN	
111	OFFICE	-	-	-	-	-	-	-	
112	OFFICE	-	-	-	-	-	-	-	PAINT WALL AT INFILLED DOOR-NEW RUBBER BASE AT INFILLED WALL
113	OFFICE	-	-	-	-	-	-	-	
114	CONFERENCE/T.A. OFFICE	CARPET	RUBBER	PAINT	PAINT	PAINT	PAINT	-	
115	CORRIDOR	VCT	RUBBER	PAINT	PAINT	PAINT	PAINT	-	NEW RUBBER BASE AT NEW PARTITION
116	CORRIDOR	CARPET	RUBBER	PAINT	PAINT	PAINT	PAINT	ACOUSTICAL	MATCH EXISTING FLOORING AND CEILING TILE
201	MEZZANINE/LIBRARY	CARPET	RUBBER	PAINT	PAINT	PAINT	PAINT	-	

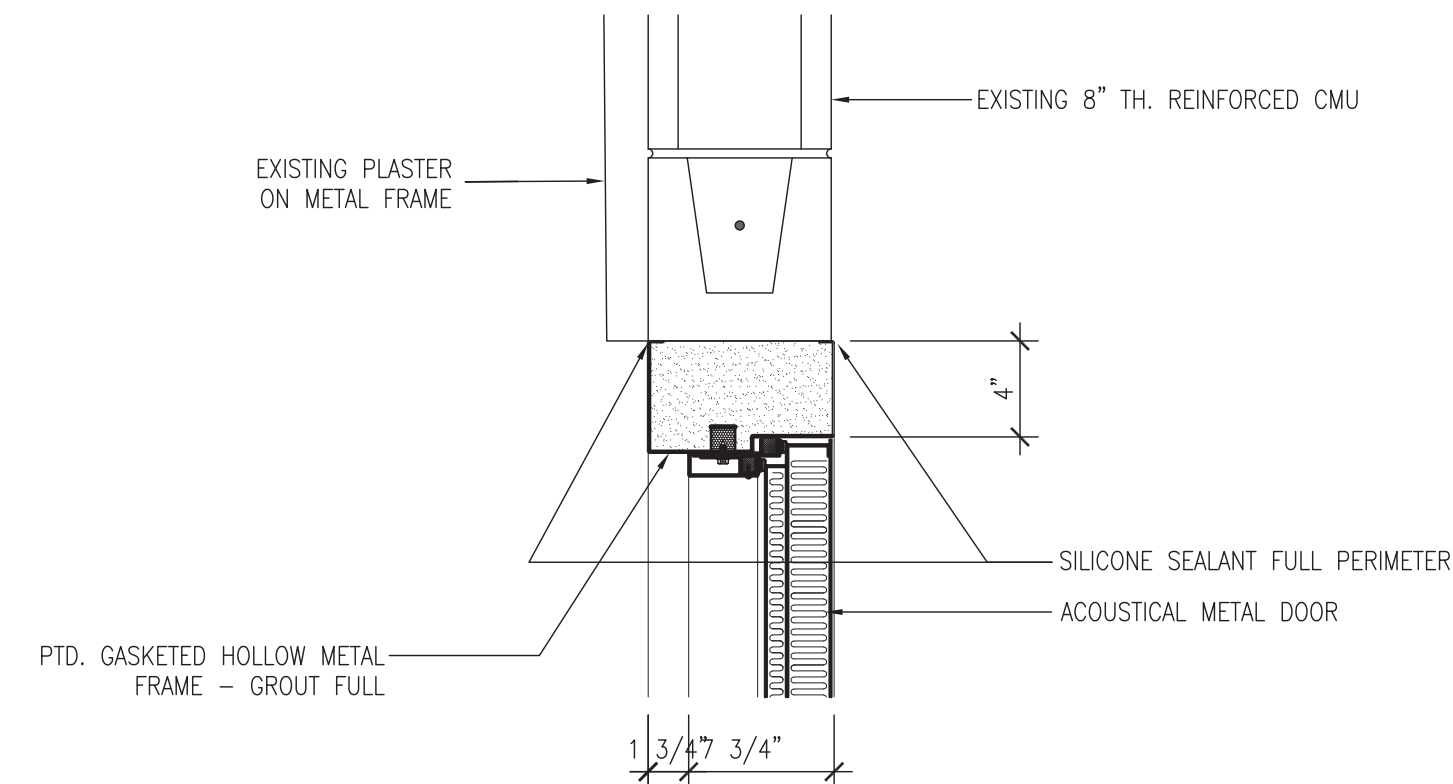
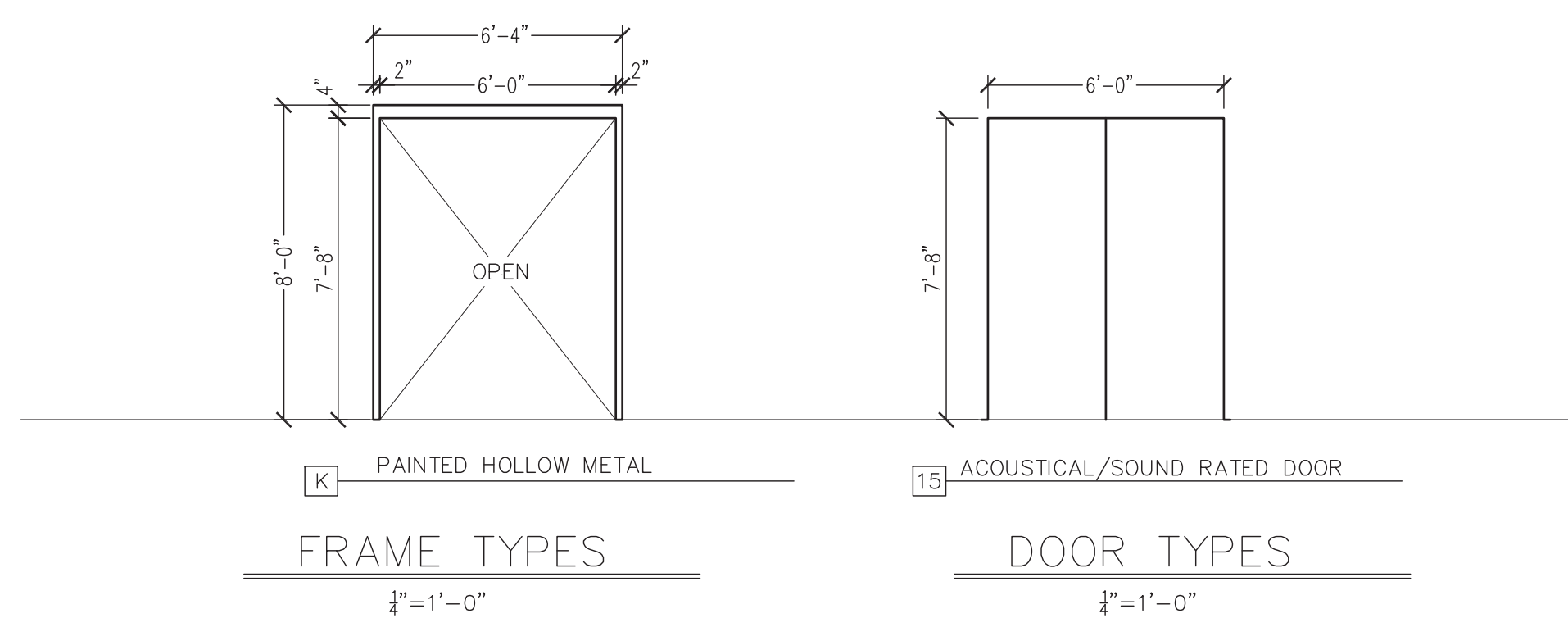
GENERAL NOTES

- ALL NEW PARTITIONS TO BE PAINTED TO MATCH ADJACENT SURFACE
- ALL NEW PARTITIONS TO RECEIVE NEW RUBBER BASE TO MATCH EXISTING

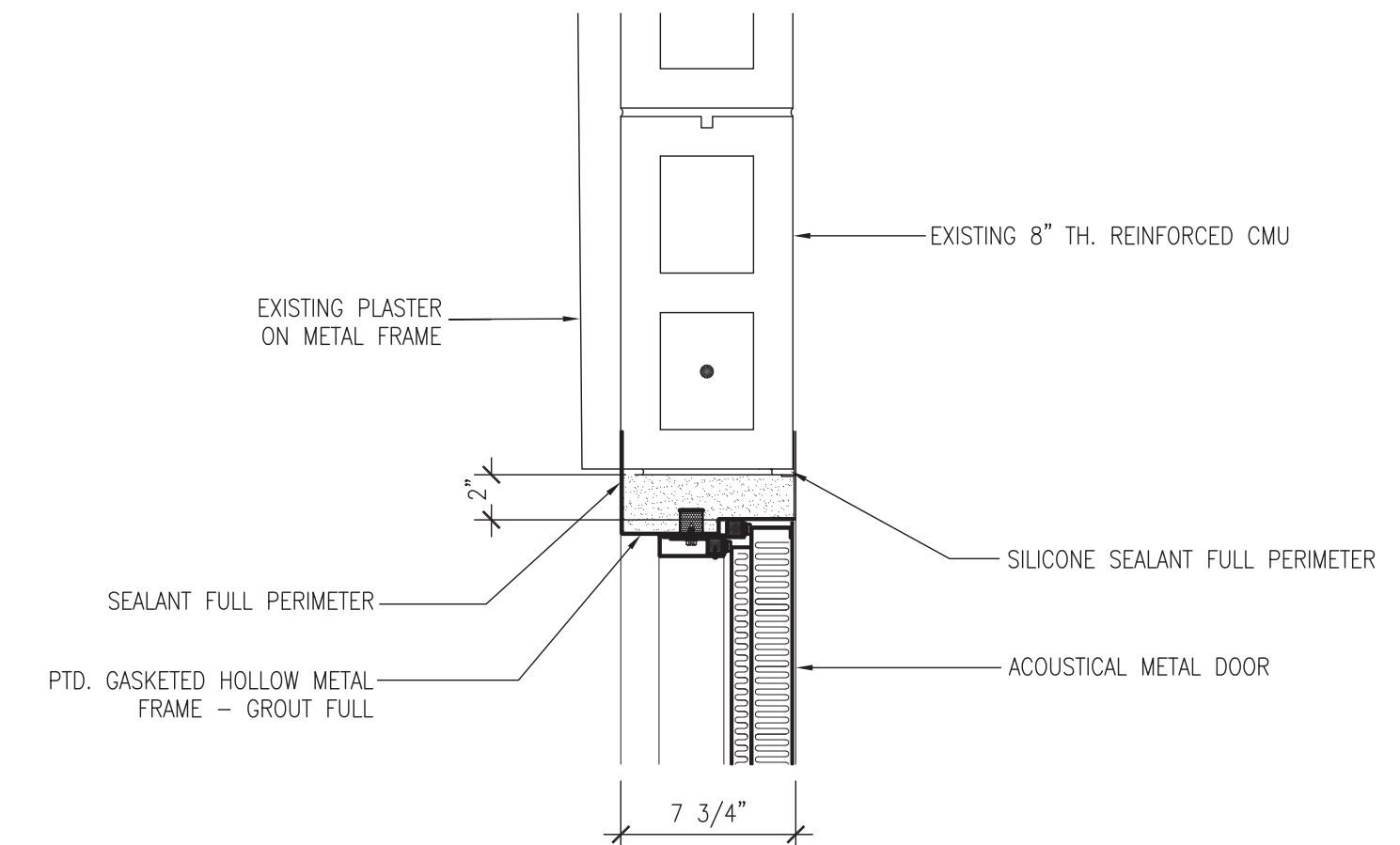
NO.	DOOR				FRAME		LABEL	SIGNAGE	DETAILS			REMARKS
	WIDTH	HEIGHT	THICK	TYPE	MAT'L.	TYPE			MAT'L.	HEAD	JAMB	
101	NO WORK											EXISTING DOOR TO REMAIN
102	4'-0"	7'-0"	1 3/4"	11	HM	J	HM	PRACTICE	7/AR5.0	8/AR5.0	3/AB.2(SIM)	STC-51 ACOUSTICAL DOOR
103	4'-0"	7'-0"	1 3/4"	11	HM	J	HM	OFFICE	7/AR5.0	8/AR5.0	3/AB.2(SIM)	STC-51 ACOUSTICAL DOOR
104A-1	PR. 3'-0"	7'-8"	1 3/4"	15	HM	K	HM	VESTIBULE	1/AR5.0	2/AR5.0	3/AB.2(SIM)	STC-51 ACOUSTICAL DOOR-REPLACE EXISTING HM FRAME & DOOR
104B-1	NO WORK											EXISTING DOOR TO REMAIN
104C	PR. 3'-0"	7'-8"	1 3/4"		HM		HM		1/AR5.0(SIM)	5/AR5.0		NEW DOOR TO BE INCLUDED IN BASE BID-VERIFY EXISTING DOOR HT.
104D	NO WORK											
105A	4'-0"	7'-0"	1 3/4"	11	HM	J	HM	PERCUSSION PRACTICE	4/AR5.0	5/AR5.0	3/AB.2(SIM)	STC-51 ACOUSTICAL DOOR
105B	4'-0"	7'-0"	1 3/4"	11	HM	J	HM	OFFICE	7/AR5.0	8/AR5.0	3/AB.2(SIM)	STC-51 ACOUSTICAL DOOR
107	PR. 3'-0"	8'-9 1/2"	1 3/4"		ALUM		ALUM		1/AR7.0	2/AR7.0	3/AR7.0	NEW DOOR TO BE INCLUDED IN BASE BID-VERIFY EXISTING DOOR SIZE
108	PR. 3'-0"	7'-0"	1 3/4"	3	SCW	C	HM	STORAGE	1/AB.4	2/AB.4		
109	PR. 3'-0"	7'-0"	1 3/4"	3	SCW	C	HM	STORAGE	1/AB.4	2/AB.4		
110	3'-0"	7'-0"	1 3/4"	2	SCW	B	PHM	OFFICE	1/AB.4	2/AB.4		6"x18" VIEW PANEL- INCLUDED IN BASE BID
114	3'-0"	7'-0"	1 3/4"	2	SCW	B	PHM	CONFERENCE	1/AB.4	2/AB.4		6"x18" VIEW PANEL- INCLUDED IN BASE BID

NOTE:

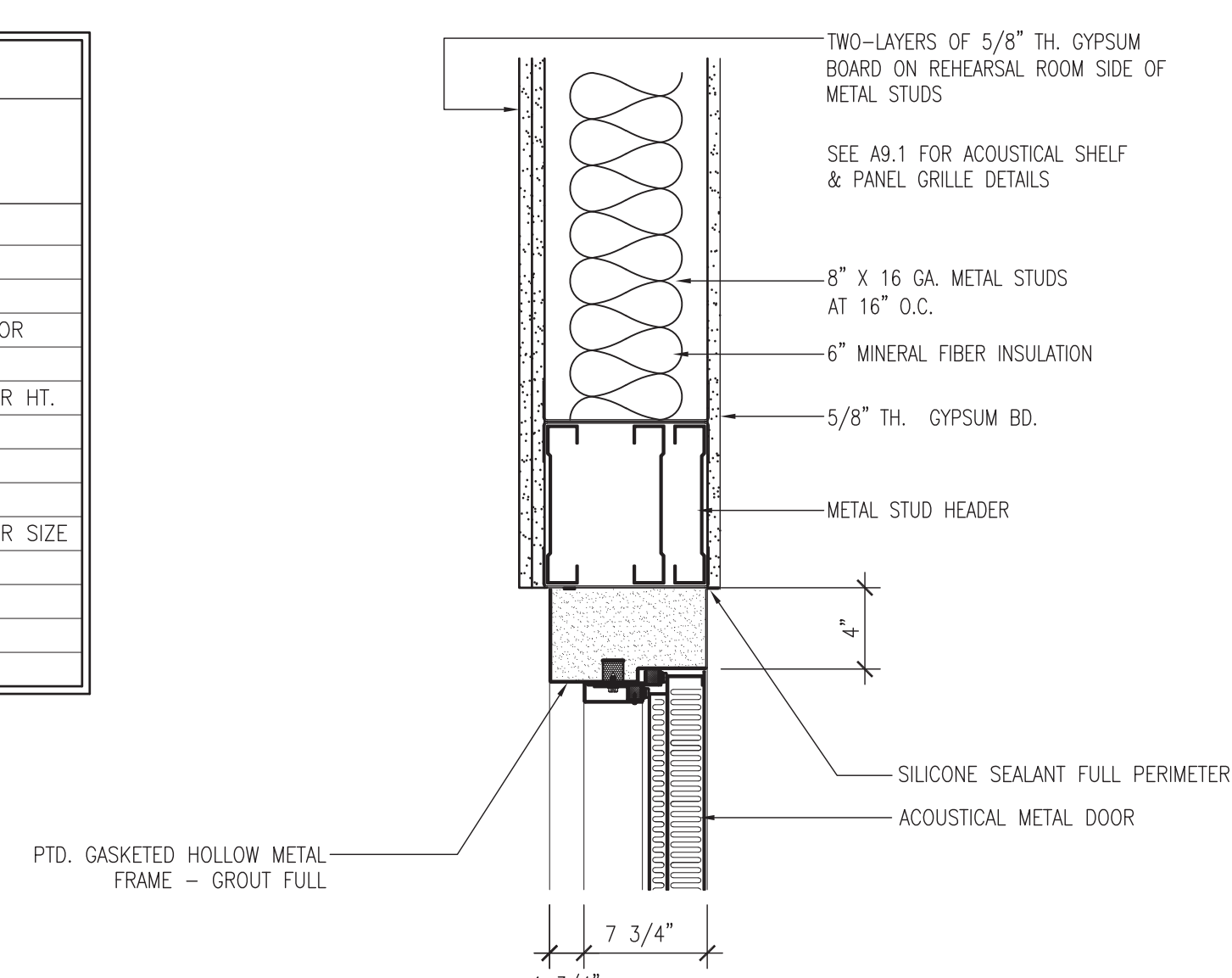
SEE A8.1 FOR ADDITIONAL DOOR AND FRAME TYPES



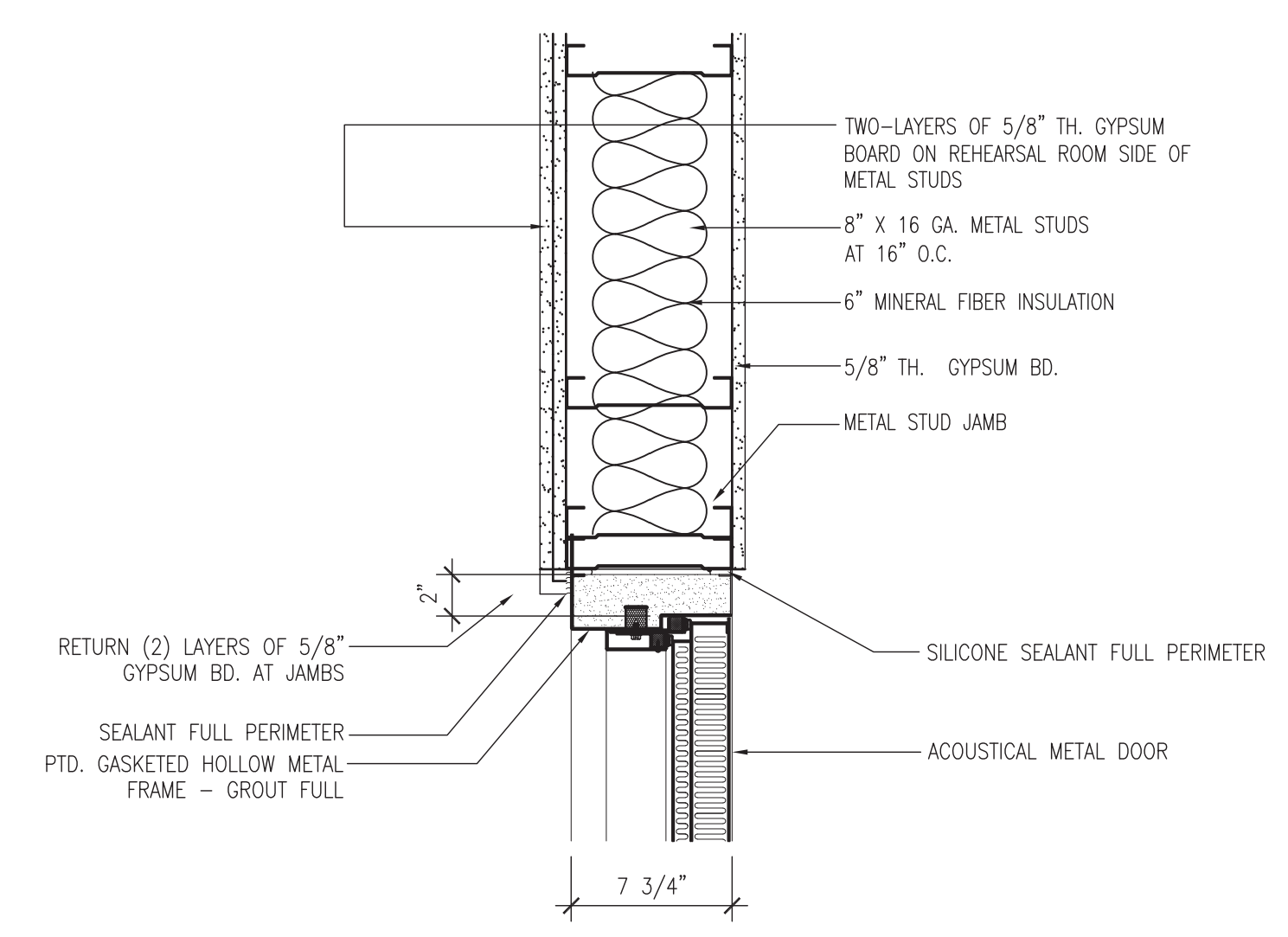
1 DOOR HEAD DETAIL
AR5.0 SCALE: 1 1/2" = 1'-0"



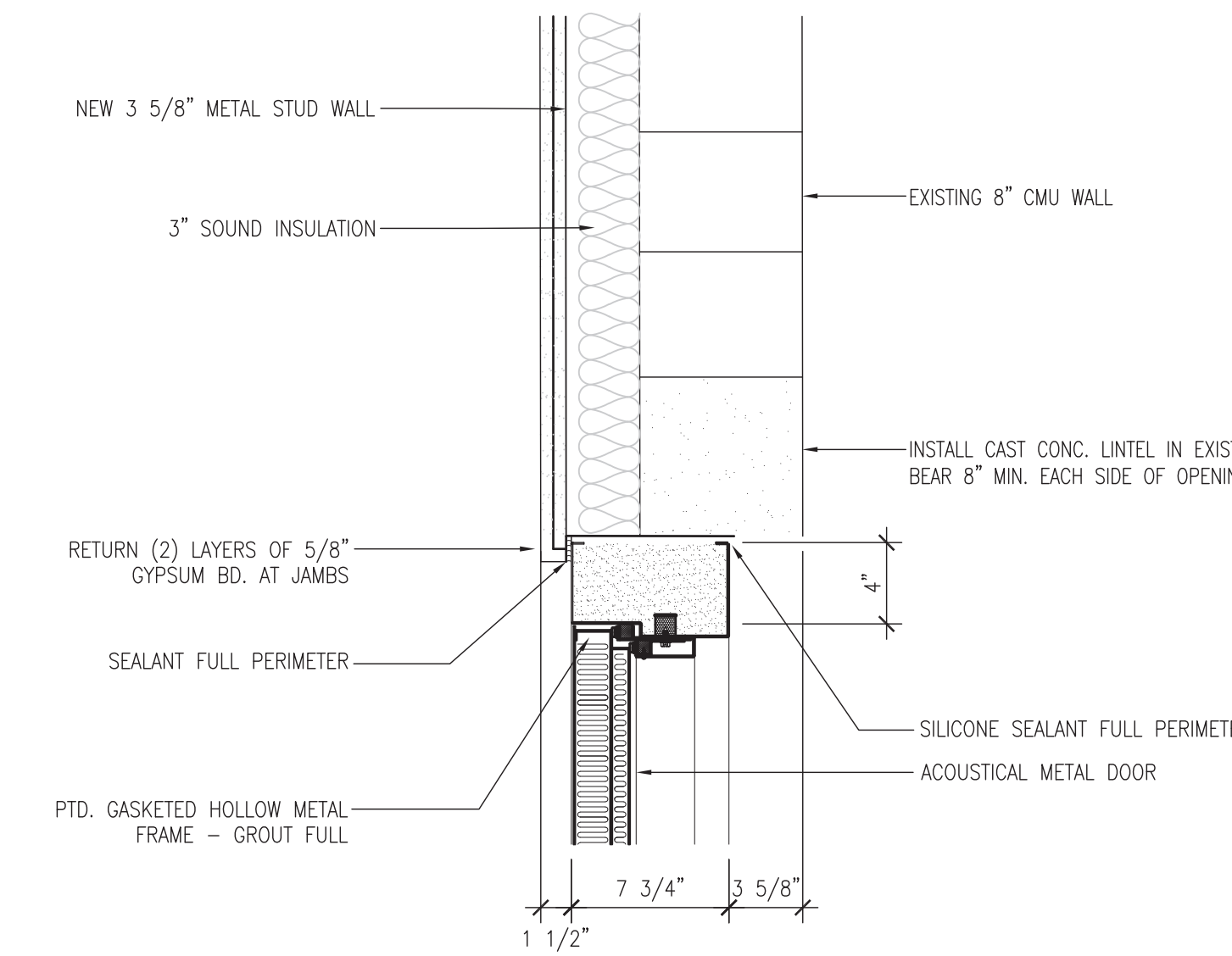
2 DOOR JAMB DETAIL
AR5.0 SCALE: 1 1/2" = 1'-0"



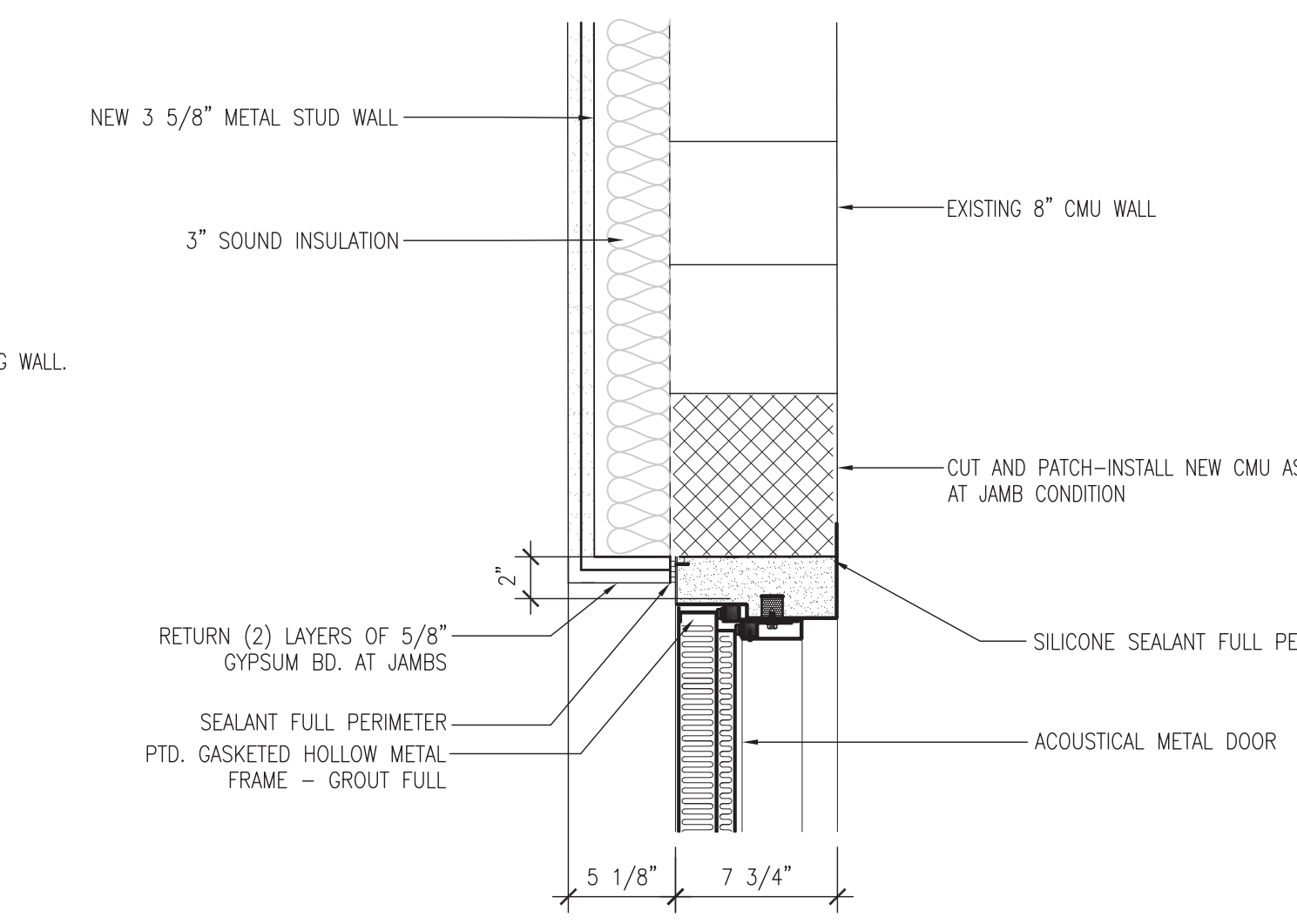
4 DOOR HEAD DETAIL
AR5.0 SCALE: 1 1/2" = 1'-0"



