



**REQUEST FOR PROPOSAL  
HVAC SERVICES  
FOR THE  
INDIANA STATE FAIR COMMISSION  
RFP-SER202400046**

DATE: APRIL 18, 2024

RE: INDIANA STATE FAIR COMMISSION – HVAC REPLACEMENT SERVICES

This Request for Proposal (“RFP”) is the official notice that the Indiana State Fair Commission, an Indiana body corporate and politic established at Ind. Code § 15-13-2-1, (the “Commission”) is seeking proposals from qualified vendors to provide HVAC Replacement Services. The intent of the Commission after the review and evaluation of responses is to enter into a contractual agreement with one or more qualified vendor(s). By bidding on these services, you are guaranteeing pricing as set forth in this RFP.

## **I. Overview**

Under Indiana Code section 15-13-3-2, the Commission is responsible for the administration of the Indiana State Fairgrounds and property owned by the Commission to provide for maximum use for the benefit of the citizens of Indiana. The Commission is a separate body, corporate and politic under Indiana law and its members are appointed by the Governor.

Although best known for hosting the 15-day Indiana State Fair in August of each year, the State Fairgrounds is a year-round venue for events, hosting over two million visitors annually. The events hosted include equestrian, livestock, small animal, car, ice, arts and crafts shows, home and builders’ shows, concerts, circuses, live horse racing, rodeos and many others.

## **II. Summary of Scope of Work**

The Commission is seeking proposals from HVAC service providers for the following services:

- Contractor shall provide labor, materials and equipment to perform the work as indicated.
- Work consists of improvements documented in the attached Indiana State Fairgrounds HVAC Replacements Plans and Specifications Manuals (Attachment A).
- Contractor shall mobilize on or after August 26, 2024.
- Contractor must coordinate their work with ongoing operations of the Indiana State Fairgrounds (ISF). The Contractor’s schedule is subject to review and approval by ISF before any work shall commence. There are many events every month at the facility. Contractor may experience interruptions as a result. These interruptions are not compensable.
- Work shall be completed by July 31, 2025.

### III. Evaluations

#### A. Evaluation of Responses

This is a best value procurement where the Commission reserves the right to select the most advantageous offer and/or offers by evaluating and comparing all factors. The Commission will appoint an evaluation team consisting of Commission employees.

The Commission reserves the right to withdraw this solicitation at any time in the process prior to contracting upon notification to all vendors in receipt of the solicitation documents by fax, letter or email to their last known business address. If such action is taken by the Commission, no Offeror will have claim for recompense. The Commission reserves the right to contact and hold discussions with responsible Offerors for the purpose of clarification to assure full understanding of the responsiveness to the solicitation.

#### B. Evaluation Criteria

1. <b>Adherence to Required Proposal Contents:</b> Responding Offeror must provide a complete proposal per the terms of this RFP and the attached Indiana State Fairgrounds HVAC Replacements Plan and Specifications Manuals.	10 points
2. <b>Price:</b> Offeror must submit information detailed in Section IX for evaluation purposes.	55 points
3. <b>Warranties/Customer Satisfaction:</b> Responding Offeror must provide documentation regarding any warranties and/or customer satisfaction policies/practices.	20 points
4. <b>References:</b> Responding Offeror must submit a completed Section X for evaluation purposes and provide descriptions of prior work, descriptions of project team as well as reference letters from previous projects	15 points
<b>Total</b>	<hr/> 100 points

#### C. Pre-Bid Questions

The Commission will receive pre-bid questions via email at [contracts@indianastatefair.com](mailto:contracts@indianastatefair.com) until 2:00 PM, May 2, 2024. The Commission reserves the right to hold further discussions for the purpose of clarification to assure full understanding of and responsiveness to this RFP.

## **IV. RFP Response Structure and Process**

### **A. Content of the Proposal**

Offeror must submit written proposals that are complete, thorough and accurate. All information requested must be submitted, or alternatively, a statement providing the rationale for not submitting the requested information must be provided. The Commission will, if determined to be in its best interest, take such statements into consideration in determining the responsiveness of the proposal. All documents submitted in response to this RFP become property of the Commission.

This RFP may contain specific quantities, phases or levels; however, this RFP does not guarantee any certain quantities, phases or levels.

The Commission reserves the right to award this RFP in whole or in part.

All proposals shall contain the sections, with the content described for each section, as set forth in **Section VI** to this RFP.

### **B. Submission Requirements**

Submit pdf of proposal to [contracts@indianastatefair.com](mailto:contracts@indianastatefair.com) by 2pm, May 16, 2024.

### **C. Prebid Meeting**

April 25, 2024, 10:00 AM EST: Administration Building Conference room (NW of Coliseum)

### **D. Key Dates**

- Submissions: See Section IV (B) above.
- Selection of Proposal(s): On or before May 30, 2024

It is Offeror's responsibility to ensure the RFP is received by the Commission on or before the above deadline. No exceptions.

No public opening due to evaluation process. All responders will be notified upon award.

## **V. State Contract Requirements**

The successful Offeror(s) will enter into a contract with the Commission under the terms and conditions set forth at **Section VIII** to this RFP. Offerors must initial each page of the section to acknowledge acceptance of these terms and conditions.

## VI. Content of Proposal

- Section 1 – Identifying Information
  - Offeror must complete the Offeror Information Response Sheet, **Section VII** to this RFP.
- Section 2 – Letter of Transmittal
  - A brief letter, prepared in standard business format, and signed by the person authorized to commit the Offeror to perform the services under this RFP. This letter should also identify all materials and enclosures submitted in response to this RFP.
- Section 3 - Acceptance by initialing the Commission's Terms and Conditions
  - Please return a copy of each page of **Section VIII** of this RFP, which sets forth the Commission's contract terms and conditions. Initial at the bottom of each page to acknowledge review and acceptance of these terms. These terms and conditions will be included in the contract with successful Offeror(s).
- Section 4 – Warranties/Customer Satisfaction
  - Responding Offeror must provide documentation regarding any warranties and/or customer satisfaction policies/practices.
- Section 5 – Pricing Information
  - Offeror must complete and submit the Pricing Information page, **Section IX**, of this RFP.
- Section 6 – References
  - Offeror must complete and submit **Section X**, of this RFP.
- Section 7 - Qualification to do Business in Indiana
  - Offeror must complete the Qualification to do Business in Indiana, **Section XI** to this RFP

**Section VI. – Contents of Proposal (cont.)**

- Section 8 – Certificate of Insurance
  - Offeror must submit a current certificate of Insurance (“COI”) with this proposal.
  - Be prepared to submit COI according to page 12, #19 upon award.
- Section 9 – W-9 Tax form

**VII. Offeror Information Cover Page to Response - *Please type or print legibly.***

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

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

City, State, Zip: \_\_\_\_\_

Contract Rep: \_\_\_\_\_  
Printed Name

Representative with Contract Signature Authority: \_\_\_\_\_

- Email of authorized signor: \_\_\_\_\_

Contact Numbers: \_\_\_\_\_  
Business Cell Fax

XBE Certified: \_\_\_\_\_  
Yes No

XBE Type: (Minority, Women, Veteran, etc. owned business): \_\_\_\_\_

## VIII. Contract Terms and Conditions

THE RESPONDER AGREES TO BE BOUND BY THE FOLLOWING TERMS AND  
CONDITIONS,  
WHICH WILL BE PART OF THE CONTRACT WHEN AWARDED:

1. **Duties of Contractor(s).** The Contractor shall provide **HVAC Replacement Services** as specified in RFP-SER202400046 and documented in the Indiana State Fairgrounds HVAC Replacement Plans and Specifications Manuals.
2. **Consideration.** Contractor shall be paid the rates/prices set forth in Contractor's response to **RFP-SER202400046**. All payments shall be made by the Commission upon receipt of detailed invoices, net 30 terms.

An annual do-not-exceed value will be entered on the cover page of the contract upon successful award.

3. **Period of Performance/Term of Contract.** This Contract shall commence upon full execution and shall expire July 31, 2025.
4. **Assignment: Successors.** The Contractor binds its successors and assignees to all the terms and conditions of this Contract. The Contractor shall not assign or subcontract the whole or any part of this Contract without the Commission's prior written consent. The Contractor may assign its right to receive payments to such third parties as the Contractor may desire without the prior written consent of the Commission, provided that Contractor gives written notice (including evidence of such assignment) to the Commission thirty (30) days in advance of any payment so assigned. The assignment shall cover all unpaid amounts under this Contract and shall not be made to more than one party.
5. **Access to Records.** The Contractor and its subcontractors shall maintain all books, documents, papers, accounting records and other evidence pertaining to the costs incurred under this Contract. They shall make such materials available at their respective offices at all reasonable times during this Contract term and for three (3) years from the date of final payment under this Contract, for inspection by the Commission or its authorized designees. Copies shall be furnished at no cost to the Commission if requested.
6. **Audits.** Contractor acknowledges that it may be required to submit to an audit of funds paid through this Contract. Any such audit shall be conducted in accordance with IND. CODE Ch. 5-11-1 *et seq.*, and audit guidelines specified by the State.

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**7. Authority to Bind Contractor.** The signatory for the Contractor represents that he/she has been duly authorized to execute this Contract on behalf of the Contractor and has obtained all necessary or applicable approvals to make this Contract fully binding upon the Contractor when his/her signature is affixed, and this Contract is not subject to further acceptance by Contractor when accepted by the Commission.

**8. Changes in Work.** The Contractor shall not commence any additional work or change the scope of the work until authorized in writing by the Commission. The Contractor shall make no claim for additional compensation in the absence of a prior written approval and amendment executed by all signatories hereto. This Contract may only be amended, supplemented or modified by a written document executed in the same manner as this Contract.

**9. Compliance with Laws.**

A. The Contractor shall comply with all applicable federal, state, and local laws, rules, regulations, and ordinances, and all provisions required thereby to be included herein are hereby incorporated by reference. The enactment of any state or federal statute or the promulgation of rules or regulations thereunder after execution of this Contract shall be reviewed by the Commission and the Contractor to determine whether the provisions of this Contract require formal modification.

B. The Contractor and its agents shall abide by all ethical requirements that apply to persons who have a business relationship with the Commission, as set forth in Indiana Code § 4-2-6 *et seq.*, the regulations promulgated thereunder, and Executive Order 05-12, dated January 10, 2005. If the Contractor is not familiar with these ethical requirements, the Contractor should refer any questions to the Indiana State Ethics Commission, or visit the Indiana State Ethics Commission website at [www.in.gov/ethics/](http://www.in.gov/ethics/). If the Contractor or its agents violate any applicable ethical standards, the Commission may, in its sole discretion, terminate this Contract immediately upon notice to the Contractor. In addition, the Contractor may be subject to penalties under Indiana Code § 4-2-6-12.

C. The Contractor certifies by entering into this Contract, that neither it nor its principal(s) is presently in arrears in payment of its taxes, permit fees or other statutory, regulatory or judicially required payments to the State of Indiana. The Contractor agrees that any payments currently due to the State of Indiana may be withheld from payments due to the Contractor. Additionally, further work or payments may be withheld, delayed, or denied and/or this Contract suspended until the Contractor is current in its payments and has submitted proof of such payment to the Commission.

D. The Contractor warrants that it has no pending or outstanding criminal, civil, or enforcement actions initiated by the State of Indiana, and agrees that it will immediately notify the Commission of any such actions. During the term of such actions, Contractor agrees that the Commission may delay, withhold, or deny work under this Contract and any supplements or amendments.

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E. If a valid dispute exists as to the Contractor's liability or guilt in any action initiated by the State of Indiana or its agencies, and the Commission decides to delay, withhold, or deny work to the Contractor, the Contractor may request that it be allowed to continue, or receive work, without delay. The Contractor must submit, in writing, a request for review to the Commission following the procedures for disputes outlined herein. A determination by the Commission shall be binding on the parties.

F. Any payments that the Commission may delay, withhold, deny or apply under this section shall not be subject to penalty or interest under IC 5-17-5.

G. The Contractor warrants that the Contractor and its subcontractors, if any, shall obtain and maintain all required permits, licenses, and approvals, as well as comply with all health, safety, and environmental statutes, rules, or regulations in the performance of work activities for the Commission. Failure to do so may be deemed a material breach of this Contract and grounds for immediate termination and denial of further work with the Commission.

H. The Contractor affirms that it is properly registered and owes no outstanding reports with the Indiana Secretary of State.

I. Contractor agrees that the Commission may confirm, at any time, that no liabilities exist to the State of Indiana, and, if such liabilities are discovered, that the Commission may bar Contractor from contracting with the Commission in the future, cancel existing contracts, withhold payments to setoff such obligations, and withhold further payments or purchases until the Contractor is current in its payments on its liability to the State of Indiana and has submitted proof of such payment to the Commission.

J. As required by IC 5-22-3-7:

(1) The Contractor and any principals of the Contractor certify that (A) the Contractor, except for de minimis and nonsystematic violations, has not violated the terms of (i) IC 24-4.7 [Telephone Solicitation Of Consumers], (ii) IC 24-5-12 [Telephone Solicitations], or (iii) IC 24-5-14 [Regulation of Automatic Dialing Machines] in the previous three hundred sixty-five (365) days, even if IC 24-4.7 is preempted by federal law; and (B) the Contractor will not violate the terms of IC 24-4.7 for the duration of the Contract, even if IC 24-4.7 is preempted by federal law.

(2) The Contractor and any principals of the Contractor certify that an affiliate or principal of the Contractor and any agent acting on behalf of the Contractor or on behalf of an affiliate or principal of the Contractor: (A) except for de minimis and nonsystematic violations, has not violated the terms of IC 24-4.7 in the previous three hundred sixty-five (365) days, even if IC 24-4.7 is preempted by federal law; and (B) will not violate the terms of IC 24-4.7 for the duration of the Contract, even if IC 24-4.7 is preempted by federal law.

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**10. Confidentiality.** The Contractor understands and agrees that data, materials, and information disclosed to Contractor may contain confidential and protected data. Therefore, the Contractor promises and assures that data, material, and information gathered, based upon or disclosed to the Contractor for the purpose of this Contract, will not be disclosed to others or discussed with third parties without the prior written consent of the Commission.

**11. Condition of Payment.** All services provided by the Contractor under this Contract must be performed after written approval of samples of materials that will be used in fabrication. Deviation from the samples during fabrication must have written approval from the Commission. The Commission shall not be required to pay for work not found to cohere with the approved material samples, inconsistent with this Contract or performed in violation of federal, state, or local law.

**12. Disputes.** Should any disputes arise with respect to this Contract, the Contractor and the Commission agree to act immediately to resolve any such disputes. Time is of the essence in the resolution of disputes.

The Contractor agrees that, the existence of a dispute notwithstanding, it will continue without delay to carry out all its responsibilities under this Contract, which are not affected by the dispute. Should the Contractor fail to continue without delay to perform its responsibilities under this Contract in the accomplishment of all non-disputed work, any additional costs incurred by the Contractor or the Commission as a result of such failure to proceed shall be born by the Contractor, and the Contractor shall make no claim against the Commission for such costs.

If the Contractor and the Commission cannot resolve a dispute within ten (10) calendar days following notifications in writing by either party of the existence of said dispute, then the following procedure shall apply:

1. The parties agree to resolve such matter through submission of the dispute to the Executive Director of the Indiana State Fair Commission who shall reduce his/her decision to writing and mail or otherwise furnish a copy thereof to the Contractor and the Commission within ten (10) working days after presentation of such dispute for this decision.
2. The decision shall be final and conclusive unless the Contractor mails or otherwise furnishes the Executive Director, within ten (10) working days after receipt of the Executive Director's decision, a written appeal.

The Commission may withhold payments on disputed items pending resolution of the dispute. The unintentional nonpayment by the Commission to the Contractor of one or more invoices not in dispute in accordance with the terms of this Contract will not be cause for Contractor to terminate this Contract, and the Contractor may bring suit to collect these amounts without following the disputes procedure contained herein.

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**13. Drug-Free Workplace.** As required by Executive Order No. 90-5 dated April 12, 1990, issued by the Governor of Indiana, the Contractor hereby covenants and agrees to make a good faith effort to provide and maintain a drug-free workplace. The Contractor will give written notice to the State within ten (10) days after receiving actual notice that the Contractor, or an employee of the Contractor in the State of Indiana, has been convicted of a criminal drug violation occurring in the workplace. False certification or violation of this certification may result in sanctions including, but not limited to, suspension of contract payments, termination of this Contract and/or debarment of contracting opportunities with the State for up to three (3) years.

In addition to the provisions of the above paragraph, if the total amount set forth in this Contract is in excess of \$25,000.00, the Contractor certifies and agrees that it will provide a drug-free workplace by:

- A. Publishing and providing to all of its employees a statement notifying them that the unlawful manufacture, distribution, dispensing, possession or use of a controlled substance is prohibited in the Contractor's workplace, and specifying the actions that will be taken against employees for violations of such prohibition;
- B. Establishing a drug-free awareness program to inform its employees of (1) the dangers of drug abuse in the workplace; (2) the Contractor's policy of maintaining a drug-free workplace; (3) any available drug counseling, rehabilitation and employee assistance programs; and (4) the penalties that may be imposed upon an employee for drug abuse violations occurring in the workplace;
- C. Notifying all employees in the statement required by subparagraph (A) above that as a condition of continued employment, the employee will (1) abide by the terms of the statement; and (2) notify the Contractor of any criminal drug statute conviction for a violation occurring in the workplace no later than five (5) days after such conviction;
- D. Notifying the State in writing within ten (10) days after receiving notice from an employee under subdivision (C)(2) above, or otherwise receiving actual notice of such conviction;
- E. Within thirty (30) days after receiving notice under subdivision (C)(2) above of a conviction, imposing the following sanctions or remedial measures on any employee who is convicted of drug abuse violations occurring in the workplace: (1) taking appropriate personnel action against the employee, up to and including termination; or (2) requiring such employee to satisfactorily participate in a drug abuse assistance or rehabilitation program approved for such purposes by a federal, state or local health, law enforcement, or other appropriate agency; and
- F. Making a good faith effort to maintain a drug-free workplace through the implementation of subparagraphs (A) through (E) above.

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- 14. Force Majeure.** In the event that either party is unable to perform any of its obligations under this Contract or to enjoy any of its benefits because of natural disaster, environmental contamination, hostile military or paramilitary action, riot, or decrees of governmental bodies not the fault of the affected party (hereinafter referred to as a "Force Majeure Event"), the party who has been so affected shall immediately give notice to the other party and shall do everything possible to resume performance. Upon receipt of such notice, all obligations under this Contract shall be immediately suspended. If the period of nonperformance exceeds thirty (30) days from the receipt of notice of the Force Majeure Event, the party whose ability to perform has not been so affected may, by giving written notice, terminate this Contract.
- 15. Funding Cancellation.** If the Executive Director, with the approval of the Commission, makes a written determination that funds are not appropriated or otherwise available to support continuation of performance of this Contract, this Contract shall be canceled. A determination by the Executive Director shall be final and conclusive. Nothing in this clause shall be construed to preclude the Contractor from being paid for work performed through the date of cancellation.
- 16. Governing Laws.** This Contract shall be construed in accordance with and governed by the laws of the State of Indiana without regard to its conflict of laws rules and suit, if any, must be brought in a competent court situated in Marion County, Indiana.
- 17. Indemnification.** To the fullest extent permitted by law, Contractor agrees to indemnify, defend and hold harmless the Commission and the State of Indiana, its agents, officers and employees from all claims and suits including court costs, attorney's fees, and other expenses caused by any act or omission of Contractor and/or its subcontractors, if any, in the performance of this Contract regardless of concurrent negligence. Contractor's indemnification obligation shall apply to the extent such damages do not result from or are not caused by the willful misconduct or negligence of the Commission, the State, its employees or agents. Any defense shall be provided by counsel approved by the Commission. The Commission and the State shall not provide such indemnification to the Contractor.
- 18. Independent Contractor.** Both parties hereto, in the performance of this Contract, will be acting in an individual capacity and not as agents, employees, partners, joint ventures or associates of one another. The employees or agents of one party shall not be deemed or construed to be the employees or agents of the other party for any purposes whatsoever.
- 19. Insurance.** Contractor shall secure and keep in force during the term of this Contract the following insurance coverage, covering the Contractor for any and all claims of any nature which may in any manner arise out of or result from Contractor's performance under this Contract:

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- A. Commercial General Liability with the following minimum coverage limits naming the Commission and the State of Indiana as additional insureds:
  - a. \$1,000,000 Per Occurrence Bodily Injury and Property Damage
  - b. \$1,000,000 Per Occurrence Personal and Advertising injury
  - c. \$2,000,000 General Aggregate
  - d. \$1,000,000 Products and Completed Operations Aggregate
- B. Commercial Automobile Liability – Minimum coverage limit of \$1,000,000 combined single limit for bodily injury and property damage, covering all owned, non-owned or hired (if applicable) automobiles used in the course of this Contract
- C. Workers Compensation - In compliance with any and all statutes requiring such coverage in the State of Indiana, covering employees, volunteers, temporary workers and leased workers.
- D. If the Contractor engages any sub-contractors or independent contractors to complete or perform any work called for in the Contract, the Contractor is responsible for maintaining evidence that all of the subcontractors or independent contractors are compliant and maintaining the required insurance as though they were parties to the Contract.
- E. Property – Contractor shall be responsible for its own personal property, regardless of the type, to be insured on a replacement cost basis.
- F. Professional Liability Insurance - Contractor shall secure and keep in force during the term of this Contract professional liability insurance covering the Contractor for any and all claims, of any nature, that may in any manner arise out of or result from this Contract.

Contractor shall provide proof of such insurance coverage by tendering to the Commission a certificate of insurance (“COI”) prior to the commencement of this Contract. The Commission must be listed as an additional insured on the COI. Contractor shall not cancel or change the insurance coverage without giving the Commission thirty (30) days prior, written notice by certified or registered mail.

**20. Indiana Tort Claims Act.** Pursuant to IC 34-13-3, et seq., the Commission is covered by the Indiana Tort Claims Act. The Commission is not obligated to indemnify or defend Contractor or its employees, agents, or affiliates for anything arising out of or relating to the Contract.

**21. Key Persons.** If both parties have designated in writing that certain individual(s) employed by Contractor are essential to the services offered pursuant to this Contract, the parties agree that should such individual or individuals no longer be employed during the term of this Contract by the Contractor for whatever reason, the Commission shall have the right to terminate this Contract upon thirty (30) days’ prior written notice.

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**22. Licensing Standards.** Contractor and its employees and subcontractors shall comply with all applicable licensing standards, certification standards, accrediting standards and all other laws, ordinances, rules and regulations governing goods or services to be provided by Contractor pursuant to this Contract. The Commission shall not be required to pay the Contractor for any services performed or goods provided when Contractor or its employees or subcontractors are not in compliance with such applicable standards, certifications, laws, ordinances, rules or regulations. If licensure, certification or accreditation is revoked, suspended, or materially changed, Contractor shall notify the Commission immediately, and the Commission may, at its option, immediately terminate this Contract.

**23. Nondiscrimination.** As required by IC 22-9-1-10 and the Federal Civil Rights Act of 1964, Contractor shall not discriminate against any employee or applicant for employment in the performance of this Contract with respect to the hire, tenure, terms, conditions or privileges of employment or in any matter directly or indirectly related to employment, because of race, color, religion, sex, disability, national origin or ancestry. Acceptance of this Contract signifies compliance with applicable federal laws, regulations, and executive orders prohibiting discrimination in the provision of services based on race, color, national origin, age, sex, disability or status as a veteran.

**24. Notice to Parties.** Whenever any notice, statement or other communication shall be sent to the Commission or Contractor, it shall be sent to the following address, unless otherwise specifically advised.

A. Notices to the Commission shall be sent to:

Indiana State Fair Commission  
Attn: Director of Facilities  
1202 East 38th Street  
Indianapolis, IN 46205-2869  
(317) 927-7500

B. Notices to the Contractor shall be sent to:

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Provide Information as seen in section VII.

**25. Order of Precedence.** Any inconsistency or ambiguity in this Contract shall be resolved by giving precedence in the following order: (1) this Contract, (2) Attachments prepared by the Commission; (3) Attachments prepared and submitted by the Contractor.

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- 26. Penalties/Interest/Attorney’s Fees.** The Commission will in good faith perform its required obligations hereunder and does not agree to pay any penalties, liquidated damages, interest, or attorney’s fees, except as required by Indiana law, in part, IC 5-17—5-1 et seq., IC 34-54-8-5 et seq., and IC 34-13-1-6 et seq.
- 27. Severability.** The invalidity of any section, subsection, clause or provision of the Contract shall not affect the validity of the remaining sections, subsections, clauses or provisions of the Contract.
- 28. Substantial Performance.** This Contract shall be deemed to be substantially performed only when fully performed according to its terms and conditions and any modification thereof.
- 29. Taxes.** The Commission is exempt from state, federal and local taxes. The Commission will not be responsible for any taxes levied on the Contractor as a result of this Contract.
- 30. Termination for Convenience.** This Contract may be terminated, in whole or in part, by the Commission whenever, for any reason, the Commission determines that such termination is in its best interest. Termination of services shall be effected by delivery to the Contractor of a Termination Notice at least thirty (30) days prior to the termination effective date, specifying the extent to which performance of services under such termination becomes effective. The Contractor shall be compensated for services properly rendered prior to the effective date of termination. The Commission will not be liable for services performed after the effective date of termination. The Contractor shall be compensated for services herein provided but in no case shall total payment made to the Contractor exceed the original Contract price or shall any price increase be allowed on individual line items if canceled only in part prior to the original termination date.
- 31. Termination for Default.** The Commission may terminate and cancel this Contract without prejudice to any rights and cause of action the Commission may have against the Contractor, if:
1. The Contractor is judged bankrupt, or
  2. The Contractor makes a general assignment for the benefit of creditors, or
  3. A receiver is appointed due to the Contractor's insolvency, or
  4. If a court of competent jurisdiction finds that the Contractor persistently disregards laws, ordinances, rules, regulations or orders of any public authority having jurisdiction, or
  5. The Contractor is acquired by or merged with another entity.

The Commission may also terminate this Contract in whole or in part, if the Contractor fails to:

1. Correct or cure any breach of this Contract;
2. Perform the services as required by this Contract;

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If the Commission terminates this Contract in whole or in part, it may acquire, under the terms and in the manner it considers appropriate supplies and services similar to those terminated, and the Contractor will be liable to the Commission for any excess costs for those supplies and services.

**32. Warranty.** The Contractor warrants all good delivered to be free from defects of material or workmanship. This warranty shall survive inspection, delivery, acceptance, and payment by the Commission of the goods.

**33. Work Standards.** The Contractor agrees to execute its respective responsibilities by following and applying at all times the highest professional and technical guidelines and standards. If the Commission becomes dissatisfied with the work product or the working relationship with those individuals assigned to work on this Contract, the Commission may request the replacement of any or all such individuals.

**34. Non-Collusion and Acceptance.** The undersigned attests, subject to the penalties for perjury, that he/she is the representative, agent, member or officer of the Contractor, that he/she has not, nor has any other member, employee, representative, agent or officer of the Contractor, directly or indirectly, to the best of his/her knowledge, entered into or offered to enter into any combination, collusion or agreement to receive or pay, and that he/she has not received or paid, any sum of money or other consideration for the execution of this Contract other than that which appears upon the face hereof.

**For the Contract:**

- 1. A Contract cover page shall be added**
- 2. The signature block will follow these terms & conditions.**

**The remainder of this page is intentionally blank.**

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Authorized Initials



**IX. Pricing Information**

Bidder shall clearly present proposed base bid and include each alternate bid(s) as indicated within the Indiana State Fairgrounds HVAC Replacements Plans and Specifications Manuals.

**X. References**

**Name** \_\_\_\_\_

**Address** \_\_\_\_\_

**Telephone** \_\_\_\_\_

**Contact Name** \_\_\_\_\_

**Email Address** \_\_\_\_\_

**Scope of Work Provided** \_\_\_\_\_

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**Name** \_\_\_\_\_

**Address** \_\_\_\_\_

**Telephone** \_\_\_\_\_

**Contact Name** \_\_\_\_\_

**Email Address** \_\_\_\_\_

**Scope of Work Provided** \_\_\_\_\_

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**Name** \_\_\_\_\_

**Address** \_\_\_\_\_

**Telephone** \_\_\_\_\_

**Contact Name** \_\_\_\_\_

**Email Address** \_\_\_\_\_

**Scope of Work Provided** \_\_\_\_\_

**XI. Qualification to do Business in Indiana**

Indiana Law requires that all corporations, limited liability companies, limited liability partnerships, and limited partnership trusts **must** be registered with the Indiana Secretary of State in order to do business in Indiana. This requirement **does not** apply to **sole proprietorships or general partnerships**. Failure to register with the Indiana Secretary of State will result in a determination that the company is not a responsible vendor.

**PLEASE INDICATE IF YOUR COMPANY IS A:**

- SOLE PROPRIETORSHIP**
- CORPORATION**
- LIMITED LIABILITY PARTNERSHIP**
- OTHER** \_\_\_\_\_
- GENERAL PARTNERSHIP**
- LIMITED LIABILITY COMPANY**
- LIMITED PARTNERSHIP**

Our corporation, limited liability company, limited liability partnership or limited partnership is incorporated in the state of \_\_\_\_\_/

This company is currently registered with the Indiana Secretary of State (check one). Failure to provide complete and accurate information may affect your future ability to do business with the State of Indiana.

- YES** **Control Number assigned by the Indiana Secretary of State for Verification Purposes** \_\_\_\_\_  
**Entity Creation date in the State of Indiana** \_\_\_\_\_  
*NOTE: This information may be obtained through the Secretary of State's office at the following website: [www.in.gov/sos/business/2436.htm](http://www.in.gov/sos/business/2436.htm)*

- NO** Our company is not registered with the Indiana Secretary of State's office.

Information concerning registration with the Indiana Secretary of State may be obtained by contacting:

Indiana Secretary of State  
Corporation Section  
302 West Washington Street, E018  
Indianapolis, IN 46204  
(317) 232-6576 or [www.in.gov/sos/business/3672.htm](http://www.in.gov/sos/business/3672.htm)

**Section XI – Continued**

I certify that the information provided is a full and true account of this company's standing with the Indiana Secretary of State as of the date this bid is submitted.

\_\_\_\_\_  
Name of Company

\_\_\_\_\_  
Authorizing Signature

\_\_\_\_\_  
Date

\_\_\_\_\_  
Printed Name and Title

**DIVISION 26 - ELECTRICAL INDEX**

Indiana State Fairgrounds HVAC Replacements

Client: Chad Lethig  
 Address: 1202 E 38<sup>th</sup> Street  
 Indianapolis, IN 46205

HEAPY  
 MEP Engineer  
 Dayton, Ohio Project No. 2023-07154.00

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MARCH, 2024

## **26 05 01      BASIC ELECTRICAL REQUIREMENTS**

### **PART 1 - GENERAL**

#### 1.1 Special Note

- A. All provisions of the Bidding Requirements, General Conditions and Supplementary Conditions, including Division 00 and Division 01, apply to work specified in this Division.
- B. The scope of the Division 26 work includes furnishing, installing, testing and warranty of all work and complete Electrical systems as shown on the E series drawings, and as specified in Division 26 and elsewhere in the project documents.
- C. Understanding that the contractors for various Divisions are sub-contractors to the Prime Contractor assignments of work by division are not intended to restrict the Prime Contractor in assignment of work among the contractors to accommodate trade agreements and practices or the normal conduct of the construction work. If there is a conflict of assigned work between Divisions 02 thru 33 and Divisions 00 and 01, Divisions 00 and 01 shall take precedence.

#### 1.2 Permits and Regulations

- A. Include payment of all permit and inspection fees applicable to the work in this Division. Furnish for the Owner certificates of approval from the governing inspection agencies, as a condition for final payment.
- B. Work must conform to the National Electrical Code, National Electrical Safety Code and other applicable local, state and federal laws, ordinances and regulations. Where drawings or specifications exceed code requirements, the drawings and specifications shall govern. Install no work contrary to minimum legal standards.
- C. All electrical work shall be inspected and approved by the local jurisdictional authority.

#### 1.3 Inspection of Site

- A. Inspect the project site and the premises of the existing building. Conditions shall be compared with information shown on the drawings. Report immediately to the Engineer any significant discrepancies which may be discovered. After the contract is signed, no allowance will be made for failure to have made a thorough inspection.

#### 1.4 Drawings and Specifications

- A. The drawings indicate the general arrangement of the work and are to be followed insofar as possible. The word "provide", as used, shall mean "furnish and install". If significant deviations from the layout are necessitated by field conditions, detailed layouts of the proposed departures shall be submitted to the Engineer for approval before proceeding with the work.
- B. Make all necessary field measurements to ensure correct fitting. Coordinate work with all other trades in such a manner as to cause a minimum of conflict or delay.
- C. The drawings and specifications shall be carefully studied during the course of bidding and construction. Any errors, omissions or discrepancies encountered shall be referred immediately to the Engineer for interpretation or correction, so that misunderstandings at a later date may be avoided. The contract drawings are not intended to show every vertical or horizontal offset which may be necessary to complete the systems. Having wireways and fittings fabricated and delivered in advance of making actual measurements shall not be

sufficient cause to avoid making offsets and minor changes as may be necessary to install bus duct, wireways, fittings and equipment.

- D. The Engineer shall reserve the right to make minor adjustment in locations of system runs and components where they consider such adjustments desirable in the interest of protecting and concealing work or presenting a better appearance where exposed. Any such changes shall be anticipated and requested sufficiently in advance as to not cause extra work, or unduly delay the work. Coordinate work in advance with all other trades and report immediately any difficulties which can be anticipated.
- E. Equipment, ductwork and piping shall not be installed in the dedicated electrical space above or in the working space required around electrical switchgear, motor control centers or panelboards as identified by NEC 110.26 Spaces about Electrical Equipment – 600 Volts Nominal or Less. For equipment rated over 600 volts nominal – 110.32 Work Space About Equipment – 110.33 Entrance to Enclosures and Access to Work Space – 110.34 Work Space and Guarding. Caution other trades to comply with this stipulation.
- F. Where any system runs and components are so placed as to cause or contribute to a conflict, it shall be readjusted at the expense of the contractor causing such conflict. The Engineer's decision shall be final in regard to the arrangement of bus duct, conduit, etc., where conflict arises.
- G. Provide offsets in system runs, additional fittings, necessary conduit, pull boxes, conductors, switches and devices required to complete the installation, or for the proper operation of the system. Exercise due and particular caution to determine that all parts of the work are made quickly and easily accessible.
- H. Should overlap of work among the trades become evident, this shall be called to the attention of the Engineer. In such event, none of the trades or their suppliers shall assume that they are relieved of the work which is specified under their branch until instructions in writing are received from the Engineer.

#### 1.5 Asbestos Materials

- A. Abatement, removal or encapsulation of existing materials containing asbestos is not included in the Division 26 Contract. Necessary work of this nature will be arranged by the Owner to be done outside of this construction and remodeling project by a company regularly engaged in asbestos abatement. Such work will be scheduled and performed in advance of work in the construction and remodeling project.
- B. If, in the performance of the work, materials are observed which are suspected to contain asbestos, the Contractor shall immediately inform the Engineer who in turn will notify the Owner. Work that would expose workers to the inhalation of asbestos particles shall be terminated. Work may be resumed only after a determination has been made and unsafe materials have been removed or encapsulated and the area declared safe.

#### 1.6 Coordination Drawings

- A. Refer to Divisions 00 and 01 for requirements.

#### 1.7 Inspection

- A. All work shall be subject to inspection of Federal, State and local agencies as may be appropriate, and of the Engineer.
- B. Obtain final inspection certificates and turn over to the Owner.