5 DOOR JAMB DETAIL
AR5.0 SCALE: 1 1/2" = 1'-0"

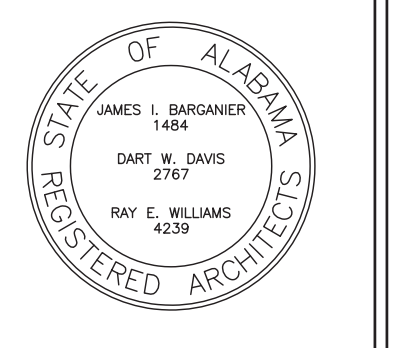


7 DOOR HEAD DETAIL
AR5.0 SCALE: 1 1/2" = 1'-0"



8 DOOR JAMB DETAIL
AR5.0 SCALE: 1 1/2" = 1'-0"

No.	Revision	Date
1	ADDENDUM	7/13/17



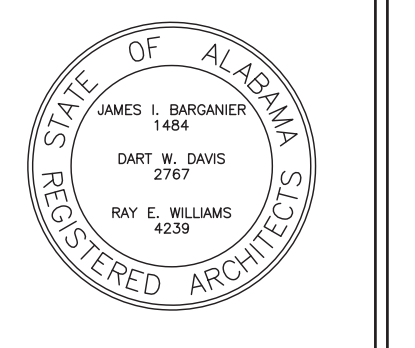
Project Number: 2016-111
BARGANIER DAVIS SIMS
Drawn By:

**GOODWIN HALL - RENOVATION
AND
BAND REHEARSAL HALL ADDITION**
Project Number 15-255

SHEET TITLE:
**DOOR SCHEDULE/
ROOM FINISH
SCHEDULE**
DRAWN BY:
JBR
CHECKED BY:
-
DATE:
6-14-2017
FILE NUMBER:
-
PROJECT NUMBER:
16-111
SHEET NUMBER:

AR5.0

No.	Revision	Date
1	ADDENDUM	7/13/17



Project Number: 2016-111
BARGANER DAVIS SIMS
Drawn By:

**GOODWIN HALL - RENOVATION
AND
BAND REHEARSAL HALL ADDITION**
Project Number 15-255

SHEET TITLE:
WALL SECTION

DRAWN BY:
JBR

CHECKED BY:
-

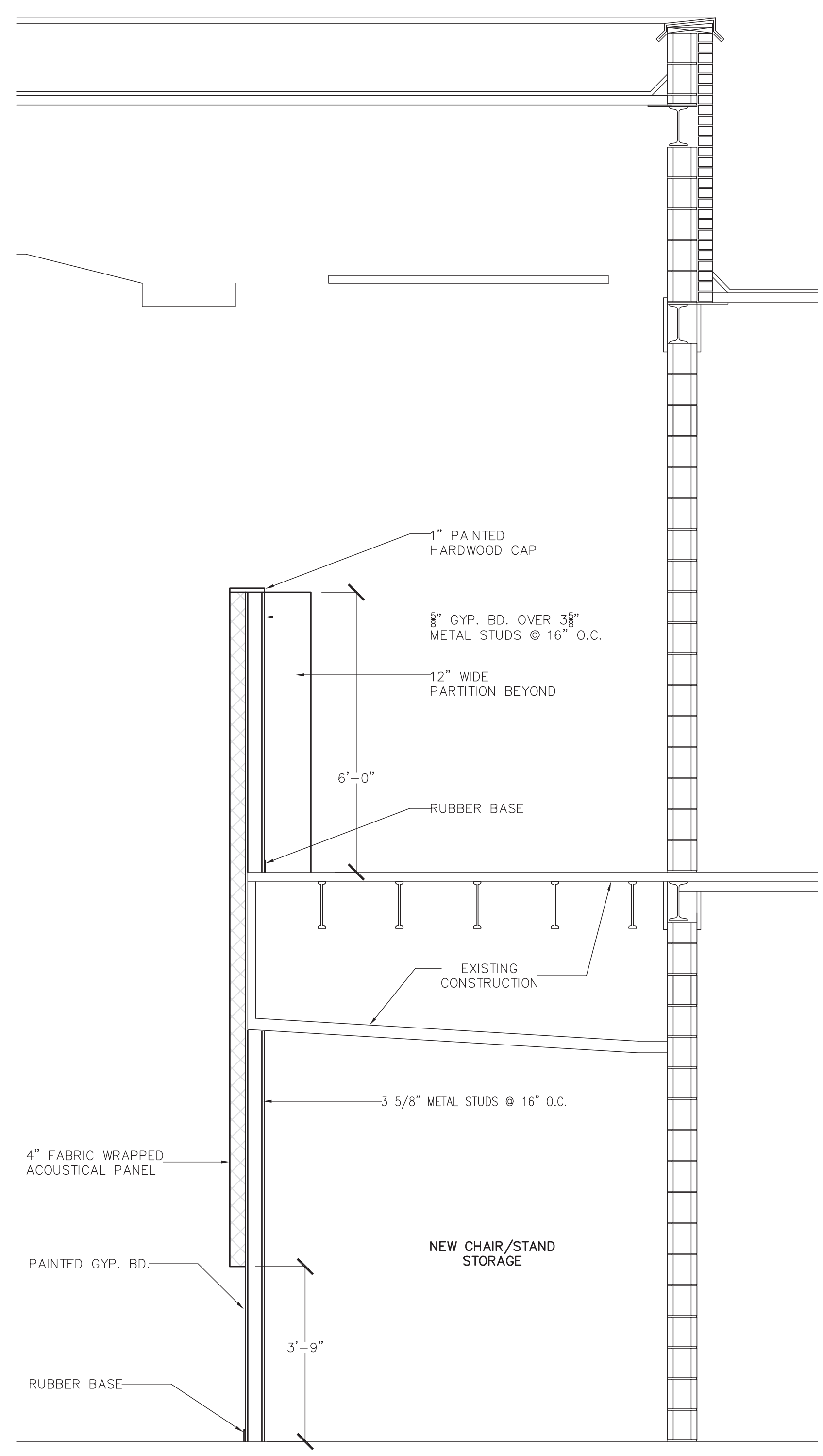
DATE:
6-14-2017

FILE NUMBER:
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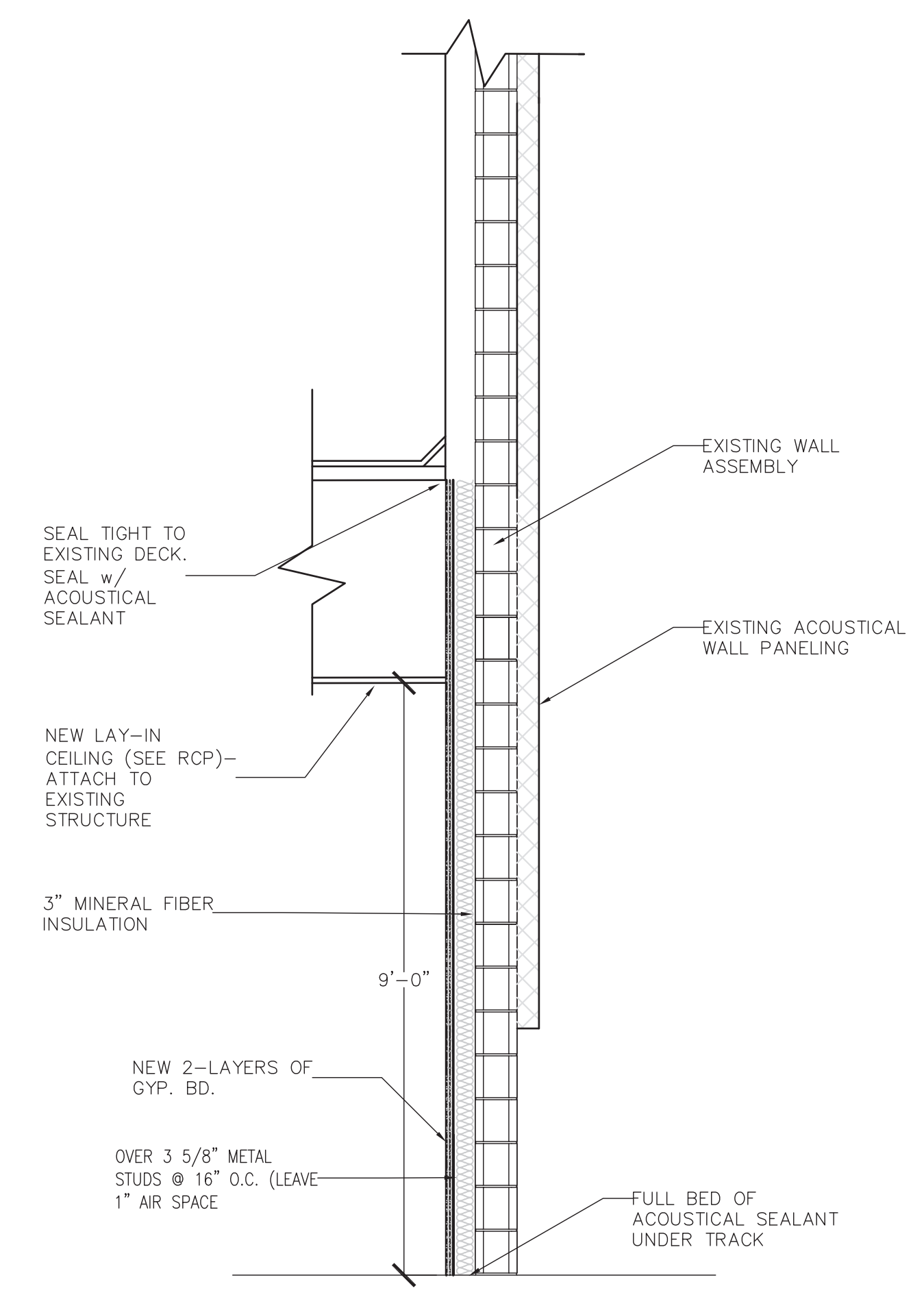
PROJECT NUMBER:
16-111

SHEET NUMBER:

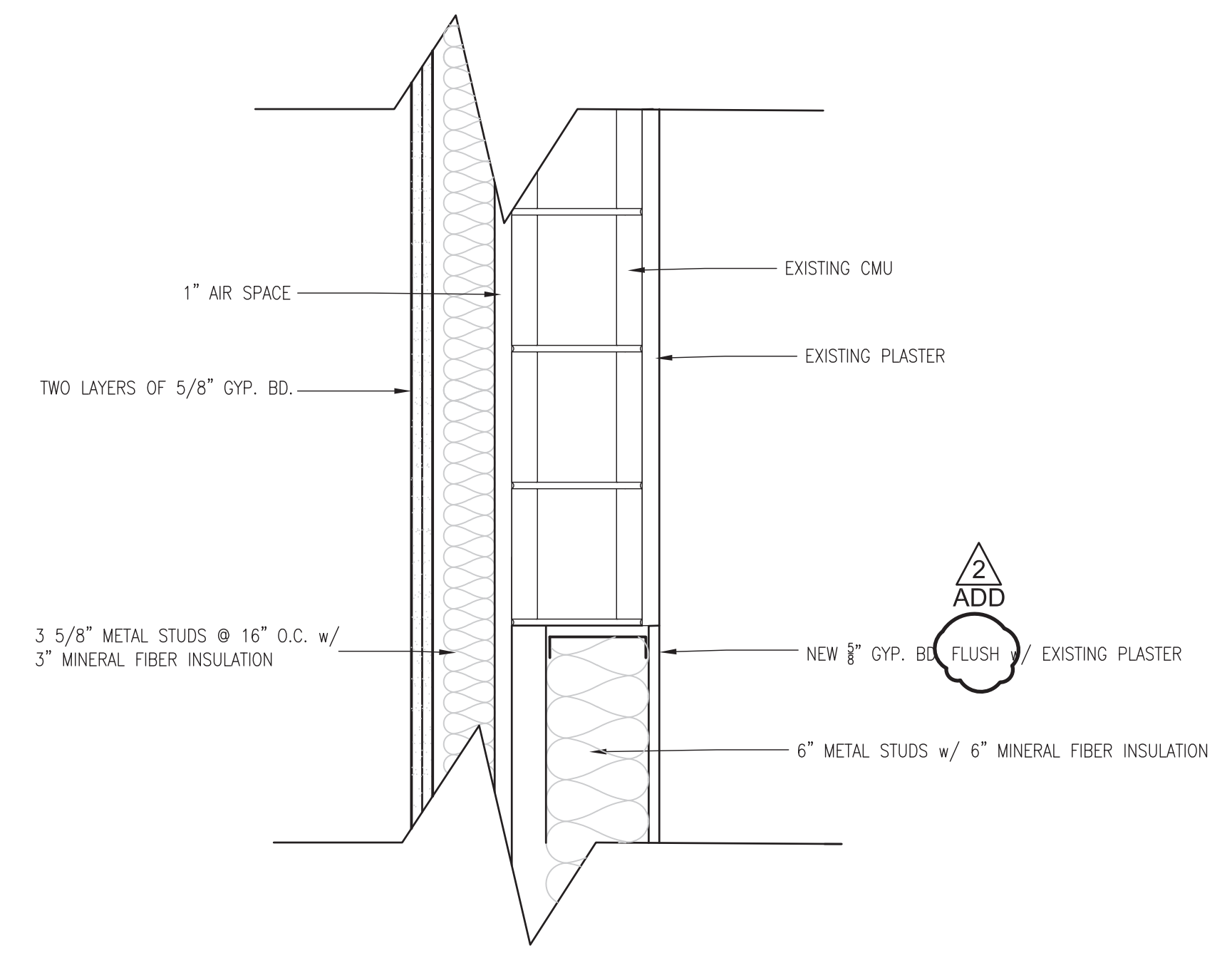
AR6.0



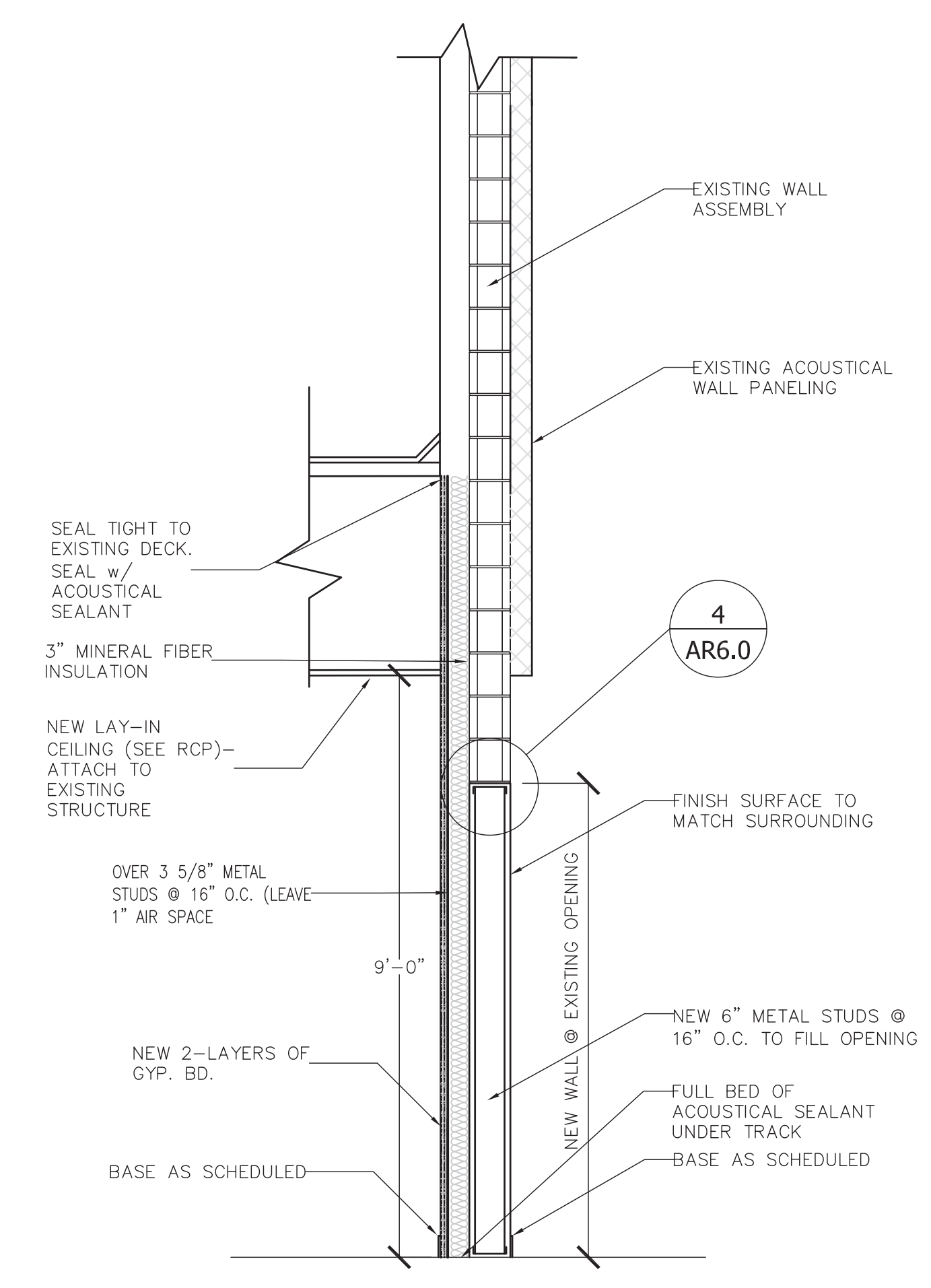
1
AR6.0
WALL SECTION
1/2"=1'-0"



2
AR6.0
WALL SECTION
1/2"=1'-0"



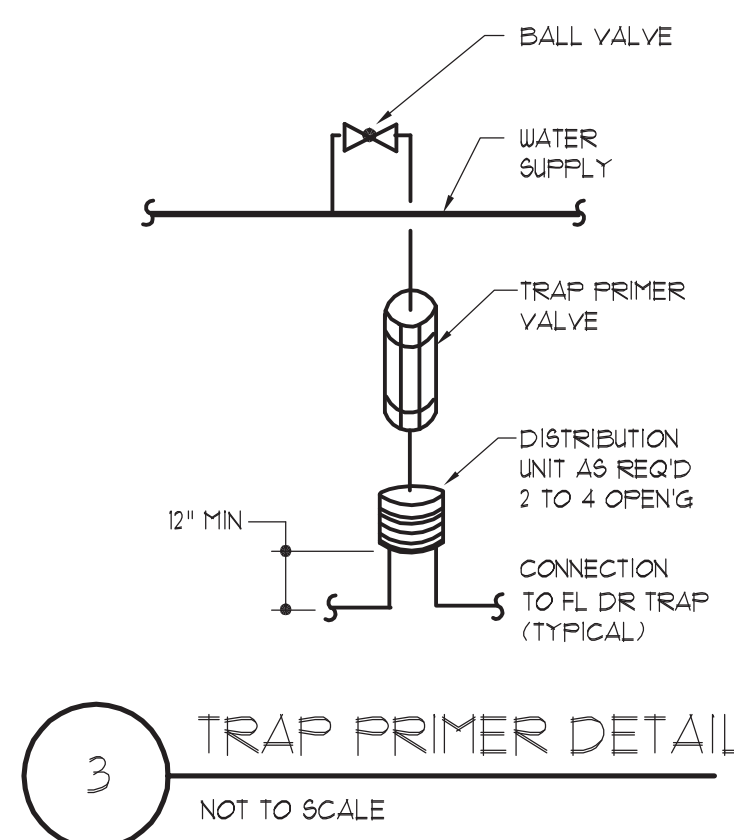
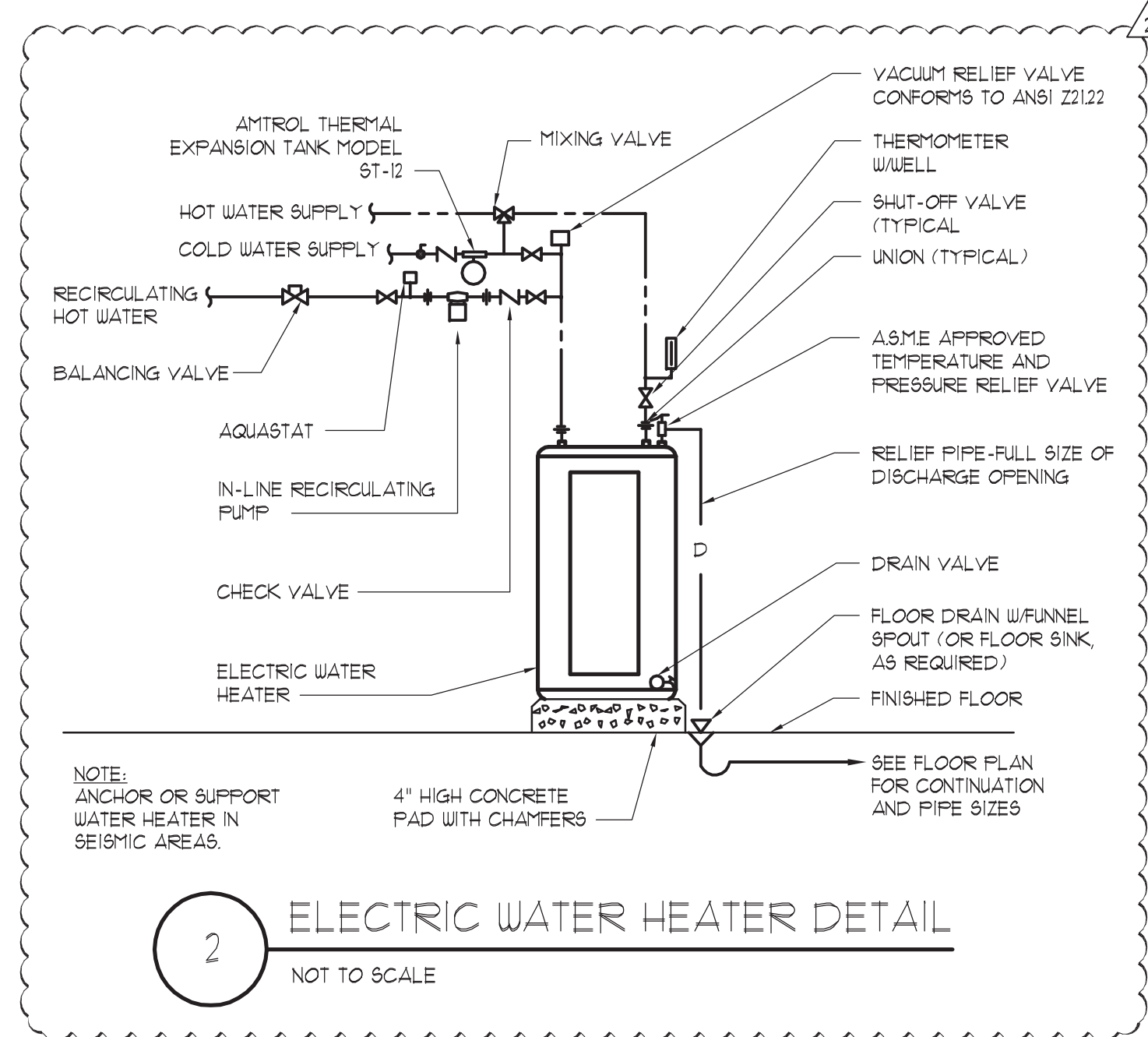
4
AR6.0
1 1/2"=1'-0"



3
AR6.0
WALL SECTION
1/2"=1'-0"

PLUMBING GENERAL NOTES

- COORDINATE LOCATION OF PIPE ROUTING WITH LIGHT FIXTURES WITH ELECTRICAL CONTRACTOR. RELOCATE PIPING, IF NECESSARY, AS DIRECTED BY THE ARCHITECT/ENGINEER.
- THE CONTRACTOR SHALL KEEP A RECORD OF THE CHANGES WHICH ARE IN CONFLICT WITH THESE DRAWINGS AND SPECIFICATIONS. AT THE COMPLETION OF THIS WORK THE CONTRACTOR SHALL SUBMIT "AS BUILT" PRINTS TO THE OWNER.
- THE DRAWINGS ARE DIAGNOSTIC AND DO NOT NECESSARILY SHOW THE EXACT ROUTING OR DETAILED FITTINGS. ALL WORK SHALL BE INSTALLED AS A COMPLETE SYSTEM WITH NECESSARY COMPONENTS, FITTINGS, STRAPS, ETC. ALL VALVES SHALL BE INSTALLED SO THAT THEY ARE ACCESSIBLE.
- REFER TO THE ENTIRE CONTRACTED DRAWING SET AND SPECIFICATIONS FOR GUIDANCE ON DIMENSIONS, CEILING HEIGHTS, DOOR SWINGS, ROOM FINISHES, STRUCTURAL DETAILS, LOCATIONS OF DUCTWORK, PIPING AND STRUCTURAL MEMBERS. INSTALL THE PLUMBING SYSTEMS SO AS NOT TO INTERFERE WITH THE INSTALLATION OR FUNCTION OF ANOTHER DISCIPLINES WORK. PIPING ROUTED EXPOSED TO VIEW SHALL BE ROUTED TIGHT TO STRUCTURE OR AS OTHERWISE DIRECTED BY ARCHITECT/ENGINEER.
- ALL DIMENSIONS OF EXISTING CONSTRUCTION ARE APPROXIMATE. THE CONTRACTORS SHALL MAKE ALL NECESSARY FIELD MEASUREMENTS OF EXISTING STRUCTURES, AND EQUIPMENT TO VERIFY DIMENSIONS SHOWN ON THE DRAWINGS. PROVIDE PROPER DIMENSIONS NOT SHOWN PRIOR TO EQUIPMENT FABRICATION. ALL COST FOR MODIFICATIONS OF NEW CONSTRUCTION DUE TO LACK OF CONFIRMATION OF DIMENSIONS BY FIELD MEASUREMENT SHALL BE THE RESPONSIBILITY OF THE PLUMBING CONTRACTOR.
- ALL PIPING MUST BE CONCEALED ABOVE THE CEILING OR IN THE WALLS UNLESS OTHERWISE NOTED.
- COORDINATE VALVE LOCATIONS WITH ARCHITECTURAL REFLECTED CEILING PLAN TO ENSURE NONE ARE INSTALLED OVER GYPSUM BOARD CEILINGS. WHERE VALVES ABOVE HARD CEILINGS CANNOT BE AVOIDED, PROVIDE ACCESS DOOR IN CEILING. ACCESS SHALL BE PROVIDED TO BOTH NEW AND EXISTING CLEANOUTS. PROVIDE ACCESS DOOR IN CEILING AS NECESSARY.
- PROVIDE SHUT-OFF VALVES AT EACH FIXTURE OR FIXTURE GROUP ON ALL DOMESTIC LINES. CONTRACTOR SHALL PROVIDE UNIT PRICE FOR 1/2", 3/4" & 1" ISOLATION VALVES.
- THE PLUMBING CONTRACTOR SHALL COORDINATE EXACT ROUTING OF ALL PIPING WITH ALL OTHER TRADES AND WITH EXISTING STRUCTURAL & PIPING OBSTRUCTIONS.