#### 1.8 Record Drawings

- A. Maintain a separate set of field prints of the contract documents and hand mark all changes or variations, in a manner to be clearly discernible, which are made during construction. Upon completion of the work and within 90 days of system acceptance, these hand marked drawings shall be turned over to the Engineer. This shall apply particularly to underground and concealed work, and to other systems where the installation varies to a degree which would justify recording the change.

#### 1.9 Final Inspection and Punch List

- A. As the time of work completion approaches, survey and inspect Division 26 work and develop a punch list to confirm that it is complete and finished. Then notify the Engineer and request that a final inspection be made. It shall not be considered the Engineer's obligation to perform a final inspection until the Contractor has inspected the work and so states at the time of the request for the final inspection.
- B. Requests to the Engineer for final inspection may be accompanied by a limited list of known deficiencies in completion, with appropriate explanation and schedule for completing these; this is in the interest of expediting acceptance for beneficial occupancy.
- C. The Engineer will inspect the work and prepare a punch list of items requiring correction, completion or verification. Corrective action shall be taken by the Contractor to the satisfaction of Engineer within 30 days of receipt of the Engineer's punch list.

#### 1.10 Warranty

- A. Warrant all workmanship, equipment and material entering into this contract for a period of one (1) year from date of final acceptance or date of beneficial use, as agreed to between Contractor and Engineer. Any materials or equipment proving to be defective during the warranty period shall be made good without expense to the Owner. Use of equipment for temporary electric is not the start of the warranty period.
- B. This provision is intended specifically to cover deficiencies in contract completion or performance which are not immediately discovered after systems are placed in operation. These items include, but are not limited to, motor controller malfunction, heater element changes required for motor controller, fuse replacement where fuses blow due to abnormal shorts, adjustments and/or replacement of malfunctioning equipment and adjusting special equipment and communication systems to obtain optimum performance.
- C. This provision shall not be construed to include maintenance items such as making normally anticipated adjustments or correcting adjustment errors on the part of the Owner's personnel.
- D. Provisions of this warranty shall be considered supplementary to warranty provisions under Division 01 General Conditions.

## **PART 2 - PRODUCTS**

### 2.1 Materials and Equipment

- A. Materials and equipment furnished shall be in strict accordance with the specifications and drawings and shall be new and of best grade and quality. When two or more articles of the same material or equipment are required, they shall be of the same manufacturer.
- B. All electrical equipment and wiring shall bear the Underwriters Laboratories, Inc. label where UL labeled items are available, and shall comply with NEC (NFPA-70) and NFPA requirements.

### 2.2 Reference Standards



- A. Where standards (NFPA, NEC, ASTM, UL, etc.) are referenced in the specifications or on the drawings, the latest edition is to be used except, however, where the Authority Having Jurisdiction has not yet adopted the latest edition, the edition so recognized shall be used.

### 2.3 Equipment Selection

- A. The selection of materials and equipment to be furnished shall be governed by the following:
  - 1. Where trade names, brands, or manufacturers of equipment or materials are listed in the specification, the exact equipment listed shall be furnished. Where more than one name is used, the Contractor shall have the option of selecting between any one of the several specified. All products shall be first quality line of manufacturers listed.
  - 2. Where the words "or approved equal" appear after a manufacturer's name, specific approval must be obtained from the Engineer during the bidding period in sufficient time to be included in an addendum. The same shall apply for equipment and materials not named in the specifications, where approval is sought.
  - 3. Where the words "equal to" appear, followed by a manufacturer's name and sometimes a model or series designation, such designation is intended to establish quality level and standard features. Equal equipment by other manufacturers will be acceptable, subject to the Engineer's approval.
- B. Substitute equipment of equal quality and capacity will only be considered when the listing of such is included as a separate item of the bid. State the deduction or addition in cost to that of the specified product.
- C. Before bidding equipment, and again in the preparation of shop drawings, verify that adequate space is available for entry and installation of the item of equipment, including associated accessories. Also verify that adequate space is available for servicing of the equipment and that required NEC clearances are met.
- D. If extensive changes in conduit, equipment layout or electrical wiring and equipment are brought about by the use of equipment which is not compatible with the layout shown on the drawings, necessary changes shall be deemed to be included in this contract.

### 2.4 Shop Drawings

- A. Electronic copies of shop drawings and descriptive information of equipment and materials shall be furnished. Submit to the Engineer for review as stated in the General Conditions and Supplementary Conditions. These shall be submitted as soon as practicable and before equipment is installed and before special equipment is manufactured. Submittal information shall clearly identify the manufacturer, specific model number, approval labels, performance data, electrical characteristics, features, specified options and additional information sufficient to evidence compliance with the contract documents. Product catalogs, brochures, etc. submitted without project specific items marked as being submitted for review will be rejected and returned without review. Shop drawings for equipment, fixtures, devices and materials shall be labeled and identified same as on the Contract Documents. If compliance with the above criteria is not provided shop drawings will be subject to rejection and returned without review. Samples shall be submitted when requested or as specified here with-in.
- B. The review of shop drawings by the Engineer shall not relieve the Contractor from responsibility for errors in the shop drawings. Deviations from specifications and drawing requirements shall be called to the Engineer's attention in a separate clearly stated notification at the time of submittal for the Engineer's review.
- C. Shop drawings of the following equipment and materials shall be submitted:
  - 1. Wireway.
  - 2. Firestopping.

3. Miscellaneous cabinets.
4. Wiring devices and coverplates.
5. Surge suppression.
6. Panelboards.
7. Fuses.
8. Motor controllers and disconnects.

### **PART 3 - EXECUTION**

#### **3.1 Testing**

- A. As each wiring system is completed, it shall be tested for continuity and freedom from grounds.
- B. As each electrically operated system is energized, it shall be tested for function.
- C. On all electric services including change-outs, backfeeds, etc. the Contractor shall verify phase rotation and voltage readings to ensure the final installation is proper. Submit to the Engineer in writing a record of voltage readings and current readings taken at no-load and fully loaded conditions.
- D. The Contractor shall perform megger and resistance tests and special tests on any circuits or equipment when an authorized inspection agency suspects the system's integrity or when requested by the Engineer.
- E. Tests shall be witnessed by field representatives of the Engineer or shall be monitored by a recorder. Furnish a written record of each system test indicating date, system, test conditions, duration and results of tests. Copies of all test reports shall be included in the O&M manuals.
- F. Instruments required for tests shall be furnished by the Contractor.

#### **3.2 Equipment Cleaning**

- A. Before placing each system in operation, the equipment shall be thoroughly cleaned; cleaning shall be performed in accordance with equipment manufacturer's recommendations.
- B. Refer to appropriate Sections for cleaning of other equipment and systems for normal operation.

#### **3.3 Operation and Adjustment of Equipment**

- A. As each system is put into operation, all items of equipment included therein shall be adjusted to proper working order. This shall include balancing and adjusting voltages and currents; verifying phase rotation; setting breakers, ground fault and other relays, controllers, meters and timers; and adjusting all operating equipment.
- B. Caution: Verify that all bearings of equipment furnished are lubricated, all motors are operating in the right direction, and correct drive settings and overload heater elements are provided on all motors. Do not depend wholly on the other trades judgment in these matters. Follow specific instructions in regard to lubrication of equipment furnished under this Contract.

**See Spec Writer Note 2.**

#### **3.4 Operating Demonstration and Instructions**

- A. Set the various systems into operation and demonstrate to the Owner and Engineer that the systems function properly and that the requirements of the Contract are fulfilled.

- B. Provide the Owner's representatives with detailed explanations of operation and maintenance of equipment and systems. A thorough review of the operating and maintenance manuals shall be included in these instructional meetings.
- C. A minimum of 48 hours continuous trouble-free operating time shall be acceptable to prove that the systems function properly.

END OF SECTION

**PART 1 - GENERAL**

1.1 Continuity of Service

- A. Work shall be so planned and executed as to provide reasonable continuous service of existing systems throughout the construction period. Where necessary to disrupt services for short periods of time for connection, alteration or switch over, the Owner shall be notified in advance and outages scheduled at the Owner's direction and Indiana State Fairgrounds events schedule.
- B. Submit, on request, a written step-by-step sequence of operations proposed to accomplish the work. The outline must include tentative dates, times of day for disruption, downtime and restoration of services. Submit the outline sufficiently in advance of the proposed work to allow the Engineer to review the information with the Owner. Upon approval, final planning and the work shall be done in close coordination with the Owner.
- C. Shutdown of systems and work undertaken during shutdown shall be bid as being done outside of normal working hours.

**PART 2 - PRODUCTS**

2.1 Access Panels

- A. Provide ceiling and wall access panels where required to gain access to concealed junction boxes, valves, traps, devices and equipment requiring service or adjustment.
- B. Access panels shall be steel construction (except where aluminum or stainless steel is specified) with concealed hinge and door with screwdriver lock. Locks in "secured" areas of the building shall have tamperproof screws and institutional grade locksets. Panels shall be 18 inches x 18 inches size unless larger panels are shown or required. Mounting frames shall be compatible with the material in which they are installed. Access panels shall be:
  - 1. Standard flush type with overlapping flange for masonry and tile walls, Milcor Style "M" or equal.
  - 2. Standard flush type for drywall ceilings and walls, Milcor Style "M" or equal.
- C. Access panels in fire rated shaft walls and in fire rated ceilings shall be "B" label or greater to match the rating of the wall or ceiling.
- D. Materials used in plenums shall be rated for plenum use conforming to the ASTM E84 25/50 smoke development and flame spread restrictions.

**PART 3 - EXECUTION**

3.1 Workmanship

- A. Materials and equipment shall be installed and supported in a first-class and workmanlike manner by mechanics skilled in their particular trades. Workmanship shall be first-class in all respects, and the Engineer shall have the right to stop the work if highest quality workmanship is not maintained.
- B. Electrical work shall be performed by a licensed Contractor in accordance with requirements of the jurisdiction.

### 3.2 Protection

- A. The Contractor shall be entirely responsible for all material and equipment furnished in connection with their work. Special care shall be taken to properly protect all parts thereof from theft, damage or deterioration during the entire construction period in such a manner as may be necessary, or as directed by the Engineer.
- B. The Owner's property and the property of other contractors shall be scrupulously respected at all times. Provide drop cloths and visqueen or similar barriers where dust and debris is generated, to protect adjacent areas.
- C. This work will be performed in areas occupied by the public. All work shall be secured and de-energized when left for completion at a later time. Review OSHA, State and Local requirements for protection of public access to electrical construction work and comply with these standards.

### 3.3 Cutting and Patching

- A. Refer to Division 01 - General Requirements for information regarding cutting and patching.
- B. Plan the work well ahead of the general construction.
- C. Where conduits, cable trays, and wireways are to pass thru, above or behind existing walls, partitions, floors, roof or ceiling, cutting, patching, refinishing and painting of same shall be included in this contract. Core drilling and saw cutting shall be utilized where practical. Contractor to examine where floors and walls etc. are to be cut for presence of existing utilities.
- D. When cutting or core-drilling floor verify location of existing electrical, plumbing or steel reinforcement. Use X-ray method to verify existence of obstructions. Either re-route existing system brace floor or alter location of new work to maintain existing system.
- E. All sleeves and openings not used or partially used shall be closed to prevent passage of fire or smoke.
- F. All materials, methods and procedures used in patching and refinishing shall be in accordance with applicable provisions of specifications governing the various trades, and shall be completed by skilled workmen normally engaged in these trades. The final appearance and integrity of the patched and refinished areas must meet the approval of the Engineer. Wall, floor and ceiling refinishing must extend to logical termination lines (entire ceiling of the room repainted, for instance), if an acceptable appearance cannot be attained by finishing a partial area.
- G. Provide steel angle or channel lintels to span openings which are cut in existing jointed masonry walls where the opening span exceeds 16 inches. Provide framing around roof openings for required support of the roof deck.
- H. Engage the Owner's Roofing Contractor on a subcontract basis for roofing and roof insulation work necessitated by the Electrical work. The Roofing Sub-Contractor shall be certified for installation and repair of the Owner's roofing system so as to maintain the existing roofing warranty.

### 3.4 Removals, Alterations and Reuse

- A. Refer to the drawings for the scope of work in the existing buildings.

- B. Cooperate with the Prime Contractor regarding all removal and remodeling work. The Contractor shall remove existing work which is associated with their trade, and which will be superfluous when the new system is installed and made operational. Void unused conduit behind walls or below floors as necessary or as directed. No wire or conduit shall be removed which will impair the functioning of the remaining work unless first replaced with a rerouted section of wire or conduit to ensure continuity. Remove inactive wiring back to the last active junction box, panelboard or piece of equipment.
- C. Upon completion, no unused conduit or stub shall extend thru floors, walls or ceilings in finished areas. Abandoned conduit where remaining in place shall have any unused wiring removed. All accessible unused conduit shall be removed.
- D. When it is necessary to reroute a section of an active circuit, the rerouted section shall be installed before removing the existing in order to minimize system down time. Rerouted sections shall be installed as required for new work.
- E. Materials and equipment which are removed shall not be reused within the scope of this project unless specifically noted to be relocated or reused. Turn over to the Owner and place where directed on the premises all removed material and equipment so designated by the Owner. All material and equipment not claimed by the Owner after a reasonable time frame shall become the property of the Contractor responsible for removal and shall be removed from the premises.
- F. Remove, store and reinstall lay-in ceiling tile and grid as needed to perform work in areas where such removal and re-installation is not to be done by the Prime Contractor. Damaged tile and/or grid shall be replaced with new matching tile and/or grid.
- G. In areas of minor work where the space is not completely vacated, temporarily move portable equipment and furnishings within the space as required to complete the work. Coordinate this activity with Owner. Protect the Owner's property by providing dust covers and temporary plastic film barriers to contain dust. Remove barriers and return equipment and furniture upon completion of the work.
- H. Refinish any surface disturbed under this work to match existing, except where refinishing of that surface is included under the General Contract.

### 3.5 Painting

- A. In addition to any painting specified for various individual items of equipment, the following painting shall be included in Division 26:
  - 1. Ferrous metal which is not factory or shop painted or galvanized and which remains exposed to view in the building including finished areas, mechanical rooms, storage rooms, and other unfinished areas shall be given a prime coat of paint and two finish coats of paint.
  - 2. Ferrous metal installed outside the building which is not factory or shop painted or galvanized shall be given a prime coat of paint and two finish coats of paint.
  - 3. Equipment and materials which have been factory or shop coated (prime or finished painted or galvanized), on which the finish has been damaged or has deteriorated, shall be cleaned and refinished equal to its original condition. The entire surface shall be repainted if a uniform appearance cannot be accomplished by touch up.
  - 4. Apply Z.R.C. Galviline cold galvanizing compound, or approved equal, for touch-up and repair of previously galvanized surfaces.
  - 5. Each backboard shall be painted with a minimum of two coats of flame retardant paint, all sides; gray enamel primer with gray matte enamel finish.

- B. Paint, surface preparation and application shall conform to applicable portions of the Painting section of Division 09 of the Specifications. All rust must be removed before application of paint.

### 3.6 Access Panels

- A. Install access panels or pay general trade to do so. Final appearance is subject to approval by the Engineer.
- B. Access locations thru HVAC ductwork must be coordinated with the ductwork installer. Location of the hinged access door with latch must be coordinated in advance with the HVAC Contractor.
- C. Location of access panels shall be planned to clear ceiling lights, ceiling support grids and other obstructions so as to allow, wherever possible, full shoulder clearance beside the device to be inspected, adjusted or repaired.

END OF SECTION

**PART 1 - GENERAL**

- 1.1 Firestopping assemblies shall be provided at penetrations of conduits, cables, cable trays and other electrical items thru fire rated floors, fire rated floor-ceiling and roof ceiling assemblies, fire rated walls and partitions and fire rated shaft walls and partitions and smoke barriers. In addition, firestopping assemblies shall be provided at penetrations thru 0-hour rated floors. Refer to the drawings for fire rated building elements.
- 1.2 Firestopping assemblies shall be tested and rated in accordance with ASTM E814, E119 and listed in accordance with ANSI / UL 1479, as published in the UL Fire Resistance Directory. Firestopping shall provide a fire rating equal to that of the construction being penetrated.
- 1.3 Firestopping materials, assemblies and installation shall conform to requirements of the Indiana State Code and the Authority Having Jurisdiction.
- 1.4 For those firestopping applications that exist for which no UL tested system is available through any manufacturer, a manufacturer's engineering judgment derived from similar UL system designs or other tests shall be submitted to local authorities having jurisdiction for their review and approval prior to installation. Engineering judgment drawings must follow requirements set forth by the International Firestop Council.
- 1.5 Shop drawings shall be prepared and submitted for review and approval. Submittals shall include manufacturer's specifications and technical data of each material, documentation of U.L. firestopping assemblies and installation instructions. Submittals shall include all information required in the Indiana State Code, most recent addition.

**PART 2 - PRODUCTS**

- 2.1 Firestopping materials shall be manufactured and/or supplied by Hilti, 3M, Tremco, or Specified Technologies Inc (STI).
- 2.2 Materials shall be in the form of caulk, putty, sealant, intumescent material, wrap strip, fire blocking, ceramic wool and other materials required for the UL listed assemblies. These shall be installed in conjunction with sleeves and materials for fill and damming.
- 2.3 Combination pre-set floor sleeve and firestopping assemblies shall be equal to Hilti CP 680.

**PART 3 - EXECUTION**

- 3.1 Installation of all materials and assemblies shall be in accordance with UL assembly drawings and the manufacturer's instructions.
- 3.2 Installation shall be done by an experienced installer who is certified, licensed or otherwise qualified by the firestopping manufacturer as having the necessary training and experience.
- 3.3 Refer to 26 05 33 Raceway and Boxes for Electrical Systems for sleeve requirements and treatment of penetrations not requiring firestopping.

END OF SECTION



**PART 1 - GENERAL**

- 1.1 Excavate for all exterior ducts, conductors, conduit, and incidental work which are included in the Electrical contract. Backfill to finish grade or to levels consistent with the Prime Contractor's and the Site Contractor's activities. Cut existing street, drive and parking lot paving, walks, curbs and other permanent hard surfaces which are to be encountered. Repair or restore exterior surfaces to original condition where such are not affected by Division 31 – Earthwork or Division 32 Exterior Improvements. All work shall comply with requirements set forth in Division 31 and 32.
- 1.2 Excavation and trench wall supporting, cribbing, sloping and stepping of excavations required for safety shall be done in accordance with OSHA and local requirements. Pumping of water from excavations and trenches which may be required during construction shall be included in the contract.
- 1.3 Contact the the Oil and Gas Producers Underground Protection Service (1-800-925-0988) and Indiana 811NOW.com?State' 811 Service sufficiently in advance of the start of any excavation so that notification can be made to member utility departments and utility companies (water, sewer, gas, petroleum, electric, telephone, cable, etc.) having underground utilities in or near the project area. Also contact those companies to verify that utility lines have been located and duly marked and identified.
- 1.4 A utility locator service shall be engaged to locate, mark and identify private lines and other utilities that are not located by the means mentioned above.
- 1.5 Existing utilities encountered during excavation work shall be protected in a manner acceptable to the utility owner. Any utilities that are damaged shall be repaired or replaced by this Contractor to the full satisfaction of the utility owner.

**PART 2 - PRODUCTS**

- 2.1 Refer to Division 31, Earthwork for bedding and backfill materials specifications.

**PART 3 - EXECUTION**

- 3.1 Exterior trenches shall be over excavated and the duct, conductor or conduit shall be laid on 4 inches minimum depth sand bed. Where ductbank is concrete encased, excavate to required depth, if fill or backfill needed under ductbank use washed pea gravel or crushed limestone and compactt.
- 3.2 Backfilling of excavations and trenches inside the building and outside under paved or other hard surfaced areas, shall be with graded pea gravel, graded coarse sand or crushed limestone 0.75 inch maximum size, to prevent undue settlement. Backfill material for non-metallic conduit shall be pea gravel or sand. Other excavations and trenches shall be backfilled with similar materials or with excavated material up to 18 inches above the top of the conduit. The remainder shall be with similar materials or with excavated material having no large clots, stones or rocks.
- 3.3 Backfill shall be mechanically compacted in layers not over 6 inches deep. Water settling will not be permitted. Where excavations have not been properly filled or where settlement occurs, they shall be refilled, compacted, smoothed off, and finally made to conform to the initial requirements. Excess excavated materials shall be removed from the site or disposed of as directed by the General Contractor. Refer to Division 31 Earthwork for compaction requirements.
- 3.4 Concrete floor slabs, paving, sidewalks, curbs, sodded and other finished surfaces which have been damaged or removed in order to install the underground work shall be replaced by this Contractor equal to original conditions. Refer to Division 31 and 32 for Surface Restoration

Requirements. This requirement is not applicable in areas where the Prime Contractor or the Site Contractor is obligated to provide new surfaces.

- 3.5 Excavation, backfill, surface repair and traffic control within the public right-of-way shall be in accordance with governing agency rules and regulations. Any fee for activity in the roadway shall be included in this contract so that no additional cost will accrue to the Owner.
- 3.6 Maintain in place adequate barricades, guards, planking, plating, signage, warning lights, etc., at and around excavations.
- 3.7 All exterior underground conduit and concrete encased ducts shall be protected against future excavation damage by placing a plastic tape warning marker in each trench during backfill. Tape shall be 6 inches wide with black letters identifying the type of service. Tape shall be equal to that manufactured by Seton. Install tape full length of the trench approximately 18 inches above and on the centerline of the conduit, duct or conductor.

END OF SECTION

## 26 05 19 A LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS

### PART 1 - GENERAL

1.1 This section pertains to the use of copper conductors, 600V insulation class.

### PART 2 - PRODUCTS

- 2.1 All conductors shall be copper: conductors shall be insulated for 600 volts.
- 2.2 Insulation types referenced are those of NEC. All conductors shall be UL labeled and shall be marked for size and type at regular intervals on its length. Conductors #8 and larger shall be stranded; #10 and smaller may be stranded provided approved terminations are used.
- 2.3 Types of conductor insulation for general use may be any of the following, subject to limitations listed, in addition to those in the NEC:
- A. Type THHN - restrictions - do not use for conductors in slab. Do not use in wet locations.
  - B. Type THWN - no restrictions.
  - C. Type XHHW - no restrictions.
- 2.4 Use shielded VFD cables for feeds from VFD to motor where conductor length is longer than 25 feet. VFD cable shall be 3 conductor XHHW low capacitance copper, full size insulated copper ground, 1.5 mil AL foil and 85 percent tinned copper woven braid shield with PVC oil and sunlight resistant jacket. UL TC-ER, 90 degrees C., 600V wet/dry. Manufactured by Belden, AWC, Lutze or equal.
- 2.5 Use conductors such as type FEP with high temperature insulation as identified in the NEC for connections to resistance heating elements or in other areas subject to temperature exceeding the rating of THWN, XHHW or THHN.
- 2.6 Color Coding – The use of colored commercial building wire is encouraged.
- A. On 208/120 volt, three phase and 240/120 volt, single phase grounded systems, wires colored black, red and blue shall be used for phase conductors. Neutral wires on these systems shall be white. If conductors No. 4 AWG or larger are not available in white or white stripes, the neutral may be a black wire identified with white tape, minimum size 0.50 inch wrapped twice around at the following points:
    - 1. At each terminal.
    - 2. At each conduit entrance.
    - 3. At intervals not more than 12 inches apart in all accessible enclosures.
  - B. On 480/277 volt, three phase system, wires colored brown, orange and yellow shall be used for phase conductors. Neutral wires on these systems shall be gray or other NEC acceptable means for distinguishing each system grounded conductor from another. If conductors No. 4 AWG or larger are not available in the proper colors, black wire may be used with 0.50 inch tape bands of the proper color at the following points:
    - 1. At each terminal.
    - 2. At each conduit entrance.
    - 3. At intervals not more than 12 inches apart in all accessible enclosures.
  - C. Equipment grounding conductors shall be green, or for 4 AWG and larger may be completely taped green, at all accessible points.

- D. All control circuits shall be red with individual wire identification on each conductor.
  - E. Where existing wiring systems (remodel work or building additions) have different color coding, consult the Engineer concerning matching existing wire color coding and phasing.
- 2.7 Wire size ampacity shall equal or exceed its overload protective device. Where wire sizes shown on the drawings are greater than the apparent ampacity requirements, the size shown shall prevail to compensate for voltage drop. In no instance shall conductors be installed that are less than required by N.E.C. Minimum conductor size shall be No. 12 AWG except No. 14 AWG may be used only for control wiring or where otherwise specifically shown.
- 2.8 When necessary to use a lubricant for pulling wires, lubricant must be listed by Underwriters' Laboratories, Inc. Only cable lubricants approved for the type of jacket material or insulation shall be used, and must be of such consistency that it will dry completely when exposed to air. Lubricant must leave no obstruction or tackiness that will prevent pulling out old wires or pulling in new wires or additional wires, and, after drying, must leave a film of lubrication which will promote easy movement of the wires. The lubricant shall contain no waxes, greases, silicones, or polyalkylene glycol oils or waxes. Lubricant shall be Ideal "Yellow 190", 3M "WL" Wire Pulling Lubricant, or approved equal.
- 2.9 Splices No. 10 AWG and smaller shall be made using the following:
- A. Preinsulated spring pressure connectors as follows: ITT Holub "Freespring", with metal grip threads 3M "Scotch-Lok", Ideal "Wingnut", Thomas and Betts Type "PT", or Buchanan "B Cap". Other hard insulated wire connectors which have bakelite or ceramic insulation are prohibited. (Non-metallic thread connectors shall not be used.)
- 2.10 Splices No. 8 AWG and larger shall be made using the following:
- A. Approved crimp type connectors with special crimping tool; T&B, Burndy, Buchanan or approved equal. Joints and free ends shall be covered with tape or approved moistureproof insulating kits. Applied insulation shall exceed 150 percent of conductor insulation voltage rating.
  - B. For two or more taps use Power Distribution Blocks by Square D, Gould, Taylor, IlSCO or Connectron.
- 2.11 Wiring in vertical raceways shall be supported with strain relief devices; Kellem's grips or approved equal.
- 2.12 Connections to equipment shall be made with pressure type terminals. On stranded wire, use spade type terminals or terminals approved for use with stranded wire. Connections shall contain only single conductors unless approved for multiples.
- A. For conductors No. 10 AWG and smaller, applied crimp type terminals shall be T&B "Sta Kon" or approved equal.
  - B. For No. 8 AWG and larger conductors, applied crimp type terminals shall be Burndy, T&B or approved equal.
- 2.13 Where tape is applied over wires and connectors on 600 volt or lower voltage applications, it shall consist of a minimum of two (2) half lapped layers of Scotch "88" or Plymouth No. 4240 for both indoor and outdoor applications, except Scotch 33 Plus or Plymouth No. 4453 is acceptable for use indoors.
- 2.14 Where fireproofing of cables is noted on the drawings or required by Code, each cable shall be arc and fireproofed with one (1) half lapped layer of Scotch Brand 77 Electric Arc and Fireproofing

Tape. Tape shall be secured with a 2 layer band of Scotch Brand 69 Glass Electrical Tape over the last wrap. Installation shall comply with manufacturer's recommendation.

- 2.15 Where installed underground, splices and terminations shall be listed and approved for waterproof application. Utilize kits approved for the application.

### **PART 3 - EXECUTION**

- 3.1 Branch circuit conductor identification means shall be permanently posted at each panelboard and switchboard. This identification shall be installed on the inside of the door and shall identify conductor colors for each voltage system in the building. Provide identification at all new panelboards and existing panelboards utilized within this project.
- 3.2 Conduit systems shall be clear and clean before pulling wire. Branch circuit conductors shall be pulled without resorting to levers or heavy pulling devices.
- 3.3 Cable pulling tensions shall not exceed recommended values.
- 3.4 Group ungrounded and grounded circuit conductors for each multiwire branch circuit by cable ties in panelboards and tap boxes.
- 3.5 Each branch circuit or multiwire branch circuit shall have its own dedicated neutral. Group neutral conductors with phase conductors by wire ties in each enclosure where multiple neutrals provided.
- 3.6 Shielded VFD cables shall be provided for VFD to motor conductors length longer than 25 feet. VFD motor feed cables shall be terminated per VFD manufacturer's direction.
- 3.7 Control conductors shall not be run in same raceway with branch circuit or motor circuit conductors.
- 3.8 Unless noted otherwise on the drawings, a maximum of 8 conductors shall be installed in a branch circuit conduit. This maximum is a count of all phase and neutral conductors only, ground conductors are not counted when determining maximum fill for this purpose.
- 3.9 Wire tags shall be provided on all main and feeder conductors in all pull boxes, wireways and panelboard and switchboard wiring gutters. Tags shall identify wire or cable number and/or equipment served. Tags shall be of flame resisting adhesive material, T&B Type WSL or approved equal.
- 3.10 Perform meggar tests on all feeders and motor branch circuit conductors prior to energization of circuits. Provide documentation in standard NETA format to the Engineer for review. Do not run meggar check on solid state equipment.

END OF SECTION

**PART 1 - GENERAL**

- 1.1 Work includes grounding and bonding of system neutral, equipment and conduit systems to conform to requirements of NEC and as detailed on the plans and in the specifications.

**PART 2 - PRODUCTS**

- 2.1 Grounding rods shall be copper clad, molten-welded copper to steel; unless otherwise designated, 0.625 inch diameter x 10 ft. long.
- 2.2 Clamps and continuity devices shall be non-ferrous material, UL approved. Connections to ground rods and all underground connections shall be "Thermoweld" or "Cadweld".
- 2.3 Ground conductors shall be insulated, identified by green insulation or by painting or taping green at all accessible locations and shall be connected with approved connectors and terminators to boxes, devices, equipment, etc. and to ground bars in panels.

**PART 3 - EXECUTION**

- 3.1 Wiring devices shall be connected with grounding jumper from ground pole on device to grounding screw in the outlet box. Branch circuit to be connected to grounding screw in the outlet box.
- 3.2 The complete metal conduit system shall be used for the equipment grounding system. Conduit systems and associated fittings and terminations shall be made mechanically tight to provide a continuous electrical path to ground and shall be safely grounded at all equipment by bonding all metallic conduit to the equipment enclosures with locknuts cutting thru paint or enclosures. Bond all conduits entering pad-mount transformers, secondary service entrance switchboard or panelboard with a ground wire connecting the grounding type bushings to the equipment ground bar. Conductors shall be sized per NEC Tables 250.66, 250.102 and 250.122. Bond all communications conduit systems to ground.
- 3.3 In addition to using the conduit system for grounding, a complete auxiliary green wire equipment grounding system shall be installed, continuous from main ground, thru distribution and branch circuit panelboards and paralleling all feeders and branch circuit wiring. Grounding conductor sizes shall comply with NEC Table 250.122, minimum size shall be #12 copper except #14 on control circuits. This shall apply to all circuits rated 100 volts or more above ground potential.
- A. Connect ground terminal on wiring devices to auxiliary green wire equipment grounding system.
- 3.4 Motor frames shall be bonded to the equipment grounding system by an independent green insulated copper wire, sized to match equipment grounding conductor. Motors with VFD shall be bonded with flat braided tinned copper straps in lieu of wire.
- 3.5 Cord connected appliance frames shall be grounded to the equipment grounding system thru a green wire in the cord.
- 3.6 Equipment mounted on vibration isolation hanger and supports shall be bonded so bond does not transmit vibration. Size bond to match equipment ground conductor.
- 3.7 A green grounding conductor shall be installed in each non-metallic conduit and all flexible conduits, including exterior underground conduits.
- 3.8 System neutral connections shall be insulated from metal enclosures except at the neutral of the service entrance equipment and on the neutral of a separately derived system.

- 3.9 The building neutral shall be identified throughout with white conductors. Where there are neutral conductors from a separately derived system (such as 120/208 volt, 3 phase, 4 wire where the main building service is 277/480 volt, 3 phase, 4 wire) the neutrals of the two systems shall be separately identifiable per NEC Article 200.
- 3.10 Where metal covers on pull boxes and junction boxes are used, they shall comply with the grounding and bonding requirements of NEC Article 250.
- 3.11 Connections to driven ground rods or other such electrodes shall be a minimum of three feet from the foundation wall or beyond the roof drip line, whichever is greater.
- 3.12 The electrodes (driven ground rods) of the electrical grounding system shall not be used for the electrodes for the lightning protection system, and vice versa.
- 3.13 Grounding Systems Tests
- A. Visual and Mechanical Inspection: Inspect ground system for compliance with plans and specifications.
    - 1. Electrical Tests
    - 2. Perform ground continuity test between main ground system and equipment frame, system neutral and/or derived neutral point. This test shall be made by passing a minimum of ten amperes DC current between ground reference system and the ground point to be tested. Voltage drop shall be measured and resistance calculated by voltage drop method.
  - B. Test Values: The main ground electrode system resistance to ground should be no greater than five ohms.
  - C. Measure neutral-to-ground insulation resistance with neutral disconnect link temporarily removed. Report resistance level. Investigate and correct low resistance levels. Replace link before re-energizing system.

END OF SECTION

**PART 1 - GENERAL**

1.1 Equipment Identification

- A. Identify all the following items with laminated plates:
  - 1. Secondary distribution switchboards, including all subassembly switches.
  - 2. Every motor controller and disconnect switch.
  - 3. Panelboards.
- B. Nameplate on motor controllers, disconnect switches, automatic transfer switches, switchgear, switchboards, panelboards and transformers shall indicate source, voltage, disconnect location, and load served.
- C. Branch circuit panelboards:
  - 1. Identify panel designation on directory card within the panel.
  - 2. Fill out branch circuit directory indicating circuit number and area served, rooms, group of rooms, lighting, convenience outlets, motors, etc. Card index shall be neatly typed. Provide electronic file for card using Excel.
  - 3. Update or replace branch circuit directory in existing panelboards in areas of alteration.
  - 4. Branch circuit phase conductor color format shall be permanently identified inside each panelboard.
- D. Wire identification:
  - 1. Identify communications and signaling system wiring and branch circuit wiring by circuit number in panels and motor control center wiring gutters by means of permanent durable wire markers wrapped around or fastened to conductors. This shall be done concurrently with pulling of conductors.

**PART 2 - PRODUCTS**

2.1 Nameplates

- A. Nameplates shall be laminated phenolic with black surface and white core. Use 0.0625 inch thick material for plates up to 2 inches x 4 inches and 0.125 inch thick for larger sizes. The lettering shall be Condensed Gothic with space between the lines equal to the width of the letters. Use 0.375 inch minimum height letters on the small plates increasing the size proportionately to plate size.
- B. The lettering on the plate shall indicate the name of equipment, the specific unit number, voltage, phases, which panel, switchboard or motor control center the equipment is served from, and any other reference data pertinent to the operation. Names and numbers shall coincide with those listed on the drawings. Sample: Panel 3A; 277/480 V, 3 phase, 4 wire, served from unit substation USI.

**PART 3 - EXECUTION**

- 3.1 Nameplates shall be secured with screws, one on each end.

END OF SECTION



**PART 1 - GENERAL**

1.1 Specific wiring applications are identified. Refer to applicable sections of the specifications.

**PART 2 - PRODUCTS**

2.1 Materials and equipment shall be as indicated on the drawings and in the specifications.

**PART 3 - EXECUTION**

3.1 Final connections to fixture pigtails shall be made with approved pressure connectors such as 3M "Scotchlok".

3.2 Miscellaneous Equipment Connections

- A. Various items of equipment such as Air Handling Units, Roof Top Units, Condensing Units, Fan Coils, Unit Heaters, Electric Heaters, etc. will be furnished and set in place by other trades. This equipment, unless otherwise shown on the drawings, will be furnished with necessary electrical outlets, operating and control switches, terminating in an electrical outlet box, or equivalent electrical connector located on the equipment. This Contractor shall furnish power wiring to these various items of equipment and connect them up complete and ready for operation.
- B. Where disconnect switches are indicated or where otherwise required, these shall be mounted in an accessible location. Care shall be taken that such switches will be accessible and do not interfere with installation of the equipment.
- C. Roughing in drawings for equipment shall be obtained from the Engineer as the time approaches when such equipment is required. (Allow a reasonable period from the time of notice to secure this information.)

3.3 Miscellaneous Wiring and Interlocks

- A. Various items of work in connection with interlocking motor and starter operations and providing wiring to serve equipment which is furnished by other trades.
- B. Interlocks between motor controllers for purposes of accomplishing sequence control or simultaneous operation of motors are all to be included by the Contractor. Requirements for a simple simultaneous motor operation interlock are indicated by a schedule on the drawings. These interlocks consist of auxiliary contacts on the starter of the lead motor wired in, according to standard diagrams of the motor starter manufacturer to energize the holding coil of the starter for the motor. These interlocks shall be thru the "automatic" position only of the starter where HOA switches are supplied. Where interlocks, other than the simple sequence above are required, these shall be as described hereinafter. This Contractor shall inquire of the Engineer during bidding, or at the earliest practical date, regarding any questions which may arise regarding the intention and scope of this work. This Contractor shall furnish extra contacts for their starters where required, in lieu of which they may furnish externally mounted relays to accomplish the specified function.
- C. The following is a list of equipment and systems requiring wiring. Note that these are in addition to standard interlocks which are scheduled on the drawings.
  - 1. Motorized backdraft dampers on exhaust fans and power roof ventilators shall be connected up to their respective associated motor leads to energize the backdraft

damper motor and open the damper when the fan operates. Dampers, operator and transformer if required, will be furnished by the fan supplier.

2. Independently mounted controllers, furnished by other trades: where starters are furnished by other trades, and are required to be mounted remote from the motor, this Contractor shall accept and mount them and perform all power and control wiring between controls and motors as indicated. Motor controllers equipped with automatic alternators shall have two independent circuits and control sources to preclude loss of operation when one circuit fails.

END OF SECTION

**26 24 16 A PANELBOARDS**

**PART 1 - GENERAL**

- 1.1 Each panelboard shall comply with all applicable codes, recommended practices and standards of IEEE, NEMA and UL. Panelboard shall be UL labeled.
- 1.2 The panelboard manufacturer shall supply equipment which is rated, listed, and labeled for the available short circuit current and the fuse/circuit breaker combinations indicated in the fault current analysis.

**PART 2 - PRODUCTS**

2.1 Panelboard Types

A. 240 Volt (Maximum) AC Panelboards

- 1. Breakers shall be “bolt-on” type and in sizes thru 100 amp shall be minimum 10,000 amp, I.C. rated with adequate rating to interrupt the available fault current, for a fully rated system or similar to:

	<b>Series Combination 200A Class “RK1” Fuses</b>	<b>Series Combination 200A Class “J” Time Delay uses</b>	<b>Series Rated Breaker/Breakers</b>
<b>Square D Eaton Siemens G.E.</b>	Use fully rated system. GB, GHB HED4, ED4 THQB	QOB BAB, QBHW HED4, ED4 THQB	QOB GB, BAB-H, GHB HED4, ED4 THQB

- 2. GFCI breaker – UL Class A (5 milliampere sensitivity, combination type). Ground fault circuit protection shall be an integral part of the branch circuit breaker which also provides overload and short circuit protection. Space required in panelboard shall be same as standard single pole circuit breaker.
- 3. Panelboard by Square D Type “NQ”, G.E. Type “AQ”, Eaton “Pow-R-Line PRL2” or Siemens P2 series.

B. 277/480 Volt AC Panelboards

- 1. Breakers shall be “bolt-on” type and in sizes thru 100 amps shall be minimum 42,000 amp I.C. rated with adequate rating to interrupt the available fault current; for a fully rated system or similar to:

	<b>Series Combination 200A Class “RK1” Fuses</b>	<b>Series Combination 200A Class “J”</b>	<b>Series Rated Breaker/Breakers</b>
<b>Square D Eaton Siemens G.E.</b>	Use fully rated system. GHB BQCH TEY	EDB GHB ED4 AND FXD6 TEY	EDB GHB BQCH TEY

- 2. Panelboards by Square D type "NF" G.E. type “AE”, Eaton “Pow-R-Line PRL2”, or Siemens P2 Series.

C. Circuit Breaker Distribution Panelboard

1. Removable front with hinged door. Bussing braced for the available fault current; 1200 amp bussing and less.
2. Main and branch breakers shall be solid state trip molded case type with long time, short time, instantaneous trip. Breakers shall be molded case type, thermal-magnetic protection, 600 Amp and larger shall be 100% rated, breakers smaller than 400Amp may be 80 percent rated.
3. Power and distribution panelboards by Square D "I-Line", Siemens "P4 Series", Eaton "Pow-R-Line PRL4" or G.E. Spectra Series.

2.2 Refer to "Identification for Electrical System" Section 26 05 53, for nameplate requirements.

2.3 General Construction

- A. Code gauge, galvanized steel tubs with minimum 4 inches clear gutters all sides. Minimum tub width 20 inches, depth 5 inches.
- B. Locking type reinforced doors with concealed hinges; equipped with directory card holder on inside of door; enameled finish. Doors over 48 inches high shall have 3 point latch and vault locks. All locks shall be master keyed cylinder, keyed alike.
- C. Permanent individual breaker pole numbers affixed adjacent to each breaker in a uniform position consisting of a stamped metallic or painted numeral.
- D. Bussing shall be copper.
- E. Branch circuit panelboard tubs and fronts shall be sized to have 225 amp bussing and accommodate 42 poles unless indicated otherwise on the drawings. Furnish number of breakers shown.
- F. A neutral bar assembly (when required) and separate ground bar assembly shall be provided. Each assembly shall be copper and have the adequate number of terminals, of sufficient size and type of anti-turn solderless lugs. Each assembly shall have conductor terminal screwdriver slots facing the front of the panel. Bond ground bar assembly to panel cabinet.
- G. Terminals for feeder conductors to the panelboard mains, neutral, ground and branch circuit breaker wiring shall be suitable for the type of conductor specified.
- H. Circuit breakers shall be bolted on type and where more than one pole is used, they shall employ a common trip.
- I. Breakers used for protection of heating, air conditioning and refrigeration equipment shall be UL "HACR" type.

2.4 The panelboards and breakers shall be adequately rated for the available fault current as indicated on the drawings and in the specifications. The total breaker and fuse short circuit and overcurrent protective system shall be U.L. Fully Rated.

**PART 3 - EXECUTION**

3.1 Mount top of wall mounted cabinets 6 feet 0 inches above floor. Coordinate location of recessed panels so they are accessible and to avoid interference with other equipment and trades. Mount and anchor floor set panelboards on a 4 inch high concrete pad furnished by this Contractor.

- 3.2 The position of breakers in each panel shall be arranged in the field for sequence phasing by this Contractor to best suit wiring conditions and balancing of phases. Fill in, typewritten, the directory of each branch circuit panelboard.
- 3.3 For multi-wire branch circuit group circuit breaker together and provide breaker handle tie. Group conductors together with tie-wrap.

END OF SECTION

## 26 27 16 ELECTRICAL CABINETS AND ENCLOSURES

### PART 1 - GENERAL

- 1.1 Work includes all special cabinets and enclosures; equipment shall conform to requirements of N.E.C. and shall be UL labeled.

### PART 2 - PRODUCTS

#### 2.1 Indoor Cabinets - NEMA 1

- A. Cabinets shall be galvanized code gauge steel, finished gray enamel or manufacturer's standard equivalent finish, of sizes shown with flush painted hinged door and master keyed cylinder locks keyed to match panelboard locks. Cabinets in finished areas shall be designed for flush mounting with separable front overlapping flange. Cabinets in concealed areas shall be surface mounted types.

#### 2.2 Outdoor Enclosure - Single Door - Small

- A. The enclosure shall meet or exceed the requirements of a NEMA 3R or 4X rating and shall be UL listed.
- B. The cabinet and door shall be constructed from 5052-H32 sheet aluminum alloy; 0.125 inch thick. The door opening shall be double flanged on all four sides.
- C. The cabinet door shall be a minimum of 80 percent of the front surface area and shall be gasketed (UL 508 table 21.1) with weather tight seal between the cabinet and door.
- D. The hinges shall be continuous and made of 0.063 inch stainless steel with 0.120 inch diameter stainless steel hinge pins.
- E. The latching mechanism shall be a slam type with Corbin #R357SGS, or equal lock with keyhole cover for NEMA 3R enclosure; for NEMA Type 4X enclosure, the latch shall be weather tight quarter turn type. Furnish 2 keys with each lock.
- F. Provide aluminum back panel 0.125 inch thick complete with all mounting hardware.
- G. Cabinet finish shall be natural aluminum finish or factory painted using the three step iron phosphate conversion technique; standard grey color unless indicated otherwise.
- H. Cabinet mounting plates shall be located at bottom and top of enclosure for either in wall mounting or surface mounting.

### PART 3 - EXECUTION

- 3.1 Mount the cabinets and enclosures as indicated on the drawings and in accordance with manufacturer's instructions.
- 3.2 Mount top of wall mounted cabinets 6 feet-0 inches above floor. Coordinate location of recessed cabinets so they are accessible and to avoid interference with other equipment and trades.
- 3.3 Refer to "Identification for Electrical System" Section for nameplate requirements.

END OF SECTION

**PART 1 - GENERAL**

- 1.1 Wiring devices are identified on the drawings per legend symbols or as specifically noted. Receptacles are identified in the legend by NEMA configuration numbers only. Catalog numbers from acceptable manufacturers for the common wiring devices shall be as listed herein. Catalog numbers are not listed for all devices. Other devices, such as clock hanger outlets, etc. shall be furnished by one of the manufacturers listed and shall be equal in quality to the device series listed.
- 1.2 When shop drawings are required for wiring devices and coverplates, the submittal shall be comprehensive for all wiring device configurations listed in the legend and for devices specifically noted on the drawings.

**PART 2 - PRODUCTS**

- 2.1 Extra hard use specification grade receptacles shall be listed by Underwriters Laboratories, Inc. Receptacles shall be minimum 20-ampere, 125 volt, NEMA configuration 5 20R and ivory (select color) in color unless noted otherwise. Where identified on drawing that receptacle is controlled a device of same design to be furnished but with controlled symbol marking.

Acceptable Manufacturer	Single	Duplex	Ground Fault	WR GFCI	Isolated Ground	Tamper Resistant
Eaton	5361	AH5362	SGF20	WRSGF20	AHIG5362	TR5362
Bryant	5361	BRY5362	GFRST20	GFWRST20	BRY5362IG	BRY5362TR
Hubbell	HBL5361	HBL5362	GFR5362SG	GFR5362SG	IG5362	HBL5362TR
Leviton	5361	5362S	G5362WT	G5362WT	5362IG	5362SG
P&S	5361	5362A	2095	IG5362		TR5362

- 2.2 Receptacles installed in a damp or wet location shall be a listed weather-resistant (WR) type.
- A. Receptacle shall be installed in a listed weatherproof enclosure, whether or not the attachable plug cap is inserted.
- 2.3 Provide GFCI devices as shown on drawings and in compliance with NEC 210.8 for type and location. Where GFCI receptacle devices not available at rating required a GFCI protection device to be provided. Bender Lifeguard series.
- 2.4 Provide a device plate to suit each particular application. Cover all empty outlet boxes with a blank plate. Coverplates shall be manufactured by Pass and Seymour, Hubbell, Cooper, Bryant, Leviton or Mulberry; Taymac is an acceptable manufacturer for weatherproof non-metallic coverplates Multi-Mac Series, "While-In-Use" type, 3.5 inches depth, 'Extra Duty', opaque grey, locking tab.
- 2.5 In finished spaces, wall plates shall be nominal .032 inch thick, made of 302 high nickel stainless steel with brushed satin finish and beveled edges. Screws shall be metal with countersunk heads and finished to match plates. Sectional plates will not be permitted.

**PART 3 - EXECUTION**

- 3.1 Locate devices as shown on the drawings, coordinate exact location with other trades, to avoid interference. Check for potential interference from door swings, cabinets, heating equipment and other wall mounted devices.
- 3.2 Clean debris from outlet boxes.
- 3.3 Install receptacles with grounding pole on bottom.

- 3.4 Verify each receptacle device is energized and test each device for proper polarity.
- 3.5 Adjust devices and wall plates to be flush and level.

END OF SECTION



**26 28 13 FUSES**

**PART 1 - GENERAL**

- 1.1 Safety switches and other fusible protective devices provided under this contract shall be complete with fuses properly sized to protect the feeders and equipment served.
- 1.2 Fuses shall not be shipped installed in switches in electrical equipment nor shall they be shipped to the job site until the equipment is ready to be energized. Fuses shall be of the same manufacturer to retain selectivity as designed.

**PART 2 - PRODUCTS**

- 2.1 Manufacturers shall be Bussmann, Mersen, Littelfuse or Edison.
- 2.2 Fuses shall be current limiting with 200,000 amperes interrupting capacity, all shall be UL labeled.
- 2.3 Fuses, 601 ampere to 6,000 ampere (bolt type dimensions) shall be UL Class "L" fuses. The size and type is indicated on drawings; Bussmann HI CAP time delay fuse KRP C shall be used.
- 2.4 Fuses with ampere ratings 1 ampere to 600 ampere (standard dimensions) shall be UL Class RK 1. The size and type is indicated on drawings. Bussmann LOW PEAK Time Delay fuse LPN RK (250 volts) or LPS RK (600 volts).
- 2.5 Where Bussmann specific fuse types are indicated above or on the drawings, acceptable fuses by cross reference of manufacturers are:

Voltage UL Class	Ratings	Bussmann	Mersen	Littel Fuse	Edison
L	600 V	HI CAP KRP C	AMP TRAP A4BQ( )	POWR-PRO KLPC	LCL
RK 1	250V 600V	Low Peak LPN RK LPS RK	AMP TRAP II A2D ( ) R A6D ( ) R	POWR-PRO LLN-RK LLS-RK	LEN-RK LES-RK

**PART 3 - EXECUTION**

- 3.1 Place a fuse identification label showing type and size inside door of each switch. Use fuse reducers where fuse gaps are larger than fuse dimension.
- 3.2 Verify fuse types before installation for proper application by voltage and ampere ratings; fuses protecting motors shall not exceed 150 percent of motor nameplate amps. (Applies to fuses in sizes 600 amps and below.)
- 3.3 Furnish the Owner with a minimum of 25 percent of quantity of each size installed, but not less than one complete set of three spare fuses for each size of fuse furnished.

END OF SECTION

## **26 28 16      DISCONNECT SWITCHES**

### **PART 1 - GENERAL**

- 1.1 Provide disconnect switches, fused and non-fused, where indicated on the drawings and in the specifications, and where required by the NEC.

### **PART 2 - PRODUCTS**

- 2.1 Disconnect switches shall be listed by Underwriter's Laboratories and shall be manufactured by Square D, Siemens, or Eaton. All starters and disconnect switches shall be of the same manufacturer unless otherwise approved.
- 2.2 Switches shall be Heavy-Duty Type, NEMA 1 enclosures, non-fused except where fuses are specified or required to protect wiring from overload; provide raintight NEMA 3R type enclosures for outdoor applications unless otherwise noted.
- 2.3 Disconnect switches shall be quick-make, quick-break, externally operated with door interlocked with operating handle. Provide solid neutral and ground bars where indicated or where required by the application.
- 2.4 Disconnect switches shall have multiple padlock provisions in the off position.
- 2.5 The fuse holders shall be designed for Class "R" rejection type fuses.
- 2.6 Refer to "Identification for Electrical Systems" Section for nameplate requirements.

### **PART 3 - EXECUTION**

- 3.1 Mount top of wall mounted disconnect switch 6 ft.-0 inches above floor where space permits.
- 3.2 Coordinate location of disconnect switches to avoid interference with other equipment and trades and allow access for safe operation.

END OF SECTION

**PART 1 - GENERAL**

- 1.1 Schedules on the drawings list motors with disconnect and starter requirements and associated controls. Motor starters and disconnects shall be furnished under this Contract except where specifically shown or specified to be furnished by other trades. Motor starters and disconnects shall be manufactured and rated in accordance with NEMA, UL and IEEE standards. IEC RATED CONTACTORS AND OVERLOADS ARE NOT ACCEPTABLE.
- 1.2 Refer to "Disconnect Switches" Section for switch requirements.
- 1.3 All motor starters shall be rated for the available fault current at the point of application.

**PART 2 - PRODUCTS**

- 2.1 Manufacturer Allen Bradley, whose catalog numbers are used herein as a standard, or equivalent by Square D Type S (Class 8536), G.E. Series CR306, Eaton Class AN16 or Siemens "U.S. Series". All starters and disconnect switches shall be of the same manufacturer unless otherwise approved.
- 2.2 Where new motor starters and disconnect switches are to be installed in existing motor control centers they shall match existing units.
- 2.3 Magnetic starters shall be line voltage suitable for the service listed on the drawings. Each starter shall have one extra auxiliary contact for future control purposes, a 3-leg melting alloy thermal overload relay on a single block, a manual reset mechanism, a 120-volt control coil, Bulletin 509. Contractor shall have the option of installing Bulletin 512 combination starters in place of separately mounted switches and starters. Disconnects shall be fused type unless otherwise specifically indicated or required by NEC.
- 2.4 A HAND-OFF-AUTO selector switch shall be mounted in the face of each starter enclosure. The selector switch shall be so wired that when it is in the HAND or AUTO position, all SAFETY controls are wired in series with the selector switch; all CONTROL DEVICES shall be wired in the AUTO position only.
- 2.5 Each starter enclosure shall have a suitable 120-volt secondary control transformer fused separately on each phase of the primary and secondary, and grounded on the secondary.
- 2.6 Each starter shall have a red LED pilot light mounted in the face of the starter enclosure. The LED shall be wired so it will be on when the motor is energized.
- 2.7 Magnetic starters shall be furnished for motors, one horsepower and greater or any 3-phase motor, unless indicated otherwise on plan.
- 2.8 Manual starters with thermal overload protection shall be furnished for fractional horsepower, single phase motors unless otherwise noted and shall be Bulletin 600 with a pilot light, flush mounted in finished areas.
- 2.9 Unless otherwise noted or required by Code, safety switches shall be Heavy Duty Type, NEMA 1 enclosures, fused except where fuses are specified or required to protect wiring from overload. Switches shall be quick make, quick break, externally operated with door interlocked with operating handle and padlock provisions in OFF position. Provide solid neutral and ground bars where required. Switches located outside shall be raintight NEMA 3R, unless otherwise noted.

### **PART 3 - EXECUTION**

- 3.1 Check full load ampere and service factor rating of each motor after installed and furnish the proper size overload heater elements to protect the motor.
- 3.2 Those portions of interlock and control wiring which are required but not prewired, shall be done in the field.
- 3.3 Motor starters and disconnect switches shall be conveniently accessible; all NEC minimum clearances from walls, pipes, ducts, equipment, etc., shall be maintained. Locate as inconspicuously as possible in finished spaces.
- 3.4 Refer to "Identification for Electrical Systems" section for nameplate requirements.
- 3.5 Place label in each motor starter door identifying motor served, nameplate horsepower, full load amperes, code letter, service factor, voltage / phase, OL type and OL size.

END OF SECTION

**PART 1 - GENERAL**

- 1.1 This specification describes the mechanical and electrical requirements for a low voltage Surge Protective Device (SPD); refer to Article 285 of the NEC. The SPD shall be suitable for application in category environments as described..
- 1.2 The SPD with integral disconnect switch and overcurrent protection shall be UL Listed for parallel connection to the electrical system and shall be weatherproof.
- 1.3 Submit the following for approval:
- A. All related shop drawings, product data, manufacturer's installation instructions and maintenance manuals.
  - B. Dimensional drawing of each SPD type indicating mounting arrangements.
  - C. Single line diagram indicating all field connection requirements, conductor and overcurrent sizes, recommended conduit type, alarm contacts, etc.
  - D. Maximum Surge Current Rating: Provide test reports demonstrating that the SPD is capable of surviving the specified maximum surge current rating. The rating shall be provided on a per mode basis. Reports shall clearly show that the tests have been performed on a COMPLETE SPD including all necessary fusing, thermal disconnects, integral disconnects, monitoring systems, etc.
  - E. Minimum repetitive surge current ratings: Test reports from a third-party testing organization will demonstrate that a COMPLETE SPD has been tested to specified ratings. A complete device will include all necessary fusing, thermal disconnects, integral disconnects, monitoring systems, etc.
  - F. Provide name of the nationally recognized independent testing laboratory that performed tests verifying that the COMPLETE SPD can survive the published surge current rating on a per mode and per phase basis and at maximum surge current level the fuses survive without blowing when the manufacturer recommended disconnect and overcurrent protection are installed in same test and circuit.
  - G. UL documented Voltage Protection Ratings (VPR) for all modes. (L-L, L-N, L-G, N-G)
  - H. Short Circuit Current Rating (SCCR).
  - I. Maximum Continuous Operating Voltage Rating (MCOV).
  - J. I-nominal (I-n).
  - K. Type listing.
- 1.4 Manufacturers Qualifications: Firms regularly engaged in the manufacture of SPD products for specified category and whose products have been in satisfactory service for not less than 5 years.
- 1.5 UL compliance and labeling: Listed per latest edition of UL 1449 Fourth Edition and latest editions of UL 1283 and UL 1414 for Electromagnetic Interference Filters, where applicable.
- 1.6 SPD shall be independently laboratory tested.

- 1.7 NEC compliance: Comply with NEC as applicable to construction and Article 285 for installation. The mounting position of the SPD shall permit a short lead length.
- 1.8 In accordance with NEC Article 285, the SPD shall be clearly marked with the short circuit current rating. The SCCR rating shall meet or exceed the rating of the equipment to which it will be applied. Providing additional fusing to meet this requirement shall not impact the maximum surge current rating or the minimum repetitive surge current rating. Test reports furnished from third party testing organizations shall verify this.
- 1.9 The SPD shall be warranted for unconditional failure replacement for a minimum of 10 years inclusive of all labor to restore the device to functionality. The first 5 years of this warranty will include the field labor required to remove/replace/or repair the failed SPD. Submit Warranty with shop drawings.
- 1.10 The SPD MOVs will be individually fused to provide full system redundancy and provide a short circuit current rating of 200kAIC. The fusing system will also allow the full maximum surge current rating to pass through without fuse operation.
- 1.11 By ANSI/IEEE C62.45 definition, "Category C3 Combination Wave" is 20 KV 1.2 microsecond open circuit voltage, 10 kA 8/20 microsecond short circuit current. Where category C3 is referenced in this specification, it shall mean the same.
- 1.12 The overcurrent protection/disconnect device shall have a short circuit current rating SCCR greater than that available on the electrical distribution system.

**PART 2 - PRODUCTS**

2.1 The SPD for main service entrance rated 800 A and above and unit substations shall be located on top of the main switch and have:

- A. SPD shall be UL labeled as Type 1 – verified through certification at UL.com.
- B. A surge current capacity of 240,000 amps minimum total per phase (8/20 microsecond surge current pulse) and rated for category C3; minimum 120 kA L-G, 120 kA L-N, 120 kA N-G.
- C. SPD shall be UL labeled with 20 kA I-nominal I-n for compliance to UL96A Lightning Protection Master Label and NFPA 780.
- D. UL 1449 Listed Voltage Protection Ratings (VPRs) shall not exceed the following:

System Voltage	L-N	L-G	L-L	N-G
208Y/120	800V	800V	1200V	700V
480Y/277	1200V	1200V	2000V	1200V

(Mode VPRs verifiable at UL.com. Numerically lower is allowed/preferred/ old-style suppressed voltage ratings (SVRs) shall not be submitted, nor evaluated due to outdated less-strenuous testing).

E. UL 1449 Listed Maximum Continuous Operating Voltage (MCOV):

System Voltage	Allowable System Voltage Fluctuation (%)	MCOV
208Y/120	25%	150V
480Y/277	15%	320V

- F. The SPD shall have a minimum repetitive surge current rating of 5,000 ANSI/IEEE C62.41 Category C3 impulses. Manufacturers may propose alternative maximum surge current ratings provided that this requirement is met.
- G. All modes of protection L-L, L-N, L-G and N-G.
- H. When a suppression filter system is supplied, it shall comply with UL 1283. Typical noise attenuation shall be:  
-34 dB at 100 kHz; -51 dB at 1 MHz; -54 dB at 10 MHz; -48 dB at 100 MHz.
- I. Approved manufacturers and models, subject to compliance with requirements, are:

MAIN SERVICE		
	120/208V	277/480V
Eaton	SPD250-208Y3M	SPD260-480Y3M
Joslyn (T&B)	JSP240-3Y208B	JSP240-3Y480B
Current Tech (T&B)	CGP120-120/208-3GY	CGP120-277/480-3GY
ASCO	520120YP25ACCLIX	520277YP25ACCLIX
Square D	SSP02EMA24D	SSP04EMA24D

2.2 The SPD for panelboards and for main service rated 400A. to 600A. where indicated on the drawings shall have:

- A. SPD shall be labeled as type 2 – verified through certification on UL.com.
- B. A surge current capacity of 120,000 amps minimum total per phase (8 x 20 microsecond waveform) and rated for category C3; 60 kA L-G; 60 kA L-N; 60 kA N-G.
- C. SPD shall be UL labeled with 20 kA I-nominal I-n.
- D. UL 1449 Listed Voltage Protection Ratings (VPRs) shall not exceed the following:

System Voltage	L-N	L-G	L-L	N-G
208Y/120	800V	800V	1000V	800V
480Y/277	1200V	1200V	1800V	1200V

- E. UL 1449 Listed Maximum Continuous Operating Voltage (MCOV) (verifiable at UL.com):

System Voltage	Allowable System Voltage Fluctuation (%)	MCOV
208Y/120	25%	150V
480Y/277	15%	320V

- F. The SPD shall have a minimum repetitive surge current rating of 5,000 ANSI/IEEE C62.41 Category C3 impulses. Manufacturers may propose alternative maximum surge current ratings provided that this requirement is met.
- G. All modes of protection L-L, L-N, L-G and N-G.
- H. UL 1283 high frequency extended range tracking filter. Typical noise attenuation shall be:

-34 dB at 100 kHz; -51 dB at 1 MHz; -54 dB at 10 MHz; -48 dB at 100 MHz.

- I. Approved manufacturers and models, subject to compliance with requirements are:

PANELBOARDS AND LOAD SIDE OF ATS		
	120/208 V	277/480 V
ASCO	520120YP13ACCLIX	520277YP13ACCLIX
Eaton	SPD 120-208Y3M	SPD 120-480Y3M
Joslyn (T&B)	JSP 120-3Y208B	JSP 120-3Y480B
Current Tech (T&B)	CGP60-120/208-3GY	CGP60-277/480-3GY
Square D	SSP02EMA12D	SSP04EMA12P

- 2.3 The SPD shall be compatible with the electrical system, voltage, current and distribution configuration.
- 2.4 The SPD shall use only solid state clamping components to limit the surge voltage.
- 2.5 The SPD shall use LED indicators, which provide indication of proper suppressor operation and of suppression-failure; provide means for assuring lamps are operable. Include optically isolated N/C drop contacts for remote monitoring.
- 2.6 A means of mechanical safety disconnect shall be provided with a symmetrical fault current commensurate with the installation location. This disconnect shall be used for isolating the SPD from the electrical service for repair/testing without taking the whole panelboard, switchboard, or ATS out of service.

### PART 3 - EXECUTION

- 3.1 For main disconnect applications, connect the SPD to the main bus on the load side of the main fuses. Provide 3 spare fuses for each SPD. Note: The SPD and overcurrent/disconnect device shall have a short circuit current rating SCCR greater than that available on the electrical system.
- 3.2 All conductors shall be copper and sized per the manufacturer's recommendations. The conductors are to be as short and straight as practically possible and shall not exceed 18 inches in length and shall be installed in PVC conduit (as local jurisdiction allows) where raceway is required. The input conductors are to be twisted together to reduce the SPD system inductance.
- 3.3 The SPD shall be installed following the SPD manufacturer's recommended practices and in compliance with all applicable codes.
- 3.4 A SPD will not withstand an overvoltage condition. Disconnect each SPD before using testing equipment on the system such as meggers and high voltage test equipment.
- 3.5 Before energizing the SPD and before installation of the SPD shall be considered complete, the Contractor shall verify the integrity of the ground system to which the SPD is connected including grounding of all service entrance neutrals and neutrals of all separately derived systems as required by the NEC.

END OF SECTION



## DIVISION 23 - HVAC INDEX

### Indiana State Fairgrounds HVAC Replacements

Client: Chad Lethig  
Address: 1202 E 38<sup>th</sup> Street  
Indianapolis, IN 46205

HEAPY  
MEP Engineer  
Dayton, Ohio Project No. 2023-07154

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FEBRUARY, 2024

## **23 05 01 BASIC HVAC REQUIREMENTS**

### **PART 1 - GENERAL**

#### 1.1 Special Note

- A. All provisions of the Bidding Requirements, General Conditions, and Supplementary Conditions, including Divisions 00 and 01, apply to work specified in this Division.
- B. The scope of the Division 23 work includes furnishing, installing, testing and warranty of all work and complete HVAC systems as shown on the M series drawings, and as specified in Division 23 and elsewhere in the project documents.
- C. Understanding that the contractors for various Divisions are sub-contractors to the Prime Contractor assignments of work by division are not intended to restrict the Prime Contractor in assignment of work among the contractors to accommodate trade agreements and practices or the normal conduct of the construction work. If there is a conflict of assigned work between Divisions 02 thru 33 and Divisions 00 and 01, Divisions 00 and 01 shall take precedence.

#### 1.2 Permits and Regulations

- A. Include payment of all permit and inspection fees applicable to the Division 23 work. Furnish for the Owner certificates of approval from the governing inspection agencies, as a condition for final payment.
- B. Work must conform to applicable local, state and federal laws, ordinances and regulations. Where drawings or specifications exceed code requirements, the drawings and specifications shall govern. Install no work contrary to minimum legal standards.

#### 1.3 Inspection of Site

- A. Inspect the project site and the premises of the existing building. Conditions shall be compared with information shown on the drawings. Report immediately to the Prime Contractor or Engineer any significant discrepancies which may be discovered. After the contract is signed, no allowance will be made for failure to have made a thorough inspection.

#### 1.4 Drawings and Specifications

- A. The drawings indicate the general arrangement of the work and are to be followed insofar as possible. The word "provide", as used, shall mean "furnish and install". If significant deviations from the layout are necessitated by field conditions, detailed layouts of the proposed departures shall be submitted to the Prime Contractor or Engineer for approval before proceeding with the work.
- B. Make all necessary field measurements to ensure correct fitting. Coordinate work with all other trades in such a manner as to cause a minimum of conflict or delay.
- C. The drawings and specifications shall be carefully studied during the course of bidding and construction. Any errors, omissions or discrepancies encountered shall be referred immediately to the Prime Contractor or Engineer for interpretation or correction, so that misunderstandings at a later date may be avoided. The contract drawings are not intended to show every vertical or horizontal offset which may be necessary to complete the systems. Having ductwork, pipe and fittings fabricated and delivered in advance of making actual measurements shall not be sufficient cause to avoid making offsets and minor changes as may be necessary to install ductwork, piping and equipment.

- D. The Engineer shall reserve the right to make minor adjustment in locations of system runs and components where considered desirable in the interest of concealing work or presenting a better appearance where exposed. Any such changes shall be anticipated and requested sufficiently in advance as to not cause extra work, or unduly delay the work. Coordinate work in advance with all other trades and report immediately any difficulties which can be anticipated.
- E. Equipment, ductwork or piping shall not be installed in the dedicated electrical space above or in the working space required around electrical switchgear, motor control centers or panelboards as identified by the National Electric Code (NEC).
- F. Where any system runs and components are so placed as to cause or contribute to a conflict, it shall be readjusted at the expense of the contractor causing such conflict. The Engineer decision shall be final in regard to the arrangement of ductwork, piping, etc., where conflict arises.
- G. Provide offsets in system runs, additional fittings, necessary drains and minor valves, traps, dampers and devices required to complete the installation, or for the proper operation of the system. Exercise due and particular caution to determine that all parts of the work are made quickly and easily accessible.
- H. Should overlap of work among the trades become evident, this shall be called to the attention of the Prime Contractor or Engineer. In such event, none of the trades or their suppliers shall assume that they are relieved of the work which is specified under their branch until instructions in writing are received from the Engineer.

#### 1.5 Asbestos Materials

- A. Abatement, removal or encapsulation of existing materials containing asbestos is not included in the Division 23 Contract. Necessary work of this nature will be arranged by the Owner and Engineer to be done outside of this construction and remodeling project by a company regularly engaged in asbestos abatement. Such work will be scheduled and performed in advance of work in the construction and remodeling project.
- B. If, in the performance of the work, materials are observed which are suspected to contain asbestos, the Contractor shall immediately inform the Engineer who in turn will notify the Owner. Work that would expose workers to the inhalation of asbestos particles shall be terminated. Work may be resumed only after a determination has been made and unsafe materials have been removed or encapsulated and the area declared safe.
- C. Material provided for work performed under Division 23 shall not contain asbestos.

#### 1.6 Inspection

- A. All work shall be subject to inspection of Federal, State and local agencies as may be appropriate, and of the Engineer.
- B. Obtain final inspection certificates and turn over to the Owner.

#### 1.7 Record Drawings

- A. Maintain a separate set of field prints of the contract documents and hand mark all changes or variations, in a manner to be clearly discernible, which are made during construction and the coordination process. Upon completion of the work, and within 90 days of system acceptance, these drawings shall be turned over to the Engineer. This shall apply particularly to underground and concealed work, and to other systems where the installation varies to a degree which would justify recording the change.

## 1.8 Operating and Maintenance Manuals

- A. Assemble three copies each of operating and maintenance manuals for the HVAC work.
- B. All “approved” shop drawings and installation, maintenance and operating instruction pamphlets or brochures, wiring diagrams, parts list and other information, along with warranties, shall be obtained from each manufacturer of the principal items of equipment. In addition, prepare and include a chart listing all items of equipment which are furnished under this contract, indicating the nature of maintenance required, the recommended frequency of checking these points and the type of lubricating media or replacement material required. Name and address of a qualified service agency. A complete narrative of how each system is intended to operate.
- C. Final air and water balance reports and as-built automatic temperature controls drawings and specifications shall also be included.
- D. These shall be assembled into three-ring loose leaf binders or other appropriate binding. An index and tabbed sheets to separate the sections shall be included. These shall be submitted to the Engineer for review. Upon approval, manuals shall be turned over to the Owner.

## 1.9 Final Inspection and Punch List

- A. As the time of work completion approaches, survey and inspect Division 23 work and develop a punch list to confirm that it is complete and finished. Then notify the Engineer and request that a final inspection be made. It shall not be considered the Engineer's obligation to perform a final inspection until the Contractor has inspected their work and so states at the time of the request for the final inspection.
- B. Requests to the Engineer for final inspection may be accompanied by a limited list of known deficiencies in completion, with appropriate explanation and schedule for completing these; this is in the interest of expediting acceptance for beneficial occupancy.
- C. The Engineer will inspect the work and prepare a punch list of items requiring correction, completion or verification. Corrective action shall be taken to the satisfaction of the Engineer within 30 days of receipt of the Engineer's punch list.