PLUMBING FIXTURE SCHEDULE

TAG	FIXTURE	CU	HU	WASTE	VENT	SPECIFICATION
E-1	WATER CLOSET	1"	N/A	4"	2"	JURN ZB615 WALL-MOUNTED TOILET W/ Z6000AV 1/6 GFF MANUAL FLUSH VALVE, BENEKE 921 SEAT WITH S.S. CHECK HINGES, AND WALL MTD. CARRIER.
E-1A	WATER CLOSET - ADA	1"	N/A	4"	2"	JURN ZB615 WALL-MOUNTED TOILET W/ Z6000AV 1/6 GFF MANUAL FLUSH VALVE, BENEKE 921 SEAT WITH S.S. CHECK HINGES, AND ADA COMPLIANT WALL MTD. CARRIER.
E-2	URINAL	1/2"	N/A	2"	1-1/2"	JURN ZB155-U 1/2" TOP SPUD URINAL W/ ZTR6203-ULF (0125 GFF) FLUSH VALVE, WITH WALL MOUNTED CARRIER.
E-2A	URINAL - ADA	1/2"	N/A	2"	1-1/2"	JURN ZB155-U 1/2" TOP SPUD URINAL W/ ZTR6203-ULF (0125 GFF) FLUSH VALVE, WITH WALL MOUNTED CARRIER AT ADA HEIGHT.
E-3	LAVATORY - ADA	1/2"	1/2"	2"	1-1/2"	JURN ZB14 SELF-RIMMING LAV W/ ZB104-XL-31 (5 GPM) FAUCET, GRID STRAINER, ZB100-D F-TRAP, INSULATION KIT, SUPPLY STOP, THERM. MIXING VALVE (MV-B) & ADA COMPLIANT. SHALL NOT CONTAIN PLASTIC PARTS.
E-4	DRINKING FOUNTAIN - ADA	1/2"	N/A	1-1/4"	2"	ELKAY MODEL LZ61TR8088K WALL MTD. DUAL FOUNTAIN W/BOTTLE FILLER, 1-1/2" P-TRAP & SUPPLY STOP, & INTEGRAL WATER COOLER.
E-5	MOP SINK	1/2"	1/2"	3"	2"	WILLIAMS 98-907 RECEPTOR W/ T-35 HOSE AND WALL HOOK, T-40 MOP HANGER, MOEN B24 VACUUM BREAK FAUCET, TILING FLANGE, & 6" FLASH CATCHER PANELS, INTEGRAL CHECK VALVES ON CU & HU.
NFUH	NON-FREEZE WALL HYDRANT	3/4"	N/A	N/A	N/A	WOODFORD B65 SERIES, FLUSH MOUNT, RECESSED BOX, SELF-DRAINING, VACUUM BREAKER, LOCKABLE.
HB	HOSE BIBB	3/4"	N/A	N/A	N/A	JR SMITH 5613-BFF ANTI-SIPHON HOSE BIBB WITH INTEGRAL CHECK VALVE.
ED	FLOOR DRAIN	N/A	N/A	N/A	N/A	JR SMITH 7000 WITH 6" TYPE B SQUARE ADJUSTABLE STRAINER WITH SATIN NICKEL BRONZE FINISH. PROVIDE WITH VANDAL PROOF SECURED TOP AND TRAP PRIMER.
FCO	FLOOR CLEAN OUT	N/A	N/A	N/A	N/A	JR SMITH 4031 WITH TAPER THREAD BRONZE PLUG AND ROUND ADJUSTABLE SCORRIATED SECURED NICKEL BRONZE TOP.
WCO	WALL CLEAN OUT	N/A	N/A	N/A	N/A	JR SMITH 4110 OR 4115 STAINLESS STEEL SHALLOW COVER OR CHROME PLATED BRONZE DEEP COVER WITH CENTER SCREW.

ELECTRIC WATER HEATER SCHEDULE

TAG	TANK (GAL.)	NO. OF HEATERS	TOTAL KW	V/Ø	RECOVERY (GPM)	TEMP. RISE (°F)	SUPPLY (°F)	MANUF. & MODEL N°	NOTES
UH-A	38	2 (NON-SIMUL.)	45	230/1	21	70°	120°	AO SMITH-PCJN-40	①

① LOW BOY STYLE MOUNTED ON SHELF IN JANITOR CLOSET

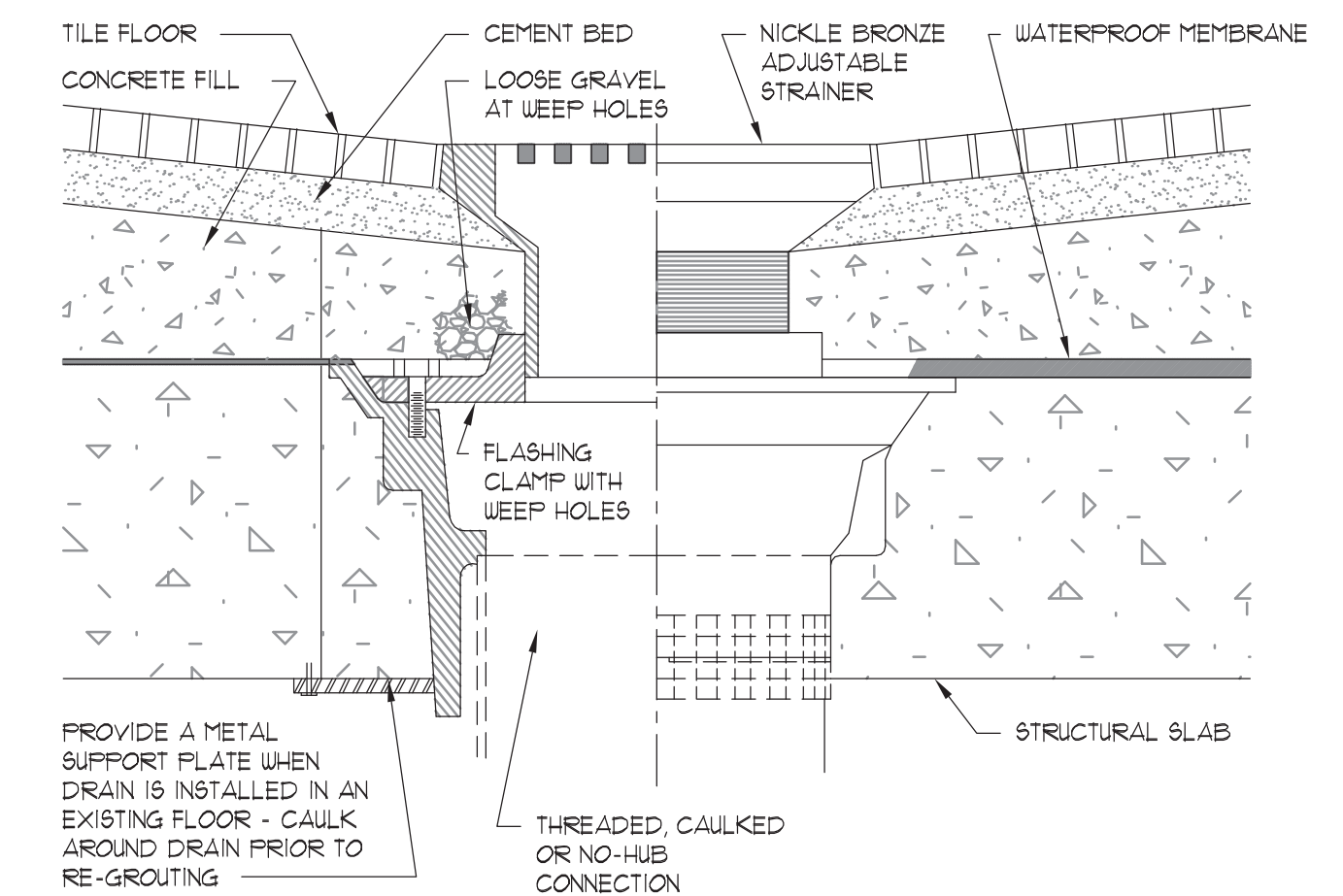
WATER SOFTENER SCHEDULE

TAG	DESCRIPTION	MAX. FLOW (GPM)	MAX. PRESSURE (PSI)	EXCHANGE CAPACITY (KILOGRAMS)	VOLT/Ø	BASIS OF DESIGN	REMARKS
WS-1	WATER SOFTENER	13	125	14,900	12Ø	MARLO. MCV-15-K	①

① OR APPROVED EQUAL

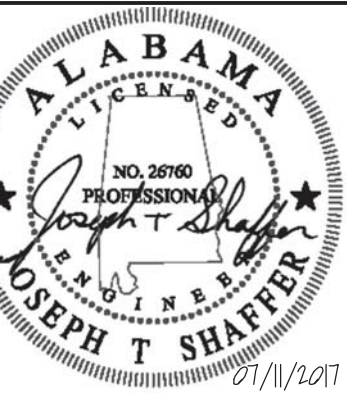
LEGEND - PLUMBING

○	A/C	ABOVE CEILING
○	AD	AREA DRAIN
○	AFG	ABOVE FINISHED GRADE
○	AF	ABOVE FINISHED FLOOR
○	AF	ABOVE FLOOR
○	BC	BALANCING COCK OR VALVE
○	B/F	BELOW FLOOR
○	BFF	BELOW FINISHED FLOOR
○	BFG	BELOW FINISHED GRADE
○	BFP	BACKFLOW PREVENTER ASSEMBLY
○	B/G	BELOW GRADE
○	CO	CLEANOUT
○	CU	DOMESTIC COLD WATER
○	CV	CHECK VALVE
○		CONNECT TO EXISTING
○		CONTINUE TO DESIGNATED LOCATION
○	DD	DECK DRAIN
○		DIRECTION OF FLOW IN PIPE
○		DIRECTION OF PITCH OF PIPE
○	ERD	EMERGENCY ROOM DRAIN
○	EST	EMERGENCY STORM WATER
○	FA	FRESH AIR
○	FAV	FRESH AIR VENT
○	FD	FLOOR DRAIN (-1 + TYPE)
○	FCO	FLOOR CLEANOUT
○	FS	FLOOR SINK
○	G	NATURAL GAS PIPING
○	GV	GATE VALVE
○	HD	HUB DRAIN
○	HB	HOSE BIBB OR DRAIN VALVE
○	HU	DOMESTIC HOT WATER
○	HUR	HOT WATER RECIRCULATE
○	IE	INVERT ELEVATION
○	NFUH	NON-FREEZE WALL HYDRANT
○	P-TRAP	P-TRAP
○		PIPING UP
○		PIPING DOWN
○		PIPING STUB OUT / CAPPED
○		PIPING TEE
○	E-1	PLUMBING FIXTURE DESIGNATION
○	PRV	PRESSURE REDUCING VALVE
○		PRESSURE GAUGE WITH GAUGE COCK
○		REFER TO PLUMBING KEYNOTES
○	S OR W	SANITARY OR WASTE PIPING BELOW FLOOR OR GRADE
○	S OR W	SANITARY OR WASTE ABOVE GROUND
○	ST	STORM WATER
○		STRAINER
○		THERMOMETER
○		UNION
○	V	VENT PIPING
○	VTR	SANITARY VENT THROUGH ROOF
○	WHA	WATER HAMMER ARRESTOR (P.D.I. SIZE)
○	WCO	WALL CLEANOUT
○	YCO	YARD CLEANOUT



AUBURN UNIVERSITY
Facilities Management
1161 West Samford Avenue
Auburn University, AL 36849
Phone: (334) 844-4810
Fax: (334) 844-9458
Safety is our first priority.
Think Safety. Act Safely.

No.	Revision	Date
1	ABC Comments	07/11/2017
2	Addendum 2	07/13/2017

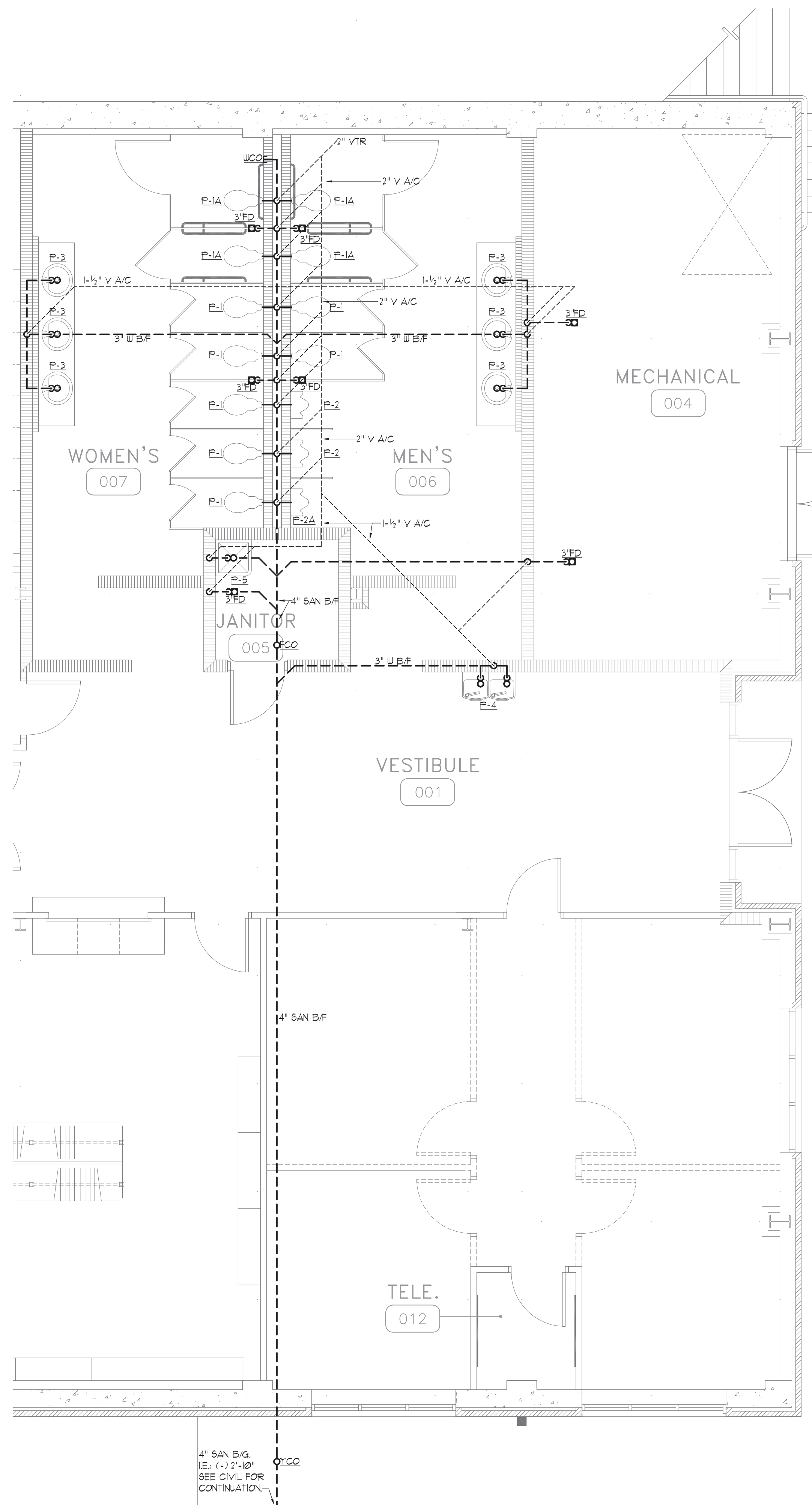


CONWAY & OWEN
Mechanical Electrical Plumbing
1105 South College Street, Suite 200
Auburn, AL 36807
P: (334) 844-6668 F: (334) 844-6669

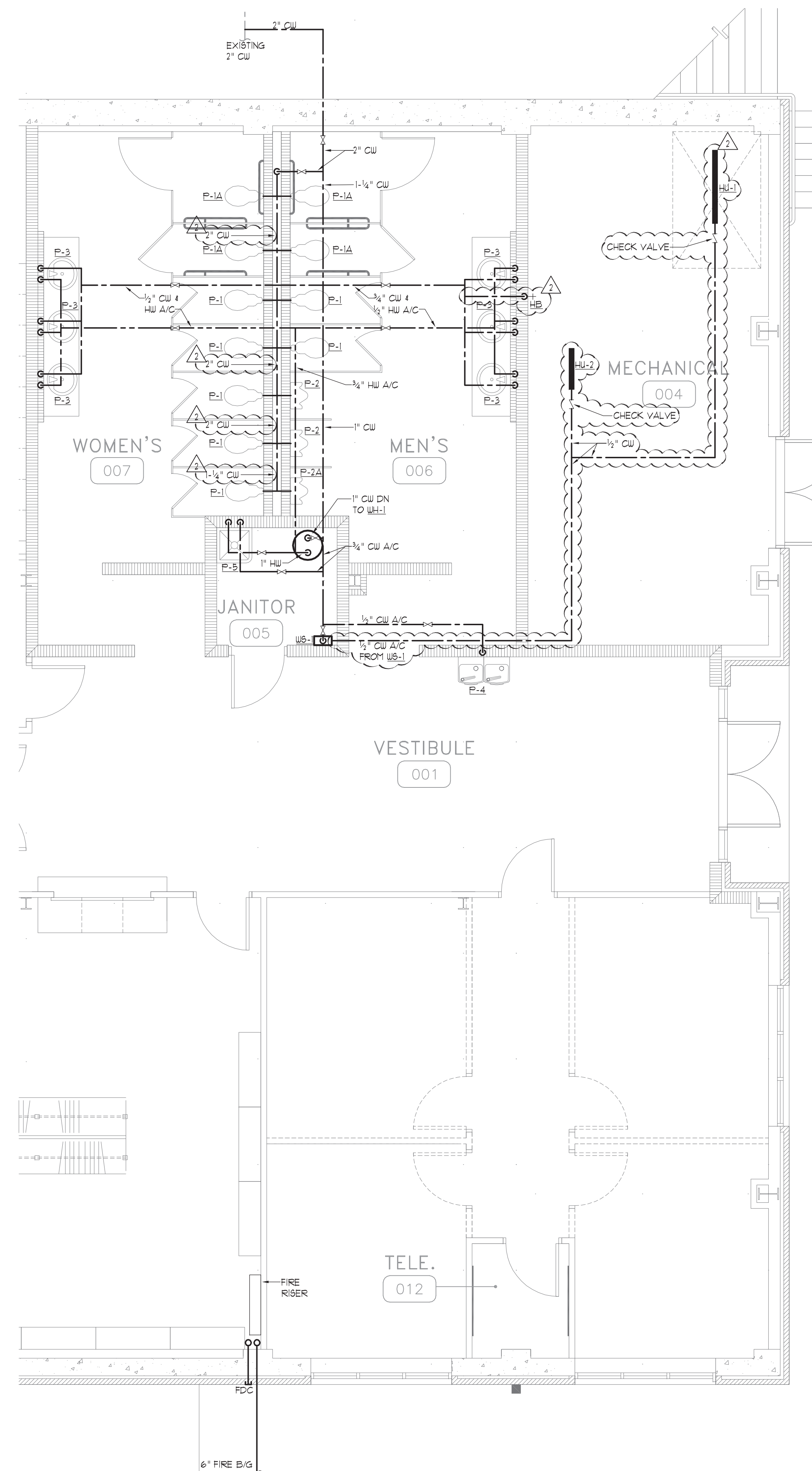
GOODWIN HALL - RENOVATION AND BAND REHEARSAL HALL ADDITION
Project Number 15-255

SHEET TITLE:
LEGEND, NOTES, & SCHEDULES - PLUMBING
DRAWN BY: MJL
CHECKED BY: JTS
DATE: 6-14-2017
FILE NUMBER:
PROJECT NUMBER: 15-255
SHEET NUMBER:

P0.1



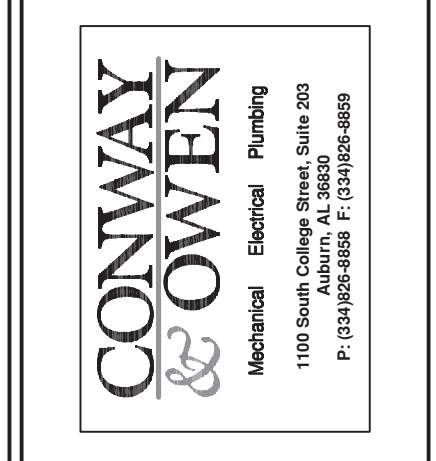
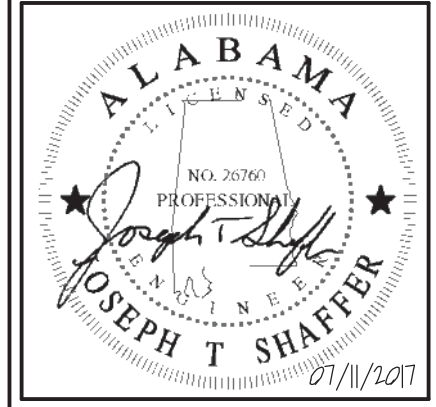
2 LOWER LEVEL FLOOR PLAN - WASTE & VENT
 SCALE: 1/4" = 1'-0"
 NORTH



1 LOWER LEVEL FLOOR PLAN - DOMESTIC WATER
 SCALE: 1/4" = 1'-0"
 NORTH

PLUMBING GENERAL NOTES:
 1. SEE SHEET P201 FOR LEGEND, NOTES, SCHEDULES & DETAILS.
 2. DETAILS ARE APPLICABLE EVEN IF NOT DIRECTLY REFERENCED.

No.	Revision	Date
1	ABC Comments	07/11/2017
2	Addendum 2	07/13/2017



**GOODWIN HALL - RENOVATION
 AND
 BAND REHEARSAL HALL ADDITION**
 Project Number 15-255

SHEET TITLE:
 LOWER LEVEL FLOOR
 PLANS - PLUMBING

DRAWN BY:
 MJL

CHECKED BY:
 JTS

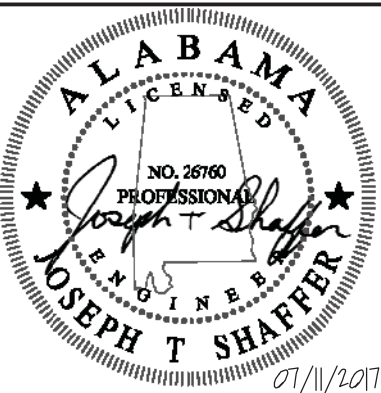
DATE:
 6-14-2017

FILE NUMBER:
 -

PROJECT NUMBER:
 15-255

SHEET NUMBER:
 -

No.	Revision	Date
1	ABC Comments	07/11/2017
2	Addendum 2	07/13/2017



CONWAY & OWEN
Mechanical Electrical Plumbing
1105 South College Street, Suite 205
Auburn, AL 36849
P: (334) 844-4849 F: (334) 844-4849

**GOODWIN HALL - RENOVATION
AND
BAND REHEARSAL HALL ADDITION**
Project Number 15-255

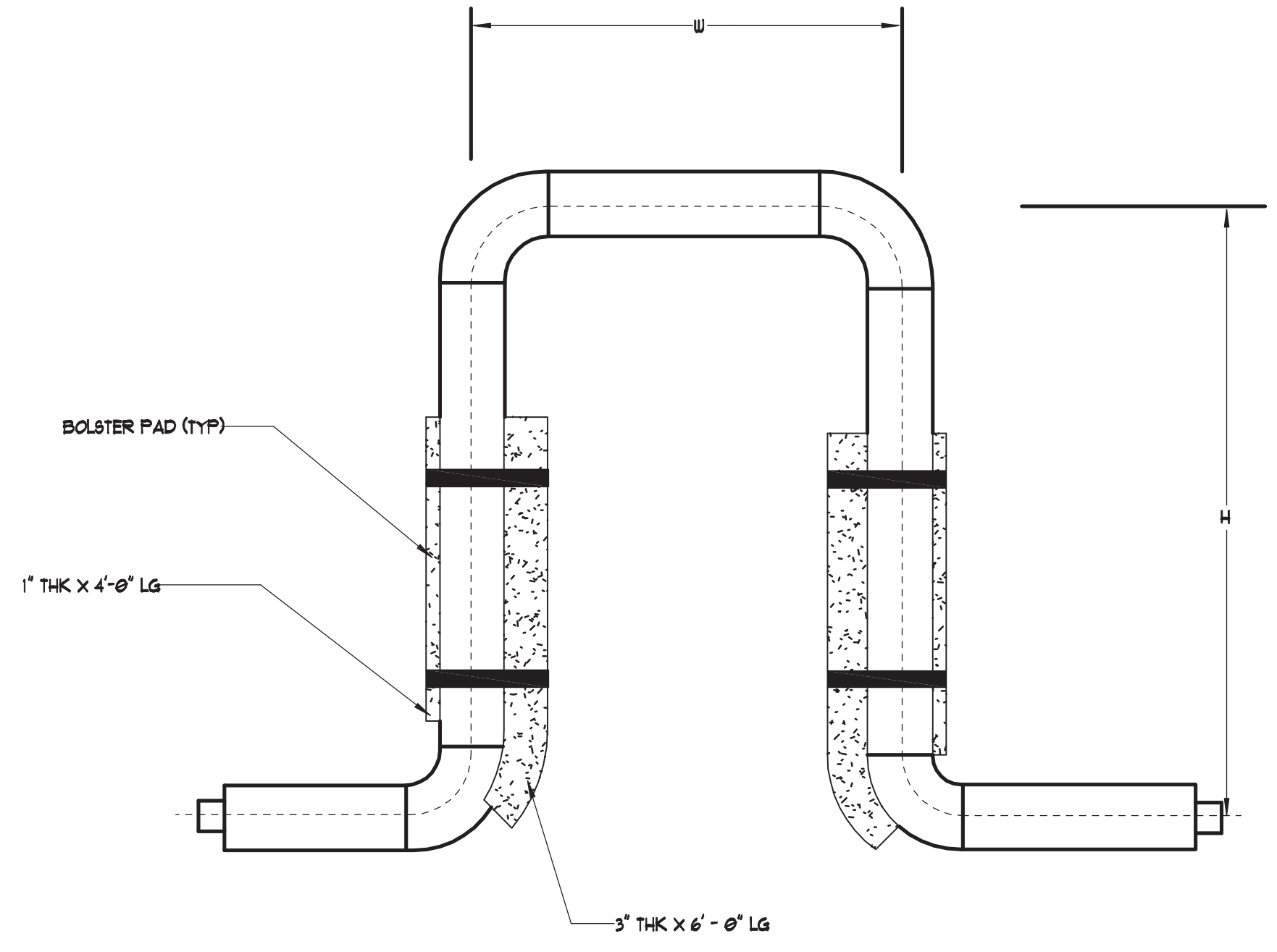
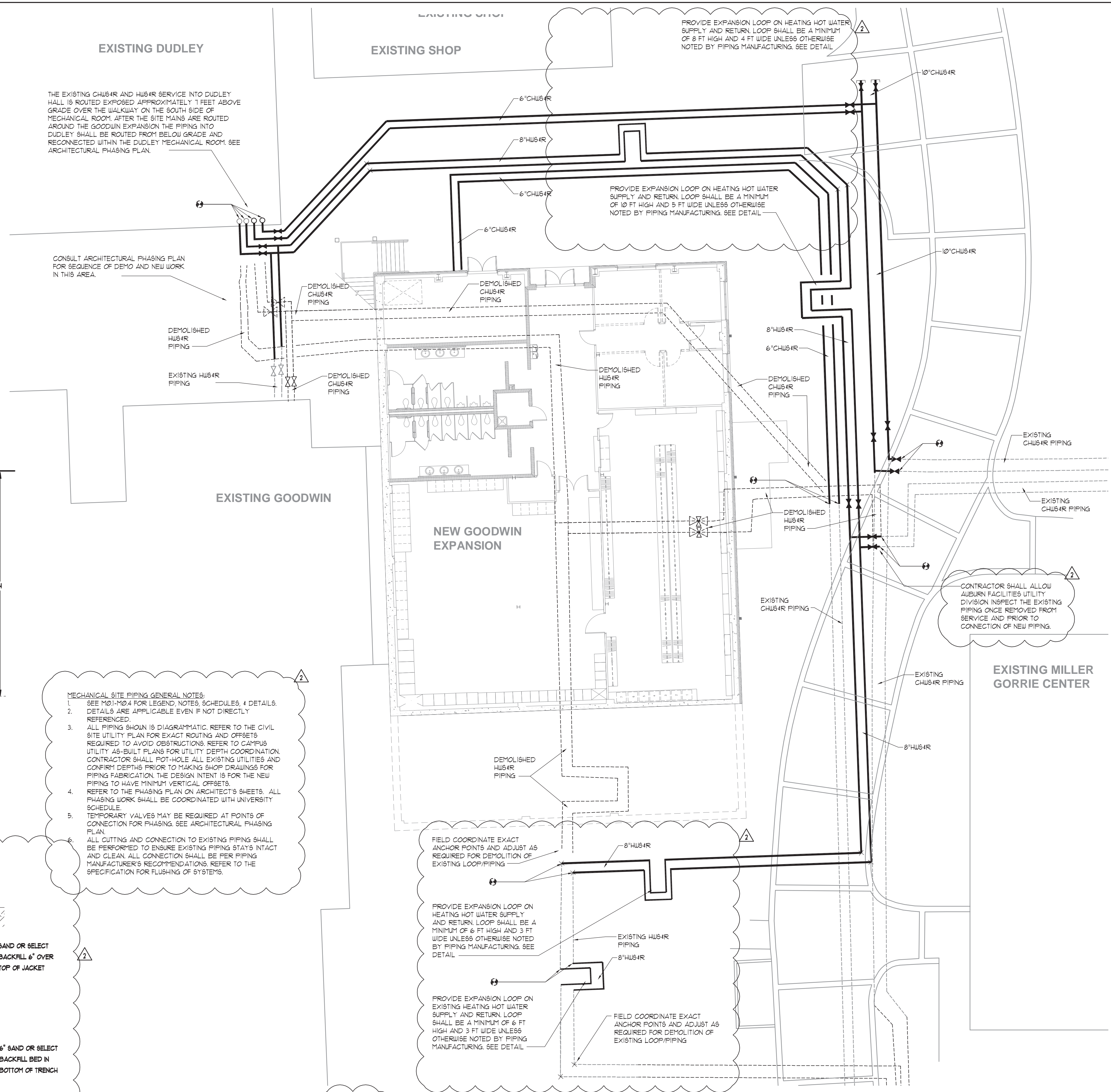
SHEET TITLE:
SITE PLAN - MECHANICAL