## 1.10 Warranty

- A. Warrant all workmanship, equipment and material entering into this contract for a period of one (1) year from date of final acceptance or date of beneficial use, as agreed to between Prime Contractor and Engineer. Any materials or equipment proving to be defective during the warranty period shall be made good without expense to the Owner. Use of equipment for temporary heating or cooling is not the start of the warranty period.
  - 1. Certain items of equipment are specified to have multi-year parts and labor warranties. Refer to individual equipment specifications.
- B. This provision is intended specifically to cover deficiencies in contract completion or performance which are not immediately discovered after systems are placed in operation. Also included shall be supplementary assistance in balancing, adjusting or providing operating instructions as the need develops, and replacing overload heater elements in starters where necessary to keep systems in operation. Heater element sizes shall not exceed the motor manufacturer's recommendations.
- C. This provision shall not be construed to include maintenance items such as replacing filters, re-tightening or repacking glands, greasing, oiling, belt tightening and cleaning strainers after these have been done for final close-out.

- D. Provisions of this warranty shall be considered supplementary to warranty provisions under Division 01 General Conditions.

## **PART 2 - PRODUCTS**

### 2.1 Materials and Equipment

- A. Materials and equipment furnished shall be in strict accordance with the specifications and drawings and shall be new and of best grade and quality. When two or more articles of the same material or equipment are required, they shall be of the same manufacturer.

### 2.2 Listing and Labeling

- A. All equipment and appliances shall be listed and labeled in accordance with the Mechanical Code. Testing shall be performed by an Approved Agency, with the seal or mark of the Agency affixed to each piece of equipment or appliance.

### 2.3 Reference Standards

- A. Where standards (NFPA, NEC, ASTM, UL, etc.) are referenced in the specifications or on the drawings, the latest edition is to be used except, however, where the Authority Having Jurisdiction has not yet adopted the latest edition, the edition so recognized shall be used.

### 2.4 Equipment Selection

- A. The selection of materials and equipment to be furnished shall be governed by the following:
  - 1. Where trade names, brands, or manufacturers of equipment or materials are listed in the specification, the exact equipment listed shall be furnished. Where more than one name is used, the contractor shall have the option of selecting between any one of the several specified. All products shall be first quality line of manufacturers listed.
  - 2. Where the words "or approved equal" appear after a manufacturer's name, specific approval must be obtained from the Engineer during the bidding period in sufficient time to be included in an addendum. The same shall apply for equipment and materials not named in the specifications, where approval is sought.
  - 3. Where the words "equal to" appear, followed by a manufacturer's name and sometimes a model or series designation, such designation is intended to establish quality level and standard features. Equal equipment by other manufacturers will be acceptable, subject to the Engineer's approval.
- B. Substitute equipment of equal quality and capacity will only be considered when the listing of such is included as a separate item of the bid. State the deduction or addition in cost to that of the specified product.
- C. Before bidding equipment, and again in the preparation of shop drawings, verify that adequate space is available for entry and installation of the item of equipment, including associated piping and accessories. Also verify that adequate space is available for servicing of the equipment.
- D. If extensive changes in pipe, duct or equipment layout, electrical or control wiring, or equipment are brought about by the use of equipment which is not compatible with the layout shown on the drawings, necessary changes shall be deemed to be included in this contract, including other effected trades.

### 2.5 Shop Drawings

- A. Electronic copies of shop drawings and descriptive information of equipment and materials shall be furnished. Submit to the Prime Contractor and Engineer for review as stated in the General Conditions and Supplementary Conditions. These shall be submitted as soon as practicable and before equipment is installed and before special equipment is manufactured. Submittal information shall clearly identify the manufacturer, specific model number, approval labels, performance data, electrical characteristics, features, specified options and additional information sufficient to evidence compliance with the contract documents. Product catalogs, brochures, etc. submitted without project specific items marked as being submitted for review will be rejected and returned without review. Shop drawings for equipment, fixtures, devices and materials shall be labeled and identified same as on the Contract Documents. If compliance with the above criteria is not provided shop drawings will be subject to rejection and returned without review. Samples shall be submitted when requested or as specified here with-in.
- B. The review of shop drawings by the Engineer shall not relieve the Contractor from responsibility for errors in the shop drawings. Deviations from specifications and drawing requirements shall be called to the Engineer's attention in a separate clearly stated notification at the time of submittal for the Engineer's review.
- C. Shop drawings of the following HVAC equipment and materials shall be submitted:
  - 1. Natural gas Piping, valves, fittings, etc. including joining methods.
  - 2. Gas pipe hangers and saddles.
  - 3. Ductwork insulation.
  - 4. Furnaces and cooling coils.
  - 5. Gas fired unit heaters.
  - 6. Gas fired radiant heaters.
  - 7. Condensing units.
  - 8. Refrigerant piping schematic and components.
  - 9. Rooftop heating and cooling units.
  - 10. Unit heaters.
  - 11. Fans.
  - 12. Fire dampers.
  - 13. Air outlets and inlets.
  - 14. Variable Frequency Drives
  - 15. Automatic Temperature Controls.

### **PART 3 - EXECUTION**

#### **3.1 Pipe Testing**

- A. All piping provided in this work shall be pressure tested, as specified below, including all connected coils and equipment.
- B. Pipe testing for HVAC piping shall be:
  - 1. Refrigerant piping - refer to appropriate Refrigeration Sections.
  - 2. Natural gas piping - refer to appropriate Natural Gas Sections.
- C. Testing shall be performed prior to application of insulation. Ensure that air is vented from piping when piping is hydrostatically tested.
- D. Tests shall be witnessed by field representatives of the Prime Contractor or Engineer or shall be monitored by a recorder. Furnish a written record of each piping system test indicating date, system, pressure, duration and results of tests. Copies of test reports shall be included in the O&M manuals.
- E. Leaks discovered during testing shall not be patched. Threaded connections shall be either tightened or replaced. Small leaks in welded pipe may be chipped and rewelded.

### 3.2 Operation and Adjustment of Equipment

- A. As each piping system and air distribution system is put into operation, all items of equipment included therein shall be adjusted to proper working order. This shall include balancing air and water systems, adjusting fan speeds, belts, pulleys, tightening packing glands, and adjusting all operating equipment.
- B. Caution: Verify that all bearings are lubricated, all motors are operating in the right direction, and correct drive settings and overload heater elements are provided on all motors. Do not depend wholly on the electrician's judgment in these matters. Follow specific instructions in regard to lubrication. Do not oil or grease presealed ball bearings unless upon manufacturer's specific instructions.
- C. Test relief valves, air vents and regulating valves to ensure proper operation.

### 3.3 Operating Demonstration and Instructions

- A. Set the various systems into operation and demonstrate to the Owner and Engineer that the systems function properly and that the requirements of the Contract are fulfilled.
- B. Provide the Owner's representatives with detailed explanations of operation and maintenance of equipment and systems. A thorough review of the operating and maintenance manuals shall be included in these instructional meetings.
- C. O&M manuals shall be submitted, reviewed and approved prior to scheduling of demonstrations.

END OF SECTION



**PART 1 - GENERAL**

- 1.1 The Engineer, at their sole discretion and without obligation, makes graphic portions of the contract documents available for use by the contractor in electronic format. These electronic files are proprietary, and remain the Engineer's Instruments of Service and shall be for use solely with respect to this project, as provided in the Standard Form of Agreement between Owner and Engineer.
- 1.2 Electronic files shall be released only after bids have been received for the project and contracts have been signed with the contractors.
- 1.3 The contractor shall acknowledge receipt of electronic files in the requested format for this project. The electronic files are provided as a convenience to the User, for use in preparing shop drawings and/or coordination drawings related to the construction of only the project identified in the Agreement. The electronic files and the information contained within are the property of the Engineer and/or the Owner, and may not be reproduced or used in any format except in conjunction with the project identified in the Agreement.
- 1.4 The User acknowledges that the information provided in the electronic files is not a substitution or replacement for the Contract Documents and does not become a Contract Document. The User acknowledges that neither the Engineer, the Consultants, the Client or the Owner make any warrant or representation that the information contained in the electronic files reflect the Contract Documents in their entirety. The User assumes full responsibility in the use of the electronic files, including the responsibility to see that all manual modifications, addenda, bulletins, clarifications and Change Orders to the drawings executed as a part of the Contract Documents have been incorporated.
- 1.5 The User acknowledges that the receipt of electronic files in no way relieves the User from the responsibility for the preparation of shop drawings or other schedules as set forth in the Contract between the Contractor and the Owner.
- 1.6 Electronic files are available in a .DWG or .RVT format for a cost as indicated in the Agreement and Waiver Form. **Providing the documents in a .DWG version that differs from the product version that the .DWG files were initially created in will incur additional charges per sheet, as indicated in the Agreement and Waiver Form.** Charges are for the Engineer's time to prepare the documents in the format stated. They are available through the Engineer's office on a C.O.D. basis only. A sample of the format will be provided by the Engineer upon request by the contractor, for the purpose of testing the compatibility of the format to the contractor's systems.
- 1.7 All drawings will be in an AutoCAD file format, when requested to be .DWG format.
- 1.8 All project models will be furnished without views.
- 1.9 All electronic files shall be stripped of the Project's name and address, the Engineer's any consultant's name and address, and any professional licenses indicated on the contract documents, (and all dimensions, verbiage, and statistical information). Use of these electronic files is solely at the contractor's risk and shall in no way alter the contractor's Contract for Construction.
- 1.10 The User agrees to indemnify, hold harmless and defend the Engineer, the Consultants, the Owner, the Client and any of their agents from any litigation resulting from the use of (by any means of reproduction or electronic media) these files. The Engineer makes no representation regarding fitness for any particular purpose, or suitability for use with any software or hardware, and shall not be responsible or liable for errors, defects, inexactitudes, or anomalies in the data, information, or documents (including drawings and specifications) caused by the Engineer's or its consultant's computer software or hardware defects or errors; the Engineer's or its consultant's electronic or disk transmittal of data, information or documents; or the Engineer's or its consultant's reformatting or automated conversion of data, information or documents electronically or disk transmitted from the Engineer's consultants to the Engineer.

- 1.11 The contractor waives all claims against the Engineer, its employees, officers, and consultants for any and all damages, losses, or expenses the contractor incurs from such defects or errors in the electronic files. Furthermore, the contractor shall indemnify, defend, and hold harmless the Engineer, and its consultants together with their respective employees and officers, harmless from and against any claims, suits, demands, causes of action, losses, damages or expenses (including all attorney's fees and litigation expenses) attributed to errors or defects in data, information or documents, including drawings and specifications, resulting from the contractor's distribution of electronic files to other contractors, persons, or entities.

**PART 2 - PRODUCTS – NOT USED**

**PART 3 - EXECUTION**

- 3.1 Attached "Agreement" shall be submitted with accompanying payment to the Engineer prior to delivery of electronic files.

END OF SECTION



**23 05 02A  
ELECTRONIC FILES HEAPY RELEASE FORM TO CONTRACTORS**

**Project:** Indiana State Fairgrounds HVAC Replacements  
1202 E. 38<sup>th</sup> Street, Indianapolis, IN 46205  
Indianapolis, IN 46205

**Owner:** Chad Lethig

**Heapy Engineering Project Number:** 2023-07154

**Heapy Engineering Project Manager:** William Thomas

The Provider, named below, will furnish the Recipient, named below, certain documents prepared by the Provider or its sub consultants in an electronic format. These documents are hereinafter collectively referred to as "Electronic Files". The Electronic Files are instruments of the Provider services performed solely for the Owner's benefit and to be used solely for this Project. The Provider does not represent that the information contained in the Electronic Files are suitable for use on any other project or for any other purpose. If the Electronic Files are used for any other project or purpose without the Provider's specific written permission, the risk of such use shall be assumed solely by the Recipient or other user.

**Prior to the use of the Electronic Files the Provider and the Recipient agree to the following terms and conditions:**

1. The Provider and Recipient fully understand that the data contained in these electronic files are part of the Provider's Instruments of Service. The Provider shall be deemed the author of the drawings and data, and shall retain all common law, statutory law and other rights, including copyrights.
2. The Recipient confirms their request to the Provider for Electronic Files for the Project listed above, which the Recipient understands are to be provided only in accordance with, and conditioned upon, the terms and conditions of the Agreement and Waiver for Use of Electronic Files).
3. The Provider agrees that the Recipient may use the Electronic Files for the sole purpose of preparing shop drawings and/or coordination drawings for the above Project only. Any Electronic Files provided are strictly for the use of the Recipient in regard to the Project named above, and shall not be utilized for any other purpose or provided by the Recipient to any entity other than its subcontractors for the Project named above.
4. The Recipient acknowledges that the furnishing of Electronic Files in no way relieves the Recipient from the responsibility of shop drawings or other schedules as set forth in the Contract between the Contractor and the Owner.
5. The Recipient acknowledges:
  - a. That the Electronic Files do not contain all of the information of the Bid Documents or Contract Documents for the construction of the Project above.
  - b. That information in the Bid Documents or Contract Documents may be revised or modified in the future.

- c. The Provider does not have, and will not have, any duty or obligation to advise or give notice to the Recipient of any such revisions or modifications.
  - d. That the Recipient agrees that its use of the Electronic Files is at the Recipient's sole risk of liability, and that the Recipient shall make no claim or demand of any kind against the Provider arising out of Recipient's receipt or use of the Electronic Files.
- 6. The Provider makes no representation or warranty of any kind, express or implied, with respect to the Electronic Files and specifically makes no warranty that the Electronic Files shall be merchantable or fit for any particular purpose, or accurate or complete. Furthermore, any description of said Electronic Files shall not be deemed to create an implied or express warranty that such Electronic Files shall conform to said description.
- 7. Due to the unsecured nature of the Electronic Files and the inability of the Provider or the Recipient to establish controls over their use, the Provider assumes no responsibility for any consequences arising out of the use of the data. It is the sole responsibility of the Recipient to check the validity of all information contained within the Electronic Files. The Recipient shall at all times refer to the Construction Documents of the project during all phases of the project. The Recipient shall assume all risks and liabilities resulting from the use of this data, and the Recipient agree(s) to waive any and all claims and liability against the Provider and its sub consultants resulting in any way from the use of the Electronic Files.
- 8. Electronic Files are provided strictly as a courtesy by the Provider solely for the convenience of the Recipient, and are not part of the Bid Documents or Contract Documents for the Project. The Electronic Files do not replace or supplement the paper copies of any drawings, specifications, or other documents included in the Contract Documents for use on the project.
  - a. The Recipient assumes full responsibility in the use of Electronic Files, including the responsibility to see that all manual modifications, addenda, bulletins, clarifications and Change Orders to the drawings executed as a part of the Contract Documents have been incorporated.
- 9. As stated herein, the possibility exists that the Electronic Files provided may differ from the Bid Documents or Contract Documents for construction of the Project. The Provider shall not be responsible, nor be held responsible, for differences between Electronic Files, the Bid Documents, and Contract Documents. The Bid Documents or Contract Documents for the Project may be modified by the Provider at any time, either before or after construction begins. The Provider has no responsibility, either before or after any such modification, to determine or to advise the Recipient whether any such modification causes Electronic Files provided to the Recipient to be out of date, inconsistent with the Bid Documents or Contract Documents, or otherwise unsuitable or unfit for use in any way.
- 10. The Recipient assumes all risk and liability for any losses, damages, claims, or expenses (including defense and attorney fees) resulting from its receipt, use, or possession of Electronic Files furnished by the Provider. The Provider makes no representation, warranty or guarantee that the Electronic Files:
  - a. Are suitable for any other usage or purpose.
  - b. Have any particular durability.
  - c. Will not damage or impair the Recipient's computer or software.
  - d. Contain no errors or mechanical flaws or other discrepancies that may render them unsuitable for the purpose intended by the Recipient.

11. Recipient agrees to indemnify, defend and hold harmless the Provider, agents, employees, and the Owner from, and against, any and all claims, suits, losses, damages or costs, of any kind or nature, including attorney's fees, arising from or by reason of the Recipient's use of Electronic Files provided by the Provider, and such defense and indemnification obligation duties shall survive any use under this Agreement and Waiver for Use of Electronic Files.
12. The Recipient agrees that the Provider shall have no responsibility whatsoever for problems of any nature arising from transmitting and storing electronic files at a Recipient requested FTP or project management site or the conversion of the Electronic Files by the Recipient or others for use in non-native applications. The Provider will not provide Electronic Files in compressed formats. Recipient agrees to accept the files in the format provided by the Provider, and that Recipient's conversion or electronic file storage at the Recipient's requested site, shall be at Recipient's sole risk.
13. Recipient acknowledges:
  - a. That the Electronic Files provided by the Provider are a graphical representation of the building in order to generate two-dimensional industry standard drawings.
  - b. That the data contained in the Electronic Files may not be 100% accurate and should not be used for dimensional control, building layout, shop drawings, or any other similar purpose
  - c. That any schedule of materials produced directly from the Electronic Files has not been checked for accuracy.
  - d. That the information in the Electronic Files should be used only for comparative purposes and shall not be relied upon for accurate quantity estimates or used in establishing pricing.
14. Electronic Files provided by the Provider will only contain elements and content that the Provider deems necessary and appropriate to share. No specific Level of Development (LOD) is implied or expected. The Recipient agrees that no proprietary content, MvParts or Revit Families or any other AutoCAD MEP or Revit MEP content shall be removed from the model and/or used for any other purpose but to support this specific project.
15. The Provider, at its sole discretion, may modify the Electronic files before they are provided to the Recipient. Such modifications may include, but are not necessarily limited to, removal of certain information. The Provider, at its sole discretion, may refuse to provide some or all Electronic Files requested by Recipient.
16. The availability of Electronic Files that were not prepared by the Provider is subject to the consent of the Owner or consultant that prepared those Electronic Files. The Provider will not negotiate with the Owner or consultant or repeatedly solicit the Owner or consultant to obtain such consent. Neither this Agreement and Waiver for Use of Electronic Files nor any such separate Consultant's consent may be assigned or transferred by Recipient to any other person or entity.

Provider (Name of Company): \_\_\_\_\_

Recipient (Name of Company): \_\_\_\_\_

Name of authorized Recipient Representative: \_\_\_\_\_

Title of authorized Recipient Representative: \_\_\_\_\_

E-mail address of authorized Recipient Representative: \_\_\_\_\_

Signature of authorized Recipient Representative: \_\_\_\_\_

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

NOTE: Select requested Electronic File Format, File Transfer Medium and complete applicable Cost Summary.

**A. Electronic File Format (select one):**

1.  .DWG Format - List of Drawings Requested: \_\_\_\_\_

2.  Revit Project Model Requested (Model only, no Views included)

**B. File Transfer Medium (select one):**

Heapy FTP  User's FTP site  Project FTP site (when available)

**C. Delivery of Electronic Files Cost Summary:**

Available Electronic .DWG file format:

2018 DWG

If a different file version is required than the indicated available version state the requested version:

\_\_\_\_\_ .DWG

**Note that an additional charge per sheet will be incurred.**

Cost of Preparation of Division 23 Electronic .DWG Files:

First Drawing: \$50.00 \$50.00

Additional Drawings \$15.00 each \_\_\_\_\_ x \$15.00 = \$ \_\_\_\_\_

Conversion to .DWG version different from available .DWG:  
\$5.00 additional/sheet \_\_\_\_\_ x \$ 5.00 = \$ \_\_\_\_\_

Total Cost: (Please make check payable to Heapy Engineering and include a copy of this form.) \$ \_\_\_\_\_

All files will be bound together.

Available electronic Revit file format:

2024 .RVT

Cost of Preparation of Division 23 Electronic Revit Model Files:

Revit Project Model without Views \$500.00

Total Cost: (Please make check payable to Heapy Engineering and include a copy of this form.) \$ \_\_\_\_\_

**PART 1 - GENERAL**

1.1 Temporary Heating and Cooling

- A. The temporary heating and cooling for construction is provided by the Contractor.
- B. Fuel and electric costs attendant to temporary heating and cooling are not included in Division 23.
- C. The use of the permanent HVAC systems for temporary heating and cooling during the latter stages of construction shall be allowed. Expedite completion of system as practicable to this end. Maintain the system during this period. Provide and maintain temporary air filters (same as specified permanent filters) to protect coils and ducts. Replace temporary filters with the clean specified filters when the systems are turned over to the Owner. Air filters specified for the systems and units, including specified spare filters, are not to be used for temporary service.
- D. Cover all return duct openings with temporary MERV 8 filter media. Stop fans during heavy dust generating operations. Before turning the system over to the Owner, clean duct interiors and interior surfaces and components of the air handling equipment.
- E. Warranty periods on equipment, materials and system shall commence upon Owner acceptance of the building or systems. Temporary heating or cooling use shall not jeopardize or alter the warranty requirements.

1.2 Continuity of Services

- A. Work shall be so planned and executed as to provide reasonably continuous service of existing systems throughout the construction period. Where necessary to disrupt services for short periods of time for connection, alteration or switch-over, the Owner and Prime Contractor shall be notified in advance and outages scheduled at the Owner's reasonable convenience.
- B. Submit, on request, a written step-by-step sequence of operations proposed to accomplish the work. The outline must include tentative dates, times of day for disruption, downtime and restoration of services. Submit the outline sufficiently in advance of the proposed work to allow the Engineer and Prime Contractor to review the information with the Owner. Upon approval, final planning and the work shall be done in close coordination with the Owner.
- C. Shutdown of systems and work undertaken during shutdowns shall be bid as being done during normal working hours. If the Owner should require such work be performed outside of normal working hours, reimbursement shall be made for premium time expenses only, without mark-up.

**PART 2 - PRODUCTS**

2.1 Access Panels

- A. Provide ceiling and wall access panels where indicated on the drawings, or where otherwise required to gain access to devices and equipment requiring service or adjustment.
- B. Access panels shall be steel construction (except where aluminum or stainless steel is specified) with concealed hinge and door with tamperproof screws. Panels shall be 18 inches x 18 inches size unless larger panels are shown or required. Mounting frames shall be compatible with the material in which they are installed. Access panels shall be:

1. Standard flush type with overlapping flange for masonry and tile walls, Milcor Style "M" or equal.
  2. Recessed type having the door recessed to accept a drywall panel insert, for drywall ceilings and walls, Milcor Style "ATR" or equal.
  3. Standard flush type for drywall ceilings and walls, Milcor Style "M" or equal.
- C. Materials used in plenums shall be rated for plenum use conforming to the ASTM E84 25/50 smoke development and flame spread restrictions.

### **PART 3 - EXECUTION**

#### **3.1 Workmanship**

- A. Materials and equipment shall be installed and supported in a first-class and workmanlike manner by mechanics skilled in their particular trades. Workmanship shall be first-class in all respects, and the Engineer shall have the right to stop the work if highest quality workmanship is not maintained.

#### **3.2 Protection**

- A. Each Contractor shall be entirely responsible for all material and equipment furnished in connection with their work. Special care shall be taken to properly protect all parts thereof from theft, damage or deterioration during the entire construction period in such a manner as may be necessary, or as directed by the Engineer or Prime Contractor.
- B. The Owner's property and the property of other contractors shall be scrupulously respected at all times. Provide drop cloths and visqueen or similar barriers where dust and debris is generated, to protect adjacent areas.

#### **3.3 Cutting and Patching**

- A. Refer to Division 01 - General Requirements and Special Conditions for information regarding cutting and patching.
- B. Plan the work well ahead of the general construction. Sleeves shall be placed in all floor slabs, poured concrete roof decks, walls and partitions, except as noted below, to allow new piping and ductwork to pass thru and to allow for expansion, contraction and normal movement of the pipe. Where sleeves or openings have not been installed, cut holes and patch as required for the installation of this work, or pay other trades for doing this work when so directed by the Engineer or Prime Contractor. Any damage caused to the building shall be repaired or rectified.
- C. Where pipes and ducts are to pass thru, above or behind existing walls, partitions, floors, roof or ceiling, cutting, patching and refinishing of same shall be included in this contract. Core drilling and saw cutting shall be utilized where practical. Contractor to examine where floors and walls, etc. are to be cut for presence of existing utilities.
- C. When cutting or core-drilling floor verify location of existing electrical, plumbing or steel reinforcement. Use X-ray method to verify existence of obstructions. Either re-route existing system brace floor or alter location of new work to maintain existing system.
- D. All sleeves and openings not used or partially used shall be closed to prevent passage of smoke and fire.
- E. All materials, methods and procedures used in patching and refinishing shall be in accordance with applicable provisions of specifications governing the various trades, and shall be completed by skilled workmen normally engaged in these trades. The final appearance and integrity of the patched and refinished areas must meet the approval of the Engineer. Wall,



floor and ceiling refinishing must extend to logical termination lines (entire ceiling of the room repainted, for instance), if an acceptable appearance cannot be attained by finishing a partial area.

- F. Provide steel angle or channel lintels to span openings which are cut in existing jointed masonry walls where the opening span exceeds 16 inches. Provide framing around roof openings for required support of the roof deck.
- G. Engage a Roofing Contractor on a subcontract basis for roofing and roof insulation work necessitated by the HVAC work. The Roofing Sub-Contractor shall be certified for installation and repair of the existing roofing system so as to maintain the existing roofing warranty.

### 3.4 Removals, Alterations and Reuse

- A. Refer to the drawings for the scope of remodeling in the existing building.
- B. Cooperate with all trades and Prime Contractor regarding all removal and remodeling work. Unless otherwise noted, remove existing work which is associated with Division 23 and which will be superfluous when the new work is installed and made operational.
- C. Extraneous ductwork and piping which is or becomes accessible shall be removed and stubs shall be capped at the first active duct or pipe encountered. Ductwork and piping that is and remains inaccessible shall be abandoned. Ends of abandoned duct and pipe shall be capped so as to be concealed by finished surfaces. Upon completion of the work no abandoned duct, pipe, valve or stub shall extend thru finished floors, walls or ceilings.
- D. When it is necessary to reroute a section of active ductwork or piping the rerouted section shall be installed before removing the existing in order to minimize system down time. Rerouted sections shall be insulated as required for new work. Patch insulation on existing ductwork and piping which has been damaged or removed in this work.
- E. Materials and equipment which are removed shall not be reused within the scope of this project unless specifically noted to be relocated or reused. Turn over to the Owner and place where directed on the premises all removed material and equipment so designated by the Owner. All material and equipment not claimed by the Owner shall become the property of the Contractor responsible for removal and shall be removed from the premises.
- F. Remove, store and reinstall lay-in ceiling tile and grid as needed to perform work in areas where such removal and re-installation is not to be done by others. Damaged tile and/or grid shall be replaced with new matching tile and/or grid.
- G. In areas of minor work where the space is not completely vacated, temporarily move portable equipment and furnishings within the space as required to complete the work. Coordinate this activity with Owner and Prime Contractor. Protect the Owner's property by providing dust covers and temporary plastic film barriers to contain dust. Remove barriers and return equipment and furniture upon completion of the work.
- H. Refinish any surface disturbed under this work to match existing, except where refinishing of that surface is included under the General Contract.

### 3.5 Painting

- A. In addition to any painting specified for various individual items of equipment, the following painting shall be included:
  - 1. Ferrous metal which is not factory or shop painted or galvanized and which remains exposed to view in the building including finished areas, mechanical rooms, storage

- rooms, and other unfinished areas shall be given a prime coat of paint and two finish coats of paint.
2. Ferrous metal installed outside the building which is not factory or shop painted or galvanized shall be given a prime coat of paint and two finish coats of paint.
  3. Equipment and materials which have been factory or shop coated (prime or finished painted or galvanized), on which the finish has been damaged or has deteriorated, shall be cleaned and refinished equal to its original condition. The entire surface shall be repainted if a uniform appearance cannot be accomplished by touch up.
  4. Apply Z.R.C. Galvilite cold galvanizing compound or approved equal, for touch-up of previously galvanized surfaces.
  5. Inside of ducts, behind grilles and registers, shall be painted flat black to eliminate the viewing of shiny surfaces.
- B. Paint, surface preparation and application shall conform to industry standards. All rust must be removed before application of paint.
- C. Finish painting is included in the General Contract Refer to the Cutting and Patching paragraph in this Section for finishing requirements.

### 3.6 Access Panels

- A. Install access panels or pay general trade to do so. Final appearance is subject to approval by the Engineer.
- B. Location of access panels shall be planned to clear ceiling lights, ceiling support grids and other obstructions so as to allow, wherever possible, full shoulder clearance beside the device to be inspected, adjusted or repaired.
- C. Panels with recessed doors are to be fitted with insert panels of drywall. Caution the Installing Contractor to provide appropriate framing with drywall beading to ensure a finished appearance. Shim strips may be required to bring the insert panel flush with the plane of the door and wall / ceiling.

END OF SECTION

**PART 1 - GENERAL**

- 1.1 Firestopping assemblies shall be provided at penetrations of piping and non-fire damped ducts thru fire rated floors, fire rated floor-ceiling and roof ceiling assemblies, fire rated walls and partitions and fire rated shaft walls and partitions. In addition, firestopping assemblies shall be provided at penetrations thru 0-hour rated floors. Refer to the drawings for fire rated building elements and HVAC drawings for pipe and duct layouts.
- 1.2 New piping and ductwork penetrating existing building elements shall be firestopped.
- 1.3 Firestopping assemblies shall be tested and rated in accordance with ASTM E814, E119 and listed in accordance with UL 1479, as published in the UL Fire Resistance Directory. Firestopping shall provide a fire rating equal to that of the construction being penetrated.
- 1.4 Firestopping materials, assemblies and installation shall conform to requirements of the code and the Authority Having Jurisdiction.
- 1.5 For those firestopping applications that exist for which no UL tested system is available through any manufacturer, a manufacturer's engineering judgment derived from similar UL system designs or other tests will be submitted to local authorities having jurisdiction for their review and approval prior to installation. Engineer judgment drawings must follow requirements set forth by the International Firestop Council.
- 1.6 Shop drawings shall be prepared and submitted for review and approval. Submittals shall include manufacturer's specifications and technical data of each material, documentation of U.L. firestopping assemblies and installation instructions. Submittals shall include all information required by the Building Code.

**PART 2 - PRODUCTS**

- 2.1 Firestopping materials shall be manufactured and/or supplied by Hilti, 3M, Tremco, or Specified Technologies Inc (STI).
- 2.2 Materials shall be in the form of caulk, putty, sealant, intumescent material, wrap strip, fire blocking, ceramic wool and other materials required for the UL listed assemblies. These shall be installed in conjunction with sleeves and materials for fill and damming.
- 2.3 Combination pre-set floor sleeve and firestopping assemblies shall be equal to Hilti CP 680.

**PART 3 - EXECUTION**

- 3.1 Installation of all materials and assemblies shall be in accordance with UL assembly drawings and the manufacturer's instructions.
- 3.2 Installation shall be done by an experienced installer who is certified, licensed or otherwise qualified by the firestopping manufacturer as having the necessary training and experience.
- 3.3 Firestopping shall not be installed at fire dampers that would impair the needed free expansion of damper, sleeve and retaining angles in a fire condition. Refer to the installation instructions of the fire damper manufacturer.
- 3.4 Refer to 23 05 07 Piping Materials and Methods for pipe sleeve requirements and treatment of penetrations not requiring firestopping. Refer to 23 31 13 HVAC Ductwork for duct sleeve requirements where firestopping is required.

END OF SECTION

**PART 1 - GENERAL**

- 1.1 Excavate for exterior equipment pads and incidental work which are included in Division 23. Backfill to finish grade or to levels as directed by the Engineer and Prime Contractor. Cut existing street, drive and parking lot paving, walks, curbs and other permanent hard surfaces which are to be encountered. Repair or restore exterior surfaces to original condition or as directed by the Engineer. All work shall comply with requirements set forth in the project documents.
- 1.2 Excavation and trench wall supporting, cribbing, sloping and stepping of excavations required for safety shall be done in accordance with OSHA and local requirements. Pumping of water from excavations and trenches which may be required during construction shall be included.
- 1.3 Contact the Indiana811.org Utilities Protection Service sufficiently in advance of the start of any excavation so that notification can be made to member utility departments and utility companies (water, sewer, gas, petroleum, electric, telephone, cable, etc.) having underground utilities in or near the project area. Also contact those companies to verify that utility lines have been located and duly marked and identified.
- 1.4 A utility locator service shall be engaged to locate, mark and identify private lines and other utilities that are not located by the means mentioned above.
- 1.5 Existing utilities encountered during excavation work shall be protected in a manner acceptable to the utility owner. Any utilities that are damaged shall be repaired or replaced to the full satisfaction of the utility owner.

**PART 2 - PRODUCTS**

- 2.1 None

**PART 3 - EXECUTION**

- 3.1 Trenches for exterior shall be over excavated.
- 3.2 Backfilling of excavations exterior to the building, shall be with graded pea gravel, graded coarse sand or crushed limestone, 0.75 inch maximum size, to prevent undue settlement.
- 3.3 Backfill shall be mechanically compacted in layers not over 6 inches deep. Water settling will not be permitted. Where excavations have not been properly filled or where settlement occurs, they shall be refilled, compacted, smoothed off, and finally made to conform to the initial requirements. Excess excavated materials shall be removed from the site or disposed of as directed by the Owner.
- 3.4 Concrete floor slabs, paving, sidewalks, curbs, sodded and other finished surfaces which have been damaged or removed in order to install the underground work shall be replaced equal to original conditions.
- 3.5 Excavation, backfill, surface repair and traffic control within the public right-of-way shall be in accordance with governing agency rules and regulations. Any fee for activity in the roadway shall be included so that no additional cost will accrue to the Owner.
- 3.6 Maintain in place adequate barricades, guards, planking, plating, signage, warning lights, etc., at and around excavations.

END OF SECTION

**PART 1 - GENERAL**

- 1.1 Motors, starters, disconnects, devices, fuses, wiring and other electrical work included in Division 23 shall be factory installed or furnished and field installed as specified in the various specification sections and as shown on the drawings. Refer to the project documents for requirements related to each trade. Coordinate all aspects of electrical components and wiring to complete the systems.
- 1.2 Equipment control panels containing power control components shall be marked with the minimum SCCR rating. The rating shall not be less than the available fault current. Refer to the electrical drawings for the calculated available fault at the distribution panel, MCC or panelboard serving the equipment. Include confirmation of being protected from the fault current in the equipment shop drawing submittal.
- 1.3 Note: Equipment with Electronically Commutated Motors (ECM's) are sometimes factory programmed to limit current draw to the motor, to limit the available brake horsepower to better match specified performance and reduce required power circuiting. This reduced brake horsepower is likely below the motor's nameplate rating. The electrical design documents may be sized based on the ECM's nameplate motor horsepower. The equipment supplier shall notify the Division 23 and 26 contractors and the Engineer if the maximum overcurrent protection on the design documents differs from their selected equipment's nameplate data. Any required revisions to the electrical circuiting, including maximum over-current protection devices, shall be documented on the shop drawing submittal. The required revisions must be forwarded to the Division 26 contractor with enough time to adjust the over-current protection and the electric circuit installation. However, any additional cost associated with increased electrical feeder/breaker sizes or lack of coordination listed above shall be the Division 23 contractor's responsibility.
- 1.4 Refer to the Electrical drawings and verify adequacy of feeder size, sets of conductors and size, disconnecting means and other electrical requirements. Compare these to the requirements of the equipment to be furnished and report deficiencies and / or discrepancies to the Engineer in the bid period for resolution by addendum. Bear all costs for electrical changes where such issues are not properly resolved.
- 1.5 Equipment and devices shall comply with applicable standards of NEMA and shall be UL listed. All work shall comply with the National Electrical Code.
- 1.6 Electrical equipment, devices, fuses, wire, conduit and methods shall comply with applicable provisions of Division 26 - Electrical.

**PART 2 - PRODUCTS**

- 2.1 Motors
  - A. General purpose motors shall be induction type 1750 rpm NEMA Design "B" with copper windings, Class B or F insulation, and motor enclosure to suit the application. Service factor shall be 1.15 minimum.
  - B. Two-speed motors shall be two-winding type with six leads unless otherwise specified.
  - C. Motors for other than general duty application shall be furnished to suit the application and operating environment.
  - D. Premium efficiency motors shall be equal to Century "E + 3", General Electric "Energy Saver Premium Efficiency", Baldor "Super E Premium Efficient" or Reliance "Premium Energy Efficient" series. Motor efficiencies shall be tested and conform to NEMA Standard Publication MG-1 and IEEE 112 Test Method B.

- E. Motors used with Adjustable Frequency Motor Controllers (Variable Frequency Drives) shall be rated for inverter service in accordance with NEMA Standard Publication MG-1, Part 31 and designed with Class F or H insulation, but with a Class B temperature rise. Motors connected to VFD's shall be furnished with AEGIS SGR shaft grounding ring kit, installed by the equipment manufacturer.
  - F. Motor sizes shown on the drawings are to be considered minimum. Motors furnished shall be sized so as to not operate in the service factor range. Motors for direct driven pumps and fans shall be selected so as to not operate in the service factor range at any point on the curve.
  - G. Compare the electrical power requirements of the intended equipment with power feeders to the equipment shown on the Electrical drawings. Verify adequacy and compatibility of voltage, phase, wiring capacity, number and size of conductors (versus equipment connection points), maximum over-current protection, fusing and other information to that required for the equipment. If the selected equipment requires revision of the electrical, include any added cost to do so.
- 2.2 Magnetic starters shall comply with provisions of Division 26 - Electrical specifications and shall be NEMA construction (IEC rated not acceptable) with thermal overload element on each phase, 115 volt control voltage and hand-off-automatic switch, where appropriate. An integral control transformer shall be incorporated in the starter for each motor of 200 volt and greater. A single control transformer is acceptable for multiple motor packaged equipment, however, when such is the manufacturer's standard. Duplex type units (pumps, compressors, etc.) are not included in this exception. A control transformer shall be provided in each starter to ensure standby operating capability.
- 2.3 Wire and conduit shall comply with applicable provisions of Division 26 - Electrical specifications. Control wiring lighter than No. 12 AWG is acceptable where lesser ampacity will permit. All power and control wiring shall be overcurrent protected per the National Electric Code.

### **PART 3 - EXECUTION**

- 3.1 Motor connections of factory assembled equipment shall be made with flexible conduit except for plug-in electric cord connections.
- 3.2 All power wiring shall be run in conduit. Control wiring shall be run in conduit except where open wiring is specified in the various sections.
- 3.3 Fuses shall be furnished and installed in fuse clips of equipment and switches.

END OF SECTION

**PART 1 - GENERAL**

- 1.1 Provide a single enclosure adjustable frequency speed control package for induction motors where shown on the drawings and included in the Specifications with input power at the voltage and phase as scheduled on the drawings. The output power rating of the controller shall not be less than the full load rating of the motor, plus 5 percent. Controller shall be the latest design solid-state device, listed by UL, CSA or etc.
- 1.2 The adjustable frequency controller is to be PWM (pulse-width-modulated) design for motor voltage, current and frequency control. Impact three-phase AC line voltage is rectified to DC voltage for full conversion to near sensor output.
- 1.3 The supplier of the drives shall have factory trained service personnel on staff and shall submit documentation showing so with the shop drawings. Lack of documentation will result in unapproved shop drawings. The supplier shall also provide a 5-year parts and labor warranty, and a 5-year service contract for the supplied drives.
- 1.4 The drive shall have the same control logic board for all horsepower ratings. The 32-bit microprocessor will deliver the computing power necessary for complete three phase motor control.
- 1.5 The drive MTBF (Mean Time Between Failures) shall not be less than 20 years.
- 1.6 The term "Variable Frequency Drive", "VFD", "Variable Speed Drive" and other similar terms as used in Division 23 and on the drawings shall refer to Adjustable Frequency Motor Controller.
- 1.7 Motors connected to VFD's shall comply with 23 05 13 Electrical Requirements for HVAC Equipment and shall be furnished with AEGIS SGR shaft grounding ring kit, installed by the equipment manufacturer.
- 1.8 Mechanical equipment, appliances and supports that are exposed to wind shall be designed and installed to resist the wind pressure determined in accordance with the building and mechanical code. Refer to specification 23 05 30 Bases and Supports for HVAC Equipment for additional requirements.

**PART 2 - PRODUCTS**

- 2.1 Manufacturers and Suppliers
  - A. Adjustable frequency motor controllers shall be manufactured by Yaskawa, Square D, ABB, Franklin Control Systems, Allen Bradley, Mitsubishi, or Eaton.
  - B. Suppliers of adjustable frequency motor controllers must be an authorized service agent of the controller. Proof of this shall be provided with shop drawing submittals.
  - C. When adjustable frequency motor controllers are specified to be included in a factory-installed packaged system specified elsewhere in these specifications, the manufacturer of the controller is not limited to the acceptable manufacturers listed above. However, the supplier of the packaged system shall be an authorized service agent for the adjustable frequency motor controller being provided.
- 2.2 The controller shall be capable of varying its output in response to a remote 0 10 VDC or 4 20 mA signal, proportional to drive monitor functions. Provide controls mounted in face of the enclosure for the following functions:
  - A. Digital operator keypad and display, with copy function, provides local control and readout capability: Hand/Off/Auto, Speed Reference, and Reset commands.

- B. Power On, Run on Drive, Run on Bypass (when bypass is specified), and Fault LED Pilot Lights.
- C. Door mounted (face of cover) diagnostic indicator with touchpad interface shall incorporate:
  - 1. Controller Run
  - 2. Voltage to Motor
  - 3. Current to Motor
  - 4. Speed Indication in Hertz, Percent, RPM
  - 5. KW
  - 6. Elapsed Time Meter
  - 7. Overtemperature
  - 8. Overcurrent
  - 9. Overfrequency
  - 10. Overvoltage
  - 11. Undervoltage
  - 12. Motor Overload
  - 13. Ground Fault
  - 14. Short Circuit
  - 15. Phase Loss
  - 16. Control Circuit Fault
- D. "Manual/Auto" speed control selector switch and manual speed adjustment with switches and indication on face of cover. Switch shall select control of motor speed from either the ATC system or the manual speed adjustment.

2.3 The controller shall include the following inputs and output functions at a labeled terminal strip. All inputs and outputs must be completely isolated from the analog reference signal:

#### Inputs

- 1. Remote/Local operation selection
- 2. Detection of external overheat condition
- 3. Preset speed selection
- 4. Serial communication selection
- 5. PI control disable
- 6. Run/Stop control
- 7. Fault reset
- 8. Manual/Remote speed reference
- 9. Speed Control Signal
- 10. External Trip Contact NO/NC
- 11. Freezestat Trip
- 12. Smoke Detector Trip

#### Outputs

- 1. Two (2) programmable multiple function output relays providing any two (2) of the following: zero speed detection, low and high frequency detection, missing frequency reference, overtorque/undertorque detection, serial communication status, or no load detection (broken belt alert).
- 2. Trip "Fault" (Form C Contact)
- 3. Output Frequency (0-10VDC)
- 4. Choice of Output Current, Voltage and Frequency

2.4 Speed control shall be linear from 10 to 100 percent of full speed. Both the minimum and maximum speed limits shall be adjustable. The controller output frequency shall not change as a result of up to a 10 percent input voltage fluctuation. The acceleration and deceleration rates shall be fully adjustable. Provide current limit function to avoid excessive automatic acceleration and deceleration



when an overcurrent condition exists. The volts to hertz ratio shall be adjustable. Critical frequency rejection points shall be provided and shall be programmable, minimum of 3; deadband available.

- 2.5 The speed control output transistors are to be Insulated Gate Bipolar Transistor (IGBT) type for PWM design to facilitate a switching frequency of up to 12 kHz to eliminate the audible noise associated with PWM designs. The audible noise emitted from the motor must be within 5 db of the noise during across-the-line operations at all frequencies within the human audible spectrum (up to 12 kHz operating frequency). The drive must be selected for operation at or above 5 kHz without derating to satisfy the conditions for current, voltage or horsepower as shown on the drawings.
- 2.6 The controller shall permit disconnection of power from the input or output line voltage with the controller running under load without damage to the controller components. The controller shall be able to withstand an output line short (phase to phase or phase to ground) without damage to the controller components. Controller shall shut down on short circuit and detection of any of the following conditions: current 110 percent above rated current for 60 seconds; phase loss; input overvoltage and undervoltage; high internal temperature; ground fault and under frequency. Short circuit current rating (SCCR) shall not be less than 65,000 amps RMS, 100,000 amps RMS with link choke.
- 2.7 The controller shall have an automatic restart function to attempt restart after the unit trips off when power is lost to the unit. A time delay shall be provided between restarts. The unit shall not attempt to restart more than five times in the automatic mode. In addition, the controller shall have a power loss ride thru feature of at least 2 seconds (120 cycles) to prevent unnecessary trip out due to momentary input power interruptions.
- 2.8 The drive system (motor and controller) shall provide a minimum power factor of .95 at power input throughout the speed range, and a minimum efficiency (output to input line) of .82 at 100 percent speed and .70 at 50 percent speed.
- 2.9 The controller and any associated hardware shall be load tested at the controller manufacturer's plant prior to shipment.
- 2.10 The controller shall not create any feedback noise on the input line that will adversely affect electronic or microprocessor based equipment (such as computers or electron microscopes), and the controller shall not impress voltage or current spikes on the system. The minimum requirements shall conform to IEEE Standard 519, Special Applications for Line Notching and Distortion maximum 5 percent THVD at the point of connection to other building loads. The manufacturer shall provide at no additional cost any equipment to meet this requirement; i.e., A.C. line filters of the RLC type and/or isolation transformer, or both as required to meet full compliance with IEEE 519, if controller does not meet all standards.
- 2.11 Provide a 3 percent or 5 percent AC line reactor on all equipment that does not comply with the THVD requirements stated above.
- 2.12 Provide 5 percent output reactor and dv/dt filter where motor lead length is greater than 50 feet. Also provide terminations suitable for shielded output power cables.
- 2.13 The controller shall meet the requirements for Radio Frequency Interference (RFI) above 7 MHz per FCC regulations, Part 15, Subpart J for Class A devices.
- 2.14 The following additional functional features shall be provided for the controller:
  - A. Each controller shall be provided with a door interlocked disconnect means and semi-conductor rated fuses.
  - B. Input line circuit breaker – a main power circuit breaker shall be provided for input power. Door shall be interlocked and through-the-door breaker operating mechanism included. The breaker

shall be able to be padlocked with the door open or closed. Breaker to be rated for short circuit current available.

- C. Output Overload Relay - Provide an overload relay for motor protection with manual reset pushbutton, all inside the enclosure. Provide the proper size overload elements to match motor nameplate ratings before allowing the motors to be put into service. Provide overload for each motor where multiple motors are served by one controller.
- D. Serial Communications – The controller shall provide serial communication to the building automation system via one of the following protocols as coordinated with the BAS: LONWorks, BACnet, Modbus, Ethernet. The following data shall be shared between the drive and the BAS:

Analog Inputs – Speed Reference, Output Speed, Output Current, KWH Meter, Output Power, Drive Temperature, PI Feedback, AC Output Voltage, DC Bus Voltage, Fault Code, Elapsed Time-Hours, Megawatt Hour Meter, Drive Rated Current, Communication Error Code, PI Deviation, PI Output Capacity, PI Reference, Last Fault Code, Frequency Reference @ Fault, Output Frequency @ Fault, Current and Voltage @ Fault, Operation Status @ Fault, Elapsed Operation Time @ Fault.

Analog Outputs – Speed Command Acceleration Time, Deceleration Time, PI Proportional Gain, PI Integral Time, PI Mode Select, Frequency Command Upper Limit, Frequency Command Lower Limit, Number of Auto Restarts, PI Integral Limit, PI Upper Limit Value, PI Offset Adjustment, PI Primary Delay Time.

Digital (Binary) Inputs – Run/Stop Monitor, Forward/Reverse Monitor, Drive Ready Monitor, Fault Monitor, Drive Communication Error Monitor, Multi-Function Outputs, Emergency Safety Interlock Monitor, Hand/Auto Reference Monitor, Multi-Function Inputs Monitor.

Digital (Binary) Outputs – Run Forward Command, Run Reverse Command, Fault Reset Command, Panel Key Lock Command.

Provide all software and hardware necessary to complete the interface to the BAS. Provide the temperature controls installer with all necessary electronic files including XIF and object files. Provide on-site assistance to the temperature controls installer for programming, checkout, start-up and commissioning.

- E. NEMA 1 Enclosure - Controllers located indoors or in a conditioned environment shall be provided in a ventilated enclosure intended for indoor use.
- F. NEMA 3R Enclosure – Controllers located outdoors or exposed to an unconditioned environment shall be provided in a ventilated and heated enclosure intended for outdoor use that will allow for operation down to -15 degF.

### **PART 3 - EXECUTION**

- 3.1 Provide complete wiring diagrams for use in interfacing the BAS equipment. Also submit these diagrams with the shop drawings.
- 3.2 Wiring shall be in strict accordance with the manufacturer's recommendations. Provide the controller, all control and interlock wiring, and all set-up and commissioning. Coordinate power wiring requirements.
- 3.3 Each controller shall be mounted to a Unistrut frame where indicated on drawings. Provide 8 inches square by 0.375 inch painted steel base plate at floor below each vertical Unistrut channel to distribute weight on floor. Floor set controller shall be set on 4 inches high concrete base. Small units may be direct mounted to the air-handling unit casing when the AHU manufacturer approves such installation.

- 3.4 Controller shall be wall mounted, unit mounted, or mounted on unistrut framing system.
- 3.5 Shielded VFD cable (see Specification section 26 05 19 Low-Voltage Electrical Power Conductors) shall be provided between drive and motor for entire length of motor lead.
- 3.6 Refer to "Identification" Paragraph for nameplate requirements.
- 3.7 Check full load ampere and service factor rating for each motor after installed and furnish the proper size overload heater elements to protect the motor.
- 3.8 Each controller shall be started up under the supervision of the manufacturer's representative. Start-up services shall consist of an initial start-up programming and check out of the drive for proper operation. After initial startup the representative shall meet with and work with the Contractor as part of commissioning the Automatic Temperature Control system, providing additional programming and control interface as directed. In addition to start up services, the manufacturer's representative shall provide a minimum of two (2), four hour training classes at the job site for Owner operation, maintenance and servicing.

END OF SECTION

**PART 1 - GENERAL**

- 1.1 All piping shall be supported from the building structure.
- 1.2 Mechanical equipment, appliances and supports that are exposed to wind shall be designed and installed to resist the wind pressure determined in accordance with the building and mechanical code. Refer to specification 23 05 30 Bases and Supports for HVAC Equipment and 23 05 49 Vibration Control for HVAC for additional requirements.
- 1.3 All products and assemblies installed with-in the building shall not exceed a maximum flame spread of 25 and a smoke development of 50 as established by UL 723 or ASTM E84 test methods. However, "discrete" combustible components as defined by the mechanical code may be UL 2043 listed in lieu of UL 723 or ASTM E84.
- 1.4 Where cable support systems are allowed, cable shall be equal to Gripple galvanized high-tensile steel strand of 7x7, 1x19, or 7x19 configurations, as dictated by load and application.

**PART 2 - PRODUCTS**

- 2.1 Manufacturers listed below are basis of design. Other applicable manufacturers are B-line, Erico, Fee, Mason and PHD, and Gripple for cable support type systems.
- 2.2 Hangers for horizontal piping shall be equal to:

- A. General service
  - 1. Clevis type. Anvil Fig. 260.
    - a. Clevis type hangers with rollers, Anvil Fig. 181, for insulated piping systems where the length of the hanger rod between the top of the hanger and the attachment device is 3 inches or less, and where required elsewhere herein or on the drawings, to allow for expansion travel.
  - 2. Cable Support System. Not acceptable for use on steam or steam condensate services or where clevis type hangers with rollers are required per paragraph 2.2.A.1.a above. Gripple Universal Clamp for Piping with threaded connection on top, EPDM pad and retractable nylon sleeve over Gripple galvanized high-tensile steel cabling support, minimum 3:1 safety factor.
- B. Uninsulated copper tubing
  - 1. Copper plated clevis type - Anvil Fig. CT-65 (or plastic-coated clevis).
  - 2. Cable Support System. Not acceptable for use on steam or steam condensate services. Gripple Universal Clamp for Piping with threaded connection on top, EPDM pad and retractable nylon sleeve over Gripple galvanized high-tensile steel cabling support, minimum 3:1 safety factor.

2.3 Hanger Supports

- A. Hanger Rods
  - 1. Hanger rods shall be solid steel, threaded end or all thread rod, of diameter listed below. A hanger attachment device (beam clamps, concrete inserts, etc.) and locking nuts at the hanger attachment shall be provided on each hanger. Locking nuts shall be provided at each clevis, trapeze and swivel ring type hanger.
 

Pipe Sizes	Min. Rod Dia.
2" and smaller	0.375"
2.5" to 3"	0.50"
- B. Hanger Cable Support Systems

1. Cable supports shall be Gripple UniGrip Central Exit with Gripple galvanized steel cabling sized for minimum 3:1 safety factor on load imposed.
- 2.4 Refer to Part 3 for Hanger rod and cabling attachment devices for attachment to the structure.
- 2.5 Refer to Part 3 for steel spring and neoprene isolators in hanger rods, required for piping connecting to vibration isolated and/or motor driven equipment. Cable support systems are not permitted for use with vibration isolators unless the isolator manufacturer has specific installation details showing the application of cable supports.
- 2.6 Base mounted pipe supports shall be factory or shop prime coat painted equal to Anvil catalog numbers as follows:
  - A. Pipe slide having carbon steel base (with guide arrangement) and inverted tee with Teflon slide plate on each - Fig. 257, type 3.
  - B. Base mounted pipe roller stand - Fig. 271.
- 2.7 Pipe riser supports shall be as follows:
  - A. Riser clamps (for downward loads) on cold service piping (cold water, chilled water, refrigerant suction, etc.) - insulated pipe riser clamp assembly, Pipe Shields, Inc. E1000, with polyisocyanurate insulation, galvanized steel jacket, steel top thrust plates and steel riser clamps.
  - B. Riser clamps (for downward loads) on piping other than cold service - Anvil Fig. 261 except, on copper tubing, CT-121 (copper plated) or CT-121C (plastic coated).
  - C. Pipe Support Brackets for intermediate support of risers (no upward or downward load support) – Gripple Pipe Support Bracket, wall-mounted, with QT Compact Clamps or Universal Clamps; or Anvil Figure 256 galvanized steel pipe guide, Figure CT-255 for uninsulated copper tubing.
- 2.8 Pipe support bases for pipe and conduit running across the roof shall be molded polycarbonate pillow block, UV stabilized polypropylene, or UV stabilized 100% recycled rubber pipe stands. Manufactured by Miro Industries, ABI, Inc., or Anvil H-Block. Pipe supports shall require no penetration of roofing membrane. Associated metallic hardware shall be hot dipped galvanized. Pipe support methods shall be consistent with those specified above unless detailed on the drawings otherwise. Furnish protective slip sheets of roofing membrane for installation under bases.
- 2.9 Pipe supports for pipe and conduit running across the roof shall be manufactured by Advanced Support Products or Anvil H-Block, requiring no penetration of the roofing membrane. The support system shall consist of injection molded polypropylene, or UV stabilized 100% recycled rubber bases, 12 gauge hot dipped galvanized Unistrut framing and adjustable hot dipped galvanized or cadmium plated hangers and cadmium plated hanger rods as detailed. Furnish protective slip sheets of roofing membrane for installation under the bases.
- 2.10 Insulation Inserts and Saddles
  - A. Hangers on insulated horizontal piping shall be oversized to surround the pipe insulation. To protect the insulation from damage or inordinate compression due to concentrated weight, provide insulation inserts and shields as specified in 23 07 19 HVAC Pipe Insulation or equals by Anvil or Gripple

- B. Insulation saddles (shields) shall be compatible with pipe insulation materials and thicknesses. Vapor barrier shall be continuous.

### **PART 3 - EXECUTION**

3.1 Spacing of hangers and supports shall be as follows, unless otherwise shown on drawings:

1. Copper tubing (vertical) - at the base, at each floor level, and 10 ft. maximum spacing.
2. Copper tubing (horizontal) - 6 ft. spacing for tubing 1.25 inches size and smaller, 8 ft. spacing for 1.50 inches thru 2.5 inches sizes, 10 ft. spacing for tubing 3 inches size and larger.
3. PVC Pipe - spacing and hanging methods in strict accordance with code requirements and manufacturer's recommendations, with consideration being given to service temperature and expansion compensation, but no greater than 4 ft. spacing for horizontal and no greater than 10 ft. spacing for vertical piping (plus midstory guide).
4. PEX tubing – per manufacturer's instructions but no greater than 32" spacing for horizontal and no greater than 10 ft. spacing for vertical piping (plus midstory guide).

3.2 Attachment of pipe hanger rods and cabling to the structure shall be with:

- A. After-set concrete inserts, in 4 inches minimum depth concrete, set in drilled holes. Powder actuated driven fasteners are not permitted.
- B. Beam clamps in steel construction equal to Anvil Figures 92, 93, 94 or 14. Provide anchoring where clamps are attached to sloping surfaces of beam flanges and where otherwise required to ensure permanent attachment.
- C. Side beam bracket in wood construction, Anvil Figure 206, secured to the wood joist with lag screws set in drilled pilot holes.
- D. Attachment to steel deck is prohibited. Span from steel structural members with supplementary steel shapes where direct attachment to structural members is not practical. This does not apply to steel deck with concrete slab poured on the deck. Refer to A. and B. above.

3.3 Pipe supports manufactured by Miro Industries for pipe running across the roof shall be installed in accordance with the manufacturer's instructions and as detailed. Install protective slip sheets of roofing membrane under the bases to satisfy requirements of both the roofing manufacturer and the support system manufacturer.

3.4 Pate style support curbs shall be attached to the roof deck to comply with wind restraint requirements, and flashed into roofing system.

3.5 Pipe hangers shall be adjusted to proper elevation, hanger rods set in a vertical position and locking nuts secured before pipe insulation is installed.

3.6 Cabling systems shall be installed per manufacturer's installation details, and adjusted and secured with manufacturer approved devices.

3.7 Extended legs of pipe riser clamps shall be shortened as needed to maintain concealment of the clamp within the pipe chase. Ensure that adequate support is still maintained.

- 3.8 Hanger and support assemblies which are not factory plated (galvanized or copper) and will remain exposed on completion of the project shall be painted before installation.
- 3.9 Do not bend hanger rod to set in vertical position. Use manufactured hanger rod attachments that swivel to allow the hanger rods to hang vertically, or provide supplemental steel attached to the building structure and standard hanger rod attachments to allow the hanger rods to hang vertically. Refer to Manufacturers Standardization Society (MSS) Standard MSS SP-58 on Materials, Design and Manufacturer for best practices on pipe hangers and supports.

END OF SECTION

**PART 1 - GENERAL**

- 1.1 Equipment shall be supported on concrete bases, roof curbs and structural steel supports as shown on drawings or as specified. All bases, curbs and supports shall be included except as otherwise noted.
- 1.2 Wind Load Analysis
- A. HVAC equipment, ductwork, piping, conduits, etc. exposed to wind shall have positive attachment to the building structure or ground to comply with wind load requirements of the building and mechanical codes.
  - B. Wind speed design shall be 120 MPH. Refer to structural drawings for additional design requirements.
  - C. The contractor shall retain a specialty consultant to perform wind load calculations in accordance with the code and additional requirements specified in this Section. A professional engineer experienced in wind load attachment design and installation and licensed in the state where the project is located shall be responsible for calculations, attachment selections and installation details.
  - D. The Wind Load Analysis consisting of attachment design, calculations, attachment selection, installation details including anchoring methods, fastener specifications, embedment and/or welded length, etc..shall be submitted for review and record. This submittal shall be signed and sealed by a professional engineer, as stated above. This submittal will become part of the project design calculations, included in the project records, and when required, will be submitted to the authority having jurisdiction.
  - E. The wind load attachment design shall clearly indicate the attachment points to the building structure and design forces in all horizontal and vertical axes at the attachment points. The wind load attachment engineer shall coordinate all attachments with the projects structural engineer of record, who shall verify the attachment methods and the ability of the building structure to accept the loads imposed.
  - F. The wind load attachment design shall be based on actual equipment data (dimensions, weight, center of gravity, etc.) obtained from submittals or the manufacturers. The equipment manufacturer shall verify that the attachment points on the equipment can accept the combination of wind load, weight, and other loads imposed.
  - G. At the project Engineer of Record's discretion, equipment submittals may not be approved until the Wind Load Analysis has been submitted. It is the contractor's responsibility to schedule and coordinate the process in a timely fashion, including follow-up Wind Analysis submittals for equipment approved pending a Wind Analysis submittal.

**PART 2 - PRODUCTS**

- 2.1 Support for equipment shall be by one or more of the following methods:
- A. Concrete bases and pads with anchor bolts cast in place. Provide a 6" thick concrete pad that is minimum 4" wider than the equipment in each direction, formed on all sides and hand troweled to a smooth, dense finish with neatly chamfered corners. Large concrete pads on grade shall be constructed with reinforcing steel or reinforcing roadway mesh. Set anchor bolts as required for the equipment.
  - B. Structural steel angles, beams or channels, unistrut type channels or pipe. Supports shall be fabricated into a rigid framework with welded or bolted connections and cross bracing or sway



bracing. Supports shall be set on slab with base plates, or attached to the building structure as required. Brackets for relatively lightweight equipment may be attached to the wall. Equipment shall be set on and attached to the framework.

- C. Solid steel hanger rods supported from the structure above similar to pipe hangers. Provide sway bracing for equipment supported in this manner.
- 2.2 Provide exact dimensions, locations and other detail for the specific equipment provided that requires bases or supports. Set anchor bolts as required for the equipment.
  - 2.3 Equipment roof supports shall be heavy gauge galvanized steel support curbs with base plate, continuous welded corner seams, integral raised cant to match roof insulation, internal insulation, wood nailer and counterflashing. Unless otherwise noted, top of curbs shall extend 12" above the finished roof surface, 18" above for intake applications. For sloped roofs, the curb shall have a built-in slope to match roof slope so that top of curb is level.
  - 2.4 Rooftop heating cooling units shall be roof curb mounted. Curbs shall be furnished with the equipment and meet the following requirements:
    - A. The roof curb shall be 18" minimum height. Gasketing shall be furnished for field installation to ensure a weather-tight condition. For sloped roofs, the roof curb shall be sloped to match the roof slope to provide a level unit support. The roof curb shall be consistent with the footprint of the unit, including the piping cabinet and other unit components.
    - B. Minimum 2" continuous internal insulation.
  - 2.5 Refer to 23 34 00 HVAC Fans associated with that equipment.

### **PART 3 - EXECUTION**

- 3.1 Roof support curbs shall be installed and leveled and secured to the roof deck/structure. Roof insulation and roofing shall be removed and repaired to maintain the integrity of the roofing system. Provide wood cant strips around the curb only if recommended for the roofing system.
- 3.2 Bracing and Attachment
  - A. All equipment and curbs exposed to wind shall be installed and attached to structure in strict accordance with the wind load attachment design provided by the engineer to conform with requirements of the Code and referenced standards and in strict accordance with the manufacturers written instructions.
  - B. No rigid connections between equipment and the building structure shall be made that would degrade noise and vibration control.
  - C. Coordinate work with other trades. When conflicts develop in installation, they shall be brought to the attention of all involved parties and a suitable solution must be determined.
  - D. Each manufacturer of equipment shall furnish a statement stamped by a professional engineer indicating that the equipment is designed and constructed to withstand wind loads required by the code. Statement shall be based on analysis, testing or experience data, and supporting documentation shall be available upon request.

END OF SECTION

**PART 1 - GENERAL**

- 1.1 Vibration isolators shall be provided at equipment as shown on the drawings and as herein specified.
- 1.2 The supplier of isolation equipment shall study the application, the equipment to be isolated and the structure. The supplier shall assume responsibility to determine required minimum deflections and optimum deflection characteristics accounting for dynamic and static forces.

**PART 2 - PRODUCTS**

- 2.1 Following is a description of the various types of isolators, bases and rails required. Catalog designations are those of Mason Industries.

Type A1  
Ribbed or waffled neoprene pad. Series W.

Type A2  
Ribbed or waffled neoprene pad with 16 gauge metal top plate. Series WS.

- 2.2 Isolators shall be as manufactured by Mason Industries, Kinetics, or Vibro-Acoustics. All isolators shall be of one manufacturer.

**PART 3 - EXECUTION**

- 3.1 Manufacturer's instructions shall be followed carefully in setting and adjusting vibration isolators. Ensure that no direct hard surface to surface contact exists. Fasten to the building structure as recommended by the isolation supplier.
- 3.2 Where electrical connections are made to equipment mounted on isolators, caution the Electrical Contractor to connect thru flexible conduits.

END OF SECTION

**PART 1 - GENERAL**

- 1.1 Identification of Division 23 equipment shall consist of equipment labeling, pipe and duct marking as specified hereinafter.
- 1.2 Each item of major equipment shall be labeled. This shall include rooftop units, air handling units, fans, split systems, heat pumps, and other similar equipment.
- 1.3 Pipe markings shall be applied to all piping.
- 1.4 Duct markings shall be applied to all ductwork.
- 1.5 Labels, tags and markers shall comply with ANSI A13.1 for lettering size, colors and length of color field.
- 1.6 Equipment and device identification specified in other sections shall be provided as a part of those requirements.
- 1.7 Submit product data noting materials, sizes and dimensions for identification systems.

**PART 2 - PRODUCTS**

- 2.1 Equipment labeling shall be either, or a mix, of the following:
  - A. Permanently attached engraved brass or plastic laminated signs with 1 inch high lettering. Signs on exterior equipment shall be brass.
  - B. Stencil painted identification, 2 inches high letters, with standard fiberboard stencils and standard black (or other appropriate color) exterior stencil enamel.
- 2.2 Pipe markings shall be:
  - A. Plastic semi-rigid snap-on type, manufacturer's standard pre-printed color-coded pipe markers extending fully around the pipe and insulation.
  - B. Non-metallic piping that is insulated for plenum rating purposes shall be labeled with White letters on Brown background. Labeling shall state "INSULATION REQUIRED FOR PLENUM RATING – DO NOT REMOVE".
  - C. On piping and insulation 6 inches and greater diameter, full band as specified above or strip-type markers fastened to the pipe or insulation with laminated or bonded application or by color-coded plastic tape not less than 1.50 inches wide, full circle at both ends of the marker.
  - D. Arrows for direction of flow provided integral with the pipe marker or separate at each marker.
- 2.3 Duct markings shall be laminated plastic color-coded pressure sensitive vinyl tape, 2.50 inches width, 3 mils minimum thickness. Identification shall include service (supply, return, exhaust, outside air) and direction of flow.
- 2.4 Labels, markings and tags shall be manufactured by W.H. Brady, Seton, Allen, Kolbi, MSI or Industrial Safety Supply.

**PART 3 - EXECUTION**

- 3.1 Identification labeling, marking and tagging shall be applied after insulation and painting has been completed.
- 3.2 Coordinate names, abbreviations and other designations used in mechanical identification work, with corresponding designations shown, specified or scheduled on drawings.
- 3.3 The Contractors shall coordinate labeling, marking and tagging to attain coordinated and consistent systems of identification.
- 3.4 Equipment labeling shall consist of unit designation as shown on the drawings. Exhaust fan labeling shall also indicate service or room or area of service.
- 3.5 Pipe and duct markers shall be placed:
  - A. At each piece of equipment.
  - B. At 25 ft. centers in mechanical rooms and concealed spaces, but at least once per room.
  - C. At 50 ft. centers in exposed finished areas, but at least once per room.
  - D. On mains at each branch take-off.
  - E. On duct access panels.
- 3.6 Refer to appropriate sections of this specification for installation of underground line marker tape.

END OF SECTION

**PART 1 - GENERAL**

- 1.1 Provide air balancing of the new systems and existing systems affected by the new work. Balancing work shall be performed by qualified personnel of a member firm of the Associated Air Balance Council (AABC) or a member firm of the National Environmental Balancing Bureau (NEBB), who has no affiliation with the Contractor or any of its Sub-Contractors. Include a certification sheet signed and sealed by the certified testing and balancing authority. Include a list of instruments to be used for procedures, along with proof of calibration.
- 1.2 Methods, procedures, equipment, certifications, report forms and reporting information shall be in accordance with the standards of AABC or NEBB and latest edition of the SMACNA TAB Procedural Guide and industry practice.
- 1.3 During the bid period, call to attention any requirements for additional balancing dampers and manual volume dampers which are deemed necessary in addition to those shown on the drawings, and provide such so that proper balancing can be performed. Prior to installation of the systems, verify that the proper number and location of balancing devices are adequate for completion of the balancing work.
- 1.4 Prepare a balancing plan that includes strategies and step-by-step procedures. This plan should include a list of items that must be completed before balancing can proceed. Prepare a schedule to ensure adequate time for the balancing process and submit this schedule to the Engineer or Prime Contractor for review.
- 1.5 When project is in phases and partial occupancy is planned, determine process to allow balancing work to be completed before occupancy.
- 1.6 Refer to Sections of Division 23 for requirements related to the balancing work.
- 1.7 Verify that all equipment start-up services have been completed before the beginning of any balancing work. After initial start-up has been completed, inform the balancer that the systems are operating properly, that all safety interlocks and protective devices are functioning, and the systems are ready to be balanced. **Refer to SMACNA Guide 2.6.1 for items to be included in system check.**

**PART 2 - PRODUCTS – NOT USED****PART 3 - EXECUTION**

- 3.1 Air Balance
  - A. Obtain job specific fan curves for each fan being balanced, new and existing, and include in report.
  - B. Record nameplate data from fan, motor, and air handling cabinet.
  - C. Record and measure fan and motor sheaves indicating number and size of belts along with center-to-center distances.
  - D. Test and record actual operating fan rpm.
  - E. Measure and record actual running amperage.
  - F. Each air supply, return, and exhaust system, when installation is completed, including the installation of clean filters, shall be set in operation for balancing. Determine the best location in main and branch ducts for accurate duct airflow measurements. Each air outlet and inlet device, item of equipment (fan coils, air control units, etc.), shall be balanced to the quantities listed on the drawings within plus or minus 10 percent, except when more stringent requirements are required as defined below. Central fan systems (AHU's, exhaust fan

systems, etc.) shall be balanced to within plus or minus 5%. Intended pressure relationships in areas required by recognized standards and practice shall be attained.

- G. Adjust drive pulleys to attain fan speed required for the installed condition. Upon final determination of proper operating speed adjustable pulleys shall be removed and replaced with fixed pitch pulleys. Pulleys and belts of fixed drives and of adjustable drives not having sufficient adjustment range shall be changed out, at the direction of the balancer or Engineer, to obtain fan speed required for the installed condition. Labor /or materials required to make the recommended changes shall be included in Division 23.
- H. Measure velocity reading across coils, filters, and dampers on the intake side of the fan. Include data in the report.
- I. Coordinate with the Temperature Controls Installer in setting variable frequency drives and outside air, return air and vent air dampers. Supply air systems shall have ampere reading measured in the full heating, full cooling and economizer modes to determine the maximum brake horsepower.
- J. Witness all duct pressure and leakage tests. Refer to 23 31 13 and coordinate accordingly.
- K. Total air quantities of the supply fan, and the return fan, exhaust fan shall be determined by pitot tube traverse. Where impossible to take good pitot tube traverses of duct system, use total sum of terminal device air volume readings. Final settings of fan speeds shall be determined with variable speed drives at full speed.
- L. Check airflow patterns from the outside-air louvers and dampers and the return and exhaust-air dampers, through the supply-fan discharge and mixing damper. Report any issues with stratification, poor mixing or short circuiting from one air stream to the other.
- M. Check for airflow blockages.
- N. Check for proper sealing of air-handling unit components. Report all issues in balancing report.
- O. Check for proper sealing of air duct systems. Minor issues shall be reported in the balancing report. If a major issue is found, stop balancing work and report issue to the Engineer / Prime Contractor.
- P. The report shall include, but not be limited to, fan curves, both actual and design fan cfm, rpm, brake HP, entering and leaving static pressures, motor data, voltage and amperage and drive information. System air flows by device, terminal, branch and system shall be reported.