DRAWN BY:
MJL
CHECKED BY:
JTS

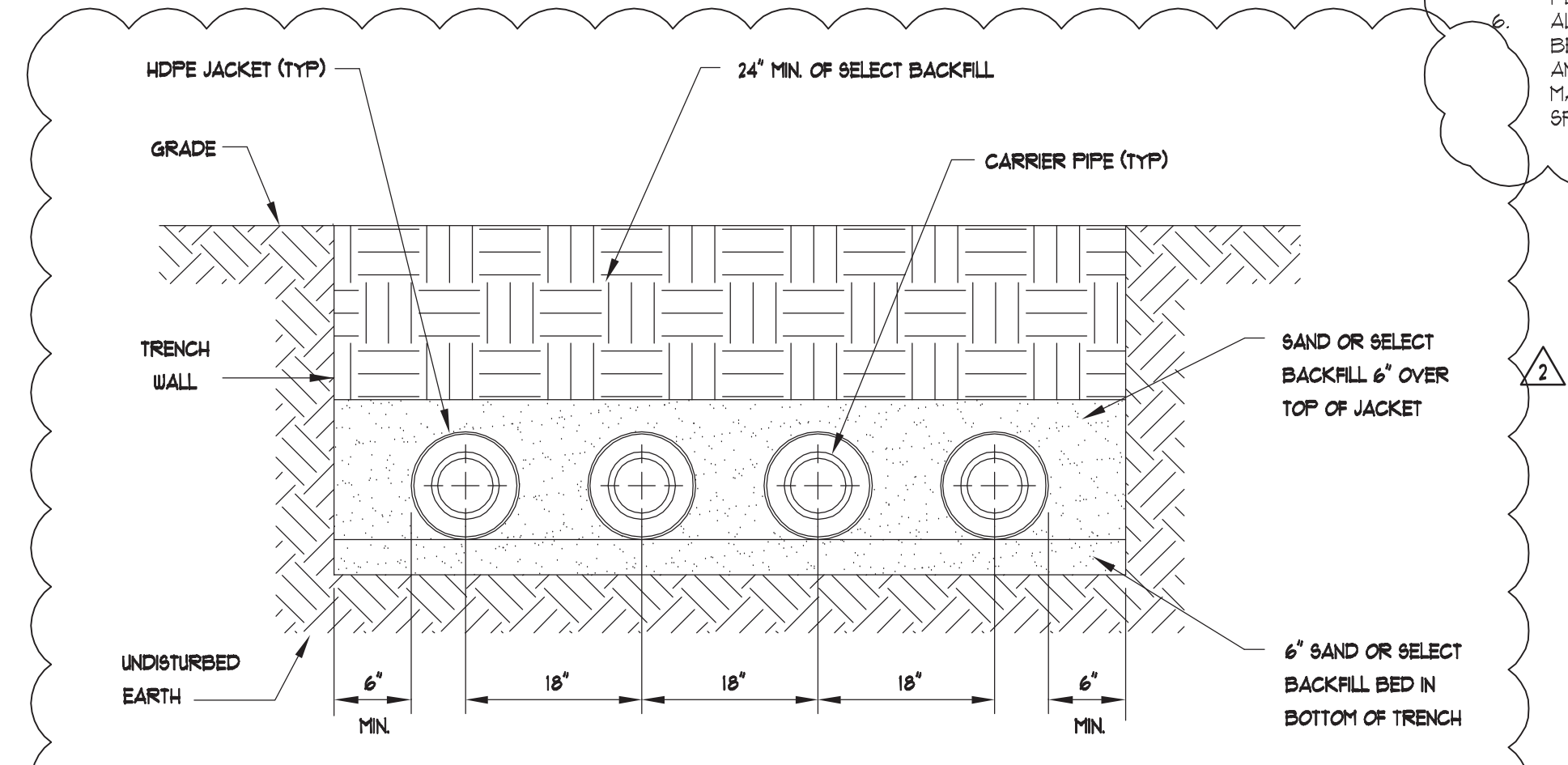
DATE:
6-14-2017
FILE NUMBER:
-

PROJECT NUMBER:
15-255

SHEET NUMBER:
M1.0
XX of XX



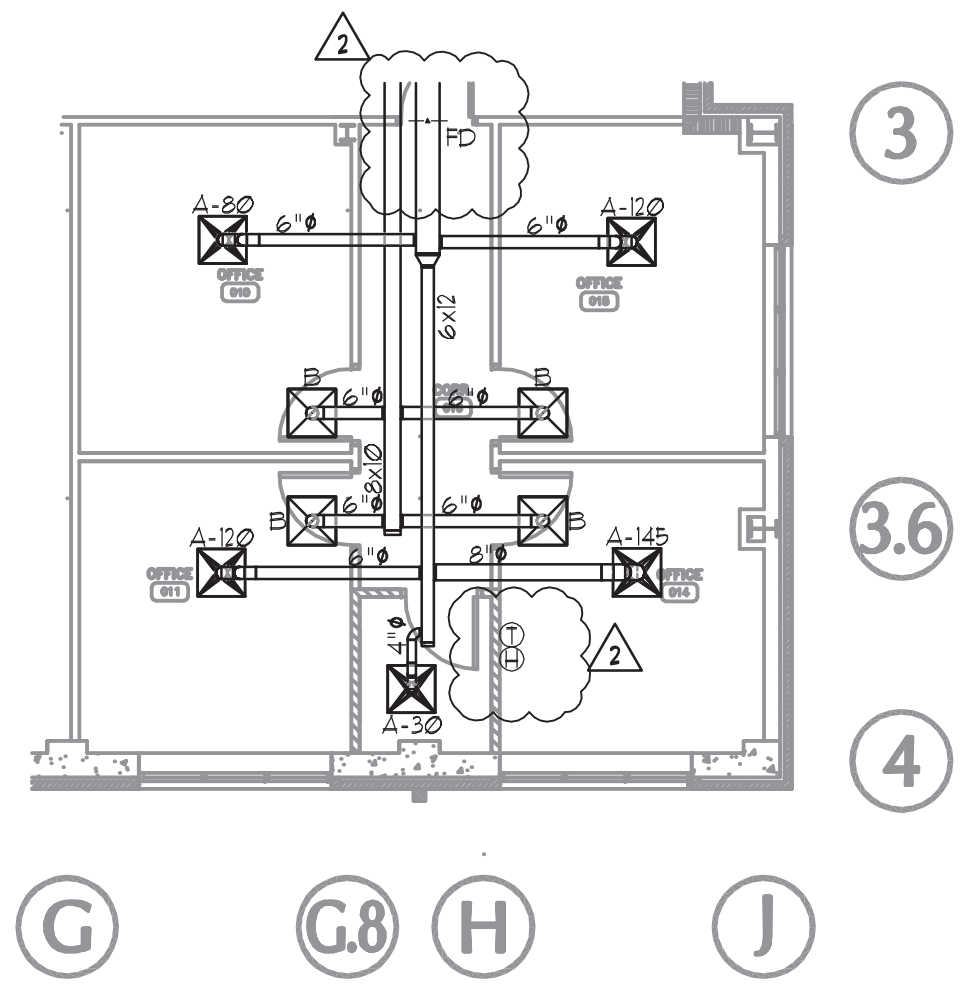
2 SITE PIPING EXPANSION LOOP DETAIL
NOT TO SCALE



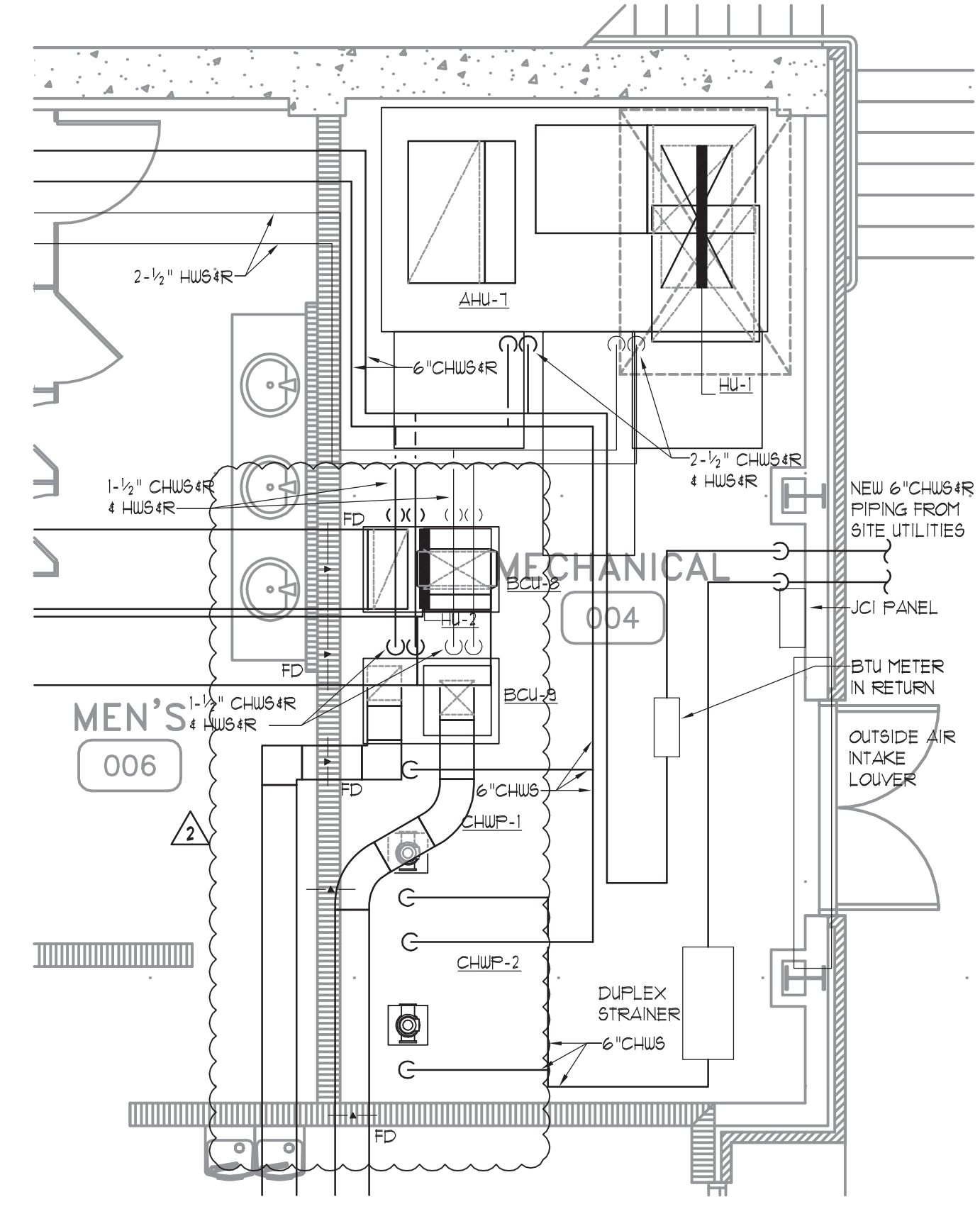
3 TYPICAL TRENCH DETAIL
NOT TO SCALE

- MECHANICAL SITE PIPING GENERAL NOTES:**
- SEE M01-M04 FOR LEGEND, NOTES, SCHEDULES, & DETAILS. DETAILS ARE APPLICABLE EVEN IF NOT DIRECTLY REFERENCED.
 - ALL PIPING SHOWN IS DIAGNAMATIC. REFER TO THE CIVIL SITE UTILITY PLAN FOR EXACT ROUTING AND OFFSETS REQUIRED TO AVOID OBSTRUCTIONS. REFER TO CAMPUS UTILITY AS-BUILT PLANS FOR UTILITY DEPTH COORDINATION. CONTRACTOR SHALL POT-HOLE ALL EXISTING UTILITIES AND CONFIRM DEPTHS PRIOR TO MAKING SHOP DRAWINGS FOR PIPING FABRICATION. THE DESIGN INTENT IS FOR THE NEW PIPING TO HAVE MINIMUM VERTICAL OFFSETS.
 - REFER TO THE PHASING PLAN ON ARCHITECT'S SHEETS. ALL PHASING WORK SHALL BE COORDINATED WITH UNIVERSITY SCHEDULE.
 - TEMPORARY VALVES MAY BE REQUIRED AT POINTS OF CONNECTION FOR PHASING. SEE ARCHITECTURAL PHASING PLAN.
 - ALL CUTTING AND CONNECTION TO EXISTING PIPING SHALL BE PERFORMED TO ENSURE EXISTING PIPING STAYS INTACT AND CLEAN. ALL CONNECTION SHALL BE PER PIPING MANUFACTURER'S RECOMMENDATIONS. REFER TO THE SPECIFICATION FOR FLUSHING OF SYSTEMS.

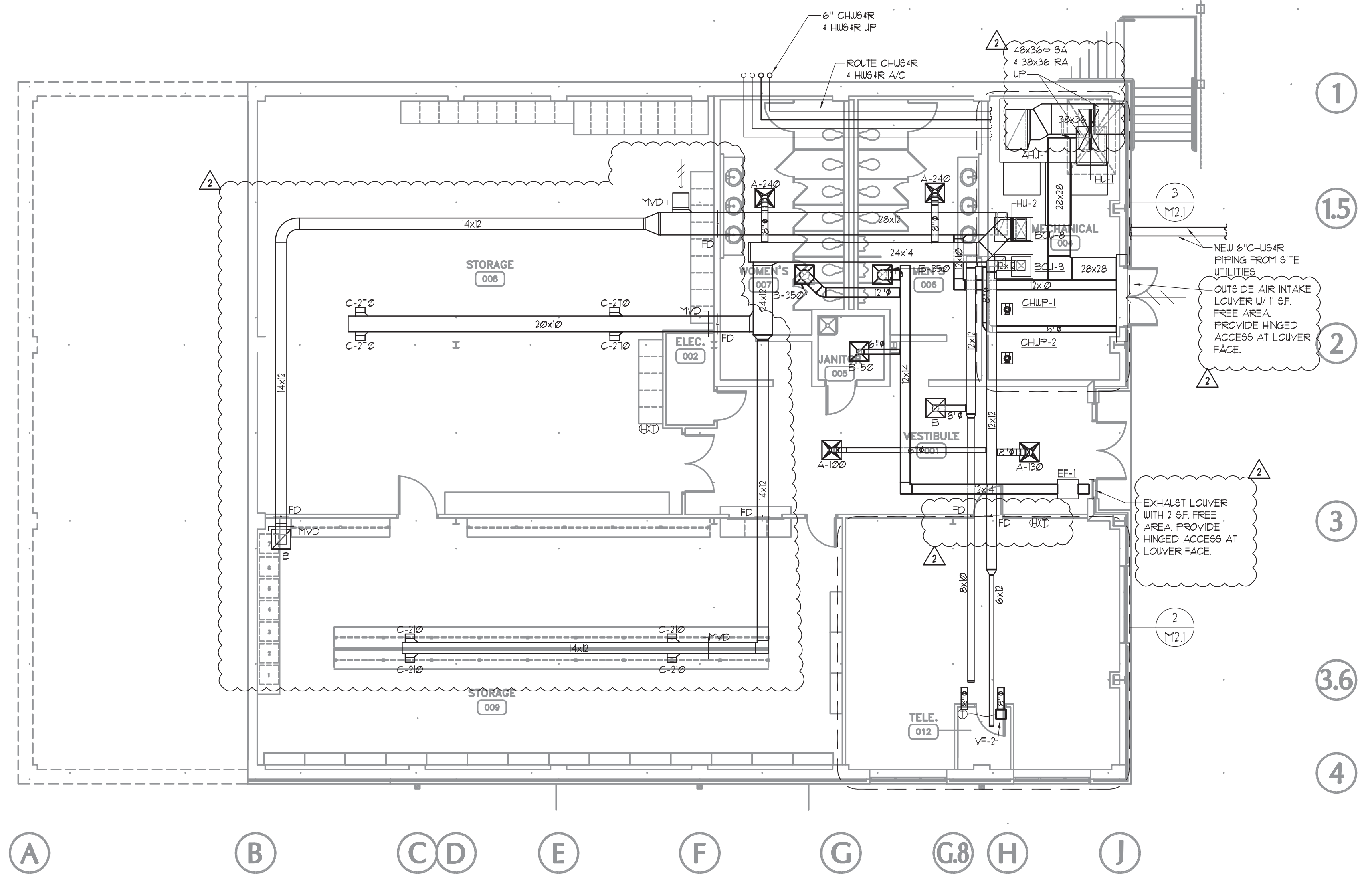
1 NORTH
SCALE: 3/32" = 1'-0"



2 LOWER LEVEL FLOOR PLAN - MECHANICAL - ALTERNATE #3
SCALE: 1/8" = 1'-0"
NORTH



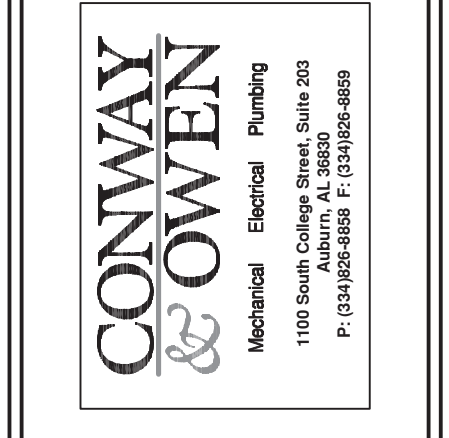
3 ENLARGED PLAN - MECHANICAL ROOM
SCALE: 1/8" = 1'-0"
NORTH



1 LOWER LEVEL FLOOR PLAN - MECHANICAL
SCALE: 1/8" = 1'-0"
NORTH

MECHANICAL GENERAL NOTES:
1. SEE M01-M04 FOR LEGEND, NOTES, SCHEDULES, & DETAILS.
2. DETAILS ARE APPLICABLE EVEN IF NOT DIRECTLY REFERENCED.

No.	Revision	Date
1	ABC Comments	07/11/2017
2	Addendum 2	07/13/2017



**GOODWIN HALL - RENOVATION
AND
BAND REHEARSAL HALL ADDITION**
Project Number 15-255

SHEET TITLE:
LOWER LEVEL FLOOR PLANS - MECHANICAL

DRAWN BY:
MJL

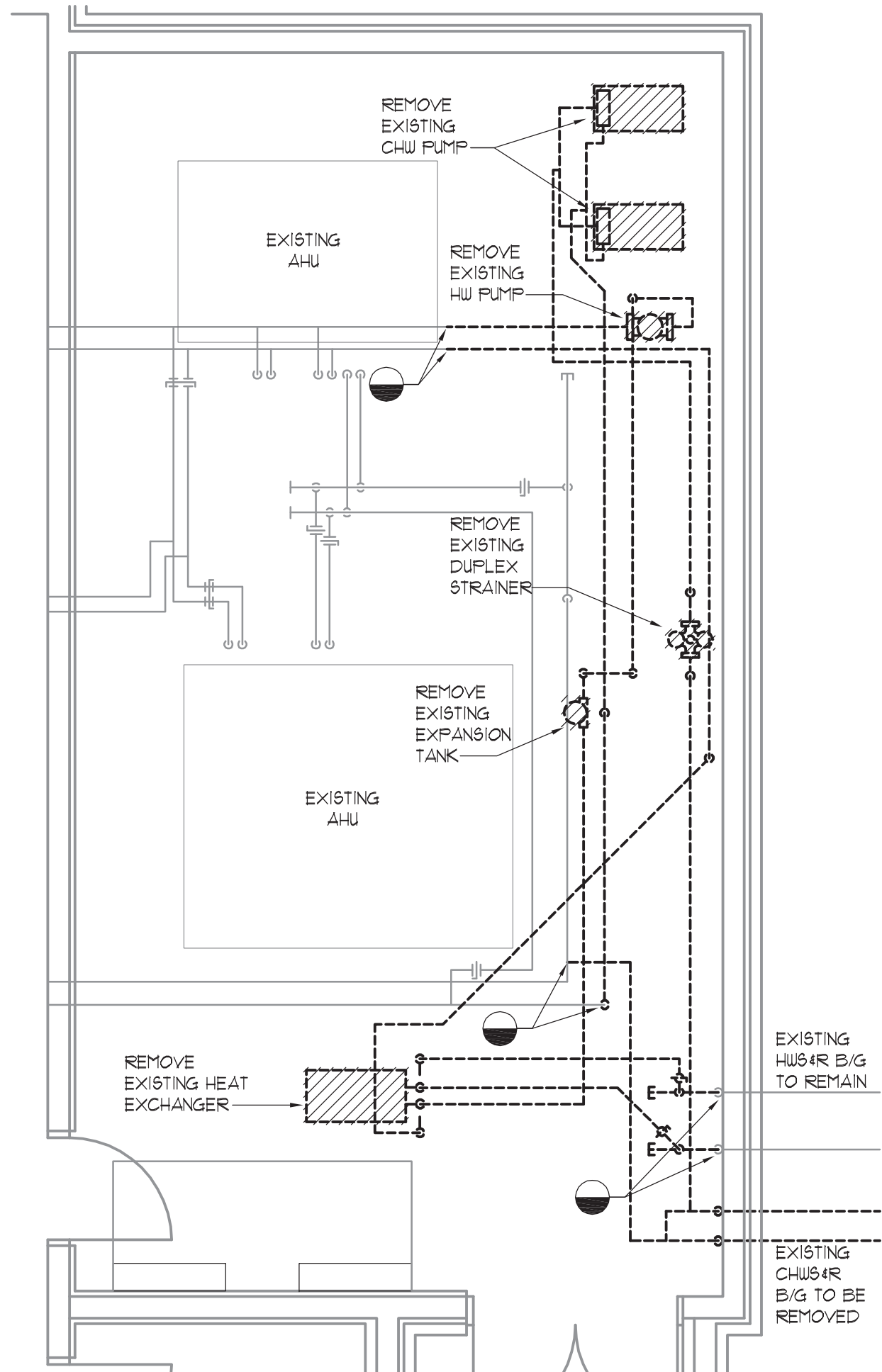
CHECKED BY:
JTS

DATE:
6-14-2017

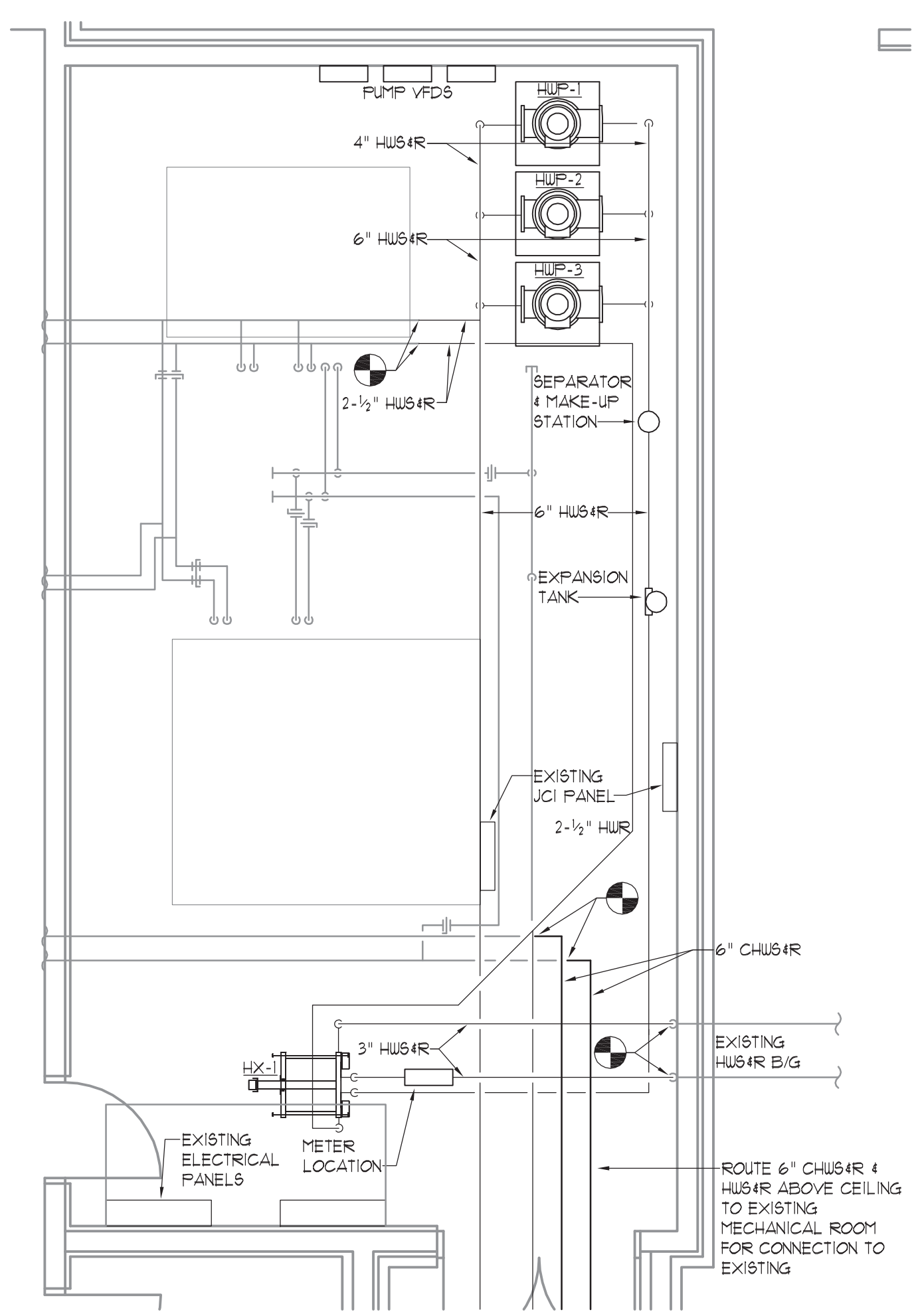
FILE NUMBER:
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PROJECT NUMBER:
15-255

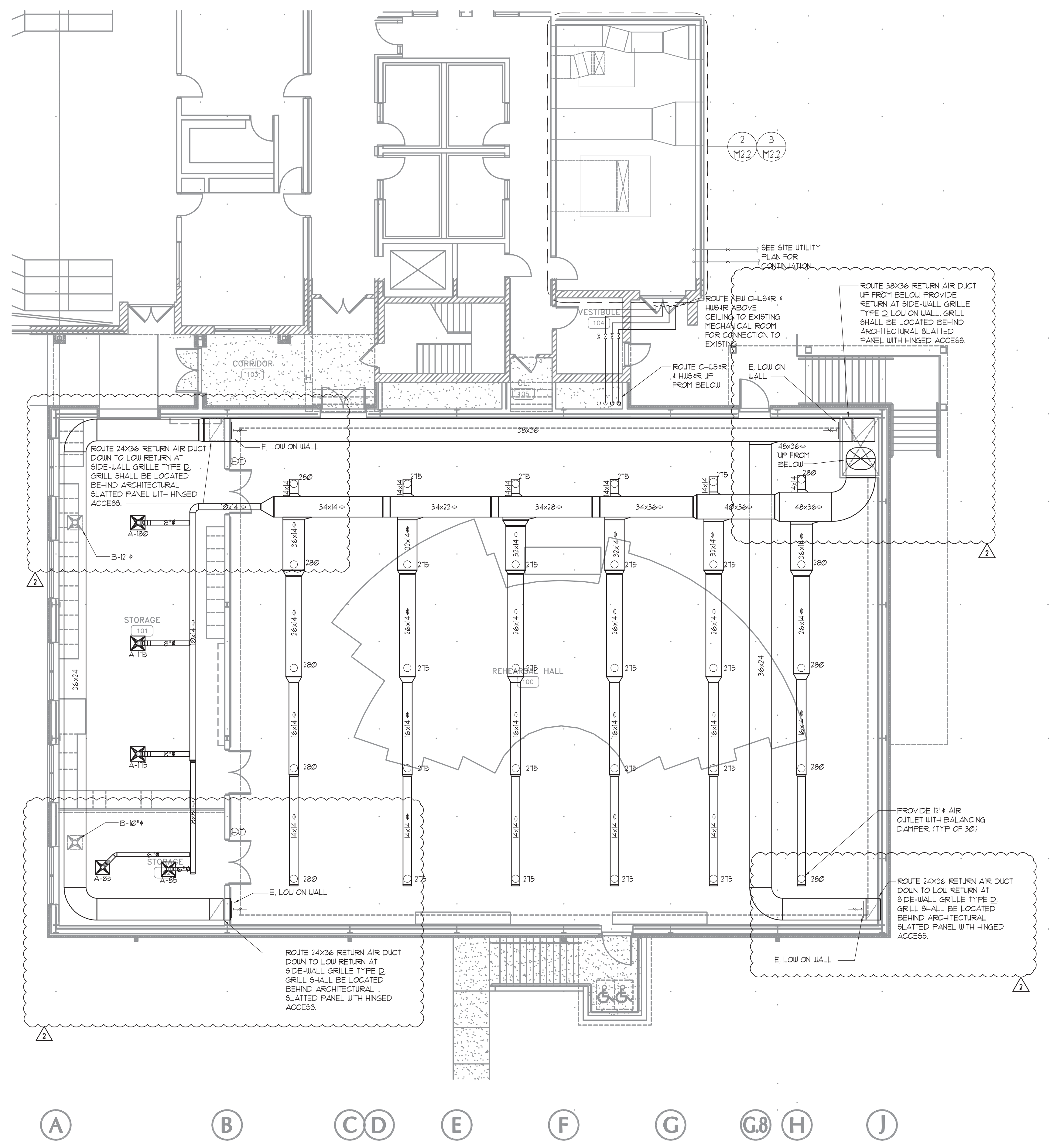
SHEET NUMBER:



2 ENLARGED DEMO PLAN - MECHANICAL ROOM
SCALE: 1/4" = 1'-0"
NORTH



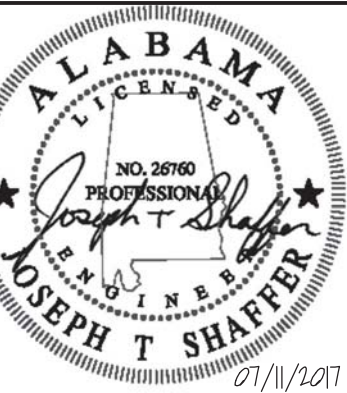
3 ENLARGED PLAN - MECHANICAL ROOM
SCALE: 1/4" = 1'-0"
NORTH



1 UPPER LEVEL FLOOR PLAN - MECHANICAL
SCALE: 1/8" = 1'-0"
NORTH

MECHANICAL GENERAL NOTES:
1. SEE M01-M04 FOR LEGEND, NOTES, SCHEDULES & DETAILS.
2. DETAILS ARE APPLICABLE EVEN IF NOT DIRECTLY REFERENCED.
3. ALL SUPPLY & RETURN DUCT LOCATED IN THE REHEARSAL ROOM SHALL BE INTERNALLY LINED FOR NOISE REDUCTION. SUPPLY DUCT SHALL BE DOUBLE WALL WITH PERFORATED INSIDE LAYER.