In addition, a sketch shall be provided for each air system balanced or surveyed, depicting exact location that fan static pressure and fan CFM readings were taken, relative to fan inlet and discharge, and what duct accessories were in place near the reading location and between the reading location and the fan. The sketch shall also depict elbows and other duct transitions in place near the reading location and between the reading location and the fan. Air handling unit sketches shall depict all air path components with-in the unit, and static pressure readings across each item. Balance reports will be rejected without this information.

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

3.2 After completion of the balancing work, a full report shall be prepared in pencil and two copies (only) submitted to the Engineer for preliminary review. After review, additional balancing, adjustments, drive replacements, readings and recordings deemed necessary shall be done and the report revised. Six typed copies of the final report shall be submitted to the Engineer for review and approval. An approved copy of the report shall be included in each set of operating and maintenance manuals.

3.3 Final Report contents: In addition to certified field report data, include the following:

- A. Table of Contents with total number of pages defined for each section of the report.
  - B. Summary of Contents - include the following:
    - 1. Indicated versus final performance.
    - 2. Notable characteristics of systems.
    - 3. Description of system operation sequence if it varies from the contract documents.
  - C. Nomenclature sheets for each item of equipment.
  - D. Notes to explain why certain final data in the body of reports varies from indicated values.
  - E. Fan Curves.
  - F. Manufacturers' test data.
- 3.4 Inspection after testing and balancing are complete, operate each system and randomly check measurements to verify that the system is operating according to the final test and balance reading documented in the final report. Submit random sampling percentages and results.
- 3.5 Seasonal Testing: If initial balancing procedures were not performed during near peak summer and winter conditions, perform additional testing, inspecting and adjusting during near peak summer or winter conditions.

END OF SECTION

**PART 1 - GENERAL**

- 1.1 All interior and exterior supply air, mixed air, and intake outside air ductwork and plenums shall be insulated unless specifically noted as “uninsulated” in the Duct Construction Schedule on the drawings, including ductwork in crawl spaces, attics, and buried under slab.
- 1.2 All interior and exterior return air ductwork and plenums shall be insulated unless specifically noted as “uninsulated” in the Duct Construction Schedule on the drawings, including ductwork in crawl spaces, and attics (when duct is above the roof insulation).
- 1.3 Unless noted otherwise below, exhaust and relief air ductwork shall be insulated from 24” upstream of the auto/backdraft damper to the point of exterior wall/roof penetration, or as noted on the Duct Construction Schedule on the drawings. Exterior exhaust air ductwork shall be insulated when noted on the Duct Construction Schedule.
- 1.4 Ductwork shall not be internally lined, unless shown otherwise for return or exhaust.
- 1.5 Jacketing shall be provided on insulation located outside for weather protection as noted below:
- 1.6 Composite insulation assemblies shall meet UL 723 or ASTM E84 requirements and not exceed maximum flame spread of 25 and smoke development of 50, except as specifically allowed below, and “discrete” combustible components as defined by the mechanical code may be UL 2043 listed in lieu of UL 723 or ASTM E84. Identification of manufacturer, thermal resistance (R-value), flame spread and smoke-development shall be clearly marked on the exterior of the insulation at intervals as required by code.
- 1.7 Submittals
  - A. Submit product description, thermal characteristics and list of materials and thickness for each service and location.
  - B. Submit manufacturers published literature indicating proper installation procedures.
- 1.8 Delivery, Storage and Handling
  - A. Materials on site shall be stored in original factory packaging, labeled with manufacturer’s identification, including product density and thickness.
  - B. Protect insulation from weather and construction traffic, dirt, water, chemical and damage, in addition to storing in original wrapping.

**PART 2 - PRODUCTS**

- 2.1 Insulation shall be manufactured by Johns Manville, Owens Corning, Certainteed, Knauf, Manson, or as listed below. Insulation for duct systems required to be insulated shall have a minimum installed R-value of 4.2 (at a 75 degrees F mean rating temperature) except as noted below:

Duct System	Minimum Installed R-Value
Supply air and return air located outdoors	R-6.0 (1)
Supply air, outside air, and mixed air located above the roof insulation in both ventilated and non-vented attics	R-6.0 (1)



Notes:

- (1) Listed R-value may be a total R-value for internal insulation plus external insulation. Refer to Duct Construction Schedule on the drawings.

"Installed" R-value for blanket insulation is the calculated R-value with 25 percent compression. "Installed" R-value for board insulation is the published nominal R-value.

- 2.2 Insulation on concealed ductwork shall be fiberglass blanket insulation with factory applied reinforced foil and kraft paper vapor barrier jacket, minimum 1.50 inches thickness and 0.75 inch p.c.f. density, formaldehyde-free or GreenGuard Certified for low formaldehyde and VOC emissions.
- 2.3 Insulation on exposed ductwork shall be fiberglass board insulation with factory applied "all service" jacket with vapor barrier, minimum 2 inches thickness and 3 p.c.f. density, formaldehyde-free or GreenGuard Certified for low formaldehyde and VOC emissions.
- 2.4 Insulation on ductwork located outdoors and required to be externally insulated shall be fiberglass board insulation with factory applied "all service" jacket with vapor barrier, minimum 2 inches thick, 3 p.c.f. density, formaldehyde-free or GreenGuard Certified for low formaldehyde and VOC emissions. Insulation shall be jacketed as described below.
- 2.5 Protective jacketing of outdoor ductwork systems and/or insulation systems shall be VentureClad 1577 CW series self-adhesive laminate, or equal by Foster Products. Finish and Color shall be Embossed Natural Aluminum (14.0 mils).

### **PART 3 - EXECUTION**

#### **3.1 Site Inspection**

- A. Before starting work, carefully inspect the site and installed work of other trades and verify that such work is complete to the point where installation of insulation materials and accessories can begin.
- B. Verify that all insulation materials and accessories can be installed in accordance with project drawings and specifications and material manufacturers' recommendations.
- C. Verify, by inspecting product labeling, submittal data, and/or certifications which may accompany the shipments, that all insulation materials and accessories to be installed on the project comply with applicable specifications and standards and meet specified thermal and physical properties.

#### **3.2 Preparation**

- A. Ensure that all surfaces over which insulation is to be installed are clean and dry.
- B. Ensure that insulation is clean, dry and in good mechanical condition with all factory-applied vapor or weather barriers intact and undamaged. Wet, dirty or damaged insulation shall not be acceptable for installation.
- C. Ensure that pressure testing of ductwork and fittings has been completed prior to installing insulation.

#### **3.3 Installation**

- A. Installation shall be done by tradesmen specializing in this work in strict accordance with manufacturer's recommendations.

- B. Install all insulation materials and accessories in accordance with manufacturer's published instructions and recognized industry practices. External duct stiffeners and bracing shall be insulated same as for duct.
- C. Blanket insulation shall be wrapped tight to the duct. Insulation shall be secured to ducts 20 inches wide and greater with weld pins and fasteners, 18 inches on center maximum. Adhesive shall be applied to the duct as an aid to installation and adhesion. Vapor barrier jacket shall be lapped, stapled and sealed with adhesive and 3 inches wide FSK pressure sensitive tape.
- D. Board insulation with factory applied jacket shall be secured to the duct with weld pins and fasteners, 12 inches on center maximum. Vapor barrier jacket shall be lapped, stapled and sealed with adhesive and 3 inches wide ASJ pressure sensitive tape.
- E. Maintain the integrity of factory-applied vapor barrier jacketing on all insulation, protecting it against puncture, tears or other damage. All staples used on cold insulation shall be coated with suitable sealant to maintain vapor barrier integrity.
- F. External insulation on supply and return ductwork located outdoors shall be weatherprotected with field applied Ventureclad. Tops of ducts shall be pitched to drain.
- G. Self-adhesive laminate jacketing shall be installed in strict accordance with manufacturers instructions.

#### 3.4 Protection

- A. Advise as to requirements for protection of the insulation work during the remainder of the construction period, to avoid damage and deterioration of the finished insulation work.
- B. Replace damaged insulation, which cannot be satisfactorily repaired, including insulation with vapor barrier damage and moisture-saturated insulation.

#### 3.5 Safety Precautions

- A. Employees shall be properly protected during installation of all insulation. Protection shall include proper attire when handling and applying insulation materials, and shall include (but not be limited to) disposable dust respirators, gloves, hard hats, and eye protection.
- B. Conduct all job site operations in compliance with applicable provisions of the Occupational Safety and Health Act, as well as with all state and/or local safety and health codes and regulations that may apply to the work.

#### 3.6 Reinsulate ductwork where existing insulation has been damaged or removed in the performance of work in this project.

END OF SECTION

**PART 1 - GENERAL**

- 1.1 Piping systems shall be insulated as described below in their entirety, including pipe, fittings, unions, specialties and all related items and equipment unless otherwise noted. Maintain access to covered P/T test ports, and similar accessories thru the use of removable and reusable caps, plugs and fittings.
- 1.2 Composite insulation assemblies shall not exceed maximum flame spread of 25 and smoke development of 50, except as specifically allowed below, as established by UL 723 or ASTM E84 test methods. However, “discrete” combustible components as defined by the mechanical code may be UL 2043 listed in lieu of UL 723 or ASTM E84.
- 1.3 The following HVAC piping shall be covered with insulation of thickness listed, to meet or exceed ASHRAE 90.1, latest publication:

Pipe System	.75” and smaller	1.0” to 1.25”	1.50” to 3”	4” to 6”	8” and larger
Refrigerant suction	1”	1.50”	1.50”	1.50”	1.50”
Refrigerant hot gas	1”	1”	1”	1”	1”
Refrigerant liquid <sup>(1)</sup>	1”	1”	1”	1”	1”

Notes:

- (1) Insulate refrigerant liquid line when recommended or required by equipment manufacturer (such as for variable refrigerant volume / flow systems).

- 1.4 Submittals
  - A. Submit product description, thermal characteristics and list of materials and thickness for each service and location.
  - B. Submit manufacturers published literature indicating proper installation procedures.
- 1.5 Delivery, Storage and Handling
  - A. Materials on site shall be stored in original factory packaging, labeled with manufacturer’s identification, including product density and thickness.
  - B. Protect insulation from weather and construction traffic, dirt, water, chemical and damage in addition to storing in original wrapping.

**PART 2 - PRODUCTS**

- 2.1 Closed cell elastomeric insulation for above grade use on systems operating at 200 degrees F and below and 2 inches or smaller pipe sizes shall be tubular closed cell pipe insulation, pre-slit longitudinally. Polyolefin insulation is not acceptable. Insulation shall be manufactured without the use of CFC’s, HCFC’s or HFC’s. It shall meet ASTM C534 and also be formaldehyde free, low VOC, dust free, resistant to mold and mildew, and shall be 25/50 rated per ASTM E84. Thermal conductivity (k) shall be maximum 0.27 at 75 degrees mean rating temperature.

Closed cell elastomeric insulation shall be Armacell AP/Armaflex SS, K-Flex USA “Insul-Tube” or Aero Flex USA “Aerocel-SSPT”. For systems operating at 180 degrees F or less, insulation shall utilize a self-sealing pressure sensitive closure system. Butt joints shall be sealed with Armaflex 520 BLV low VOC adhesive or equal. For systems operating between 180 degrees F and 200 degrees F, all joints and seams shall be sealed with Armaflex 520 BLV low VOC adhesive or equal.

For indoor systems, use shall be restricted to those systems requiring 2 inch thickness or less (due to 25/50 ASTM E-84 requirements).

Unless jacketed, for insulation located outside field paint with minimum 2 coats of an appropriate paint as recommended by the insulation manufacturer to prevent solar ultra-violet deterioration.

- 2.2 Fittings, valves, flanges and other devices, both exposed and concealed, requiring insulation shall be covered same thickness as pipe insulation with any of the following (except when removable insulation covers are specified):
  - A. For closed cell elastomeric insulation systems:
    1. Miter cutting of tubular insulation using special tools and mitering devices; or
    2. Oversized pipe insulation overlapped and shaped to conform to fitting, valve or device.
- 2.3 Hangers on insulated horizontal piping are to be oversized to surround the pipe insulation. To protect the insulation from damage or inordinate compression due to concentrated weight, the following shall be provided at each hanger:
  - A. Pipe 2 inches and smaller Equal to Anvil Fig. 168, 18 ga. sheet metal rib-lock shield with belled ends, 12 inches long.
  - B. Insulation saddles (shields) shall be compatible with pipe insulation materials and thicknesses. Vapor barrier shall be continuous.
- 2.4 Jacketing for refrigerant piping located outdoors shall be a white removable PVC plastic pipe insulation cover as manufactured by AIREX E-flex Guard. The covers shall be flexible, UV and weather resistant, with full length Velcro fastening system for easy removal and reattachment. The system shall be installed in strict accordance with the manufacturer's instructions.

### **PART 3 - EXECUTION**

#### 3.1 Site Inspection

- A. Before starting work, carefully inspect the site and installed work of other trades and verify that such work is complete to the point where installation of insulation materials and accessories can begin.
- B. Verify that all insulation materials and accessories can be installed in accordance with project drawings and specifications and material manufacturers' recommendations.
- C. Verify, by inspecting product labeling, submittal data, and/or certifications which may accompany the shipments, that all insulation materials and accessories to be installed on the project comply with applicable specifications and standards and meet specified thermal and physical properties.

#### 3.2 Preparation

- A. Ensure that all surfaces over which insulation is to be installed are clean and dry.
- B. Ensure that insulation is clean, dry and in good mechanical condition with all factory-applied vapor or weather barriers intact and undamaged. Wet, dirty or damaged insulation shall not be acceptable for installation.
  1. Due to condensation issues, fiberglass insulation shall not be installed until building is covered and conditioned.

- C. Ensure that pressure testing of piping and fittings has been completed prior to installation.

### 3.3 Installation

- A. Installation shall be done by tradesman specializing in insulation work in strict accordance with manufacturers' recommendations. Installers shall be factory trained and certified for the insulation systems being installed. Submit credentials upon request.
- B. Install all insulation materials and accessories in accordance with manufacturer's published instructions and recognized industry practices.
- C. Install insulation on piping subsequent to installation of heat tracing and acceptance tests.
- D. Overlap and seal all longitudinal joints. Staples and adhesive may be used as stated above. Tape and seal cross joints. Vapor barrier shall be continuous on insulation of all cold services. Vapor barrier type mastic shall be used where needed to maintain a vapor seal, including over staples.
- E. Where insulation is terminated, insulation shall be beveled at 45 degrees and the beveled surface sealed with vapor barrier mastic. Except in ceiling spaces, PVC caps over straight cut ends which have been vapor sealed may be used in lieu of beveling.
- F. Insulation on cold service piping shall be run thru floor and wall sleeves to maintain vapor barrier continuity. Insulation on other services may likewise be run continuous when sleeve size permits. Refer to the 23 05 07 Piping Materials and Methods for special considerations which must be given at fire rated wall and floor penetrations. Refer to Section 23 05 29 Hangers and Supports for HVAC Piping for non-compressible insulation or blocking material and sheet metal saddles required at pipe hangers. . Provide insulation and vapor barrier on and around supports for pipe risers of services which require vapor seal so as to prevent sweating.
- G. Provide removable insulation sections to cover parts of equipment which must be opened periodically or maintenance, and for cooling condensate piping clean-outs.

### 3.4 Protection

- A. Advise as to requirements for protection of the insulation work during the remainder of the construction period, to avoid damage and deterioration of the finished insulation work.
- B. Replace damaged insulation, which cannot be satisfactorily repaired, including insulation with vapor barrier damage and moisture-saturated insulation.

### 3.5 Safety Precautions

- A. Employees shall be properly protected during installation of all insulation. Protection shall include proper attire when handling and applying insulation materials and shall include (but not be limited to) disposable dust respirators, gloves, hard hats and eye protection.
- B. Conduct all job site operations in compliance with applicable provisions of the Occupational Safety and Health Act, as well as with all state and/or local safety and health codes and regulations that may apply to the work.

END OF SECTION

**PART 1 - GENERAL**

- 1.1 Refer to the HVAC Drawings, Section 23 09 93 Sequences of Operations, Section 23 09 95 BAS Points List, for sensor and device requirements.
- 1.2 All products used in the installation shall be new, currently under manufacture, and shall be applied in standard off the shelf products. This installation shall not be used as a test site for any new products unless explicitly approved by the Engineer in writing. Spare parts shall be available for at least 10 years after completion of this contract.
- 1.3 System shall conform to the following minimum standards over network connections:
  - A. Reporting Accuracy. System shall report values with the minimum end-to-end accuracy listed in Table 1.
  - B. Control Stability and Accuracy. Control loops shall maintain measured variable at setpoint within tolerances listed in Table 2.

TABLE 1: Reporting Accuracy

Measured Variable	Reported Accuracy
Space Temperature	±0.5°C [±1°F]
Ducted Air	±0.5°C [±1°F]
Outside Air	±1.0°C [±2°F]
Dewpoint	±1.5°C [±3°F] (-76 to 176°F scale)
Delta-T	±0.15°C [±0.25°F]
Relative Humidity	±5% RH (0 – 90% scale)
Airflow (terminal)	±10% of full scale (see Note 1)
Airflow (measuring stations)	±5% of full scale
Airflow (pressurized space)	±3% of full scale
Air Pressure (ducts)	±25 Pa [±0.1" w.g.]
Air Pressure (space)	±3 Pa [±0.01" w.g.]
Electrical (A, V, W, Power factor)	±1% of reading
(see Note 3)	

Notes:

- (1) Accuracy applies to 10 percent - 100 percent of scale.
- (2) For both absolute and differential pressure.
- (3) Not including utility supplied meters.

TABLE 2: Control Stability and Accuracy

Controlled Variable	Control Accuracy	Range of Medium
Air Pressure	$\pm 50$ Pa [ $\pm 0.2$ " w.g.]	0-1.5 kPa [0-6" w.g.]
	$\pm 3$ Pa [ $\pm 0.01$ " w.g.]	-25 to 25 Pa [-0.1 to 0.1" w.g.]
Airflow	$\pm 10\%$ of full scale	
Space Temperature	$\pm 1.0^{\circ}\text{C}$ [ $\pm 2.0^{\circ}\text{F}$ ]	
Duct Temperature	$\pm 1.5^{\circ}\text{C}$ [ $\pm 3.0^{\circ}\text{F}$ ]	
Differential Enthalpy	$\pm 5$ kJ/kg [ $\pm 3$ Btu/lb]	35 – 63 kJ/kg [20-36 Btu/lb]
Humidity	$\pm 5\%$ RH	

## PART 2 - PRODUCTS

### 2.1 Actuators And Operators

#### A. Electronic Actuators

1. Actuators shall include electronics to receive the digital controllers analog position signal and maintain the position through the use of positive position feedback. Actuator shall be UL or other approved testing agency listed. Actuators shall be manufactured by Belimo Air Controls or approved equal.
2. Electronic actuators shall have electronic overload or digital rotation sensing circuitry to prevent damage to the actuator throughout the rotation of the actuator.
3. Unless noted otherwise as "floating point control", mechanical fail safe shall incorporate a spring-return mechanism to return to the device to its "normal" position on loss of power. Electronic fail safe shall incorporate an active balancing circuit to maintain equal charging rates among the Super Capacitors with a visual indication of the fail safe status on the actuator face with the power fail position field adjustable between 0 to 100 percent in 10 degree increments, an adjustable 0 – 10 second operational delay, and capable of changing the fail-safe position through an integrated switch without removing the mounted actuator.
4. All rotary spring-return actuators shall be capable of both clockwise and counter-clockwise spring-return operation. Linear actuators shall spring-return to the retracted position.
5. Proportional actuators shall accept a 0 to 10 VDC or 0 to 20 mA control signal and provide a 2 to 10 VDC or 4 to 20 mA operating range.
6. All 24 VAC/VDC actuators shall operate on Class 2 wiring and shall not require more than 10 VA for AC or more than 8 W for DC applications. Actuators operating on 120 VAC or 230 VAC shall not require more than 11 VA.
7. All actuators shall have an external manual gear release to allow manual positioning of the device when the actuator is not powered. Spring-return actuators with more than 7 N•m [60 in-lb] torque capacity shall have a manual crank for this purpose.
8. Actuators shall be provided with a raceway fitting and a minimum 1m electrical cable and shall be pre-wired to eliminate the necessity of opening the actuator housing to make electrical connections.
9. Actuators shall be designed for a minimum of 60,000 full-stroke cycles at the actuator's rated torque.

### 2.2 Sensors And Transmitters

- A. Any temperature or humidity sensing device mounted on an exterior wall shall be fitted with an insulated sub-base.
- B. Binary Temperature Devices

1. Low-voltage space thermostats shall be 24 V, bimetal-operated type, concealed setpoint adjustment, 55 degrees F to 85 degrees F setpoint range, 2 degrees F maximum differential, and vented ABS plastic cover. Provide subbase with manual or automatic switching as required to perform the specified functions. Thermostats shall be single or multi-stage or modulating output as required to perform the functions specified.
2. Line-voltage space thermostats shall be bimetal-actuated, open contact or bellows-actuated, enclosed, snap-switch type, or equivalent solid-state type, UL listed for electrical rating, concealed setpoint adjustment, 55 degrees F to 85 degrees F setpoint range, 2 degrees F maximum differential, and vented ABS plastic cover. Provide subbase with manual or automatic switching as required to perform the specified functions. Thermostats shall be single or multi-stage or modulating output as required to perform the functions specified.
3. Low-limit thermostats (freezestats). Low-limit airstream thermostats shall be UL listed, vapor pressure type or electronic type, with an element 20 ft. minimum length. Element shall cover the face of the coil at 1 ft. centers in a horizontal serpentine fashion and shall respond to the lowest temperature sensed by any 1 ft. section. When one freezestat cannot meet this requirement provide multiple freezestats. Unless noted otherwise, low-limit thermostats shall be manual reset type. Freezestats shall be supplied as DPST with one (1) set of normally closed contacts wired directly to fan circuit and one (1) set of normally open contacts to provide an alarm to the BAS.

#### C. Temperature Sensors

1. Temperature sensors shall be thermistors and be suitable for the application. Where feasible, provide the same sensor type throughout the project. Avoid using transmitters unless absolutely necessary. Sensor accuracy over the application range shall be 0.36 degree F or less between 32 to 150 degrees F. Stability error of the thermistor over five years shall not exceed 0.25 degree F cumulative. A/D conversion resolution error shall be kept to 0.1 degree F. Total error for a thermistor circuit shall not exceed 0.5 degree F.
2. Duct sensors shall be single point or averaging as shown or specified. Averaging sensors shall be a minimum of 5 feet in length per 10 sq. ft. of duct cross section. Mixed air and discharge air sensors shall be averaging type.
3. Space sensors shall be equipped with setpoint adjustment, occupancy mode override switch, display, and communication port. Thermostat cover shall be rectangular high impact ABS plastic (or equal) in a neutral cover.
4. Provide matched temperature sensors for differential temperature measurement.
5. Outdoor temperature sensors shall be platinum type and have a minimum accuracy of  $\pm 0.5$  degrees F from -40 degrees F to 140 degrees F and a measuring range from -20 degrees F to 120 degrees F. Outdoor temperature sensors shall be mounted on the north side of the building within a ventilated enclosure that protects the sensor from thermal building mass biasing, solar radiation and precipitation without affecting performance.

#### D. Humidity Sensors

1. Duct and room sensors shall have a sensing range of 20 percent to 80 percent. Accuracy shall be  $\pm 5$  percent of range. Accuracy shall be as stated in paragraph 1.4.
2. Duct sensors shall be provided with a sampling chamber.
3. Outdoor air humidity sensors shall have a sensing range of 0 percent to 100 percent RH. Accuracy shall be  $\pm 5$  percent of range. Accuracy shall be as stated in paragraph 1.4. They shall be suitable for ambient conditions of -40 degrees F to 140 degrees F. Outdoor humidity sensor shall be within a ventilated enclosure that protects the sensor from thermal building mass biasing, solar radiation and precipitation without affecting performance.
4. Humidity sensor's drift shall not exceed 1 percent of full scale per year.

#### E. Current Transformers

1. AC current transformers shall be UL/CSA recognized and completely encased (except for terminals) in approved plastic material.



2. Transformers shall be available in various current ratios and shall be selected for  $\pm 1$  percent accuracy at 5 A full scale output.
3. Transformers shall be split-core type for installation on new or existing wiring.

F. Voltage Transmitters

1. AC voltage transmitters shall be self-powered single loop (two-wire) type, 4 to 20 mA output with zero and span adjustment.
2. Ranges shall include 100 to 130 VAC, 200 to 250 VAC, 250 to 330 VAC, and 400 to 600 VAC full-scale, adjustable, with  $\pm 1$  percent full-scale accuracy with 500 ohm maximum burden.
3. Transmitters shall be UL/CSA recognized at 600 VAC rating and meet or exceed ANSI/ISA S50.1 requirements.

G. Control Transformers

1. Control transformers shall be UL listed. Furnish Class 2 current-limiting type or furnish overcurrent protection in both primary and secondary circuits for Class 2 service in accordance with NEC requirements. Limit connected loads to 80% of rated capacity.

H. DC Power Supply

1. DC power supply output shall match output current and voltage requirements. Unit shall be full-wave rectifier type with output ripple of 5.0 mV maximum peak-to-peak. Regulation shall be 1.0% line and load combined, with 100-microsecond response time for 50% load changes. Unit shall have built-in overvoltage and overcurrent protection and shall be able to withstand a 150% current overload for at least three seconds without trip-out or failure.
  - a. Unit shall operate between 0°C and 50°C (32°F and 120°F). EM/RF shall meet FCC Class B and VDE 0871 for Class B and MIL-STD 810C for shock and vibration. Line voltage AC input Class 1 (120 VAC or greater) units shall have UL recognition and/or CSA listing.

I. Surge and Transient Protection

1. Provide each digital controller with surge and transient power protection. Surge and transient protection shall consist of the following devices, installed externally to the controllers.
2. Power Line Surge Protection
  - a. Provide surge suppressors on the incoming power at each controller or grouped terminal controllers. Surge suppressors shall be rated in accordance with UL 1449, have a fault indicating light, and conform to the following:
    - 1) The device shall be a transient voltage surge suppressor, hard-wire type individual equipment protector for 120 VAC/1 phase/2 wire plus ground.
    - 2) The device shall react within 5 nanoseconds and automatically reset.
    - 3) The voltage protection threshold, line to neutral, shall be no more than 211 volts.
    - 4) The device shall have an independent secondary stage equal to or greater than the primary stage joule rating.
    - 5) The primary suppression system components shall be pure silicon avalanche diodes.
    - 6) The secondary suppression system components shall be silicon avalanche diodes or metal oxide varistors.
    - 7) The device shall have an indication light to indicate the protection components are functioning.
    - 8) All system functions of the transient suppression system shall be individually fused and not short circuit the AC power line at any time.
    - 9) The device shall have an EMI/RFI noise filter with a minimum attenuation of 13 dB at 10 kHz to 300 MHz.

- 10) The device shall comply with IEEE C62.41, Class "B" requirements and be tested according to IEEE C62.45.
  - 11) The device shall be capable of operating between -20 degrees F and +122 degrees F.
3. Telephone and Communication Line Surge Protection
    - a. Provide surge and transient protection for DDC controllers and BAS network related devices connected to phone and network communication lines, in accordance with the following:
      - 1) The device shall provide continuous, non-interrupting protection, and shall automatically reset after safely eliminating transient surges.
      - 2) The protection shall react within 5 nanoseconds using only solid-state silicon avalanche technology.
      - 3) The device shall be installed at the distance recommended by its manufacturer.
  4. Controller Input/Output Protection
    - a. Provide controller inputs and outputs with surge protection via optical isolation, metal oxide varistors (MOV), or silicon avalanche devices. Fuses are not permitted for surge protection.

#### J. Current-Operated Switches and Relays

1. Current-operated switches and relays shall be self-powered, solid-state with adjustable trip current. The switches and relays shall be selected to match the current of the motor application and output requirements of the BAS.
2. Current switches and relays for fan or pump proof shall be fully adjustable and shall have L.E.D. indicators. Form "A" (normally open) relays shall not be polarity sensitive.
  - a. For motors controlled by VFD's, the current switches and relays shall accommodate variable frequency drive (VFD) outputs down to 6 HZ without contact chatter, with an adjustability range compatible with the motor application and operation. VFD motor loads of less than 1.5 amps may be multi-wound around current relay to increase "sensed" amperage to minimum setpoint for activation.
  - b. For EC Motors, the current switches and relays shall be specifically manufactured for EC Motors, and adjustable to accommodate the motor's "keep alive current". Coordinate switch and relay selection with the equipment and motor vendors.

#### K. Pressure transducers

1. Transducer shall have linear output signal. Zero and span shall be field adjustable.
2. Transducer sensing elements shall withstand continuous operating conditions of positive or negative pressure 50 percent greater than calibrated span without damage.
3. Air velocity pressure sensors shall use differential pressure to determine airflow rate and have repeatability within 1 percent of reading and an accuracy of  $\pm 5$  percent of range. The velocity range shall be from 0 to 3250 FPM.

- L. Differential pressure type switches (air service) shall be UL listed, SPDT snap-acting, pilot duty rated (125 VA minimum), NEMA 1 enclosure, with scale range and differential suitable for intended application, or as shown.

### 2.3 Control Dampers

- A. Control dampers shall be parallel or opposed blade type as specified below or as scheduled or detailed on drawings.
  1. Unless otherwise shown on drawings as opposed blade, outdoor / return air mixing dampers and face and bypass (F&BP) dampers shall be parallel blade, arranged to direct air-streams toward each other.

2. Relief air and other modulating dampers shall be opposed blade type where modulating operation is required of the dampers.
  3. Two-position shutoff dampers may be parallel or opposed blade type with blade and side seals.
  4. Dampers shall be made to required / specified size without blanking off free area.
  5. Outside air dampers and relief air dampers shall be spring return normally closed. Return air dampers shall be spring return normally open.
- B. Frames shall be 4 inches x 1 inch x .080 inch (minimum) 6063T5 extruded aluminum hat channel with mounting flanges on both sides of the frame. Each corner shall be reinforced for maximum rigidity.
  - C. Blades shall be airfoil type 6063T5 extruded aluminum (maximum 6 inches depth) with integral structural reinforcing tube running full length of each blade.
  - D. Bearings shall be maintenance free and made of a resin-polycarbonate combination.
  - E. Seals shall be silicone type on all dampers exposed to outdoor air condition (outside air, relief air and dampers directly behind louvers). Seals on all other dampers shall be TPE/EPDM. Adhesive or clip-on type blade seals are not acceptable. Blade seals shall be field replaceable.
  - F. Individual damper sections shall not be larger than 48 inches x 60 inches. Provide a minimum of one damper actuator per section.
  - G. Linkage hardware shall be installed in the frame side and constructed of aluminum and corrosion-resistant, zinc-plated steel, complete with cup-point trunnion screws. Linkage attached to blade faces are not acceptable.
  - H. Axles shall be hexagonal (round not acceptable) to provide positive locking connection to blades and linkage.
  - I. Submittal shall include leakage, maximum airflow and maximum pressure ratings based on AMCA Publication 500. Dampers shall be tested and certified in accordance with AMCA 511 for Air Performance and Air Leakage. Parallel blade dampers shall be selected with a damper characteristic ratio of 2.5. Opposed blade dampers shall be selected with a damper characteristic ratio of 10. Include approach velocity, correction factor, pressure drop at 1500 fpm, and free area ratio on damper submittal.
  - J. Provide a damper operator for each panel. No jack shafting is permitted. Damper provided for direct coupled actuators shall have extended shafts.
  - K. Outside air and relief air dampers shall be insulated and thermally broken with an air leakage rating not to exceed 8 cfm/sq. ft. at 4 inches differential static pressure. Damper shall be a Tamco Series 9000 SC, Ruskin TED50 Series, Greenheck ICD or approved equal.
  - L. Return air and other control dampers shall be aluminum air foil and frame construction. Leakage rate shall not exceed 8 cfm/sq. ft. at 4 inches differential static pressure. Dampers shall be a Tamco Series 1000, Ruskin CD-50, Greenheck VCD or approved equal.

### **PART 3 - EXECUTION**

#### **3.1 Examination**

- A. The project plans shall be thoroughly examined for control device and equipment locations. Any discrepancies, conflicts, or omissions shall be reported to the Engineer for resolution before rough-in work is started.

- B. Inspect the site to verify that equipment may be installed as shown. Any discrepancies, conflicts, or omissions shall be reported to the Engineer for resolution before rough-in work is started.
- C. Examine the project drawings and specifications. If head room or space conditions appear inadequate, or if any discrepancies occur between the plans and the temperature controls work and the plans and the work of others, then report these discrepancies to the Engineer and obtain written instructions for any changes necessary to accommodate the temperature controls work with the work of others. Any changes in the work made necessary by the failure or neglect to report such discrepancies shall be made by and costs borne by this Contractor.

### 3.2 Installation Of Sensors

- A. Install all sensors in accordance with the manufacturer's recommendations.
- B. Mount sensors rigidly and adequately for the environment within which the sensor operates.
- C. Room temperature sensors shall be installed on concealed junction boxes properly supported by the wall framing.
- D. All wires attached to sensors shall be air sealed in their raceways or in the wall to stop air transmitted from other areas affecting sensor readings.
- E. Mixed air temperature sensors shall be located a minimum of 12 inches in front of 1st downstream coil (to prevent false reading of M.A.T.).
- F. Sensors used in mixing plenums, and hot and cold decks shall be of the averaging type. Averaging sensors shall be installed in a serpentine manner vertically across face area. Each bend shall be supported with a capillary clip.
- G. Low limit thermostats (freezestats) shall be installed in a serpentine manner horizontally across the coil face at 1 ft. centers. Each bend shall be supported with a capillary clip. Provide minimum 1 ft. of sensing element for each 1 ft. of coil area. Freezestat controller shall be located outside of airstream and installed in strict accordance with manufacturer's instructions. For freezestats with auto-reset (refer to para 2.2-B.3 or control sequences), provide indoor NEMA 1 panel to house latching control relay, with reset button and light on face of panel. The latching relay shall have separate contacts for latching circuit (N.O.), AHU / fan safety circuits (N.C.) and DDC alarm input (N.O.). The circuit shall be arranged to automatically reset after power failure. For outdoor units, mount panel in mechanical room. For indoor units, mount panel on or near associated AHU.
- H. Install outdoor air temperature sensors on north wall complete with sun shield at designated location.
- I. Differential Air Static Pressure
  - 1. Supply Duct Static Pressure: Pipe the high-pressure tap to the duct using a pitot tube. Pipe the low-pressure port to a tee in the high-pressure tap tubing of the corresponding building static pressure sensor (if applicable), or to the location of the duct high-pressure tap and leave open to the plenum.
  - 2. Return Duct Static Pressure: Pipe the low-pressure tap to the duct using a pitot tube. Pipe the low-pressure port to a tee in the high-pressure tap tubing of the corresponding building static pressure sensor.
  - 3. Building Static Pressure: Pipe the low-pressure port of the pressure sensor to the static pressure port located on the outside of the building through a high-volume accumulator. Pipe the high-pressure port to a location behind a thermostat cover at the specified location. Outdoor air pressure sensing points shall be located on each side of the building and piped together in a common manifold.

4. The piping to the pressure ports on all pressure transducers shall contain a capped test port located adjacent to the transducer.
5. All pressure transducers, other than those controlling VAV boxes, shall be located in field device panels, not on the equipment monitored or on ductwork. Mount transducers in a location accessible for service without use of ladders or special equipment.
6. All air differential pressure sensors shall have gauge tees mounted adjacent to the taps.

### 3.3 Actuators

- A. Mount and link control damper actuators per manufacturer's instructions.
  1. To compress seals when spring-return actuators are used on normally closed dampers, power actuator to approximately 5 degrees open position, manually close the damper, and then tighten the linkage.
  2. Check operation of damper/actuator combination to confirm that actuator modulates damper smoothly throughout stroke to both open and closed positions.
  3. Provide all mounting hardware and linkages for actuator installation.
  4. Dampers: Actuators shall be direct-mounted on damper shaft or jackshaft unless shown as a linkage installation. For low-leakage dampers with seals, the actuator shall be mounted with a minimum 5 degrees available for tightening the damper seals. Actuators shall be mounted following manufacturer's recommendations.

### 3.4 Local Control Panels

- A. Local control panels shall be provided for the equipment being controlled. Panel shall be mounted in mechanical, electrical rooms or electrical closets. Mount panels on wall, columns or independent supports near each respective unit. Do not mount on the unit proper unless the unit has internal jam isolation and the control panel and unit have been designed for direct mounting.

### 3.5 Identification Of Hardware And Wiring

- A. All wiring and cabling, including that within factory fabricated panels, shall be labeled at each end within 2 inches of termination with the DDC address or termination number.
- B. Permanently label or code each point/object of field terminal strips to show the instrument or item served.
- C. Identify control panels with minimum 0.50 inch letters on laminated plastic nameplates.
- D. Identify all other control components with permanent labels. All plug-in components shall be labeled such that removal of the component does not remove the label.
- E. Manufacturers' nameplates.
- F. Identifiers shall match record documents.
- G. Upon completion of the project, furnish a complete set of these drawings and diagrams, framed under clear plastic, and hang on the wall of the Mechanical Equipment Room where directed.

END OF SECTION

## **23 09 47 CONTROL POWER AND WIRING FOR HVAC**

### **PART 1 - GENERAL**

- 1.1 Provide all electrical wiring, both line voltage and low voltage, which is required to perform the automatic control functions.
- 1.2 Where power sources are required beyond sources explicitly shown on the Division 26 drawings, these shall be provided under the Division 23 Contract. Where auxiliary contacts are required on starters to perform the required functions these, too, shall be provided under the Division 23 Contract. Where not provided under Division 26, auxiliary external relays may be provided in lieu of auxiliary contacts.
- 1.3 Wiring, both line and low voltage, shall comply with The National Electric Code (NEC) and shall be subject to approval of the local code enforcing authorities.
- 1.4 Provide sufficient slack and flexible connections to allow for vibration of piping and equipment.
- 1.5 Install all equipment in readily accessible locations as defined by the National Electrical Code (NEC).
- 1.6 Do not install Class 2 wiring in conduit containing Class 1 wiring. Boxes and panels containing high voltage may not be used for low voltage wiring except for the purpose of interfacing the two (e.g., relays and transformers).
- 1.7 All wires attached to sensors shall be air sealed in their raceways or in the wall to stop air transmitted from other areas affecting sensor readings.
- 1.8 Provide tagging or labeling of conduit so that it is always readily observable which conduit was installed or used in implementation of this Work.
- 1.9 All wiring and cabling, including that within factory fabricated panels, shall be labeled at each end within 5 cm [2 inches] of termination with the DDC address or termination number.
- 1.10 Communication conduits shall not be installed closer than six feet from high power transformers or run parallel within six feet of electrical high power cables. Care shall be taken to route the cable as far from interference generating devices as possible. Where communication wire must cross high power wire (deemed as 110VAC or greater) it must do so at right angles.
- 1.11 All shields shall be grounded (earth ground) at one point only to eliminate ground loops. All shield grounding shall be done at the controller location with the shield at the sensor/device end of the applicable wire being left long and "safed" off in an appropriate manner.
- 1.12 There shall be no power wiring, in excess of 30 VAC rms, run in conduit with communications wiring. In cases where signal wiring is run in conduit with communication wiring, all communication wiring and signal wiring shall be run using separate twisted pairs (24awg) in accordance with the manufacturer's wiring practices.

### **PART 2 - PRODUCTS**

- 2.1 Wire, conduit and installation methods shall conform to applicable provisions of Division 26 - Electrical except that wiring smaller than No. 12 and conduit smaller than 0.75 inch are permitted as appropriate for the application.
- 2.2 Communication wire shall meet the following requirements as a minimum. Control system manufacturers recommendations which exceed these requirements shall govern.

- A. Category 6 plenum rated, 4 twisted pair, non-shielded (UTP) station cable (capable of transmission speeds up to 100 Mb/s) shall be used for control system networking. Cable shall be insulated with FEP material and sequentially marked at 2 foot intervals. Color as selected by Owner.

Gauge	24 AWG
Nominal O.D.	.17 in.
Min. Bend Radius	.5 in.
Standards/Certification	UL 444, UL 13 EIA/TIA 568, Cat. 5 PN-2841
DC Resistance	9.38 ohm/100 m
Maximum mutual capacitance of a pair @ 1 Khz	5.6 nF/100 m
Unbalanced Capacitance per pair to ground @ 1 Khz	330 pF/100 m
Impedance	100 ohm ± 15%
Structured Return Loss 10/100 Mhz	23/16 dB/100 m
Attenuation (max at 100 m)	4.1 dB @ 4 Mhz 8.2 dB @ 16 Mhz 22.0 dB @ 100 Mhz
NEXT (min. at 100 m)	53.0 dB @ 4 Mhz 44.0 dB @ 16 Mhz 32.0 dB @ 100 Mhz
Propagation Delay (min. @ 10 Mhz)	5.7 ns/m

### 2.3 Wiring and raceways

- A. General: Provide copper wiring, plenum cable, and raceways as specified in the applicable sections of Division 26.
- B. All insulated wire to be copper conductors, UL labeled for 90 degrees C minimum service.
- C. Conduit for Control Wiring, Control Cable and Transmission Cable: Electrical metallic tubing (EMT) with compression fittings, cold rolled steel, zinc coated or zinc-coated rigid steel with threaded connections.
- D. Outlet Boxes (Dry Location): Sheradized or galvanized drawn steel suited to each application, in general, four inches square or octagon with suitable raised cover.
- E. Outlet Boxes (Exposed to Weather): Threaded hub cast aluminum or iron boxes with gasket device plate.
- F. Pull and Junction Boxes: Size according to number, size, and position of entering raceway as required by National Electrical Codes. Enclosure type shall be suited to location.
- G. Sensor and/or signal cabling for controller I/O shall be multi-conductor type, stranded copper conductors, shielded, with plenum rated outer jacket. Conductor size shall be as recommended by the manufacturer for cable length and device power consumption.

### 3.1 All line voltage wiring and low voltage wiring in the following locations and applications shall be run in conduit regardless of local building code allowances:

- A. Mechanical Rooms, Electrical Rooms and other similar equipment rooms.
- B. Vertical risers (except if contained within a 2-hr or greater rated shaft).
- C. Open Areas where wiring will be exposed to view or tampering.

D. Outdoors.

- 3.2 Thermostats and other wall mounted sensors shall be installed on a single gang box. EMT conduit shall be installed from the wall box to the plenum; cabling within the wall shall be in conduit.

END OF SECTION



**23 09 95 DIRECT DIGITAL CONTROL SYSTEM POINTS LIST**

**PART 1 - GENERAL**

1.1 The following list and those shown on the drawings shall be the minimum points required of the Direct Digital Control System (DDCS). It is not the intent to show all required points. If or when additional points are required to accomplish the sequences of control specified, these points shall also be provided. The point types are identified as follows:

- DI Contact Input (NO or NC)
- DO Contact Output (NO or NC)
- AI Analog Input
- AO Analog Output
- PI Pulsed Input

1.2 Packaged Rooftop Units and Grade Mounted Units

Type	Description	Quantity
AI	Return Air Temperature	1
AI	Mixed Air Temperature	1
AI	Supply Air Temperature	1
AI	Supply Air Static Pressure	1
AI	Leaving H.W. Coil Temperature	1
DI	Supply Fan Status	1
AO	Economizer Dampers	1
AO	Supply Fan Volume Control	1
AI	Air Filter Pressure Drop	1
DI	Freezestat	1
DO	Fan System Start/Stop	1
AI	Space Temperature	*
AI	Return Air Humidity	1
DI	Smoke Alarm	**
DO	Smoke Damper Closures	1
DI	Smoke Damper End Switches	***

\*One sensor for unoccupied control, additional space sensor as shown on drawings. When DDC zone control is specified all zone thermostats shall be DDC inputs.

\*\*For notice of smoke detection at the B.A.S. (in addition to hardwired starter interlock for unit shutdown) and smoke damper control.

\*\*\*One for each smoke damper.

1.3 Exhaust Fan Systems

Type	Description	Quantity
DO	Exhaust Fan Start/Stop	*
DI	Exhaust Fan Status	*

1.4 General or Global Points:

Type	Description	Quantity
AI	Outside Air Humidity	1
AI	Outdoor Air Temperature	1

**PART 2 - PRODUCTS - NOT USED**

**PART 3 - EXECUTION - NOT USED**

END OF SECTION

## **23 23 00 REFRIGERANT PIPING**

### **PART 1 - GENERAL**

- 1.1 Refrigerant piping and related devices shall be provided extending between DX Mini Split System Heat Pumps and Condensing units and associated cooling coils mounted to gas fired furnaces.
- 1.2 Refrigerant piping shall conform to ANSI B31.5 and ASTM B280. Refrigerant piping systems and components shall be engineered, installed, tested and placed in operation in accordance with ASME B31.5, latest edition.
- 1.3 Pipe arrangement, devices and sizing information shown on the drawings is limited due to variations in equipment manufacturers' requirements. The equipment supplier shall prepare project-specific drawings of each piping system showing numbers and sizes of piping, devices and accessories, coil circuitry, traps, double suction risers and other such detail required for the application shown on the drawings and as specified herein. Drawings shall be submitted to the Engineer for review with the equipment shop drawings.
- 1.4 The equipment supplier shall provide piping installation instructions to the Installing Contractor and supervision as needed to ensure that the piping system is installed in accordance with the equipment manufacturer's recommendations.

### **PART 2 - PRODUCTS**

- 2.1 Refrigerant tubing shall be Type "ACR" hard seamless copper thoroughly cleaned and dehydrated for use with the refrigerant used. Tubing which has not been so prepared and sealed or which has been open to the atmosphere for any length of time shall not be used. All changes in direction of piping shall be made with wrought copper fittings.
- 2.2 Refrigerant piping may be soft copper pre-charged refrigerant tubing with compatible end connections as may appropriate for project conditions.
- 2.3 Refrigerant devices and specialties shall be specifically designed for refrigerant applications and of construction pressure class consistent with the duty imposed.
  - A. A filter-drier shall be provided in the liquid line near the condensing unit or evaporator coil.
  - B. A thermal expansion valve shall be provided in the liquid line at each evaporator coil if an expansion valve or device is not integral with the unit. The expansion valve shall be diaphragm type with external equalizer and external superheat adjustment.
  - C. A liquid line electric solenoid valve or a "hard shutoff" thermal expansion valve shall be provided where the liquid line exceeds 50 ft. in length.
  - D. All refrigerant access ports shall be fitted with locking-type tamper-resistant caps.

### **PART 3 - EXECUTION**

- 3.1 Pipe arrangement, devices and sizing information shown on the drawings is schematic in nature, limited due to variations in equipment manufacturers' requirements. The equipment supplier shall prepare project-specific drawings of each piping system showing numbers and sizes of piping, devices and accessories, coil circuitry, traps, double suction risers and other such detail required for the application shown on the drawings and as specified herein. Exact routing, and pipe quantities and sizing shall be per manufacturer's requirements. Refrigerant piping shall conform to ANSI B31.5 and ASTM B280. Refrigerant piping systems and components shall be engineered, installed, tested and placed in operation in accordance with ASME B31.5, latest edition. Drawings

shall be submitted to the Engineer for review with the equipment shop drawings. Exact routing, and pipe quantities and sizing shall be per manufacturer's requirements.

- 3.2 All joints shall be brazed using silver brazing alloy while flowing an inert gas such as dry nitrogen through the piping.
- 3.3 Piping shall be hung from the building structure with clevis hangers and rods as described in 23 05 29 Hangers and Supports for HVAC Piping. Hangers for insulated pipe shall be oversized and a sheet metal saddle with belled ends incorporated to protect the insulation.
- 3.4 Each refrigerant piping system shall be 24-hour positive-pressure leak tested with dry nitrogen at 600 psi, and then 24-hour negative-pressure tested to between 200 and 500 microns, or per equipment manufacturer's requirements, whichever is more stringent. The test pressures shall be demonstrated to be maintained for at least 24 hours for each pressure test, with starting and ending pressures recorded and documented. A system shall be considered "proven-tight" when there is no more than a 40 psig loss during the positive-pressure test, and no more than a 50 micron rise for the negative-pressure test. If a test fails, triple nitrogen purge and repeat the test after the leak has been repaired. Once a system has been "proven-tight", the system shall then be purged and charged with the required amount of refrigerant per the equipment manufacturer's instructions.

END OF SECTION

**PART 1 - GENERAL**

- 1.1 Ducts, sheet metal plenums and associated devices, accessories and work items shall be provided as shown on the drawings and as specified hereinafter.
- 1.2 Ductwork, materials, construction, reinforcing and installation shall conform to SMACNA HVAC Duct Construction Standards, latest edition, and other applicable SMACNA standards. In addition, duct systems, components and accessories shall comply with applicable provisions of NFPA 90A, 90B, 96 and 255, and UL 181, 181A, and 181B, including smoke and flame ratings.
- 1.3 Variation of duct configuration or sizes other than those of equivalent or lower loss coefficient is not permitted except by written permission. Size round ducts installed in place of rectangular ducts in accordance with ASHRAE table of equivalent rectangular and round ducts.
- 1.4 A copy of each of the applicable current SMACNA Standards manuals shall be on the job site during the progress of the work.
- 1.5 Refer to the Duct Construction and Sealing Schedule on the drawings for information pertinent to the various duct systems, such as duct materials, SMACNA pressure class, seal and leakage class, external insulation, duct liner, etc.
- 1.6 Ductwork shall not be internally lined, unless shown otherwise for return or exhaust.
- 1.7 Refer to 23 05 05 Firestopping for requirements related to non-fire dampered ductwork penetrating fire rated walls and partitions.
- 1.8 Mechanical equipment, appliances and supports that are exposed to wind shall be designed and installed to resist the wind pressure determined in accordance with the building and mechanical code. Refer to specification 23 05 30 Bases and Supports for HVAC Equipment for additional requirements.

**PART 2 - PRODUCTS**

- 2.1 Sheet metal shall be lock forming quality galvanized steel, ASTM A924/A924M and A653/A653M, G60 coating designation, 24 gauge minimum, except as otherwise noted or specified. Other materials and construction for special applications required are as shown on the drawings and specified below. ASTM A653 G90 coating shall be used for ductwork located outdoors / and / (wet environment) as noted in the duct construction schedule on the drawings.
- 2.2 Ductwork, as noted on the drawings, that will remain exposed in finished areas and on the roof which will be painted shall be fabricated of sheet metal with galvanized or bonderized (phosphated) coating.
- 2.3 Flexible duct shall be installed as detailed on the drawings and shall not pass through any wall, floor, or ceiling. Flexible ducts and air connectors shall not pass through any fire-resistance-rated assembly.
  - A. Flexible air (duct) connectors for galvanized steel ductwork shall be:

Constructed of galvanized steel spiral wire mechanically locked to an airtight laminated aluminum foil, fiberglass and aluminized polyester duct fabric. Duct shall be rated at a minimum of 10 inches w.c. positive pressure and 4 inches w.c. negative pressure. Unless otherwise detailed on the drawings, length shall be limited to 4 feet for Air Terminal Units and 5 feet for Air Devices .

Insulated flexible duct shall have 1 inch thick R-4.2 fibrous glass insulation and .10 perm polyethylene vapor barrier outer jacket, equal to Flexmaster Type 5B or / .05 perm reinforced metalized vapor barrier outer jacket, equal to Flexmaster 5M. Insulated duct assembly shall conform to be UL 181 and listed as Class I Flexible Air Connector.

Non-insulated flexible duct shall be equal to Flexmaster NI-55, shall conform to UL181 and be listed as Class I Flexible Air Connector.

#### 2.4 Rectangular Ductwork

- B. Elbows shall have an inside radius equal to the duct width. Where 90 degrees elbows are shown to be square on the drawings, they shall be square (mitered) with turning vanes, single vane type in lengths 32 inches and less, double wall in longer vanes, installed and supported per SMACNA. Elbows less than 90 degrees shall be radiused. Non-radiused elbows less than 90 degrees, with or without turning vanes, are not permitted.
- C. Square Tee fittings shall include turning vanes. The widths of the two branch ducts shall add up to the width of the main duct, and the duct depths shall remain constant. Turning vanes shall be single vane type in lengths 32 inches and less, double wall in longer vanes, installed and supported per SMACNA.
- D. Offsets and transitions shall conform to SMACNA. Unless shown otherwise on plans, transition angles shall be limited to 60 degrees on converging transitions as measured on the interior, and 30 degrees on diverging transitions as measured on the interior.
- E. Branch take-offs, where not detailed otherwise, shall be with a static boot (45 degrees clinch collar) per SMACNA. Straight tap take-offs are not permitted.
- F. Divided flow branches shall conform to SMACNA. Bull head tees without vanes are not permitted.
- G. Manufactured duct connectors similar to Ductmate Industries "25", "35" and "45" may be used on rectangular ductwork except where welding or brazing is specifically required. Adhere strictly to manufacturer's instructions. SMACNA duct gauge thickness and reinforcing shall be maintained when using this joining method, or the manufacturer's requirements, whichever is more stringent. Connector components shall be constructed from same material as the duct section being connected.

#### 2.5 Fan Transitions

- A. Fan inlet – Maximum 15 degrees diverging as measured on the interior, and 30 degrees converging as measured on the interior, and first duct elbow shall be minimum 2.5 fan inlet diameters away unless shown otherwise on plans.
- B. Fan Discharge -- Maximum 15 degrees diverging as measured on the interior, and 30 degrees converging as measured on the interior, and first duct elbow shall be minimum 2.5 fan inlet diameters away unless shown otherwise on plans

#### 2.6 Round and Flat Oval Ductwork:

- A. Round and flat oval duct shall be factory or shop formed spiral lock seam, United McGill Air Products "Uni Seal" or "Uni Rib" or equal by Langdon, Semco, Tangent Air, Precision Duct or approved equal.
- B. In lieu of the above, round duct, fittings and connectors may be Linx Industries' Lindab "Safe" (single wall) or "ISOL" (double wall) duct systems with fitting ends factory equipped with double lipped "U" profile EPDM gasket. Spiral ducts shall conform to Lindab standards and

shall be calibrated to published dimensional tolerances of Lindab. Insulation R-valves and liner types shall be as specified above.

- C. Elbows and fittings for spiral lock seam round and flat oval ductwork shall be factory solid welded, equal to United McGill Air Products "Uni Seal" and "Acousti-k27" with beaded sleeve transverse joint connectors, or equal by Langdon, Semco, Tangent Air, Precision Duct or approved equal. For duct systems classified at less than 3" w.c., elbows and fittings may be roll pressed type. Elbows shall be long radius type and, where shown, square type ells shall be mitered with turning vanes. Branch take offs shall utilize a 45 degree entry low loss tap or a conical lateral tap to minimize pressure loss, except that streamlined conical taps may be used where space constraints dictate. Tee fittings shall include elongated proportional turning vanes to equalize airflow around the ells. Wye branches shall be used at end of runs unless shown otherwise. Offsets and transitions shall conform to SMACNA. Transition angles shall be limited to 60 degrees on converging transitions as measured on the interior, and 30 degrees on diverging transitions as measured on the interior. Divided flow branches shall conform to SMACNA. Bull head tees without vanes are not permitted.
  - D. Construction, reinforcing, supports, etc. shall either conform to SMACNA or to the duct manufacturer's standards, whichever is more stringent.
  - E. Round duct of 1 inch and less (positive and negative) static pressure construction class may be longitudinal seam. Elbows for longitudinal seam round ductwork shall be factory or shop formed segmented standing seam or pleated. Other fittings shall be comparable to the elbows.
- 2.7 Air device duct connections for round duct branch connections to rectangular sheet metal ducts shall be 24 gauge sheet metal, equal to Flexmaster Series FL, straight side, minimum 24 gauge with and without manual damper, as described on the drawings. When manual damper is provided it shall be minimum 22 gauge with stamped re-enforcements and include .375" square shaft and locking quadrant equal to Ventlok 639 or Rossi "Everlock", with 2" standoff and nylon bushings. Air terminal unit duct connections for round duct branch connections to rectangular sheet metal ducts shall be 24 gauge sheet metal conical type equal to Flexmaster Series CB. Connectors installed on interior lined rectangular duct shall have an integral insulation guard sleeve. Rectangular tap-to-round branch connection with static boot configuration shall be equal to Flexmaster Type STO. Similar fittings equal to Flexmaster Series DB and DC shall be used for fiberglass ductboard system. Buckley "Air Tite" fittings or similar by "Snap Rite", equal to the specified Flexmaster fittings, with neoprene gasket and adhesive facing, additionally secured with minimum four sheetmetal screws, may be used for air device duct taps to rectangular sheet metal duct which is not internally lined.
- 2.8 Duct sealants containing asbestos are prohibited. All duct sealants, tapes and connectors shall be listed and labeled in accordance with UL 181A, 181B or 181C as applicable to the application. Duct sealant materials shall be one or more of the following (compatible with the application):
- A. LEED Compliant solvent based sealers and mastics equal to Design Polymeric, with a maximum VOC content of 50 grams/liter.
  - B. Water base duct sealers and mastics equal to United McGill or Foster Products when the installation environment is above 40 degrees F.
  - C. Acetone based duct sealers and mastics, equal to Precision Adhesives, when the installation environment is between 0 degrees F and 40 degrees F, zero reportable V.O.C.'s.
  - D. Mineral impregnated fiber tape with liquid sealant duct joint sealer equal to that manufactured by Hardcast, Inc., Two Part II Sealing System, maximum V.O.C. of 135 g/l.
- 2.9 Duct Access Doors (Non-Grease Ducts)

- A. Access doors shall be factory fabricated constructed of the same material as the ductwork (except galvanized sheet metal for fiberglass duct), complete with hinged door, cam lock latches, frame and neoprene gasket between door and frame. Doors in insulated ductwork (internal and external) shall have double wall insulated doors. Access doors shall be 16 inches x 16 inches minimum except smaller where duct size will not permit such size.
- B. Access doors and panels shall be designed to provide tight seal commensurate with the duct pressure. Apply duct sealer or rubber gasket between frame and duct. On ducts of 3 inches S.P. and higher construction class, mechanical fastening of the frame and rubber gasket shall be provided.
- C. Where sufficient clearance is not available to allow the door to swing open 90 degrees, an access panel with neoprene gasket, frame, chain connected to both the panel and ductwork, and cam lock latches on all four sides shall be provided in lieu of the hinged door.

### **PART 3 - EXECUTION**

- 3.1 Duct thickness, construction, reinforcing, support and installation including cabling systems, shall conform to SMACNA HVAC Duct Construction Standards, latest edition and other applicable SMACNA standards. Duct reinforcing shall be external to the duct except that rectangular ducts of 3 inches s.p. class or greater with a dimension exceeding 48 inches may utilize internal tie-rod supports in accordance with SMACNA. Only round tubing, rods or conduit is permitted as tie-rods, utilizing the minimum diameters required by SMACNA.
- 3.2 Transverse joints and longitudinal seams shall be assembled with sealant to conform to SMACNA sealing requirements as indicated in the Duct Construction Schedule on the drawings. Selection of sealant materials shall be compatible with the application. Sealants shall be applied in accordance with manufacturer's recommendations, including application temperature ranges.
- 3.3 Attachment of hangers and straps to the structure shall be with:
  - A. After-set concrete inserts, in 4 inches minimum depth concrete, set in drilled holes. Powder actuated driven fasteners are not permitted.
  - B. Beam clamps in steel construction. Provide anchoring where clamps are attached to sloping surfaces of beam flanges and where otherwise required to ensure permanent attachment.
  - C. Side beam bracket in wood construction, secured to the wood joist with lag screws set in drilled pilot holes.
  - D. Unistrut type channel support system may be utilized. Channel shall be pre-set or attached to the structure with inserts or clamps.
  - E. Attachment to steel deck is prohibited. Span from steel structural members with supplementary steel shapes where direct attachment to structural members is not practical. This does not apply to steel deck with concrete slab poured on the deck. Refer to A. and B. above.
- 3.4 Ductwork outside shall be sealed with mineral impregnated fiber tape. Ductwork shall be supported per SMACNA and as noted or detailed on the drawings. Ductwork, whether externally insulated or not, shall be jacketed as specified in 23 07 13 Duct Insulation.
- 3.5 Ductwork with galvanized or bonderized coating shall be wiped clean to remove dirt, dust, oil and other contaminants in the shop before delivery to the jobsite. Care shall be taken in storage and installation to maintain cleanliness of the surfaces. Prior to painting, again wipe the surfaces clean.



- 3.6 Flexible air (duct) connectors shall be attached to metal duct with Panduit nylon banding straps or stainless steel clamps. Nylon banding straps shall be tightened utilizing a cable tie gun. Outer jacket of insulated flexible duct shall be closed at the ends with sealant and nylon banding straps or U.L. listed aluminum foil duct tape equal to Nashua No. 617022 with UL 181 listing printed on the face. Maximum length shall be 7 ft. with support at 4 ft. maximum spacing. Duct shall be free of sags and sharp bends. Utilize flexible duct elbow supports at all elbows. Flexible supports shall be UL listed for ceiling return air plenum use per UL 2043, UL 723 or ASTM E84, as manufactured by Titus (Flexright) or Thermaflex (Flex Flow) or approved equal. Independently supported radius'd sheet metal elbows may be used in lieu of flexible duct elbow supports when installed directly on air devices.
- 3.7 Flexible air (duct) connectors shall not be installed:
- A. Where ductwork is exposed.
  - B. Thru any wall, ceiling, floor or fire rated or smoke rated assembly.
  - C. In the immediate vicinity of, and connecting to, air devices in fire rated ceilings where the assembly details require steel ductwork.
- 3.8 Duct and plenum connections to air supply, return or exhaust units and fans (other than power roof ventilators or any Type I grease duct fan) shall be made with a 4 inches wide intervening section of flexible incombustible fabric equal to Ventfabrics "Ventglas", to prevent the transmission of fan noise and vibration to the ductwork. Fastening shall consist of angle clamps and bolts made up to be air tight similar to Ventfabrics "Metaledge". Duct connections to Type I grease duct fans shall be flanged and gasketed with material rated for no less than 1500 degF.
- 3.9 Duct access doors shall be provided for access to equipment, damper operators, devices and instruments inside the duct, at each fire damper, smoke damper and duct smoke detector (refer to Electrical drawings) and where otherwise shown. A wall or ceiling access panel shall be provided where duct access is required thru a wall or inaccessible ceiling. Refer to 23 05 04 Basic HVAC Materials and Methods for such access panels.
- 3.10 Coordinate openings required for the passage of ductwork thru walls, partitions, floors and roofs with the General Contractor. Sleeves are not required except as stated below.
- 3.11 Sheet metal sleeves in conjunction with fire dampers shall be placed in walls and floors to pass ductwork.
- 3.12 Annular spaces around ducts or duct insulation passing thru non-fired rated walls and partitions shall be closed with caulking or other compatible material to retard the passage of smoke. Annular spaces around ducts not fitted with fire dampers that pass thru non-fire rated floors shall be similarly closed.
- 3.13 Stored ductwork shall be blocked up off the ground and completely covered with visqueen. Open ends of both stored and erected duct shall be capped or covered with visqueen secured with duct tape before the end of each day's work to preclude contamination or entry of foreign materials. Factory made covers with elastic banding as manufactured by Duct Cap are also an acceptable means for temporary duct closure.
- 3.14 Where duct surfaces can be seen thru grilles, registers and diffusers, the inside of the duct shall be coated with flat black paint before the device is installed, to eliminate obtrusive appearances.
- 3.15 Ductwork and piping shall not be run above electrical switchgear or panelboards, nor above the access space in the immediate vicinity of the equipment in accordance with The National Electric Code.

- 3.16 Coordinate duct layout carefully with other trades to avoid conflict with structural elements, lighting and plumbing heating piping. Flattening of ductwork and offsets to fit ductwork in available space is generally shown. In the absence of such, arrange the ductwork to maintain concealment and allow ceilings and lights to be installed as intended. Do not hang ductwork until possible interference with electrical and mechanical trades have been resolved. Having ductwork fabricated and delivered in advance shall not be justification for interference with other trades.

END OF SECTION

## **23 33 00 AIR DUCT ACCESSORIES**

### **PART 1 - GENERAL**

- 1.1 Ductwork accessories specified herein shall include manual balancing dampers and backdraft dampers. Refer to the drawings for scope and application.
- 1.2 Balancing dampers are also specified to be furnished with "spin-in" duct taps specified in Section 23 31 13 HVAC Ductwork and in Section 23 37 00 Air Outlets and Inlets. Automatically controlled dampers are specified in the temperature controls sections and also specified as integral components of air handling equipment, fans, VAV control units and other such equipment.
- 1.3 Manual balancing dampers, in addition to those shown, which will be required to effect a positive balancing of air in the system shall be provided in the ductwork. The company or agent who is to balance the air systems shall call the HVAC Contractor's attention to requirements for additional balancing dampers which are deemed necessary.

### **PART 2 - PRODUCTS**

- 2.1 Dampers and accessory items shall be constructed of galvanized steel, except those in ducts of stainless steel, aluminum, PVC coated or other such materials shall be stainless steel to maintain the intended corrosion resistance of the system.
- 2.2 Balancing dampers shall be single cross-blade up to 12 inches blade width and in larger sizes, multiple blade type 6 inches maximum width with opposed blade arrangement. Dampers shall have a full length continuous drive shaft and be controlled by a locking quadrant positioner with handle and minimum .375" square shaft, equal to Rossi "Everlock" or Ventlok #641 and for externally insulated ducts Rossi "Everlock" with 2" stand-off or Ventlok #644. For ductwork classified as 2" and greater, provide HiVel Ventlok Acorn Nut, End Bearing and gasket hardware.
- 2.3 Backdraft dampers shall be adjustable counter-balanced type with extruded aluminum frame and blades and extruded vinyl edge seals, equal to Ruskin CBD6. Backdraft dampers in stainless steel, aluminum, PVC or "wet" ductwork shall be stainless steel counter-balanced equal to Carnes FANA/FAPA.

### **PART 3 - EXECUTION**

- 3.1 Manual and backdraft dampers shall be installed per manufacturer's installation instructions.

END OF SECTION

**PART 1 - GENERAL**

- 1.1 Fans shall be provided as specified below and shown on the drawings, complete with motors, drives and associated devices.
- 1.2 Fans shall be constructed, rated and labeled in accordance with AMCA Standard 210 67 and AMCA 300. Fans shall be statically and dynamically balanced throughout the operating range. Submittals shall include fan curves showing operating point(s), system curves, and surge lines.
- 1.3 Classification for Spark Resistant Construction shall conform with AMCA 99.
- 1.4 Refer to Section 23 05 13 Electrical Requirements for HVAC Equipment and Section 23 05 31 HVAC Equipment Drives for required provisions.
- 1.5 Refer to Section 23 05 49 Vibration Control for HVAC for vibration isolator types.
- 1.6 Provide dimensional drawings and product data on each exhaust fan assembly. Provide fan curves for each fan at the specified operation point with the flow, static pressure, and horsepower clearly plotted. For multiple fan assemblies, fan curves shall be adjusted to show assembly operation.
- 1.7 Dampers shall be tested and licensed for air performance and leakage in accordance with ANSI/AMCA standard 500-D and AMCA publication 511.
- 1.8 Equipment shall carry an all-inclusive manufacturer's parts and labor warranty for a period of one (1) year(s) from date of final acceptance or date of beneficial use, as agreed to between Contractor and Engineer or Construction Manager. The all-inclusive parts and labor warranty for ECM's and associated controllers shall be for a period of 5 years. Any materials, equipment, or controls found to be defective during this warranty period shall be made good without expense to the Owner, including any required replacement of fluids, glycol, or refrigerant. The warranty shall include a delayed start-up provision such that the warranty does not begin at time of delivery. The labor for the warranty shall be performed by the manufacturer's authorized service agent.

**PART 2 - PRODUCTS**

- 2.1 Induction motors 1 HP and larger shall be "premium efficiency" series motors. Motors shall be 1750 rpm unless specifically noted otherwise. Drives and couplings shall be protected with guards conforming with OSHA standards. Motors connected to VFD's shall comply with 23 05 13 Electrical Requirements for HVAC Equipment and shall be furnished with AEGIS SGR shaft grounding ring kit, installed by the equipment manufacturer. Refer to Section 23 05 13 Electrical Requirements for HVAC Equipment.
- 2.2 The following lists types of fans, related construction features and manufacturers. All fans of any one listed type shall be of the same manufacturer.
  - A. Type G1 - Wall Mounted Propeller Panel Fan (mounted in vertical)  
Wall mounted propeller fan shall be adjustable "V" belt drive or direct drive, as indicated, with resiliently mounted motor, permanently lubricated ball bearings, wall mounting plate with formed orifice and enamel or epoxy finish paint.

Fans for exhaust application shall be furnished with a safety guard or screen on the inlet and a motorized backdraft damper on the discharge.

Fans for intake application shall be furnished with a motorized backdraft damper with center pivoted blades and safety guard or screen on the discharge.

Fans shall be manufactured by PennBarry, Cook, Greenheck.

- 2.3 Motor HP shall be sufficient to handle the full load of the fan, including drive losses, at the selected condition without exceeding the motor rating. In no case shall the motor size be less than shown without prior approval from the Engineer. All motors greater than .083 HP but less than 1 HP shall be ECM motors or shall have a minimum motor efficiency of 70%. EC motors shall be provided with motor mounted speed pot control, 0-10 volt DC external speed control, and with a 24V transformer for external speed control and damper control with input voltage compatible with the fan motor voltage. Controllers shall be by the fan manufacturer. All motors 1 HP and larger shall be "premium efficiency" series. Refer to Section 23 05 13 Electrical Requirements for HVAC Equipment.
- 2.4 Belt drive units shall have adjustable motor base, "V" belts and pulleys. Refer to Section 23 05 31 HVAC Equipment Drives.
- 2.5 Motorized backdraft dampers, where specified, shall be furnished with an electronic damper actuator with voltage compatible with the fan motor voltage and electric service to the fan. If not compatible, a transformer shall be provided with the fan and damper actuator to afford the appropriate voltage. Where the fan motor is fed from a Variable Frequency Drive controller (VFD) provide a control contactor or relay and extend the control from the VFD damper control output relay to open/close the damper when associated fan motor is started/stopped.