No.	Revision	Date
1	ABC Comments	07/11/2017
2	Addendum 2	07/13/2017



CONWAY & OWEN
Mechanical Electrical Plumbing
1105 South College Street, Suite 200
Auburn, Alabama 36849
P: (334) 844-6688 F: (334) 844-6689

**GOODWIN HALL - RENOVATION
AND
BAND REHEARSAL HALL ADDITION**
Project Number 15-255

SHEET TITLE:

UPPER LEVEL FLOOR
PLANS - MECHANICAL

DRAWN BY:
MJL

CHECKED BY:
JTS

DATE:
6-14-2017

FILE NUMBER:
-

PROJECT NUMBER:
15-255

SHEET NUMBER:
-

M2.2
XX OF XX

LIGHTING FIXTURE SCHEDULE						
FIXTURE TYPE	DESCRIPTION	INPUT WATTS	LAMPS	BALLAST	MANUFACTURER	NOTES
A	1'X4' PENDANT MOUNTED FIXTURE LED STRIP FIXTURE, 3000 LUMENS	UNV / 33 W	LED / 3500K	ELECTRONIC / 0-10V DIMMING	LITHONIA 72LN-L48-3000LM-MVOLT-35K-80CRI OR APPROVED EQUAL BY COOPER OR HUBBELL	-
AE	SAME AS TYPE "A" EXCEPT PROVIDED WITH EMERGENCY BATTERY PACK, MINIMUM 1000 LUMENS	-	-	-	-	-
B	2'X4' LINEAR RECESSED FIXTURE	UNV / 31 W	LED / 3500K	ELECTRONIC / 0-10V DIMMING	LITHONIA 2VTL4-30L-ADP-EZI-LF835 OR APPROVED EQUAL BY COOPER OR HUBBELL	-
BE	SAME AS TYPE "B" EXCEPT PROVIDED WITH EMERGENCY BATTERY PACK, MINIMUM 1000 LUMENS	-	-	-	-	-
C	6" PENDANT-MOUNTED CYLINDER DOWNLIGHT	UNV / 36.9 W	LED / 3500K	ELECTRONIC / 0-10V DIMMING	INDY L66P-33LM-35K-MVOLT-X-G3-80CRI-TZ OR APPROVED EQUAL BY COOPER OR HUBBELL	11
CE	SAME AS TYPE "C" EXCEPT PROVIDED WITH EMERGENCY BATTERY PACK, MINIMUM 1000 LUMENS	-	-	-	-	11
CV	4' RECESSED COVE FIXTURE, 1800 LUMENS, COORDINATE TRIM/CEILING AND MOUNTING WITH ARCHITECT	UNV / 20 W	LED / 3500K	ELECTRONIC / 0-10V DIMMING	FLUXIERX NTI-L-CEILING-B-A-35-EI-M-4 OR APPROVED EQUAL BY COOPER OR HUBBELL	-
D	6" RECESSED DOWNLIGHT, 2000 LUMENS, ROUND OPEN REFLECTOR, CLEAR, SPECULAR FINISH, WHITE PAINTED FLANGE	UNV / 23.2 W	LED / 3500K	ELECTRONIC / 0-10V DIMMING	GOTHAM EVO-35/20-6AR-MUD-L8-MVOLT-EZIO OR APPROVED EQUAL BY COOPER OR HUBBELL	-
DE	SAME AS TYPE "D" EXCEPT PROVIDED WITH EMERGENCY BATTERY PACK, MINIMUM 1000 LUMENS	-	-	-	-	-
U	EXTERIOR WALL-MOUNTED LED WALL PACK FIXTURE, PROVIDE WITH EMERGENCY BATTERY PACK, FINISH SELECTED BY ARCHITECT	UNV / 25 W	LED / 3000K	ELECTRONIC	LITHONIA 16ST-LED-F2-30K-MVOLT-E1WH OR APPROVED EQUAL BY COOPER, HUBBELL, OR CREE	-
X	COMPACT, LOW-PROFILE EXIT SIGN, GREEN LETTERING ON WHITE BACKGROUND, FURNISH WITH EMERGENCY OPTION FOR MAINTENANCE-FREE NICKEL-CADMIUM BATTERY FOR 2-HOUR OPERATION WITH INTEGRAL TEST SWITCH AND AC-ON INDICATOR	UNV	LED	ELECTRONIC	LITHONIA 1LRP SERIES OR APPROVED EQUAL BY COOPER OR HUBBELL	-

LIGHTING FIXTURE SCHEDULE NOTES

- SEE PLANS FOR FIXTURES BEING DIMMED. ALL DIMMING CONTROLS SHALL BE 0-10V. COORDINATE FIXTURE COMPATIBILITY WITH DIMMING CONTROLS.
- CONFIRM VOLTAGE WITH DRAWINGS AND COORDINATE ALL MOUNTING HEIGHTS/FINISHES WITH ARCHITECT PRIOR TO ORDERING AND INSTALLATION.
- PROVIDE MOUNTING OPTION(S) NECESSARY TO ACCOMMODATE CEILING TYPES SPECIFIED BY ARCHITECTURAL DOCUMENTS FOR RECESSED FIXTURES.
- PROVIDE ALL HARDWARE AND ACCESSORIES TO INSTALL FIXTURES AS INDICATED IN FIXTURE DESCRIPTION.
- MANUFACTURER PART NUMBERS MAY NOT NECESSARILY MATCH DESCRIPTION. OBTAIN CLARIFICATION IF A CONFLICT EXISTS BETWEEN DESCRIPTION AND MODEL NUMBER.
- ALL LAMPS SHALL BE BY THE SAME MANUFACTURER. PROVIDE 5% (MINIMUM 10 LAMPS OF EACH TYPE) SPARE LAMP ATTIC STOCK FOR OWNER AT PROJECT COMPLETION.
- MANUFACTURER LISTED AS AN "OR EQUAL" DOES NOT GUARANTEE APPROVAL. FIXTURE PERFORMANCE MUST MEET OR EXCEED SPECIFIED FIXTURE.
- ALL FIXTURES NOT SPECIFICALLY LISTED BY MODEL NUMBER REQUIRE A PRIOR APPROVAL SUBMITTAL IN WRITING. NO VERBAL APPROVALS WILL BE ALLOWED.
- FIXTURES FURNISHED BY INTERIOR DESIGNER AND SHIPPED TO SITE, TO BE RECEIVED, STORED, AND INSTALLED BY GC. GC SHALL SUPPLY ALL LAMPS AND ACCESSORIES.
- FIXTURE ALLOWANCE IS FOR FIXTURE AND SHIPPING COST TO THE JOBSITE ONLY. GC SHALL INCLUDE COST TO RECEIVE, STORE AND INSTALL FIXTURE. GC SHALL SUPPLY ALL LAMPS AND ACCESSORIES.
- PROVIDE REMOTE-MOUNTED DRIVERS FOR MAINTENANCE ACCESS. COORDINATE EXACT LOCATION WITH ARCHITECT AND OWNER PRIOR TO ROUGH-IN.

LIGHTING CONTROL SYSTEM NOTES:

- PROVIDE A COMPLETE LIGHTING CONTROL SYSTEM AND LIGHTING CONTROL PANEL BY WATTSTOPPER 1LP8 (OR APPROVED EQUIVALENT BY LEVITON OR SQUARE D POWERLOGIC) WITH BMS INTERFACE MODULE. CONTROL PANEL PROTOCOL SHALL BE BACKNET MSTP OR BACKNET OVER IP TO INTERFACE WITH CAMPUS BUILDING AUTOMATION SYSTEM. CONTROL PANEL FEATURES INCLUDE BUT NOT EXCLUSIVE TO: OVERRIDE BUTTONS AND ALL ASSOCIATED CONTROL WIRING.
- OVERVERRIDE SWITCH SHALL ALLOW AN OCCUPANT TO KEEP THE LIGHTS ON FOR AN ADDITIONAL 2-HOURS AND SHALL HAVE A PILOT LIGHT NEATLY LABELLED DESCRIBING THE AREA IT CONTROLS.
- COORDINATE TIME SETTINGS WITH THE OWNER.
- PROVIDE CONTROL POWER AS REQUIRED.
- ALL COMPONENTS SHALL BE FROM THE SAME MANUFACTURER.
- OVERVERRIDE BUTTON SHALL OPERATE AS NOTED IN DOCUMENTS.

LIGHTING CONTROL PANEL SCHEDULE "LCP"

RELAY	DESCRIPTION OF LIGHTING TO BE CONTROLLED	CONTROL	CIRCUIT #	NOTES
1	EXTERIOR LIGHTING	PHOTOCELL ON/OFF	LP-ID-1	SEE SHEET E10 FOR PHOTOCELL LOCATION
2	LOWER LEVEL LIGHTING	TIME CONTROL ON/OFF	LP-ID-3	-
3	UPPER LEVEL LIGHTING	TIME CONTROL ON/OFF	LP-ID-9	-
4	SPARE	-	-	-
5	SPARE	-	-	-
6	SPARE	-	-	-
7	LOWER LEVEL OFFICE CONTROLLED RECEPTACLES	TIME CONTROL ON/OFF	LP-ID-39	PROVIDE UNDER ALTERNATE 3
8	LOWER LEVEL OFFICE CONTROLLED RECEPTACLES	TIME CONTROL ON/OFF	LP-ID-41	PROVIDE UNDER ALTERNATE 3

VOICE/DATA AND SECURITY NOTES

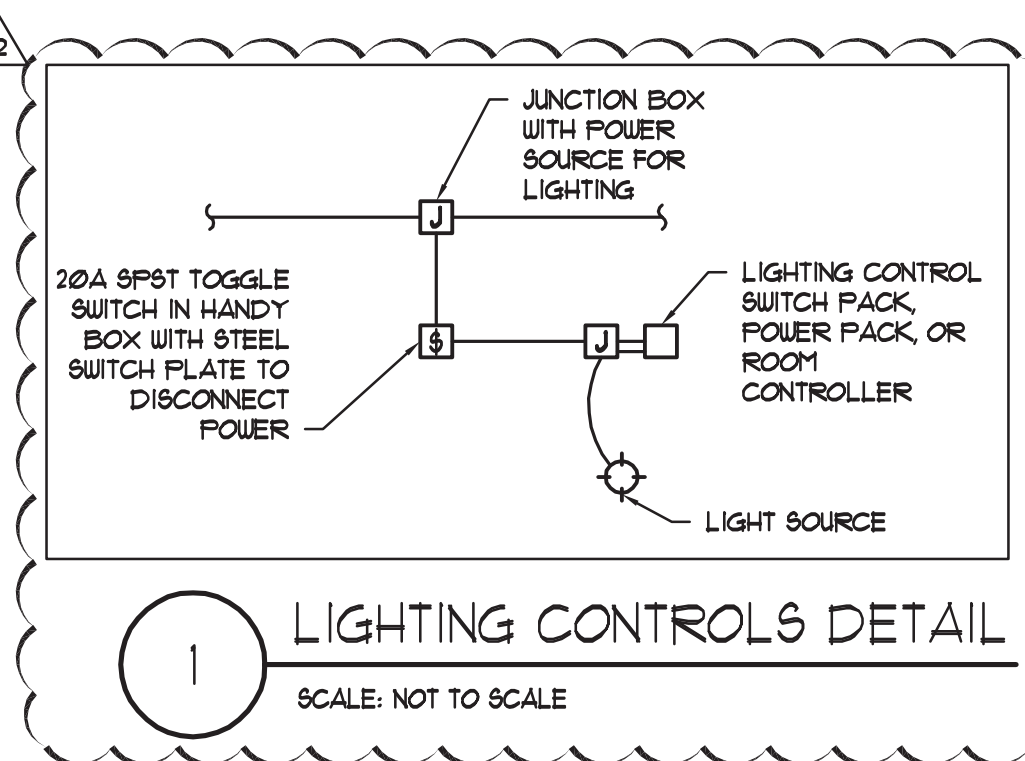
- PROVIDE OUTLET BOX WITH 1" CONDUIT WITH FULL STRING (UNLESS NOTED OTHERWISE ON PLANS) TO 6" ABOVE ACCESSIBLE CEILING AND ROUTED TO NEAREST CORRIDOR CABLE TRAY, TELECOM HOOKS, OR TO THE TELECOM ROOM FOR ALL WALL MOUNTED VOICE/DATA AND SECURITY DEVICES.
- CONDUITS ROUTED TO CABLE TRAY SHALL MAKE A MECHANICAL CONNECTION TO THE CABLE TRAY AT THE TOP RAIL WITH A NYLON BUSHING. GAPS AND SPACES ARE NOT PERMITTED BETWEEN CONDUIT AND CABLE TRAY.
- CONDUITS ROUTED TO TELECOM HOOKS SHALL TERMINATE WITHIN 6' OF A CABLE HOOK IN THE ABOVE CEILING CORRIDOR.
- FULL BOXES SHALL BE INSTALLED FOR EVERY 180 DEGREES OF BEND IN A CONDUIT. FULL BOXES SHALL BE INSTALLED ABOVE CORRIDORS WHERE CABLE TRAYS OR CABLE HOOKS ARE NOT USED.
- WHERE IT IS NECESSARY TO AGGREGATE SEVERAL CONDUITS INTO A JUNCTION BOX, THE CONDUIT FROM THE JUNCTION BOX TO THE CABLE TRAY/HOOKS OR TELECOMMUNICATIONS ROOM SHALL BE SIZED ACCORDING TO THE NUMBER OF 1" CONDUITS BEING AGGREGATED IN ACCORDANCE WITH THE NEC CONDUIT FILL CAPACITY CHART.
- PROVIDE POWER FOR SECURITY SYSTEM DEVICES AS REQUIRED.
- CONTRACTOR SHALL COORDINATE ALL VOICE/DATA/IT CONDUIT AND CONNECTIONS WITH AUBURN UNIVERSITY OFFICE OF INFORMATION TECHNOLOGY (AU OIT) PRIOR TO ROUGH-IN.

FIRE ALARM NOTES:

- ALL NEW FIRE ALARM DEVICES SHALL BE ADA APPROVED.
- ALL FIRE ALARM DEVICES ARE TO BE CONNECTED TO THE BASE BUILDING FIRE ALARM SYSTEM BY A NICET LEVEL 3 LICENSED INSTALLER AS APPROVED BY THE UNIVERSITY.
- ADDITIONS AND ALTERATIONS TO THE FIRE ALARM SYSTEM REQUIRE TESTING, A RECORD OF COMPLETION, AND RECERTIFICATION. ADDITIONALLY, THE WORK SHALL BE PERFORMED BY QUALIFIED PERSONNEL AS DEFINED IN NFPA 72 (2010), 10.4.2.
- THE STATE OF ALABAMA CERTIFIED FIRE ALARM ACT REQUIRES THAT EVERY BUSINESS WHO INSTALLS FIRE ALARM SYSTEMS IN COMMERCIAL OCCUPANCIES MUST BE LICENSED AS A CERTIFIED FIRE ALARM CONTRACTOR. THE CONTRACTOR MUST HAVE A NICET LEVEL III TECHNICIAN IN A POSITION OF RESPONSIBILITY, AND THE LICENSE WILL BE ISSUED IN THE NAME OF THE CERTIFICATE HOLDER AND THE CONTRACTOR. THE CERTIFIED FIRE ALARM ACT ALSO REQUIRES THAT TECHNICIANS WORKING FOR THE CERTIFIED CONTRACTOR MUST HOLD A CURRENT NICET LEVEL II, OR EQUIVALENT, CERTIFICATION. THE FIRE ALARM SPECIFICATIONS SHALL REQUIRE CONTRACTORS WISHING TO BID ON FIRE ALARM WORK TO SHOW EVIDENCE AT THE PRE-BID CONFERENCE THAT HE/SHE MEETS THE CERTIFICATION REQUIREMENTS OF THE ACT AND HOLDS A PERMIT ISSUED BY THE STATE FIRE MARSHAL.
- CONTRACTOR TO VERIFY EXISTING FIRE ALARM SYSTEM IS MONITORED BY AN APPROVED SUPERVISING STATION IN ACCORDANCE WITH NFPA 72.
- REMOVE ALL FIRE ALARM SMOKE DETECTORS IN THE CONSTRUCTION AREA TO AVOID GETTING DUST OR DIRT IN THE SMOKE DETECTORS. DUCT MOUNTED SMOKE DETECTORS WILL SAMPLE DUST DURING THE CONSTRUCTION PROCESS. POWER DOWN AIR HANDLING UNITS UNTIL CONSTRUCTION IS COMPLETE.
- SPEAKER: SPEAKER NOTIFICATION APPLIANCES SHALL BE LISTED TO UL 1480. THE SPEAKER SHALL OPERATE ON A STANDARD 250V RMS OR 120V RMS NAC USING TWISTED/SHIELDED WIRE. THE FOLLOWING TAPS ARE AVAILABLE: 0.35W, 0.35W/10W AND 2.0W. AT THE LOW TAP, THE SPEAKER HAS MINIMUM UL RATED SOUND PRESSURE LEVEL OF 84DBA AT 10 FEET. THE SPEAKER SHALL HAVE A FREQUENCY RESPONSE OF 400 TO 4000 HZ FOR FIRE ALARM AND 125 TO 12KHZ FOR GENERAL SIGNALING.

PROJECT ALTERNATES NOTES:

- REFER TO ARCHITECTURAL DRAWINGS FOR MORE DETAIL ON PROJECT ALTERNATES.
- IN GENERAL, THE PROJECT ALTERNATES SHALL BE AS FOLLOWS:
 - ALTERNATE 1: RENOVATION WORK IN EXISTING BUILDING.
 - ALTERNATE 2: ADDITION OF ACUSTICAL CURTAINS, INCLUDING ALL TRACK, MOTORS, CONTROLS, AND ACCESSORIES FOR A COMPLETE INSTALLATION.
 - ALTERNATE 3: ADDITION OF LOWER LEVEL OFFICE SPACES.
 - ALTERNATE 4: NOT APPLICABLE TO ELECTRICAL CONTRACTOR.



1 LIGHTING CONTROLS DETAIL

SCALE: NOT TO SCALE

ELECTRICAL LEGEND

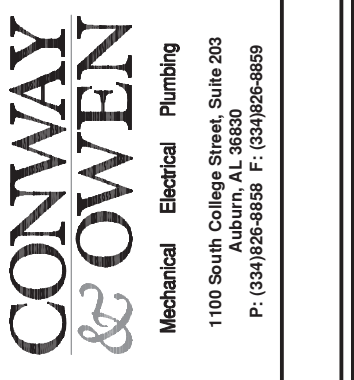
SYMBOL	DESCRIPTION	MOUNTING HEIGHT ON CENTER (COORD. WITH ARCH)
☐	FLUORESCENT LIGHT FIXTURE	
⬮	EMERGENCY LIGHT FIXTURE	
○	CEILING MOUNTED LIGHT FIXTURE	
○	CEILING MOUNTED WALL WASH LIGHT FIXTURE	
⊗	EXIT SIGN (PROVIDE FACES AND ARROWS AS SHOWN)	
⊗	WALL MOUNTED EXIT SIGN (PROVIDE FACES AND ARROWS AS SHOWN)	
~	CONDUIT RUN CONCEALED IN WALL OR CEILING	
~	CONDUIT RUN CONCEALED IN THE FLOOR, UNDERGROUND, OR UNDER THE ELEVATED SLAB	
~	CONDUIT RUN EXPOSED. ROUTE PARALLEL/PERPENDICULAR TO WALLS AND STRUCTURE.	
~	CIRCUITS HOMERUN TO THE PANEL	
	NUMBER OF CONDUCTORS (GROUND NOT SHOWN)	
~~~~	FLEXIBLE CONDUIT OR CORD	
▬	FLYWOOD BACKBOARD	
⊕	DUPLEX RECEPTACLE - WALL MOUNTED	18"
⊕	CONTROLLED DUPLEX RECEPTACLE - WALL MOUNTED - HUBBELL B7R2C2GRY OR EQUAL	18"
⊕ or ⊕	ISOLATED GROUND DUPLEX RECEPTACLE - WALL MOUNTED	18"
⊕ or GFI	GFCI DUPLEX RECEPTACLE - WALL MOUNTED	18"
⊕	OUTLET ABOVE THE COUNTER	6" ABOVE COUNTER
⊕	QUADRUPLER RECEPTACLE - WALL MOUNTED	18"
⊕	SPECIAL AMP/VOLT RECEPTACLE - WALL MOUNTED	18"
⊕	VOICE AND DATA OUTLET - WALL MOUNTED	18"
⊕	TELEVISION CABLE OUTLET - PROVIDE CABLE	18"
⊕	JUNCTION BOX	
⊕	JUNCTION BOX - WALL MOUNTED	
↔	9PST SWITCH - WALL MOUNTED	48"
↔	3-WAY SWITCH - WALL MOUNTED	48"
↔	DIMMER SWITCH - WALL MOUNTED (PROVIDE WATTAGE AS REQUIRED)	48"
↔	LOW-VOLTAGE DIMMER SWITCH - WALL MOUNTED (PROVIDE WATTAGE AS REQUIRED)	48"
⊕	WALL MOUNTED OCCUPANCY SENSOR - WATTSTOPPER DW-31L COLOR TO MATCH STANDARD OUTLETS	48"
⊕	CEILING MOUNTED OCCUPANCY SENSOR - WATTSTOPPER CI-200. PROVIDE ACCESSORIES AS REQ'D. PROVIDE WITH CONTACT FOR JOHNSON CONTROLS INTERFACE	
⊕	211/480 VOLT PANELBOARD OR DISTRIBUTION PANEL	
⊕	120/208 VOLT PANELBOARD OR DISTRIBUTION PANEL	
⊕	DISCONNECT (FRAME AND POLES TO MATCH OCP OR AS NOTED)	
⊕	FIRE ALARM FULL STATION - WALL MOUNTED	48" AFF TO TOP OF BOX
⊕	FIRE ALARM ADA APPROVED AUDIO/VISUAL (110cd) - PROVIDE SEPARATE AMBER STROBE DEVICE AT EACH LOCATION	80" AFF TO BOTTOM OF VISUAL
⊕	FIRE ALARM ADA APPROVED VISUAL ONLY (110cd) - PROVIDE SEPARATE AMBER STROBE DEVICE AT EACH LOCATION	80" AFF TO BOTTOM OF VISUAL
⊕	FIRE ALARM ADA APPROVED AUDIO ONLY	
⊕	FIRE ALARM FULL STATION AT 48" AFF TO TOP OF BOX AND AUDIO/VISUAL AT 80" AFF TO BOTTOM OF VISUAL. PROVIDE SEPARATE AMBER STROBE DEVICE AT EACH LOCATION.	
⊕	SMOKE DETECTOR - CEILING MOUNTED	
⊕	SMOKE DETECTOR OR DUCT MOUNTED SMOKE DETECTOR IN RETURN AIR PATH PER NFPA	
AC	ABOVE COUNTER	
AFF	ABOVE FINISHED FLOOR	
BFG	BELOW FINISHED GRADE	
E / R	EXISTING / RELOCATED	
FAA	FIRE ALARM ANNUNCIATOR PANEL	
FACP	FIRE ALARM CONTROL PANEL	
UNO	UNLESS NOTED OTHERWISE	
W/P	WEATHER PROOF	
XPR	TRANSFORMER	



AUBURN UNIVERSITY

Facilities Management  
 1161 West Samford Avenue  
 Auburn University, AL 36849  
 Phone: (334) 844-4810  
 Fax: (334) 844-9458  
*Safety is our first priority.  
 Think Safety. Act Safely.*

No.	Revision	Date
1	ABC Comments	07/11/2017
2	Addendum 2	07/12/2017



**GOODWIN HALL - RENOVATION  
 AND  
 BAND REHEARSAL HALL ADDITION**  
 Project Number 15-255

SHEET TITLE:  
 LEGEND AND NOTES - ELECTRICAL

DRAWN BY:  
 ATS  
 CHECKED BY:  
 CC  
 DATE:  
 6-14-2017  
 FILE NUMBER:  
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 PROJECT NUMBER:  
 15-255  
 SHEET NUMBER:

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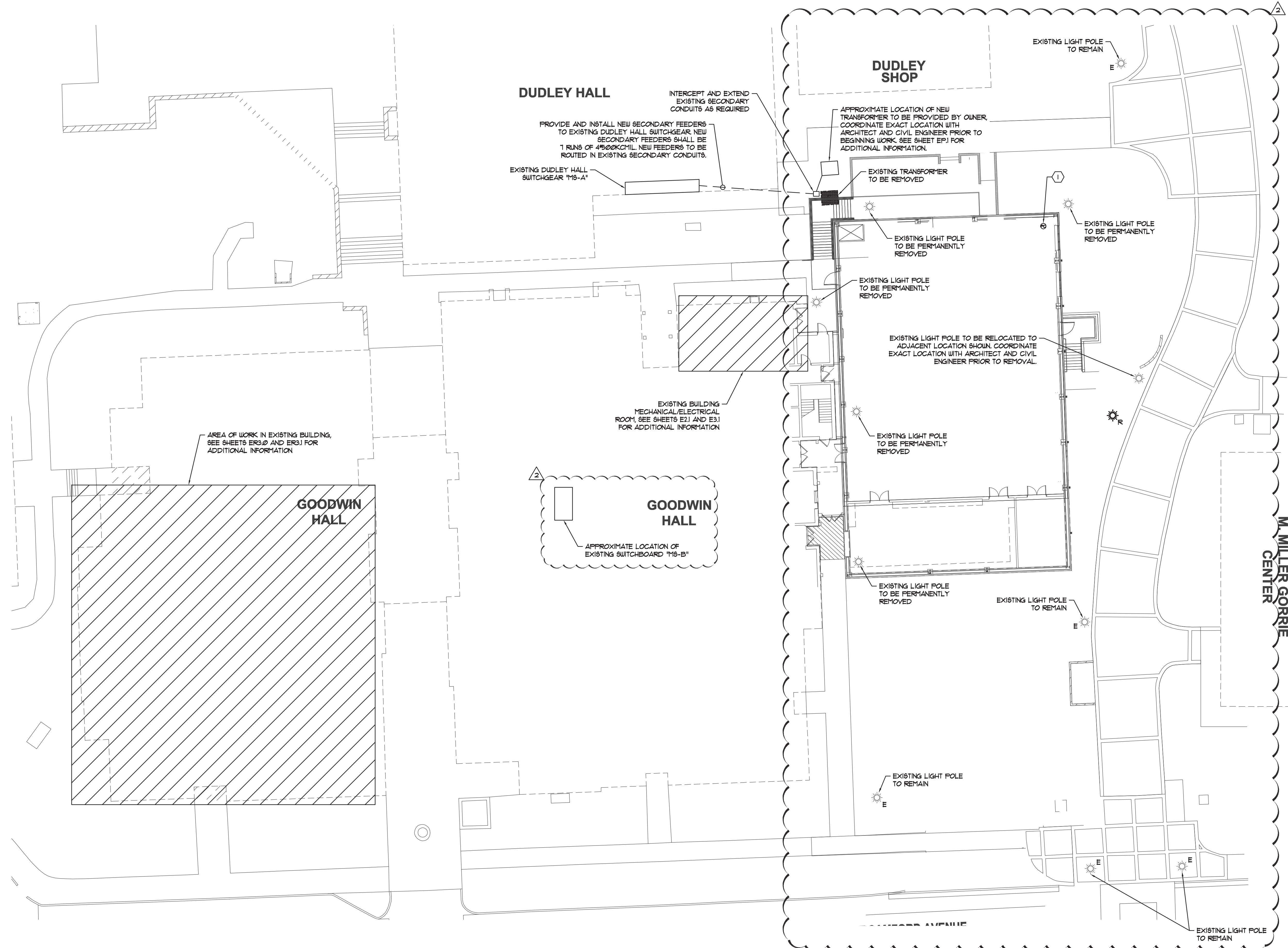


**GENERAL NOTES:** (APPLY TO THIS SHEET ONLY)

1. LABEL PANELBOARD SCHEDULES PER NEC 408.4. CONTRACTOR SHALL IDENTIFY ALL SPARE BREAKERS AND MOVE THEM TO THE "OFF" POSITION.
2. ALL BRANCH CIRCUITS SHALL BE WIRED ¾" C, 2-#12, 1-#12G MINIMUM. UNLESS OTHERWISE NOTED ON THE PLANS, ALL HOMERUNS SHALL BE A MINIMUM ¾" CONDUIT. PROVIDE ADDITIONAL GROUND OF EQUAL SIZE FOR ISOLATED GROUND CIRCUITS.

**KEY NOTES:** (APPLY TO THIS SHEET ONLY)

1. PROVIDE AND INSTALL PHOTOCELL ON NORTH-FACING ROOF TO INTERFACE WITH LIGHTING CONTROL PANEL FOR CONTROL OF EXTERIOR LIGHTING. COORDINATE EXACT LOCATION WITH ARCHITECT PRIOR TO ROUGH-IN.



**SITE PLAN - ELECTRICAL**  
SCALE: 1/16" = 1'-0"  
NORTH

**AUBURN UNIVERSITY**  
Facilities Management  
1161 West Samford Avenue  
Auburn University, AL 36849  
Phone: (334) 844-4810  
Fax: (334) 844-9458  
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No.	Revision	Date
1	ABC Comments	07/11/2017
2	Addendum 2	07/12/2017

REGISTERED PROFESSIONAL ENGINEER  
ELECTRICAL  
CONWAY & OWEN  
FE# 207153 07/12/2011

**CONWAY & OWEN**  
Mechanical Electrical Plumbing  
1100 South College Street, Suite 200  
Auburn, AL 36849  
P: (334) 844-9458 F: (334) 844-9459

**GOODWIN HALL - RENOVATION AND BAND REHEARSAL HALL ADDITION**  
Project Number 15-255

SHEET TITLE:  
SITE PLAN - ELECTRICAL

DRAWN BY:  
ATS

CHECKED BY:  
CC

DATE:  
6-14-2017

FILE NUMBER:  
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PROJECT NUMBER:  
15-255

SHEET NUMBER:

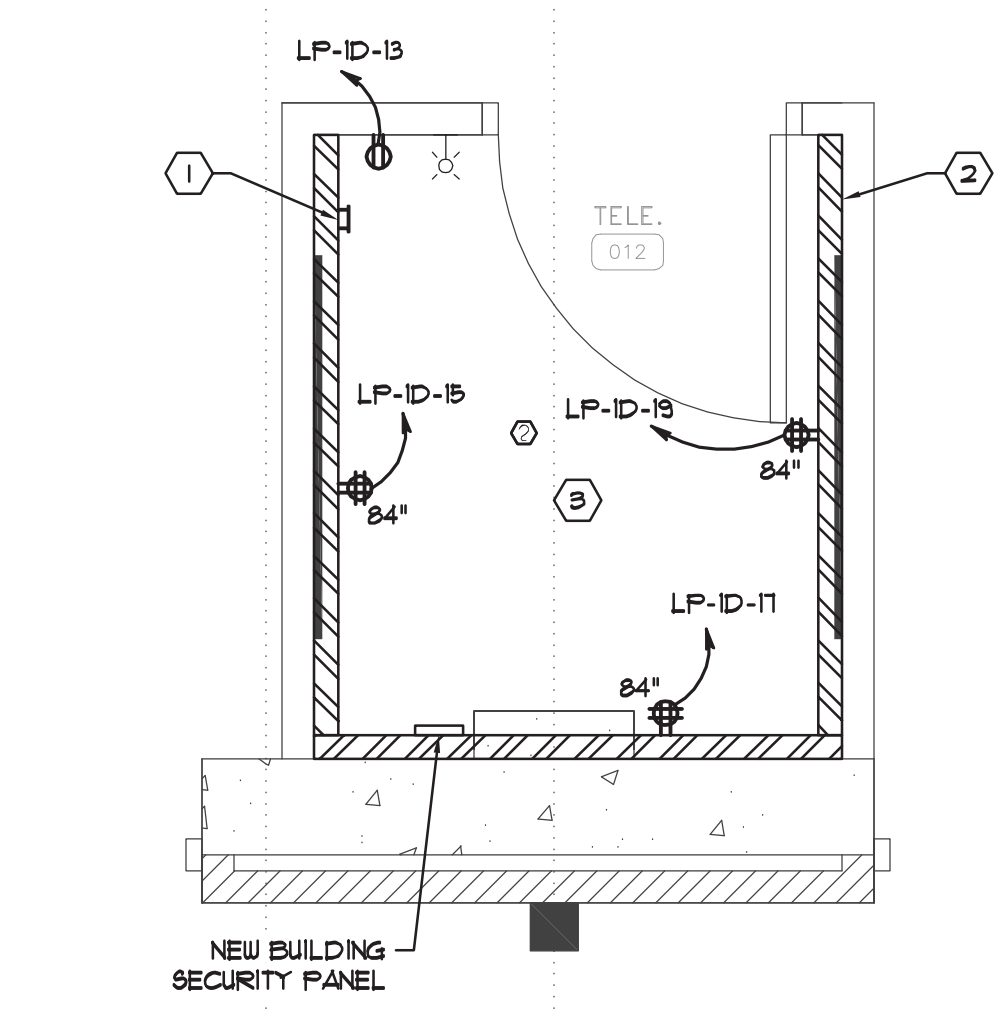
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**GENERAL NOTES: (APPLY TO THIS SHEET ONLY)**

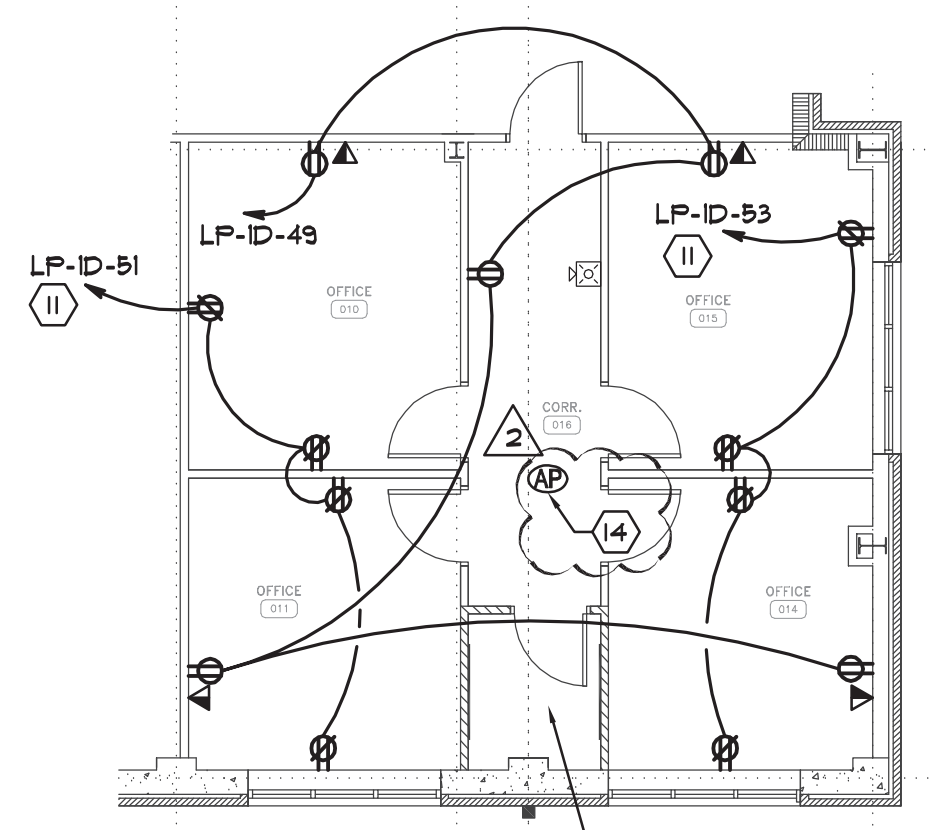
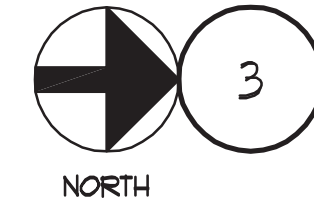
1. IN AREAS OTHER THAN THE TELECOMMUNICATIONS ROOM, COORDINATE THE EXACT LOCATION OF ALL DEVICES (RECEPTACLES, LOW VOLTAGE, FIRE ALARM, ETC.) WITH ARCHITECT PRIOR TO ROUGH-IN IN ORDER TO COORDINATE WITH CASEWORK AND OTHER ITEMS.
2. LABEL PANELBOARD SCHEDULES PER NEC 408.4. CONTRACTOR SHALL IDENTIFY ALL SPARE BREAKERS AND MOVE THEM TO THE "OFF" POSITION.
3. DO NOT MOUNT OUTLETS BACK TO BACK, OFFSET TO NEXT STUD SPACE.
4. ALL BRANCH CIRCUITS SHALL BE WIRED 1/2" C. 2-#12, 1-#10 MINIMUM, UNLESS OTHERWISE NOTED ON THE PLANS. ALL HOMERUNS SHALL BE A MINIMUM 3/4" CONDUIT. PROVIDE ADDITIONAL GROUND OF EQUAL SIZE FOR ISOLATED GROUND CIRCUITS.
5. WHERE ELECTRONIC DOOR HARDWARE IS INSTALLED, COORDINATE EXACT CONNECTION REQUIREMENTS WITH EQUIPMENT MANUFACTURER PRIOR TO ROUGH-IN. CONTRACTOR SHALL PROVIDE RELAY AND ASSOCIATED WIRING TO CONNECT ELECTRONIC DOOR HARDWARE INTO FIRE ALARM SYSTEM SO THAT UPON ACTIVATION OF THE FIRE ALARM SYSTEM, DOOR LOCKS WILL RELEASE FOR EMERGENCY EGRESS.

**KEY NOTES (APPLY TO THIS SHEET ONLY)**

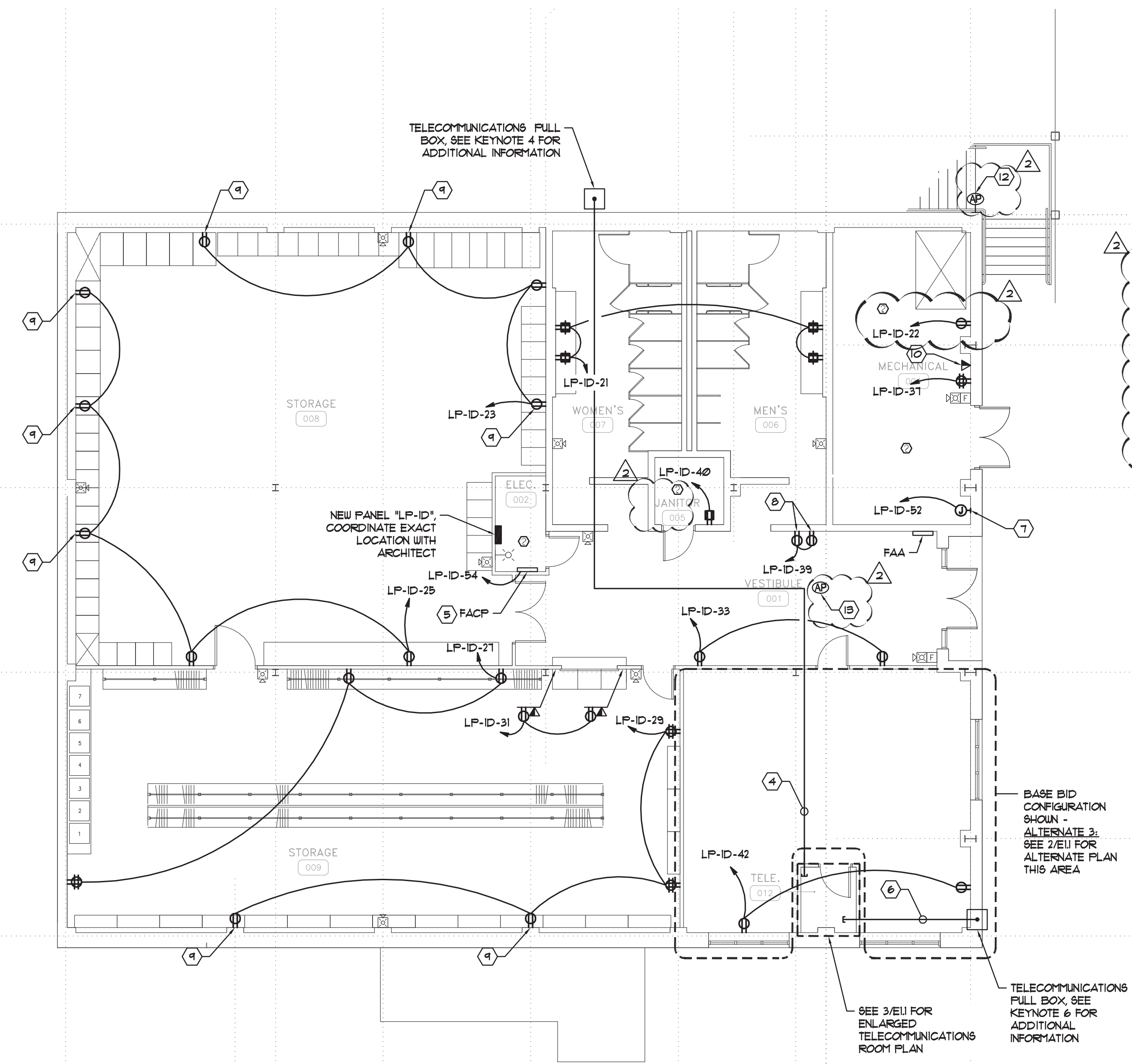
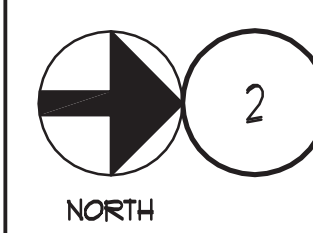
1. PROVIDE AND INSTALL 1/4" X 2" X 12" COPPER BUSBAR WITH STAND-OFF BUSHINGS (ERICO #EGBA1422EE OR EQUAL) WITH #6, 3/4" C. TO EXISTING BUILDING GROUND. COORDINATE EXACT TERMINATION LOCATION WITH AU OIT PRIOR TO ROUGH-IN.
2. IN TELECOMMUNICATIONS ROOM, PROVIDE AND INSTALL TELECOM BACKBOARD MOUNTED TO ALL WALLS. TELECOM BACKBOARD SHALL BE CONSTRUCTED OF 3/4" AC-GRADE PLYWOOD PAINTED ON ALL SIDES. THE BACKBOARD SHALL BE OF EITHER FIRE-RETARDANT PLYWOOD OR PAINTED WITH TWO COATS OF FIRE-RESISTANT PAINT. THE PLYWOOD SHOULD BE MOUNTED VERTICALLY TO ALL WALLS IN THE TELECOMMUNICATIONS ROOM WITH TOGGLE OR BUTTERFLY BOLTS.
3. PROVIDE AND INSTALL A WIRE BASKET-TYPE CABLE TRAY AT THE TOP OF THE TELECOM BACKBOARD. ANY CONDUITS THAT ENTER THE ROOM SHALL BE CONNECTED TO THE CABLE TRAY BY A DIRECT MECHANICAL CONNECTION. CABLE TRAY TO BE MINIMUM 4" X 12" CABLOFIL #CF105 OR EXACT EQUIVALENT WIRE BASKET TRAY.
4. PROVIDE AND INSTALL (1) 4" CONDUIT WITH FULL-STRING FROM MAIN BUILDING TELECOMMUNICATIONS ROOM. PROPOSED ROUTING SHOWN. SEE SHEET E12 FOR CONTINUATION. COORDINATE EXACT LOCATION AND ROUTING WITH ARCHITECT PRIOR TO ROUGH-IN. COORDINATE INSTALLATION WITH AU OIT, PROVIDE FULL-BOXES AS REQUIRED.
5. PROVIDE AND INSTALL 3/4" C. WITH FULL-STRING FROM FIRE ALARM CONTROL PANEL TO TELECOMMUNICATIONS ROOM. COORDINATE EXACT LOCATION AND ROUTING WITH ARCHITECT PRIOR TO ROUGH-IN. CONNECT TO GOODWIN EXISTING BUILDING FIRE ALARM CONTROL PANEL.
6. PROVIDE AND INSTALL (2) 1" CONDUIT WITH FULL-STRING FROM TELECOMMUNICATIONS ROOM TO ANY CABINET ON FIRST FLOOR. PROPOSED ROUTING SHOWN. SEE SHEET E12 FOR CONTINUATION. COORDINATE EXACT LOCATION AND ROUTING WITH ARCHITECT PRIOR TO ROUGH-IN. COORDINATE INSTALLATION WITH AU OIT, PROVIDE FULL-BOXES AS REQUIRED.
7. PROVIDE AND INSTALL JUNCTION BOX FOR CONNECTION TO IRRIGATION SYSTEM POWER. COORDINATE EXACT LOCATION AND CONNECTION REQUIREMENTS WITH ARCHITECT PRIOR TO ROUGH-IN.
8. PROVIDE AND INSTALL RECEPTACLES TO SERVE ELECTRIC DRINKING FOUNTAIN. INSTALL RECEPTACLES IN LOCATIONS INDICATED ON DRINKING FOUNTAIN SHOP DRAWINGS CONCEALED BEHIND ADA COVER. RECEPTACLES SHALL BE PROTECTED BY A GFCI BREAKER.
9. RECEPTACLES TO BE MOUNTED IN BASEBOARD TO COORDINATE WITH CASEWORK. COORDINATE EXACT LOCATION WITH ARCHITECT PRIOR TO ROUGH-IN.
10. PROVIDE AND INSTALL DATA CONNECTION FOR BUILDING AUTOMATION SYSTEM CONTROL PANEL. CONDUIT SHALL BE CONNECTED DIRECTLY TO THE CONTROL PANEL BOX. COORDINATE EXACT LOCATION WITH ARCHITECT PRIOR TO ROUGH-IN.
11. ALTERNATE 3: CIRCUIT TO BE ROUTED THROUGH LIGHTING CONTROL PANEL FOR THE CONTROL. COORDINATE TIME SETTINGS WITH OWNER. SEE SHEET E01 FOR LIGHTING CONTROL PANEL DETAILS. ALL CONTROLLED RECEPTACLES SHALL BE PERMANENTLY MARKED TO VISUALLY DIFFERENTIATE THEM FROM UNCONTROLLED RECEPTACLES.
12. PROVIDE AND INSTALL WALL-MOUNTED JUNCTION BOX FOR CONNECTION TO OUTDOOR WIRELESS ACCESS POINT. PROVIDE AND INSTALL A 1" CONDUIT WITH FULL-STRING TO LOWER LEVEL TELECOMMUNICATIONS ROOM. COORDINATE EXACT LOCATION AND CONNECTION REQUIREMENTS WITH AU OIT PRIOR TO ROUGH-IN.
13. IN BASE BID (DO NOT INSTALL IF ALTERNATE 3 IS ACCEPTED), PROVIDE AND INSTALL CEILING-MOUNTED JUNCTION BOX FOR CONNECTION TO WIRELESS ACCESS POINT. PROVIDE AND INSTALL A 1" CONDUIT WITH FULL-STRING TO LOWER LEVEL TELECOMMUNICATIONS ROOM. COORDINATE EXACT LOCATION AND CONNECTION REQUIREMENTS WITH AU OIT PRIOR TO ROUGH-IN.
14. ALTERNATE 3: PROVIDE AND INSTALL CEILING-MOUNTED JUNCTION BOX FOR CONNECTION TO WIRELESS ACCESS POINT. PROVIDE AND INSTALL A 1" CONDUIT WITH FULL-STRING TO LOWER LEVEL TELECOMMUNICATIONS ROOM. COORDINATE EXACT LOCATION AND CONNECTION REQUIREMENTS WITH AU OIT PRIOR TO ROUGH-IN.



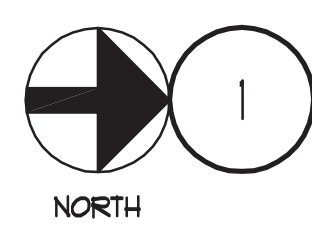
**ENLARGED TELECOMMUNICATIONS ROOM PLAN - ELECTRICAL**  
SCALE: 1/2" = 1'-0"



**PARTIAL FLOOR PLAN - ALTERNATE 3 - ELECTRICAL**  
SCALE: 1/8" = 1'-0"



**NEW BUILDING LOWER FLOOR PLAN - ELECTRICAL**  
SCALE: 1/8" = 1'-0"



**AUBURN UNIVERSITY**  
Facilities Management  
1161 West Samford Avenue  
Auburn University, AL 36849  
Phone: (334) 844-4810  
Fax: (334) 844-9458  
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No.	Revision	Date
1	ABC Comments	07/11/2017
2	Addendum 2	07/12/2017



**GOODWIN HALL - RENOVATION AND BAND REHEARSAL HALL ADDITION**  
Project Number 15-255

SHEET TITLE:  
LOWER FLOOR PLAN - ELECTRICAL

DRAWN BY:  
ATS  
CHECKED BY:  
CC  
DATE:  
6-14-2017  
FILE NUMBER:  
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PROJECT NUMBER:  
15-255  
SHEET NUMBER:

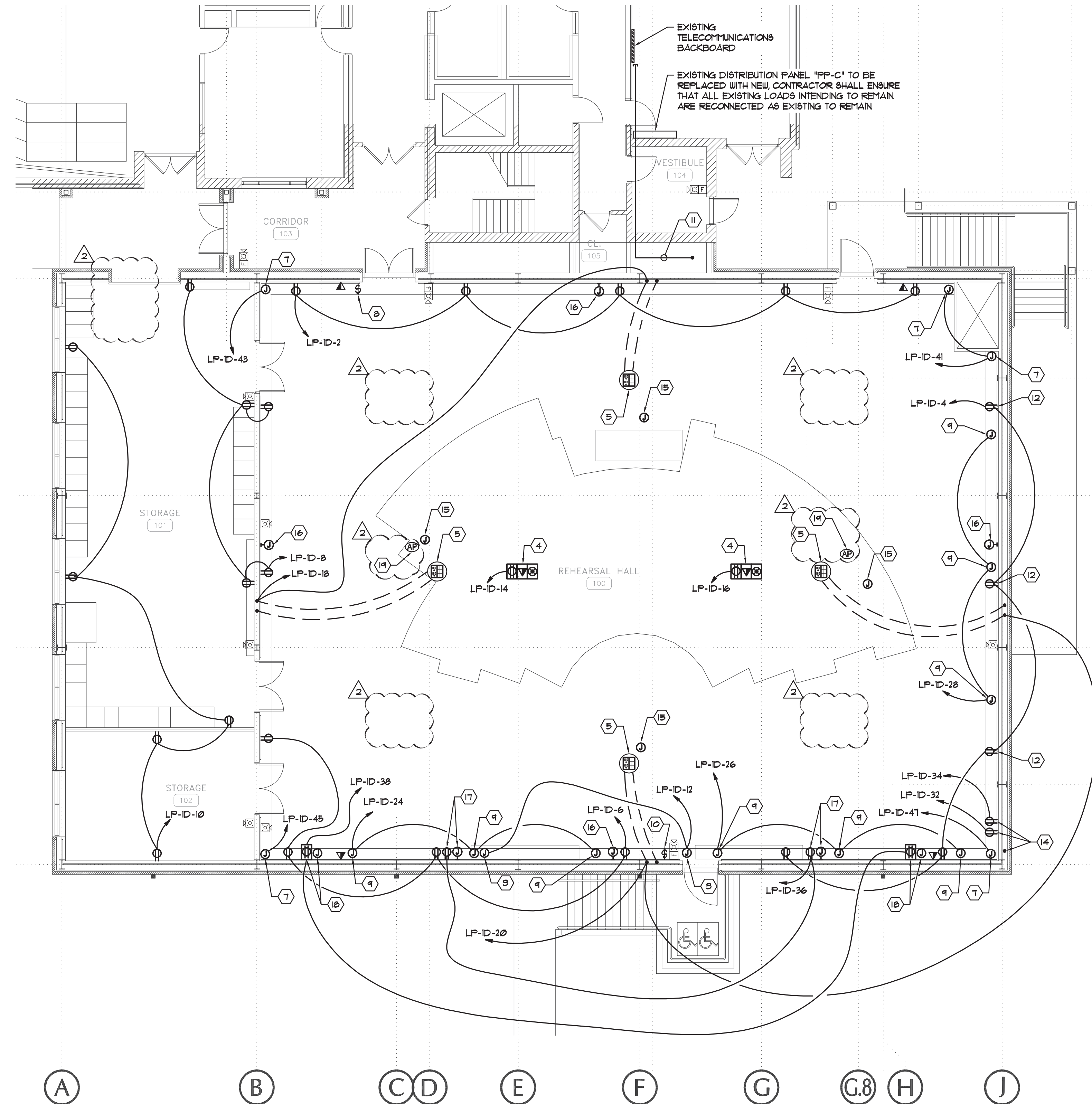
**E1.1**

**GENERAL NOTES:** (APPLY TO THIS SHEET ONLY)

1. COORDINATE EXACT LOCATION OF ALL DEVICES WITH CASEWORK AND WALL TYPES WITH ARCHITECT PRIOR TO ROUGH-IN. PROVIDE ELECTRICAL BOX EXTENDERS AS REQUIRED.
2. LABEL PANELBOARD SCHEDULES PER NEC 408.4. CONTRACTOR SHALL IDENTIFY ALL SPARE BREAKERS AND MOVE THEM TO THE "OFF" POSITION.
3. DO NOT MOUNT OUTLETS BACK TO BACK, OFFSET TO NEXT STUD SPACE.
4. ALL BRANCH CIRCUITS SHALL BE WIRED 3/4" C, 2-#2, 1-#12G MINIMUM, UNLESS OTHERWISE NOTED ON THE PLANS. ALL HOMERUNS SHALL BE A MINIMUM 3/4" CONDUIT. PROVIDE ADDITIONAL GROUND OF EQUAL SIZE FOR ISOLATED GROUND CIRCUITS.
5. WHERE ELECTRONIC DOOR HARDWARE IS INSTALLED, COORDINATE EXACT CONNECTION REQUIREMENTS WITH EQUIPMENT MANUFACTURER PRIOR TO ROUGH-IN. CONTRACTOR SHALL PROVIDE RELAY AND ASSOCIATED WIRING TO CONNECT ELECTRONIC DOOR HARDWARE INTO FIRE ALARM SYSTEM SO THAT UPON ACTIVATION OF THE FIRE ALARM SYSTEM, DOOR LOCKS WILL RELEASE FOR EMERGENCY EGRESS.

**KEY NOTES:** (APPLY TO THIS SHEET ONLY)

- 1 NOT USED.
- 2 NOT USED.
- 3 PROVIDE AND INSTALL CEILING MOUNTED JUNCTION BOX FOR MOTORIZED PROJECTOR SCREEN. PROVIDE AND INSTALL 1" CONDUIT WITH FULL-STRING TO A/V RACK LOCATION (KEYNOTE 14). COORDINATE EXACT LOCATION AND CONNECTION REQUIREMENTS WITH ARCHITECT PRIOR TO ROUGH-IN.
- 4 PROVIDE AND INSTALL CEILING MOUNTED JUNCTION BOX FOR POWER/DATA CONNECTION TO PROJECTOR. PROVIDE AND INSTALL 1" CONDUIT WITH FULL-STRING ROUTED BACK TO LOWER LEVEL TELECOMMUNICATIONS ROOM FOR LOW VOLTAGE CONNECTIONS. PROVIDE AND INSTALL 1" CONDUIT WITH FULL-STRING TO A/V RACK LOCATION (KEYNOTE 14). COORDINATE EXACT LOCATION AND CONNECTION REQUIREMENTS WITH ARCHITECT PRIOR TO ROUGH-IN.
- 5 PROVIDE AND INSTALL WIREMOLD POKE THROUGH RECA/TCBK OR APPROVED EQUAL FLOOR BOX TO HAVE A MINIMUM OF 1 QUADRIPLEX POWER AND 4 DATA PORTS. PROVIDE AND INSTALL 1" CONDUIT WITH FULL-STRING ROUTED BACK TO LOWER LEVEL TELECOMMUNICATIONS ROOM FOR LOW VOLTAGE CONNECTIONS. PROVIDE AND INSTALL 1" CONDUIT WITH FULL-STRING TO A/V RACK LOCATION (KEYNOTE 14). COORDINATE EXACT QUANTITY AND LOCATION WITH ARCHITECT PRIOR TO ROUGH-IN.
- 6 NOT USED.
- 7 ALTERNATE 2: PROVIDE AND INSTALL JUNCTION BOX FOR CONNECTION TO MOTORIZED CURTAINS. COORDINATE EXACT LOCATION, QUANTITY, CONNECTION, AND CONTROL REQUIREMENTS WITH ARCHITECT PRIOR TO ROUGH-IN.
- 8 ALTERNATE 2: PROVIDE AND INSTALL (4) CONTROL SWITCHES FOR MOTORIZED CURTAINS INDICATED IN KEYNOTE 1. COORDINATE EXACT QUANTITY, LOCATION, AND CONNECTION REQUIREMENTS WITH ARCHITECT PRIOR TO ROUGH-IN.
- 9 PROVIDE AND INSTALL JUNCTION BOX FOR CONNECTION TO MOTORIZED SHADES. COORDINATE EXACT LOCATION, QUANTITY, CONNECTION, AND CONTROL REQUIREMENTS WITH ARCHITECT PRIOR TO ROUGH-IN.
- 10 PROVIDE AND INSTALL (2) CONTROL SWITCHES FOR MOTORIZED SHADES INDICATED IN KEYNOTE 9. COORDINATE EXACT QUANTITY, LOCATION, AND CONNECTION REQUIREMENTS WITH ARCHITECT PRIOR TO ROUGH-IN.
- 11 TELECOMMUNICATIONS CONDUIT, PROPOSED ROUTING SHOWN. SEE SHEET E11 FOR CONTINUATION AND ADDITIONAL INFORMATION. COORDINATE EXACT LOCATION AND ROUTING WITH ARCHITECT PRIOR TO ROUGH-IN.
- 12 RECEPTACLES TO BE MOUNTED IN BASEBOARD TO COORDINATE WITH WALL-MOUNTED MIRROR. COORDINATE EXACT LOCATION WITH ARCHITECT PRIOR TO ROUGH-IN.
- 13 NOT USED.
- 14 A/V RACK LOCATION, PROPOSED CONDUIT ROUTING SHOWN. SEE SHEET E11 FOR CONTINUATION AND ADDITIONAL INFORMATION. PROVIDE AND INSTALL (2) DEDICATED RECEPTACLES ON ADJACENT WALL FOR A/V RACK POWER. COORDINATE EXACT LOCATION AND ROUTING WITH ARCHITECT PRIOR TO ROUGH-IN.
- 15 PROVIDE AND INSTALL CEILING-MOUNTED JUNCTION BOX FOR CONNECTION TO A/V MICROPHONE. PROVIDE AND INSTALL 1" CONDUIT WITH FULL-STRING TO A/V RACK LOCATION (KEYNOTE 14). COORDINATE EXACT LOCATION AND CONNECTION REQUIREMENTS WITH ARCHITECT PRIOR TO ROUGH-IN.
- 16 PROVIDE AND INSTALL JUNCTION BOX AT 96" AFF FOR CONNECTION TO A/V CAMERA. PROVIDE AND INSTALL 1" CONDUIT WITH FULL-STRING TO A/V RACK LOCATION (KEYNOTE 14). COORDINATE EXACT LOCATION AND CONNECTION REQUIREMENTS WITH ARCHITECT PRIOR TO ROUGH-IN.
- 17 PROVIDE AND INSTALL JUNCTION BOX AND RECEPTACLE AT 120" AFF FOR CONNECTION TO A/V SPEAKER. PROVIDE AND INSTALL 1" CONDUIT WITH FULL-STRING TO A/V RACK LOCATION (KEYNOTE 14). COORDINATE EXACT LOCATION AND CONNECTION REQUIREMENTS WITH ARCHITECT PRIOR TO ROUGH-IN.
- 18 PROVIDE AND INSTALL CEILING-MOUNTED JUNCTION BOX AND RECEPTACLE FOR CONNECTION TO A/V SUB. PROVIDE AND INSTALL 1" CONDUIT WITH FULL-STRING TO A/V RACK LOCATION (KEYNOTE 14). COORDINATE EXACT LOCATION, CONNECTION REQUIREMENTS, AND MOUNTING REQUIREMENTS WITH ARCHITECT PRIOR TO ROUGH-IN.
- 19 PROVIDE AND INSTALL CEILING-MOUNTED JUNCTION BOX FOR CONNECTION TO WIRELESS ACCESS POINT. PROVIDE AND INSTALL 1" CONDUIT WITH FULL-STRING TO LOWER LEVEL TELECOMMUNICATIONS ROOM. COORDINATE EXACT LOCATION AND CONNECTION REQUIREMENTS WITH ARCHITECT PRIOR TO ROUGH-IN.



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

No.	Revision	Date
1	ABC Comments	07/11/2017
2	Addendum 2	07/12/2017



**GOODWIN HALL - RENOVATION AND BAND REHEARSAL HALL ADDITION**  
 Project Number 15-255

SHEET TITLE:  
 FIRST FLOOR PLAN - ELECTRICAL

DRAWN BY:  
 AT5

CHECKED BY:  
 CC

DATE:  
 6-14-2017

FILE NUMBER:  
 -

PROJECT NUMBER:  
 15-255

SHEET NUMBER:

**E1.2**

**GENERAL NOTES:** (APPLY TO THIS SHEET ONLY)

1. LABEL PANELBOARD SCHEDULES PER NEC 408.4. CONTRACTOR SHALL IDENTIFY ALL SPARE BREAKERS AND MOVE THEM TO THE "OFF" POSITION.
2. ALL BRANCH CIRCUITS SHALL BE WIRED ¾" C, 2-#12, 1-#12G MINIMUM, UNLESS OTHERWISE NOTED ON THE PLANS. ALL HOMERUNS SHALL BE A MINIMUM ¾" CONDUIT. PROVIDE ADDITIONAL GROUND OF EQUAL SIZE FOR ISOLATED GROUND CIRCUITS.

**LIGHTING CONTROL KEY NOTES** (APPLY TO THIS SHEET ONLY)

1. ROOM CONTROLLER WITH 0-10V DIMMING OUTPUTS, WATTSTOPPER #LMRC-213 OR APPROVED EQUIVALENT
2. THREE BUTTON LOW VOLTAGE ROOM CONTROLLER SWITCH, LMSU-103 OR APPROVED EQUIVALENT, BUTTONS AS FOLLOWS:
  - RAISE ALL
  - LOWER ALL
  - ALL TOGGLE ON/OFF
3. LOW VOLTAGE CEILING-MOUNTED DUAL TECHNOLOGY VACANCY SENSOR WATTSTOPPER #LMDC-100 OR APPROVED EQUIVALENT

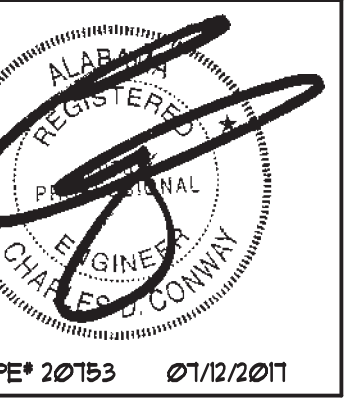
**KEY NOTES** (APPLY TO THIS SHEET ONLY)

1. EMERGENCY NIGHTLIGHT FIXTURE, CONTRACTOR SHALL CONNECT TO UN-SWITCHED "HOT" IN LIGHTING CIRCUIT.
2. EMERGENCY EGRESS LIGHTING FIXTURE, CONNECT TO SWITCHED "HOT" FOR NORMAL OPERATION AND CONNECT UN-SWITCHED "HOT" TO THE BATTERY PACK IN FIXTURE FOR CHARGING SO THAT IN THE EVENT POWER IS LOST, FIXTURE WILL TURN ON FOR EMERGENCY EGRESS LIGHTING.
3. ROUTE CIRCUIT THROUGH LIGHTING CONTROL PANEL, CONTRACTOR SHALL ROUTE UN-SWITCHED "HOT" AROUND LIGHTING CONTROL PANEL FOR EMERGENCY EGRESS LIGHTING FIXTURES SO THAT IN THE EVENT POWER IS LOST FIXTURES WILL TURN ON.
4. CONNECT TO NEAREST CORRIDOR LIGHTING CIRCUIT CONTROLLED BY LIGHTING CONTROL PANEL.
5. CONNECT TO NEAREST LIGHTING CIRCUIT WITH LOCAL OCCUPANCY SENSOR CONTROLS (TELECOM ROOM).
6. CONTRACTOR SHALL PROVIDE OVERRIDE SWITCH FOR LIGHTING CONTROL SYSTEM. SWITCH SHALL TURN LIGHTS ON/OFF DURING NORMAL BUSINESS HOURS AND OPERATE AS AN OVERRIDE SWITCH AFTER BUSINESS HOURS. REFER TO LIGHTING CONTROL PANEL ON SHEET E01 FOR ADDITIONAL INFORMATION.



**AUBURN**  
UNIVERSITY  
Facilities Management  
1161 West Samford Avenue  
Auburn University, AL 36849  
Phone: (334) 844-4810  
Fax: (334) 844-9458  
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No.	Revision	Date
1	ABC Comments	07/11/2017
2	Addendum 2	07/12/2017



FE# 207153 07/12/2011

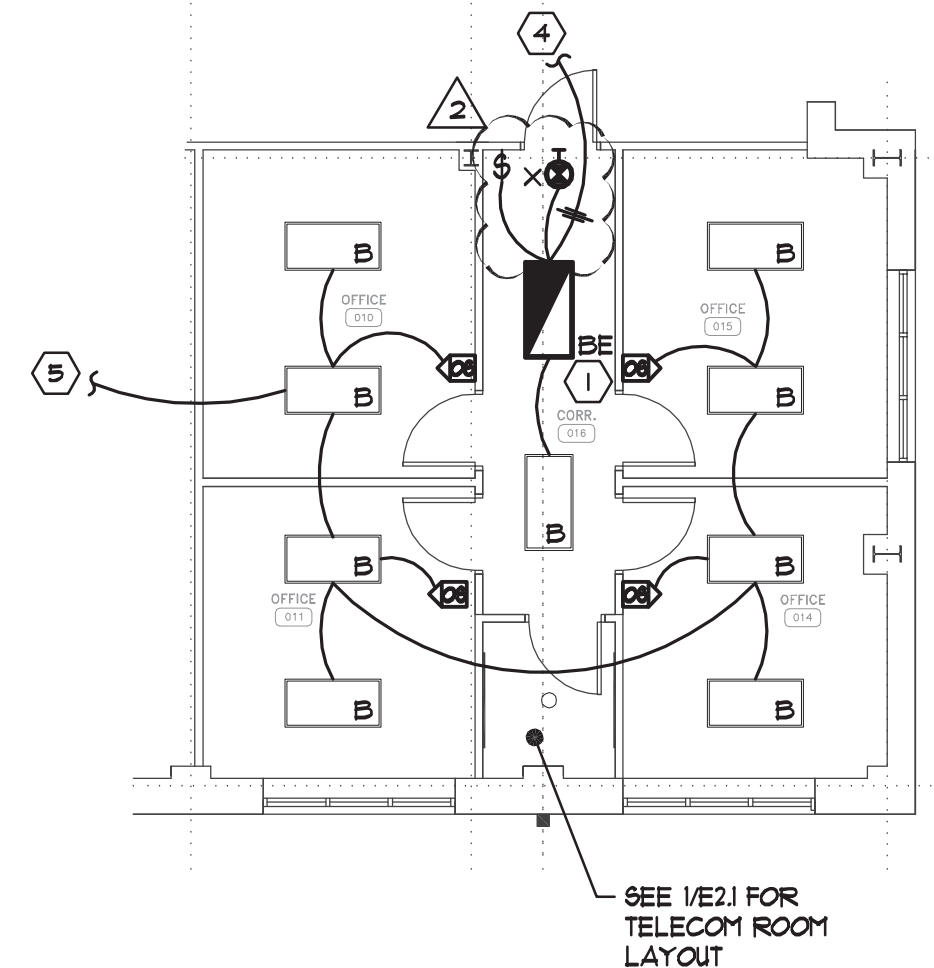
**CONWAY & OWEN**  
Mechanical Electrical Plumbing  
1105 South College Street, Suite 205  
Auburn, AL 36849  
P: (334) 844-2828 F: (334) 844-2829

**GOODWIN HALL - RENOVATION  
AND  
BAND REHEARSAL HALL ADDITION**  
Project Number 15-255

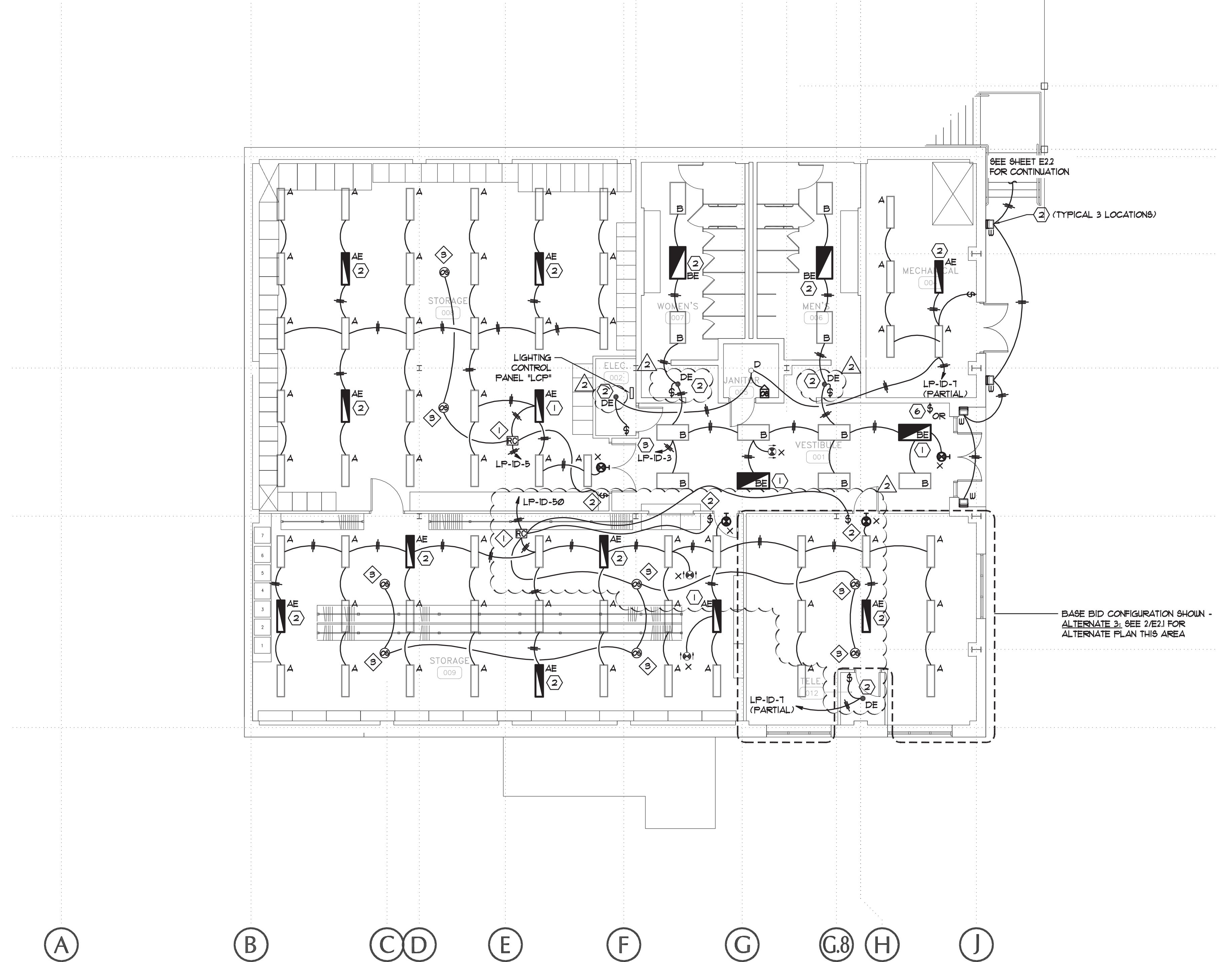
SHEET TITLE:  
LOWER FLOOR  
PLAN - LIGHTING

DRAWN BY:  
ATS  
CHECKED BY:  
CC  
DATE:  
6-14-2017  
FILE NUMBER:  
-  
PROJECT NUMBER:  
15-255  
SHEET NUMBER:

**E2.1**



**2** PARTIAL FLOOR PLAN - ALTERNATE 3 - LIGHTING  
SCALE: 1/8" = 1'-0"  
NORTH



**1** NEW BUILDING LOWER FLOOR PLAN - LIGHTING  
SCALE: 1/8" = 1'-0"  
NORTH

**GENERAL NOTES:** (APPLY TO THIS SHEET ONLY)

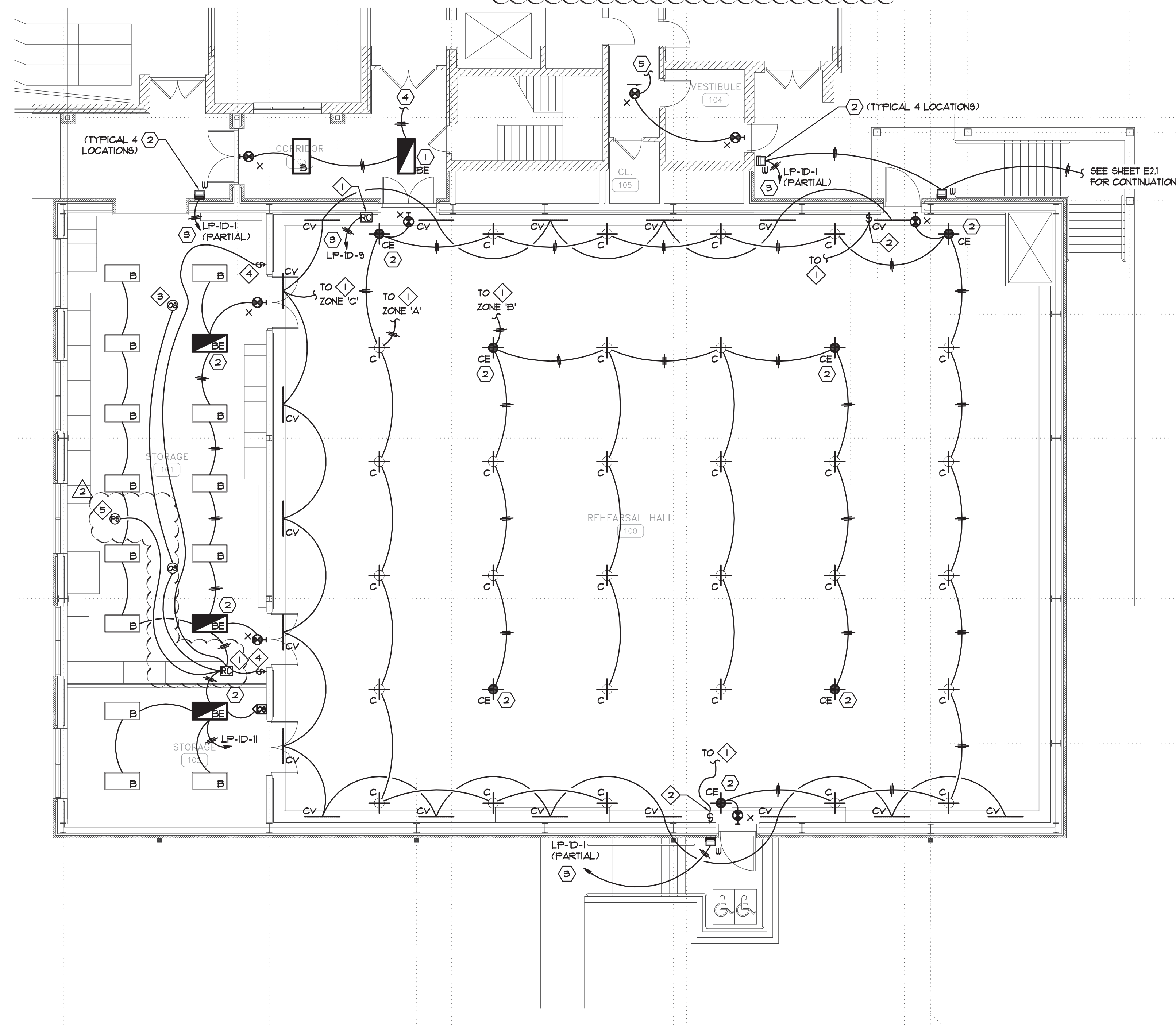
1. LABEL PANELBOARD SCHEDULES PER NEC 408.4. CONTRACTOR SHALL IDENTIFY ALL SPARE BREAKERS AND MOVE THEM TO THE "OFF" POSITION.
2. ALL BRANCH CIRCUITS SHALL BE WIRED 3/4" C, 2-#12, 1-#12G MINIMUM, UNLESS OTHERWISE NOTED ON THE PLANS. ALL HOMERUNS SHALL BE A MINIMUM 3/4" CONDUIT. PROVIDE ADDITIONAL GROUND OF EQUAL SIZE FOR ISOLATED GROUND CIRCUITS.

**LIGHTING CONTROL KEY NOTES** (APPLY TO THIS SHEET ONLY)

1. ROOM CONTROLLER WITH 0-10V DIMMING OUTPUTS, WATTSTOPPER #LMRC-213 OR APPROVED EQUIVALENT
2. EIGHT BUTTON LOW VOLTAGE ROOM CONTROLLER SWITCH, WATTSTOPPER #LMSU-100 OR APPROVED EQUIVALENT, BUTTONS AS FOLLOWS:
  - ALL OFF
  - RAISE ALL
  - LOWER ALL
  - ZONE A TOGGLE ON/OFF
  - ZONE B TOGGLE ON/OFF
  - ZONE C TOGGLE ON/OFF
  - SCENE 1 (COORDINATE SETTINGS WITH ARCHITECT/OWNER)
3. LOW VOLTAGE CEILING-MOUNTED DUAL TECHNOLOGY VACANCY SENSOR WATTSTOPPER #LMDC-100 OR APPROVED EQUIVALENT
4. THREE BUTTON LOW VOLTAGE ROOM CONTROLLER SWITCH, WATTSTOPPER #LMSU-103 OR APPROVED EQUIVALENT, BUTTONS AS FOLLOWS:
  - RAISE ALL
  - LOWER ALL
  - ALL TOGGLE ON/OFF
5. LOW VOLTAGE SINGLE-ZONE ON/OFF AND DIMMING PHOTOSENSOR, WATTSTOPPER #MLS-400 OR APPROVED EQUIVALENT.

**KEY NOTES** (APPLY TO THIS SHEET ONLY)

1. EMERGENCY NIGHTLIGHT FIXTURE, CONTRACTOR SHALL CONNECT TO UN-SWITCHED "HOT" IN LIGHTING CIRCUIT.
2. EMERGENCY EGRESS LIGHTING FIXTURE, CONNECT TO SWITCHED "HOT" FOR NORMAL OPERATION AND CONNECT UN-SWITCHED "HOT" TO THE BATTERY PACK IN FIXTURE FOR CHARGING SO THAT IN THE EVENT POWER IS LOST, FIXTURE WILL TURN ON FOR EMERGENCY EGRESS LIGHTING.
3. ROUTE CIRCUIT THROUGH LIGHTING CONTROL PANEL, CONTRACTOR SHALL ROUTE UN-SWITCHED "HOT" AROUND LIGHTING CONTROL PANEL FOR EMERGENCY EGRESS LIGHTING FIXTURES SO THAT IN THE EVENT POWER IS LOST FIXTURES WILL TURN ON.
4. CONNECT TO EXISTING CORRIDOR LIGHTING CIRCUIT AND CONTROL IN THE AREA. ROUTE UN-SWITCHED "HOT" IN CIRCUIT FOR CONNECTION TO EMERGENCY EGRESS FIXTURES AND EXIT SIGNAGE.
5. CONNECT TO UN-SWITCHED "HOT" IN EXISTING CORRIDOR LIGHTING CIRCUIT IN THE AREA FOR CONNECTION TO EMERGENCY EGRESS EXIT SIGNAGE.



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

**AUBURN UNIVERSITY**  
 Facilities Management  
 1161 West Samford Avenue  
 Auburn University, AL 36849  
 Phone: (334) 844-4810  
 Fax: (334) 844-9458  
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No.	Revision	Date
1	ABC Comments	07/11/2017
2	Addendum 2	07/12/2017

FE# 20153 07/12/2017

**CONWAY & OWEN**  
 Mechanical Electrical Plumbing  
 1100 South College Street, Suite 205  
 Auburn, AL 36809  
 P: (334) 844-9458 F: (334) 844-9459

**GOODWIN HALL - RENOVATION  
 AND  
 BAND REHEARSAL HALL ADDITION**  
 Project Number 15-255

SHEET TITLE:  
 FIRST FLOOR PLAN - LIGHTING

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 ATS

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 CC

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 15-255

SHEET NUMBER:

**E2.2**

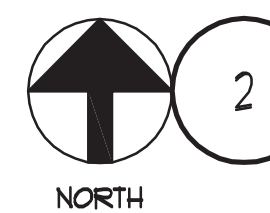
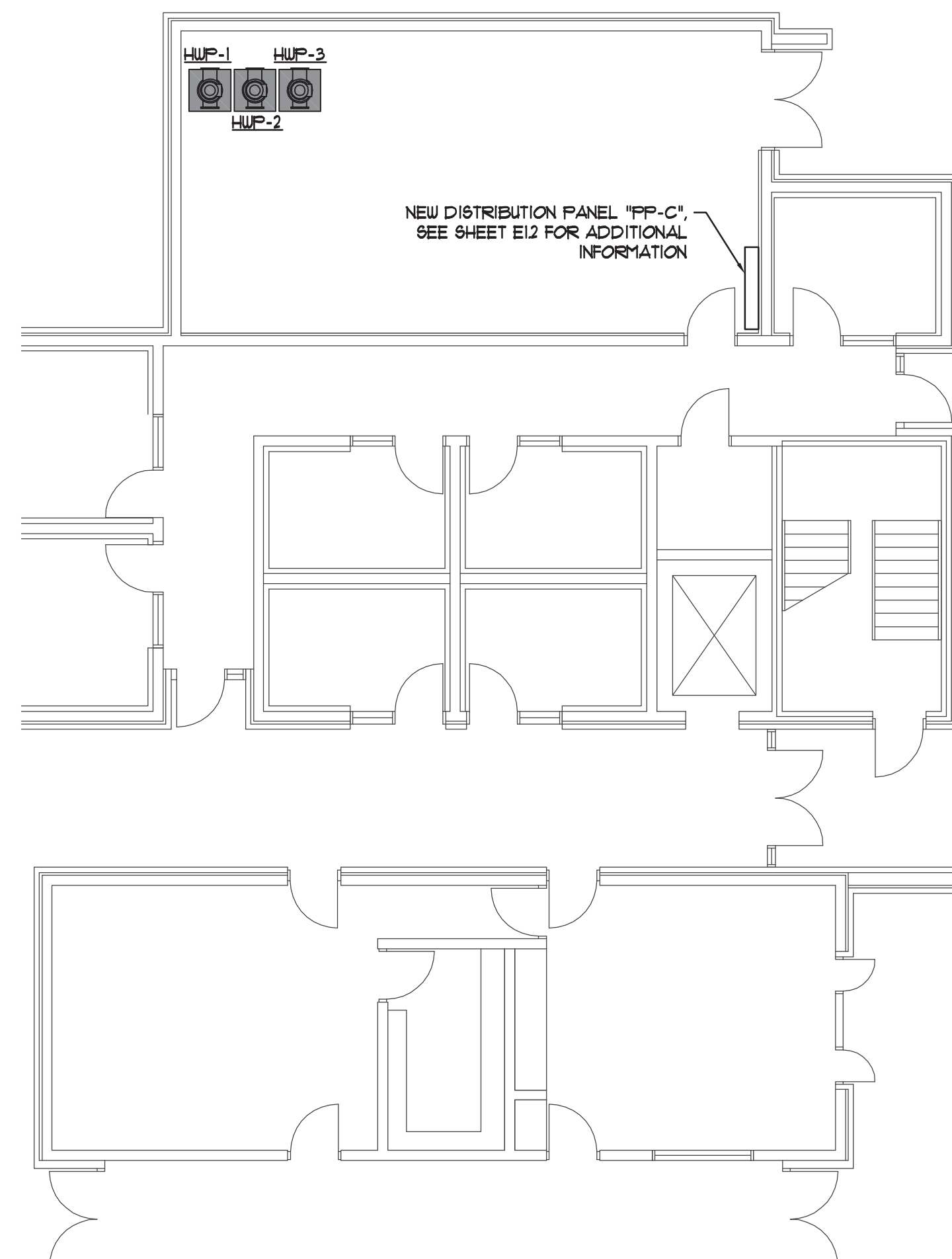
MECHANICAL EQUIPMENT ELECTRICAL CONNECTION SCHEDULE

TAG	LOAD	VOLT/PHASE	CIRCUIT DESIGNATION	BREAKER	BRANCH CIRCUIT	DISCONNECT	NOTES
AHU-1	35.5 A	200/3	FP-C-67,69,71	60A/3P	3#4, 1#0G, 1/4"C.	60A/3P	1, 4
BCU-8	9.5 A	200/3	FP-C-13,15,17	5A/3P	3#2, 1#2G, 3/4"C.	30A/3P	4
BCU-9	5.15 A	200/3	FP-C-19,81,83	5A/3P	3#2, 1#2G, 3/4"C.	30A/3P	-
EF-1	1/4 HP	120/1	LF-ID-35	20A/1P	2#2, 1#2G, 3/4"C.	MOTOR RATED SWITCH	2
CHWP-1	20 HP / 59.4 A	200/3	FP-C-8,10,12	100A/3P	3#2, 1#2G, 1/2"C.	100A/3P	1
CHWP-2	20 HP / 59.4 A	200/3	FP-C-14,16,18	100A/3P	3#2, 1#2G, 1/2"C.	100A/3P	1
HUP-1	7.5 HP / 24.2 A	200/3	FP-C-56,58,60	50A/3P	3#6, 1#0G, 1/4"C.	60A/3P	1
HUP-2	7.5 HP / 24.2 A	200/3	FP-C-62,64,66	50A/3P	3#6, 1#0G, 1/4"C.	60A/3P	1
HUP-3	7.5 HP / 24.2 A	200/3	FP-C-68,70,72	50A/3P	3#6, 1#0G, 1/4"C.	60A/3P	1
HU-1	46 A	200/3	FP-C-14,16,18	50A/3P	3#6, 1#0G, 1/4"C.	60A/3P	-
HU-2	11 A	200/3	FP-C-80,82,84	25A/3P	3#0, 1#0G, 3/4"C.	30A/3P	-
VF-1	1/4 HP	120/1	LF-ID-44	20A/1P	2#2, 1#2G, 3/4"C.	MOTOR RATED SWITCH	3
WH-1	4.5 KW	200/3	FP-C-61,63,65	20A/3P	3#2, 1#2G, 3/4"C.	30A/3P	-

**GENERAL NOTES (APPLY TO THIS SHEET ONLY)**  
 1. ALL EQUIPMENT DISCONNECTS SHALL BE LOCKABLE. WHERE MOTOR RATED SWITCHES ARE USED, PROVIDE LOCK-OUT ATTACHMENT.

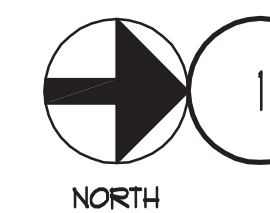
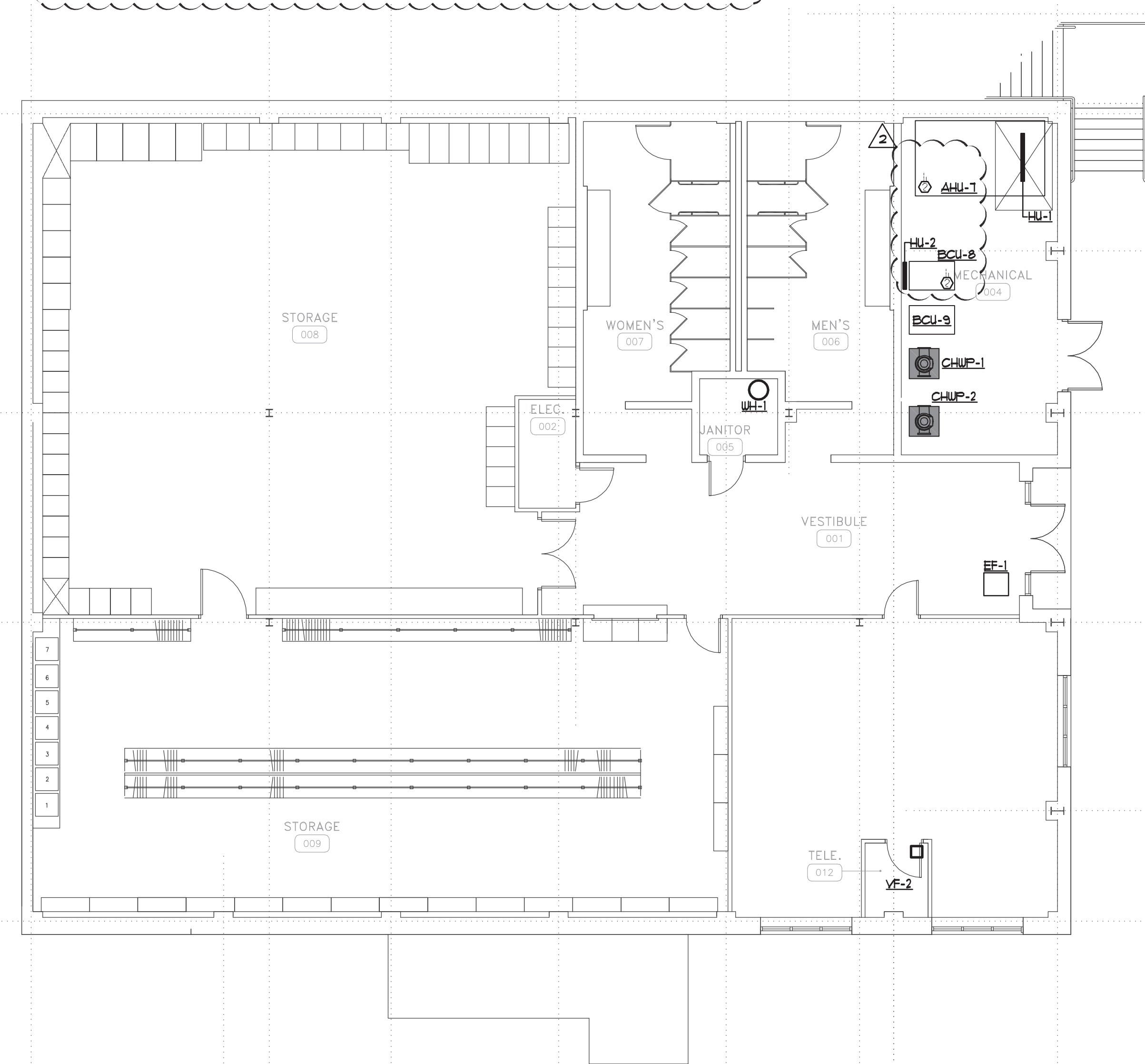
MECHANICAL EQUIPMENT ELECTRICAL CONNECTION SCHEDULE NOTES:

1. PROVIDE CONNECTION TO VFD. COORDINATE WITH MECHANICAL CONTRACTOR.
2. FAN TO BE CONTROLLED VIA BUILDING MANAGEMENT SYSTEM.
3. FAN TO BE CONTROLLED VIA THERMOSTAT PROVIDED BY MECHANICAL CONTRACTOR.
4. PROVIDE DUCT-MOUNTED SMOKE DETECTOR FOR UNIT. COORDINATE LOCATION WITH MECHANICAL CONTRACTOR.



EXISTING BUILDING PARTIAL FLOOR PLAN - ELECTRICAL (MECHANICAL)

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



NEW BUILDING LOWER FLOOR PLAN - ELECTRICAL (MECHANICAL)

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



AUBURN

UNIVERSITY

Facilities Management

1161 West Samford Avenue

Auburn University, AL 36849

Phone: (334) 844-4810

Fax: (334) 844-9458

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No.	Revision	Date
1	ABC Comments	07/11/2017
2	Addendum 2	07/12/2017



GOODWIN HALL - RENOVATION  
 AND  
 BAND REHEARSAL HALL ADDITION  
 Project Number 15-255

SHEET TITLE:  
 LOWER FLOOR  
 PLAN - ELECTRICAL  
 (MECHANICAL)

DRAWN BY:  
 ATS

CHECKED BY:  
 CC

DATE:  
 6-14-2017

FILE NUMBER:  
 -

PROJECT NUMBER:  
 15-255

SHEET NUMBER:

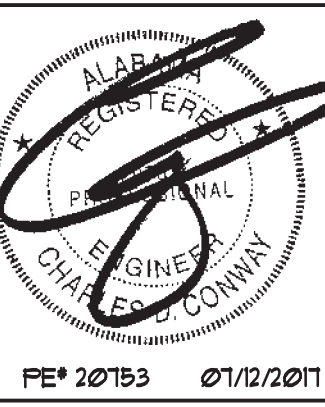
E3.1



AUBURN UNIVERSITY

Facilities Management
1161 West Samford Avenue
Auburn University, AL 36849
Phone: (334) 844-4810
Fax: (334) 844-9458
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Revision table with columns: No., Revision, Date. Includes entries for ABC Comments and Addendum 2.



CONWAY & OWEN
Mechanical, Electrical, Plumbing
1105 South College Street, Suite 200
Auburn, AL 36809
P: (334) 844-0444 F: (334) 844-0449

GOODWIN HALL - RENOVATION AND BAND REHEARSAL HALL ADDITION
Project Number 15-255

SHEET TITLE: RISER DIAGRAM AND SCHEDULES - ELECTRICAL

DRAWN BY: ATS
CHECKED BY: CC

DATE: 6-14-2017
FILE NUMBER:
PROJECT NUMBER: 15-255
SHEET NUMBER:

E5.0

NEW DISTRIB. PANEL "PP-C-SEC.1" SCHEDULE

Schedule table for NEW DISTRIB. PANEL "PP-C-SEC.1" with columns for CKT NO, DESCRIPTION, LOAD, NOTE, BKR, PHASE (A, B, C), BKR, NOTE, LOAD, DESCRIPTION, CKT NO. Includes summary rows for LIGHTING, RECEPT, MOTORS, A/C, HEATING, KITCHEN, MISC, TOTAL KVA, and TOTAL AMP.

NEW DISTRIB. PANEL "PP-C-SEC.2" SCHEDULE

Schedule table for NEW DISTRIB. PANEL "PP-C-SEC.2" with columns for CKT NO, DESCRIPTION, LOAD, NOTE, BKR, PHASE (A, B, C), BKR, NOTE, LOAD, DESCRIPTION, CKT NO. Includes summary rows for LIGHTING, RECEPT, MOTORS, A/C, HEATING, KITCHEN, MISC, TOTAL KVA, and TOTAL AMP.

NOTE: ALL CONDUCTORS SIZES IN THIS SCHEDULE ARE SIZED FOR COPPER.

RISER DIAGRAM FEEDER SCHEDULE table with columns: TAG, NUMBER OF SETS, CONFIG, PHASE/NEUTRAL SIZE PER SET, EQUIP. GROUND PER SET, CONDUIT SIZE PER SET, NOTES. Includes entry 200A.

PANEL LOAD NOTES:

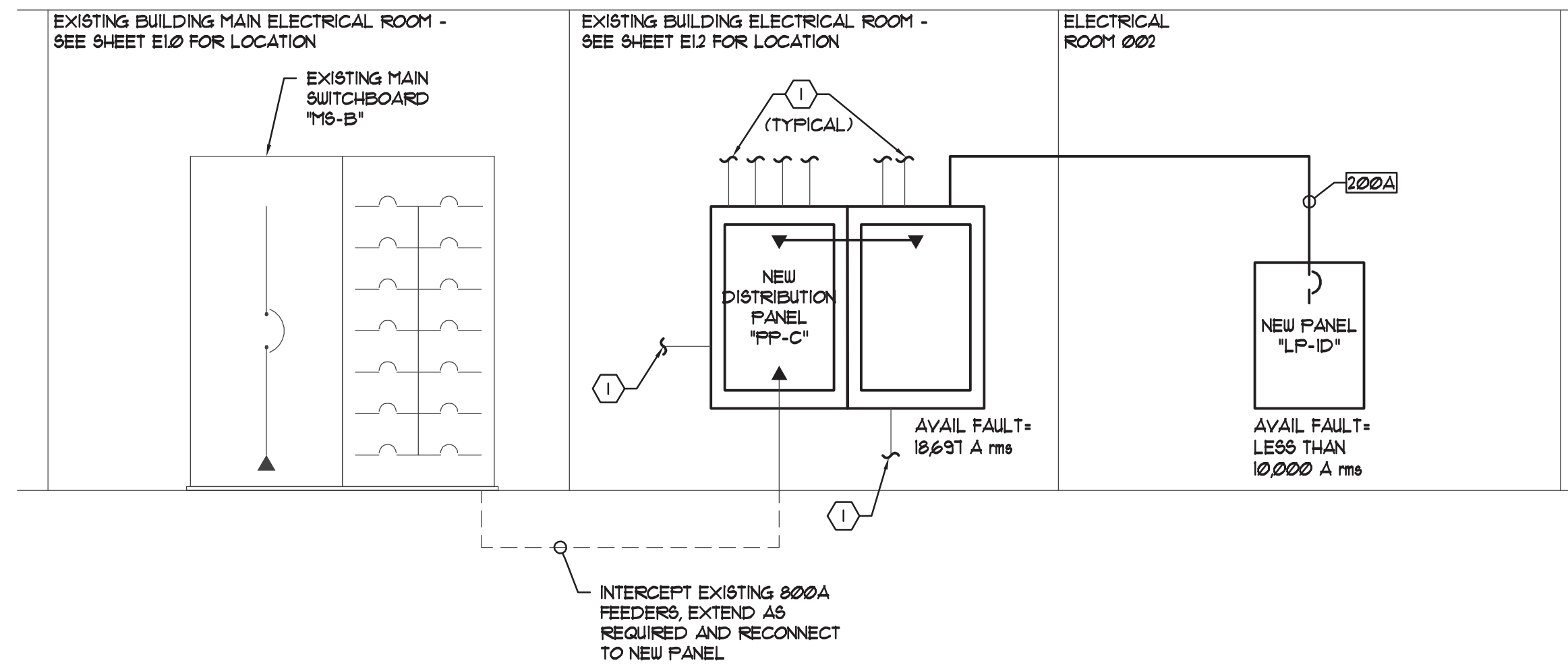
- 1. M5-B:
-- EQUIPMENT RATING
-- 3000 AMP
-- EXISTING LOAD (BASED ON DEMAND HISTORY)
-- 192.8 KVA - 535.6 AMP
-- ADDED LOAD
-- 13.9 KVA - 31.4 AMP
-- NEW LOAD
-- 306.7 KVA - 851.9 AMP

RISER DIAGRAM NOTES:

- 1. FOR ALL NEW PANELBOARDS SUPPLIED BY A FEEDER, PROVIDE A LABEL INDICATING THE DEVICE OR EQUIPMENT FROM WHICH THE POWER SUPPLY ORIGINATES PER NEC 408.4(B).
2. PROVIDE ARC-FLASH WARNING LABELS PER NEC 110.16 ON ALL NEW ELECTRICAL EQUIPMENT AND ANY EXISTING ELECTRICAL EQUIPMENT THAT IS MODIFIED.
3. FIELD MARK ELECTRICAL SERVICE EQUIPMENT WITH A CONSPICUOUS AND PERMANENT LABEL THAT INDICATES THE AVAILABLE FAULT CURRENT IN ACCORDANCE WITH NEC 110.24.
4. LABEL PANELBOARD SCHEDULES PER NEC 408.4. CONTRACTOR SHALL IDENTIFY ALL SPARE BREAKERS AND MOVE THEM TO THE "OFF" POSITION.

KEY NOTES (APPLY TO THIS SHEET ONLY)

- 1. FOR EXISTING LOADS TO BE RECONNECTED (SEE PANEL SCHEDULES FOR ADDITIONAL INFORMATION) UPON REPLACEMENT OF PANEL "PP-C", EXTEND EXISTING CONDUITS/WIRING AND RECONNECT AS EXISTING TO REMAIN. SPECIAL CARE SHALL BE TAKEN TO LOCATE BREAKERS IN NEW PANEL TO AVOID SPLICING EXISTING FEEDERS. FIELD VERIFY EXISTING BREAKER SIZES PRIOR TO PURCHASE OF NEW BREAKERS TO RE-FEED EXISTING EQUIPMENT.



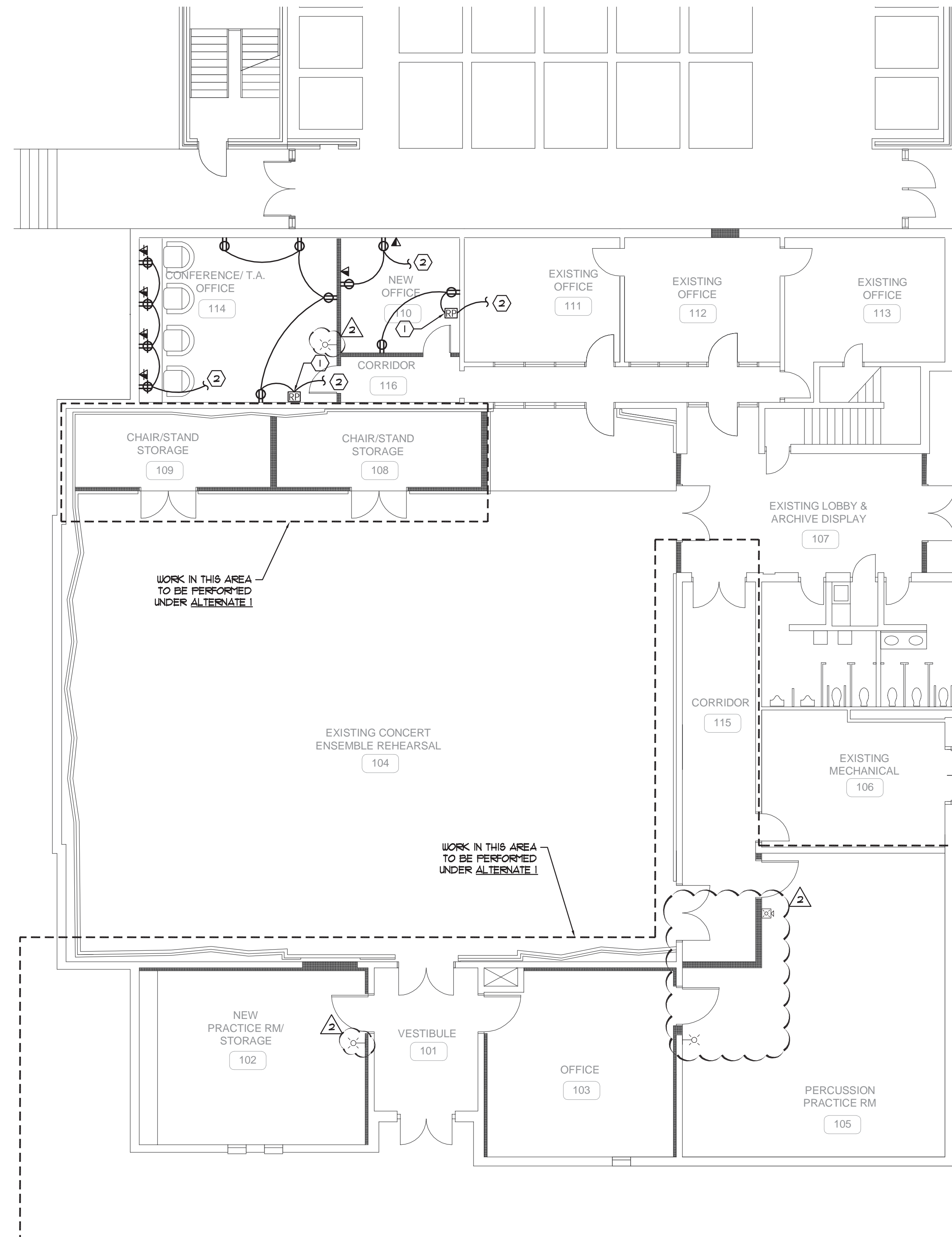
1 RISER DIAGRAM - ELECTRICAL
NOT TO SCALE

**GENERAL NOTES:** (APPLY TO THIS SHEET ONLY)

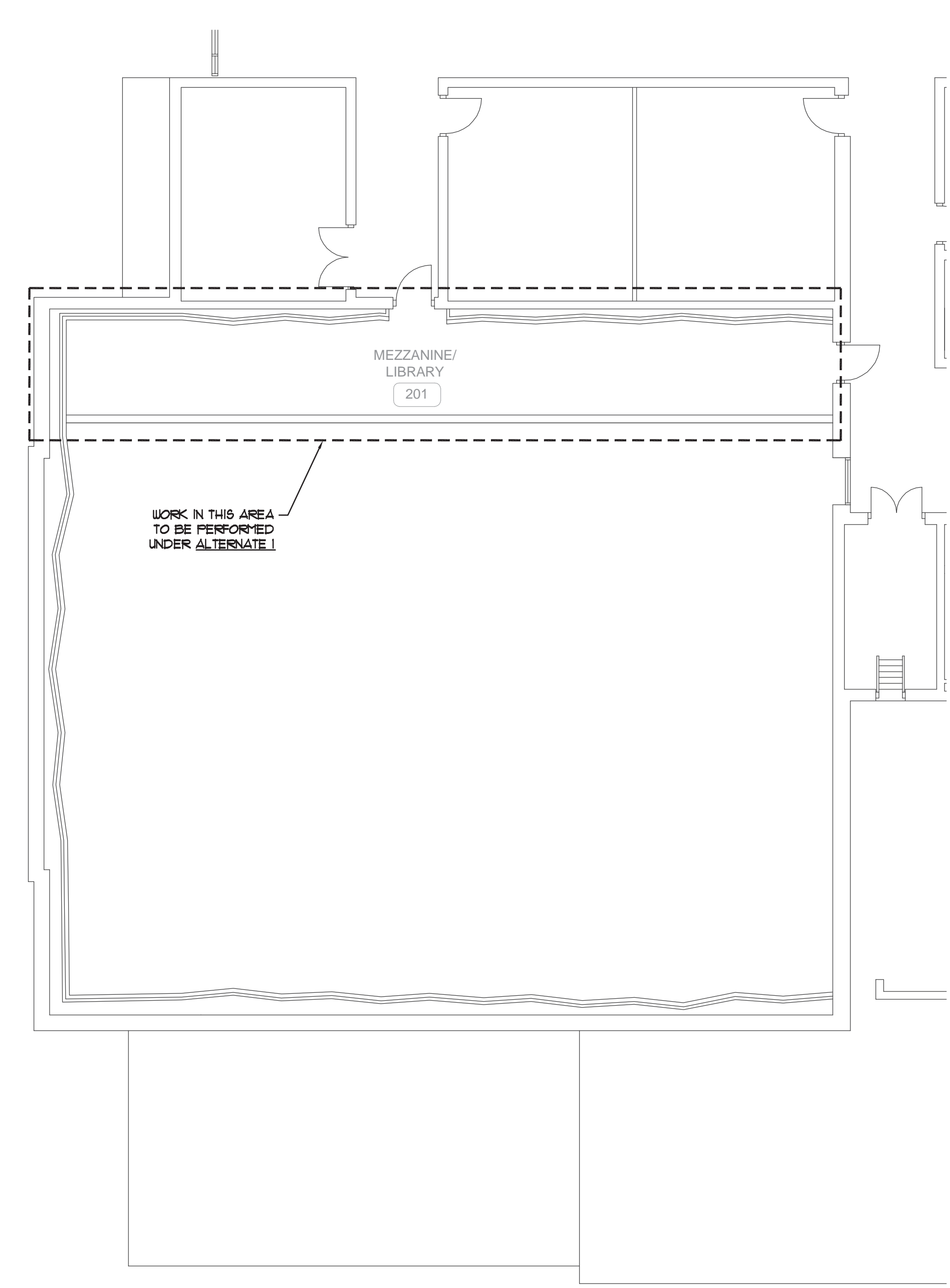
1. LABEL PANELBOARD SCHEDULES PER NEC 408.4. CONTRACTOR SHALL IDENTIFY ALL SPARE BREAKERS AND MOVE THEM TO THE "OFF" POSITION.
2. ALL BRANCH CIRCUITS SHALL BE WIRED ¾" C, 2-#12, 1-#12G MINIMUM, UNLESS OTHERWISE NOTED ON THE PLANS. ALL HOMERUNS SHALL BE A MINIMUM ¾" CONDUIT. PROVIDE ADDITIONAL GROUND OF EQUAL SIZE FOR ISOLATED GROUND CIRCUITS.
3. PROVIDE 4"x4" OUTLET BOX WITH A SINGLE-GANG PLASTER RING AND 1" CONDUIT WITH PULL STRING (UNLESS NOTED OTHERWISE ON PLANS) TO 6" ABOVE ACCESSIBLE CEILING AND ROUTED TO NEAREST CORRIDOR CABLE TRAY, TELECOM HOOKS, OR TO THE TELECOM ROOM FOR ALL WALL MOUNTED VOICE/DATA AND SECURITY DEVICES.

**KEY NOTES:** (APPLY TO THIS SHEET ONLY)

1. RECEPTACLE PACK CONTROLLER. SEE SHEET ER3.1 FOR CONTINUATION.
2. CONNECT TO EXISTING SPARE RECEPTACLE CIRCUIT MADE AVAILABLE BY DEMOLITION. PROVIDE NEW CIRCUIT AS REQUIRED. COORDINATE EXACT LOCATION AND CONNECTION REQUIREMENTS WITH ARCHITECT PRIOR TO ROUGH-IN.



**1** PARTIAL EXISTING FIRST FLOOR PLAN - ELECTRICAL  
SCALE: 1/8" = 1'-0"  
NORTH



**2** PARTIAL EXISTING SECOND FLOOR PLAN - ELECTRICAL  
SCALE: 1/8" = 1'-0"  
NORTH

**AUBURN**  
UNIVERSITY  
Facilities Management  
1161 West Samford Avenue  
Auburn University, AL 36849  
Phone: (334) 844-4810  
Fax: (334) 844-9458  
*Safety is our first priority.  
Think Safety. Act Safely.*

No.	Revision	Date
1	ABC Comments	07/11/2017
2	Addendum 2	07/12/2017

**CONWAY & OWEN**  
Mechanical Electrical Plumbing  
1100 South College Street, Suite 205  
Auburn, AL 36849  
P: (334) 844-2222 F: (334) 844-2222

**GOODWIN HALL - RENOVATION  
AND  
BAND REHEARSAL HALL ADDITION**  
Project Number 15-255

SHEET TITLE:  
RENOVATION  
FLOOR PLANS -  
ELECTRICAL

DRAWN BY:  
ATS

CHECKED BY:  
CC

DATE:  
6-14-2017

FILE NUMBER:  
-

PROJECT NUMBER:  
15-255

SHEET NUMBER:

**ER3.0**