### **PART 3 - EXECUTION**

- 3.1 Install fans and roof curbs level and plumb, in accordance with manufacturer's written instructions. Support units as described below using the vibration control devices specified herein.
  - A. Suspended unit: Suspend unit from structural steel support frame using threaded steel rods and vibration isolation as specified here-in or indicated in the fan schedule.
- 3.2 Arrange installation of fans to provide access space around fans for service and maintenance.
- 3.3 Adjust damper linkages for proper damper operation. Motorized backdraft dampers are to be wired to open when the fan operates. Coordinate with Division 26.
- 3.4 Factory furnished devices which are not installed and wired in the factory shall be field installed and wired by Division 23, complete and ready for operation.
- 3.5 Perform the following operations and checks before start-up.
  - A. Remove shipping blocking and bracing.
  - B. Verify unit is secure on mountings and supporting devices and that connections for piping, ductwork and electrical are complete. Verify proper thermal overload protection is installed in motor starters and disconnects.
  - C. Verify proper motor rotation direction and verify fan wheel free rotation and smooth bearing operation. Align belts and reinstall belt guards.
  - D. Lubricate bearings, pulleys, belts and other moving parts with factory-recommended lubricants.
  - E. Verify manual and automatic volume control, and fire and smoke dampers in connected ductwork systems are in the full-open position.

END OF SECTION

## **23 37 00 AIR OUTLETS AND INLETS**

### **PART 1 - GENERAL**

- 1.1 Air outlet and inlet devices include grilles, registers, diffusers, louvers and special air diffusion devices associated with ceiling and lighting systems.
- 1.2 Refer to the schedule on the drawings for description, catalog numbers, materials, finishes, accessories, mounting and other details of the devices required.
- 1.3 Supply air devices in ceilings shall have their backsides externally insulated for condensation control. This external insulation shall be field installed, same as that specified for supply air ductwork.

### **PART 2 - PRODUCTS**

- 2.1 Air distribution devices other than louvers and specialty products shall be Titus, Price, or Krueger Air Devices. All devices of a common type shall be by the same manufacturer.
- 2.2 Air outlet and inlet devices shall be equal to those specified by catalog number and description in the schedule on the drawings. Dampers shall be galvanized steel, unless otherwise noted, opposed blade configuration. Damper operators shall be concealed screw type. An auxiliary mounting frame shall be furnished with each grille and register except those mounted on exposed ducts or in lay in application.

### **PART 3 - EXECUTION**

- 3.1 Verify & ensure compatibility of ceiling mounted devices with the ceilings and suspension systems (lay in, concealed spline, plaster, drywall, etc.).
- 3.2 Carefully align square and rectangular devices with the vertical and horizontal building lines. Diffusers shall be attached rigidly to the ductwork. Where connected by flexible ducts, special supports shall be provided as required, either from the ceiling suspension system or by independent suspension wires or rods from the building structure.
- 3.3 Externally insulate the backsides of supply air devices that are mounted in. Insulation shall comply with 23 07 13 DUCT INSULATION.
- 3.4 Inside of ducts behind grilles, registers and diffusers shall be painted flat black, as needed, to eliminate the sight of shiny surfaces.

END OF SECTION

## **23 41 00 AIR FILTERS**

### **PART 1 - GENERAL**

- 1.1 Air filters, housings and framework shall be provided as shown on the drawings and as specified herein. Refer to the drawings for air filter types, service and mounting.
- 1.2 Air filters specified in air handling equipment sections shall be furnished with that equipment as accessory items, factory installed. Air filters supplied in the filter manufacturer's housing shall be provided through the local authorized filter representative, and filters installed by the local authorized filter representative.
- 1.3 Efficiency standards herein refer to ASHRAE Standard 52.2 Minimum Efficiency Reporting Values (MERV). Filters shall be UL Class 2.
- 1.4 Refer to Section 23 33 00 Air Duct Accessories for air filter pressure differential gauges.
- 1.5 Mechanical equipment, appliances and supports that are exposed to wind shall be designed and installed to resist the wind pressure determined in accordance with the building and mechanical code. Refer to specification 23 05 30 Bases and Supports for HVAC Equipment for additional requirements.

### **PART 2 - PRODUCTS**

- 2.1 Air filters, housings and framing systems shall be manufactured by Camfil Farr, American Air Filter or Flanders, or TriDim equal to that listed below. All filters and filter holding frames shall be standard sizes; 12 inches x 24 inches, 20 inches x 24 inches, or 24 inches x 24 inches.
- 2.2 Air Filters
  - A. Type B2 - Pleated Panel.  
2 inches thick extended surface pleated panel type with non-woven cotton and synthetic fabric media in a beverage board frame chemically bonded to the media, with welded wire support grid. Rated as a MERV 8 filter. 4.4 to 1 gross media area to face area. 0.30 inch w.g. maximum initial pressure drop at 500 fpm face velocity. Camfil Farr 30/30.
- 2.3 Filter holding frames for field erected filter banks shall be factory fabricated of 16 gauge galvanized steel with gaskets and spring type fasteners, equal to Camfil Farr Type 8.
- 2.4 Side access filter housings shall be designed to meet a system efficiency equal to the specified filter efficiency and be factory assembled to accommodate a single set of 2 inches deep filters. Housing shall facilitate upstream and downstream connection to ductwork and equipment as shown. Housing shall be nominal 60"x24". Housing shall consist of:
  - A. Factory fabricated 16-gauge galvanized steel with hinged and neoprene-gasketed door at each end. Housing and doors shall be 1 inch thick double wall sheet metal with 1 inch thick 1-1/2 lb. density fiberglass insulation between.
  - B. Anodized extruded aluminum slide rails for each set of filters.
  - C. Slide rails for final filters, equipped with reinforced nylon pile and designed to accommodate a universal holding frame. Universal holding frame, constructed of galvanized steel with integral U-shaped slide channels multiple fasteners and polyurethane foam gasketing. Leakage rate upstream to downstream shall be less than 1.5 percent of rated flow at 3 inches w.g. negative.
  - D. Static pressure taps across filters for individual and total pressure drop gauging.
  - E. Housing shall be weatherproof for outdoor installation.

- F. Housing shall be capable of 6 inches w.g. negative and positive pressures and have less than 0.5 percent leakage of rated flow at 3 inches w.g. negative.
- G. Housing shall be designed to pass an in-service efficiency test complying with the filter efficiency requirements.
- H. Housing shall be of the same manufacturer as the filters, equal to Camfil Farr "Glide/Pack".

### **PART 3 - EXECUTION**

- 3.1 Furnish one complete initial set of filters and one complete set of spare filters for each filter bank in the project. Spare filters are not required for Type B2 filters. This is in addition to filters used for temporary heating.
- 3.2 Install filter components, housings and holding frames in strict accordance with the manufacturer's instructions, supervised by the local authorized filter representative. Install necessary airtight baffles between duct plenums and filter frames. Arrange access and clearance for removal and servicing of air filters. The air filters themselves shall be installed by the local authorized filter representative. The Owner or their representative shall be invited to witness the install.
- 3.3 Filter media included herein shall not be used for temporary heating and ventilation operation of the central air systems.
- 3.4 Place spare filter media for storage where directed by the Owner.

END OF SECTION



## **23 54 17 FURNACE FORCED AIR (GAS FIRED/CONDENSING)**

### **PART 1 - GENERAL**

- 1.1 Furnaces including evaporator and air cooled condensing unit shall be furnished as specified below and shown on drawings.
- 1.2 Furnace shall be AGA design certified and shall deliver an Annual Fuel Utilization Efficiency rating of 90 percent or higher.
- 1.3 Equipment shall carry an all-inclusive manufacturer's parts and labor warranty for a period of one (1) year from date of final acceptance or date of beneficial use, as agreed to between Contractor and Engineer or Construction Manager, except that the heat exchanger shall have a ten (10) year warranty. Any materials, equipment, or controls found to be defective during this warranty period shall be made good without expense to the Owner, including any required replacement of fluids, glycol or refrigerant. The warranty shall include a delayed start-up provision such that the warranty does not begin at time of delivery. The labor for the warranty shall be performed by the manufacturer's authorized service agent.

### **PART 2 - PRODUCTS**

- 2.1 Furnace shall be multiposition condensing type with pilot relite or spark ignition system, induced combustion system, condensing heat exchanger and heating output capacity as specified.
- 2.2 Furnace cabinet shall be thermally and acoustically insulated heavy gauge cold rolled steel painted with rust resistant finish coat. Cabinet shall have filter rack in return air opening complete with 1 inch cleanable air filter.
- 2.3 Unit shall have heat exchanger assembly which includes the combustion chamber, combustion air and gas intake manifolds. Assembly shall include primary and secondary heat exchangers as required by a particular manufacturers design.
- 2.4 Furnace shall have variable speed direct drive blower and blower motor. Unit shall be complete with blower door safety switch, control box, pressure switch, inducer motor, sight glass fan relays, limit controls and all other operating and safety controls required.
- 2.5 Gas controls shall be readily accessible UL/FM compliant gas train with plug cock, pressure regulator, low-voltage automatic main and redundant gas valve, leak test valves downstream of each gas valve, high and low gas pressure switches, and all other required safeties. Delivery pressure of gas to the furnace regulator (at the inlet of the furnace gas train) will be 7 inches w.c.
- 2.6 Furnace shall be furnished complete with evaporator and remote air cooled condensing unit matched to furnish required cooling capacity. Condensing unit shall have weather protected steel cabinet, permanent split-capacitor type condenser fan motor, high efficiency compressor with crankcase heater and restart delay, high and low pressure switches, external service valves with refrigerant filter-drier and all required control transformers, relays and terminals.
- 2.7 Furnace shall be complete with remote thermostat having subbase for fan control and heat-cool setting.
- 2.8 Furnace and cooling components shall be as manufactured by Carrier, Bryant, Lennox or Trane.

### **PART 3 - EXECUTION**

- 3.1 Install furnaces and condensing units in locations as shown on drawings. Equipment shall be installed in strict accordance with manufacturers recommendations.

- 3.2 Provide gas vents, refrigeration piping, control and electrical requirements as specified in other sections of the specification.

END OF SECTION

**23 55 34      GAS FIRED UNIT HEATERS**

**PART 1 - GENERAL**

- 1.1 Gas fired propeller unit heaters shall conform to the requirements as shown on drawings and as hereinafter specified.
- 1.2 Unit heaters shall have AGA design certification with all electric wiring and controls conforming to applicable requirements of NEC and local codes.

**PART 2 - PRODUCTS**

- 2.1 Heaters shall be indirect fired horizontal projection blower fan type having corrosion-resistant aluminized steel burner and heat exchanger. Heat exchanger shall have flue gas connection with draft diverter. Burner shall deliver an Efficiency rating of 80% combustion efficiency or higher.
- 2.2 Fan shall be statically and dynamically balanced with totally enclosed, thermal overload protected motor of voltage indicated on the drawings. Furnish unit with inlet fan guard and adjustable horizontal and vertical deflector blades for complete directional control of air.
- 2.3 Heater casing shall be draw-formed steel with corrosion-resistant baked-enamel finish.
- 2.4 Gas train and controls shall be UL/FM compliant, including main gas shutoff valve for low-voltage main gas valve and pressure regulator, pilot shutoff valve, pilot burner with thermocouple and 100 percent safety shutoff, control transformer, limit controls and fan switch. Delivery pressure of gas to the heater regulator (at the inlet of the heater gas train) will be 7 inches w.c.
- 2.5 Provide a line voltage heating thermostat for wall mounting / mounting on unit heater inlet.
- 2.6 Heaters shall be Reznor, Modine or Sterling.

**PART 3 - EXECUTION**

- 3.1 Heaters shall be installed in locations shown on the drawings. Hanger rods shall be attached to building roof structure in an owner approved manner with suitable x-bracing furnished in order to prevent sway.

END OF SECTION

**PART 1 - GENERAL**

- 1.1 Condensing units shall be factory assembled air cooled type couple to furnace, complete with safeties and operating controls. Refer to drawings for locations and configurations.
- 1.2 The unit shall be UL listed and capacities certified in accordance with AHRI.
- 1.3 Refer to Section 23 23 00 Refrigerant Piping.
- 1.4 Equipment shall carry an all-inclusive manufacturer's parts and labor warranty for a period of five (5) years from date of final acceptance or date of beneficial use, as agreed to between Contractor and Engineer or Construction Manager. Any materials, equipment, or controls found to be defective during this warranty period shall be made good without expense to the Owner, including any required replacement of fluids, glycol or refrigerant. The warranty shall include a delayed start-up provision such that the warranty does not begin at time of delivery. The labor for the warranty shall be performed by the manufacturer's authorized service agent.

Also include one year service warranty on the entire refrigeration system and its associated interlocks. This warranty shall obligate the supplier and installer to service the equipment and attend to all legitimate service calls and make necessary repairs, alterations, additions, adding refrigerant charge, etc., for a period of one year without additional cost to the Owner.

- 1.5 Mechanical equipment, appliances and supports that are exposed to wind shall be designed and installed to resist the wind pressure determined in accordance with the building and mechanical code. Refer to specification 23 05 30 Bases and Supports for HVAC Equipment for additional requirements.

**PART 2 - PRODUCTS**

- 2.1 The condensing unit shall be air cooled type complete with the following features and accessories:
  - A. 2-stage (70% to 100%) scroll compressor mounted on neoprene isolators with winding thermostat, crankcase heater when required for low temp service, and force feed lubrication.
  - B. Condenser, complete with copper tube aluminum fin coil, sub cooling circuit, propeller fan with a direct drive motor and fan guards.
  - C. Service valves on liquid and suction connections.
  - D. Controls, complete with overload protection for each motor and compressor, high and low pressure and temperature cut outs, and start relay. All safety controls, except low pressure, shall be manual reset or wired into a reset relay circuit to avoid cycling on safeties.
  - E. Weatherproof enclosing cabinet with insulated interior surfaces for sound deadening.
  - F. Single pump down control or liquid accumulator to prevent liquid slugging.
  - G. Snow legs.
  - H. Low ambient control means to permit the unit to start and operate to as low as 30 degrees ambient temperature. Provide control arrangement with dampers, wind guards, or other devices as required and an ambient thermostat to prevent operation of the unit below the listed temperature.

- 2.2 Condensing Units shall be rated under AHRI 210/240 and 340/360 and shall have minimum Energy Efficiency Ratings as specified below. Multiple or variable speed compressor units shall achieve this rating at high speed.

<u>Size (cooling)</u>	<u>Indoor Unit Heat Source</u>	<u>Rating Condition</u>	<u>Min Efficiency</u>
<65,000 Btuh	Any	AHRI 210/240	13.0 SEER
65,000 – <135,000 Btuh	Electric or None	AHRI 340/360	12.9 IEER
	Gas	AHRI 340/360	12.7 IEER

- 2.3 Condensing unit and furnace shall be by the same manufacturer.

### **PART 3 - EXECUTION**

- 3.1 Provide all control wiring required to operate the system, including all interlocks to ensure that unit cannot operate until the room air fan operates.
- 3.2 All work in connection with refrigerant piping and accessories, including complete charging, start up, test, and demonstration of the proper functioning of the refrigeration system shall be included.

END OF SECTION

**PART 1 - GENERAL**

- 1.1 Heat pump condensing units shall be factory assembled air cooled type couple to fan coil units, complete with safeties and operating controls. Refer to drawings for locations and configurations.
- 1.2 The unit shall be UL listed and capacities certified in accordance with AHRI.
- 1.3 Refer to Section 23 23 00 Refrigerant Piping.
- 1.4 Equipment shall carry an all-inclusive manufacturer's parts and labor warranty for a period of five (5) years from date of final acceptance or date of beneficial use, as agreed to between Contractor and Engineer or Construction Manager. Any materials, equipment, or controls found to be defective during this warranty period shall be made good without expense to the Owner, including any required replacement of fluids, glycol or refrigerant. The warranty shall include a delayed start-up provision such that the warranty does not begin at time of delivery. The labor for the warranty shall be performed by the manufacturer's authorized service agent.

Also include one year service warranty on the entire refrigeration system and its associated interlocks. This warranty shall obligate the supplier and installer to service the equipment and attend to all legitimate service calls and make necessary repairs, alterations, additions, adding refrigerant charge, etc., for a period of one year without additional cost to the Owner.

- 1.5 Mechanical equipment, appliances and supports that are exposed to wind shall be designed and installed to resist the wind pressure determined in accordance with the building and mechanical code. Refer to specification 23 05 30 Bases and Supports for HVAC Equipment for additional requirements.

**PART 2 - PRODUCTS**

- 2.1 The heat pump condensing unit shall be air cooled type complete with the following features and accessories:
  - A. 2-stage (70% to 100%) scroll compressor mounted on neoprene isolators with winding thermostat, crankcase heater when required for low temp operation, and force feed lubrication.
  - B. Condenser, complete with copper tube aluminum fin coil, sub cooling circuit, propeller fan with direct drive motor and fan guards.
  - C. Service valves on liquid and suction connections.
  - D. Controls, complete with overload protection for each motor and compressor, high and low pressure and temperature cut outs, and start relay. All safety controls, except low pressure, shall be manual reset or wired into a reset relay circuit to avoid cycling on safeties.
  - E. Reversing valve and defrost control.
  - F. Weatherproof enclosing cabinet with insulated interior surfaces for sound deadening.
  - G. Single pump down control or liquid accumulator to prevent liquid slugging.
- 2.2 Heat pump condensing Units shall be rated under AHRI 210/240 and 340/360 and shall have minimum Energy Efficiency Ratings as specified below. Multiple or variable speed compressor units shall achieve this rating at high speed.

COOLING MODE PERFORMANCE:

<u>Size (cooling)</u>	<u>Indoor Unit Heat Source</u>	<u>Rating Condition</u>	<u>Min Efficiency</u>
<65,000 Btuh	Any	AHRI 210/240	14.0 SEER
65,000 – <135,000 Btuh	Electric or None Gas	AHRI 340/360 AHRI 340/360	12.2 IEER 12.0 IEER

HEATING MODE PERFORMANCE:

<u>Size (cooling)</u>	<u>Indoor Unit Heat Source</u>	<u>Rating Condition</u>	<u>Min Efficiency</u>
<65,000 Btuh	Any	AHRI 210/240	8.20 HSPF
65,000 – <135,000 Btuh	Any	47db / 43wb O.A. AHRI 340/360 17db / 15wb O.A. AHRI 340/360	3.30 COP <sub>H</sub> 2.25 COP <sub>H</sub>

2.3 Heat pump condensing unit and DX fan coil unit shall be by the same manufacturer.

**PART 3 - EXECUTION**

- 3.1 Provide all control wiring required to operate the system, including all interlocks to ensure that unit cannot operate until the room air fan operates.
- 3.2 All work in connection with refrigerant piping and accessories, including complete charging, start up, test, and demonstration of the proper functioning of the refrigeration system shall be included.

END OF SECTION

## 23 81 19 B SELF-CONTAINED AIR CONDITIONERS ROOFTOP

### PART 1 - GENERAL

- 1.1 The heating and cooling units shall be factory packaged rooftop and grade mounted cooling-heating units with circulating fan, gas fired heating section, and air cooled refrigeration section. Units shall be roof curb mounted. Units shall be grade mounted as shown on the drawings.
- 1.2 Units shall be tested and certified by UL or ETL to conform to applicable ANSI standards.
- 1.3 Shop drawing submittals shall include detailed control sequences for the unit controller that are intended to comply with the specifications and drawings. A document with listed control methodologies and options with the selected ones indicated as being provided is acceptable. A document that shows control methodologies and options available without an indication of which are being provided is NOT acceptable and will be a basis for rejection.

A copy of the Approved Submittal shall be sent to the Start-up Technician and the BAS Contractor for coordination.

A copy of the Start-up report that indicates what sequences have been programmed shall be submitted for review and record purposes

- 1.4 The equipment vendor shall formally request a controls coordination meeting thru the Div 23 contractor, who shall then engage the Construction Manager, BAS vendor, Commissioning Agent, and project Engineer.
- 1.5 Equipment shall carry an all-inclusive manufacturer's parts and labor warranty for a period of two (2) years (5 years for compressor and related refrigerant system, and furnace heat exchangers) from date of final acceptance or date of beneficial use, as agreed to between Contractor and Construction Manager. Any materials, equipment, or controls found to be defective during this warranty period shall be made good without expense to the Owner, including any required replacement of fluids, glycol or refrigerant. The warranty shall include a delayed start-up provision such that the warranty does not begin at time of delivery. The labor for the warranty shall be performed by the manufacturer's authorized service agent.
- 1.6 Mechanical equipment, appliances and supports that are exposed to wind shall be designed and installed to resist the wind pressure determined in accordance with the building and mechanical code. Refer to specification 23 05 30 Bases and Supports for HVAC Equipment for additional requirements.

### PART 2 - PRODUCTS

- 2.1 Unit shall be specifically designed for outdoor rooftop installation on a full roof curb. Completely factory assembled and tested, piped, internally wired and shipped in one piece. Units are direct expansion cooling only with 100 percent economizer capability (including relief air), enthalpy controller. Provide non-fused disconnect switch and all operating and safety controls, furnished factory installed. All units shall be factory run tested.
- 2.2 Unit casing shall be constructed of aluminum or galvanized steel, finished with two coats of weather resistant paint. Casing shall be minimum 1" thick double wall R-4 insulated type. Provide hinged access panels for access to filters, unit control panel, supply and return fans and other components needing service. Refrigeration components and compressor shall be accessible through hinged doors or removable panels. All access doors and panels shall be double wall construction with neoprene gaskets. Roof assembly curved or cross broken for natural drainage. All exterior seams shall be filled with sealant. Unit base shall have formed recess with factory installed flexible base to match roof curb assembly.



- 2.3 Units shall be roof curb mounted arranged for vertical air discharge and return (except RTU-1-DNR which shall be for horizontal discharge for supply air return). Grade-mounted units shall be arranged for vertical air discharge and return but furnished with an extended height curb for horizontal duct configuration thru the curb and shall be set on a concrete pad. Refer to details on the drawings.
- 2.4 Supply air and return air duct housings with duct connections on the side of the unit, for grade mounted units, shall be furnished with the unit, fabricated of steel and insulated on the interior.
- 2.5 Roof curb shall be full-perimeter type, 24 inches in height, designed to match unit base. Curb shall consist of insulated steel, wood nailer, counterflashing, cant strip, and seals and gasketing to ensure weathertight installation.
- 2.6 Indoor air circulating fan shall be forwardly curved (except RTU-1-AG shall be backward curved) centrifugal type with resiliently mounted motor, direct drive and meet NEMA premium efficiency for over 1 hp or an ECM for 1 hp and under. Note particularly fan duty and HP requirements listed on the drawings.
- 2.7 Heating section shall be natural gas fired with powered burner, corrosion resistant stainless steel heat exchanger, spark igniting pilot, U.L./FM compliant gas piping train with regulator, manual and automatic gas valves on main and pilot piping, combustion safety controls and operating controls. The heating section shall have modulating gas controls with minimum 1.2:1 turn down. Units shall have a minimum thermal efficiency of 80 percent. Delivery pressure of gas to the heater regulator (at the inlet of the heater gas train) will be 7 inches w.c. Provide a low pressure kit as necessary for proper burner operation.
- 2.8 Refrigeration section shall consist of compressor(s), evaporator coil, condenser coils, condenser fans, refrigerant piping and devices. The compressor system shall be two-stage / three stage stage / variable speed scroll type with spring mounting as scheduled on drawings. First stage of cooling shall be variable speed for RTU-1-AG. Coils shall be aluminum fins bonded to copper tubes, all joints brazed, and shall have a minimum of two refrigerant circuits intertwined over the full face of the coil. Coils that are face-split or row-split are not acceptable. Condenser fans shall be direct driven propeller type with wire guards.
- 2.9 Units shall be rated under ANSI/AHRI Standards and shall have minimum Energy Efficiency Ratings as specified below. Multiple or variable speed compressor units shall achieve this rating at high speed.

<u>Size (cooling)</u>	<u>Heat Source</u>	<u>Rating Condition</u>	<u>Min Efficiency</u>
<65,000 Btuh	Gas	AHRI 210/240	14.0 SEER
65,000 – <135,000 Btuh	Gas	AHRI 340/360	12.7 IEER
135,000 – <240,000 Btuh	Gas	AHRI 340/360	12.2 IEER
240,000 – <760,000 Btuh	Gas	AHRI 340/360	11.4 IEER
760,000 Btuh and greater	Gas	AHRI 340/360	11.0 IEER

- 2.10 (RTU-1-AG Only) - Motors 1 HP and larger shall be "premium efficiency" series motors. Motors connected to VFD's shall comply with 23 05 13 Electrical Requirements for HVAC Equipment and shall be furnished with AEGIS SGR shaft grounding ring kit, installed by the equipment manufacturer. Refer to Section 23 05 13 Electrical Requirements for HVAC Equipment.
- 2.11 (All other RTUs on project) - Fans with Electronically Commutated Motors (ECM's) shall be selected such that the maximum available motor RPM shall at minimum accommodate 10% additional fan CFM at a 21% increase in fan static pressure, over what is specified as the duty point. This elevated performance point shall also not exceed the motor's Hp limitations or the fan's

construction class. Shop drawing information shall reflect these requirements. Motor speeds shall be adjustable in the field, and any hard programmed limitations of motor speed or fan performance shall be based on the required elevated performance stated above

2.12 Filters shall be 2" MERV 8 throwaway media filters.

Furnish one complete initial set of filters and one complete set of spare filters for each filter bank in the project. This is in addition to filters used for temporary heating.

Refer to 23 41 00 for specific requirements for RTU-1-AG return ductwork which requires a filter bank.

2.13 Return air and outside air dampers and modulating controls shall be arranged for minimum outside air intake and up to 100 percent outside air while in economizer cycle. Control package shall include a fully modulating return air/outside air electric damper operator, automatic dry bulb temperature changeover control and adjustable mixed air thermostat. All dampers shall be neoprene or extruded vinyl edged for tight sealing. Outside air and relief air openings shall be weather protected and equipped with bird screening.

2.14 Barometric relief air shall be incorporated in the units.

2.15 The unit shall be provided with an electronic system of controls for refrigeration, furnace and supply fan mounted in a unit control panel, wired and tested in the factory. Magnetic starters with overload protection shall be provided for each motor.

2.16 A wall mounted space thermostat shall be furnished with each unit. The thermostat shall be programmable electronic with thermometer, automatic heating cooling changeover, seven day time clock with night set back control and timed override. A sub base panel shall be furnished in conjunction with the thermostat with status lights for dirty filter, economizer malfunction and cooling malfunction. Furnish a differential pressure switch, relays and other devices to accommodate the status lights. Provide an Optimum Start Controller in lieu of fixed time controls. Internal and external temperature sensors shall be provided and installed per manufacturers recommendations. Controls for day economization and optimum off control shall be provided as well. Provide a BACnet interface card to make RTU points (setpoint, unit status, alarm, etc.) viewable from the existing BAS.

A. Sequences of Operation

1. All sequences shall comply with ASHRAE Standard 90.1 – 2010.
2. Occupied / Unoccupied scheduling shall be programmed in the RTU controller per the Owner's direction.
3. Night Setback Heating mode shall be initiated while the RTU is in Unoccupied mode to keep the representative space temperature above the night setback temperature setpoint (60 degF, adjustable)
4. Night Set-up Cooling mode shall be initiated while the RTU is in Unoccupied mode to keep the representative space temperature and humidity below the night set-up temperature setpoint (80 degF, adjustable) and Rh below 60% (adjustable).
5. An Adaptive Optimal Start program shall start the unit in advance of the scheduled "Occupied" time to ensure proper space temperature at occupancy time.
6. Safeties shall shut down the unit in an orderly fashion and alarm the BAS.

7. The air handling unit components (DX coil, gas heater, economizer, fan speed, hot gas reheat, etc.) shall be sequenced to satisfy the "Occupied" discharge air temperature setpoint. Supply air temperature setpoint for "warm-up" cycles shall be 95 degF (adjustable), and 54 degF during "cool-down" cycles (adjustable).
  8. Economizer Control shall be a Differential Dry Bulb sequence with an "Off" setpoint of 60 degF DB outside air temperature.
  9. Supply fan system speed shall modulate to maintain zone temperature setpoint.
  10. DX Coil – If the RTU fan system is "on" and the economizer is active and at 100 percent (outside air dampers full open) and RTU supply air temperature is above setpoint, the solenoid valves and compressor stepping / speed shall be sequenced to satisfy the setpoint. If the RTU fan system is "on" and the economizer is NOT active and the RTU supply air temperature is above setpoint, the solenoid valves and compressor stepping / speed shall be sequenced to satisfy the setpoint. Provide on and off time delays between steps. Provide Dp switch wired in series with cooling control for interlock thru software to keep cooling off unless the supply fan system is operating.
  11. Gas Heater – Modulate to maintain zone temperature setpoint.
  12. Hot Gas Reheat – (RTU-1-AG,RTU-1-DNR, RTU-1,2,3,4,6-FB) – If space relative humidity rises above 60%, unit shall enter dehumidification mode and utilize hot gas reheat to temper supply air to maintain space temperature.
- B. Communication from the unit controller to the BAS network shall use BACnet MS/TP or BACnet/IP, whichever is approved by the BAS vendor.
  - C. All operational capabilities described in previous sections above shall be automatically executed at equipment start-up to ensure proper operation and assist in commissioning.
  - D. Shop drawing submittal requirements
    1. Detailed Control Sequences shall be submitted with shop drawings. These sequences shall be job specific and NOT just a regurgitation of specified sequences.
    2. Job Specific Control Diagrams and Points Lists showing exact integration points and data with the BAS.
    3. Control components cut sheets with options and features selected.

2.17 Units shall be manufactured by Daikin, Carrier, Trane, AAON.

### **PART 3 - EXECUTION**

- 3.1 Roof curb shall be set in place, leveled and secured to deck structure. Units shall be installed with a solid roof deck below. Supply & return duct connects shall extend thru the curb and connected to unit via flex connectors (curb shall not be used as a supply or return plenum). Cutouts of roof for supply and return ducts shall be caulked and sealed to prevent noise transmission.
- 3.2 Provide a concrete pad for grade mounted units. The supply duct housing shall be set on the pad, caulked air-tight and the unit set on the housing.
- 3.3 Provide condensate drainage piping from the drain pan with a deep trap and cleanout as detailed on the drawings.

- 3.4 Coordinate power wiring with Division 26 thru a fused disconnect switch to one set of power terminals in each unit. Provide all additional power and control wiring required for the completion of the systems. All wiring shall be run in 0.50 inch and larger conduit in accordance with applicable provisions of Division 26.

END OF SECTION

**PART 1 - GENERAL**

- 1.1 The heating-cooling systems shall be variable capacity, DX split heat pump systems. The systems shall consist of indoor fan coil unit(s) matched to outdoor air-cooled heat pump condensing unit(s), singularly or multiple indoor units on a single outdoor unit, and associated controls. Refer to drawings for capacities and arrangements.
- 1.2 The design is based on Friedrich equipment. The other manufacturers listed in Part 2 are acceptable manufacturers but shall include in their bid price all necessary revisions from the basis of design required to install their system, including but not limited to variations in electrical services, branch controllers, pipe sizing, quantities and arrangements.
- 1.3 Equipment shall be rated in accordance with ARI 210/240 and so labeled, and shall be Listed by UL or ETL and so labeled.
- 1.4 The condensing units shall be factory charged with R-410A refrigerant.
- 1.5 The systems shall carry a five (5) year warranty from date of installation. In addition, the compressors shall be covered by the manufacturer's limited warranty for a period of seven (7) years from date of installation. If, during these periods, any part shall fail to function properly due to defects in workmanship or material, it shall be replaced or, at the discretion of the manufacturer, repaired. The 2<sup>nd</sup> thru 5<sup>th</sup> year and 2<sup>nd</sup> thru 7<sup>th</sup> year warranties do not include labor.
- 1.6 Refer to the HVAC and Electrical drawings for electrical power feeds. Compare unit requirements to feeder sizes shown. Refer to 23 05 13 Electrical Requirements for HVAC Equipment.
- 1.7 Installing contractor shall be factory trained and certified to install the systems. Training shall be documented by the manufacturer and certification shall be submitted for review with shop drawings, prior to the installation of the systems.
- 1.8 Mechanical equipment, appliances and supports that are exposed to wind shall be designed and installed to resist the wind pressure determined in accordance with the building and mechanical code. Refer to specification 23 05 30 Bases and Supports for HVAC Equipment for additional requirements.

**PART 2 - PRODUCTS**

- 2.1 Each Air-Cooled Heat Pump Condensing Unit shall consist of:
  - A. General:
    1. Each outdoor unit shall be specifically matched to the corresponding indoor unit size(s), factory assembled and pre-wired with all necessary electronic and refrigerant controls. The refrigeration circuit of the condensing unit shall consist of inverter scroll or rotary compressors, motors, fans, condenser coil, electronic expansion valves, solenoid valves, 4-way valve, distribution headers, capillaries, filters, shut off valves, oil separators, service ports and refrigerant regulator. High/low pressure gas line, liquid and suction lines, individually insulated between the outdoor and indoor units.
    2. Accumulator with refrigerant level sensors and controls; high-pressure safety switch, over-current protection and DC bus protection.
    3. High efficiency oil separator plus additional logic controls to ensure adequate oil volume in the compressor is maintained.
    4. Auto-charging feature and a refrigerant charge check function. The unit shall be capable of metering the refrigerant charge as additional refrigerant is added to the system and will calculate how much additional refrigerant is to be added to the system.
    5. Oil recovery cycle shall be automatic occurring after start of operation and then at re-occurring intervals during unit operation.

6. The system shall automatically restart operation after a power failure and will not cause any settings to be lost, thus eliminating the need for re-programming.
  7. Unit shall have a sound rating no higher than 64 dB(A) measured at 3 feet from any side of the unit.
- B. Cabinet shall be fabricated of galvanized or rust-protected steel, bonderized and finished with a powder coated baked enamel. The outdoor unit shall come furnished with four (4) mounting feet, mounted across the base pan, to allow bolting to an equipment pad.
  - C. Condenser fans shall be statically and dynamically balanced direct drive, variable speed propeller type. Fan motor shall have inherent protection, permanently lubricated bearings, and be completely variable speed. Fan motor shall be mounted for quiet operation. Fan shall be provided with a raised guard to prevent contact with moving parts.
  - D. Condenser coils shall be copper or other nonferrous construction with corrugated fin tube. The fins shall be aluminum or covered with an anti-corrosion acrylic resin and hydrophilic, rated for up to 500 hours salt spray. Automatic defrost shall remove any frost from the outdoor unit allowing the system to maintain heating capacity.
  - E. Compressor
    1. Compressors shall be inverter scroll or rotary type, inverter-driven variable speed, capable of changing the speed to follow the variations in total cooling and heating load.
    2. Each compressor shall be equipped with a crankcase heater (if required for specified design and operating conditions), high pressure safety switch, and internal thermal overload protector.
    3. The capacity control range shall be minimum 10% to 100%.
    4. Compressor assembly shall be installed on vibration isolators.
    5. The following safety devices shall be included on the condensing unit: high pressure switch, control circuit fuses, fusible plug, high pressure switch, overload relay, inverter overload protector, thermal protectors for compressor and fan motors, over current protection for the inverter and anti-recycling timers.

Units shall be rated under AHRI 210/240 and 340/360. Single-Phase cooling-only units shall meet or exceed the DOE requirement of 14 SEER. Single-Phase heat pump units shall meet or exceed the DOE requirement of 14 SEER and 8.2 HSPF.

Note: Shop drawing submittals shall include AHRI ratings to show compliance with the requirements.

## 2.2 Fan Coil Units

### A. Wall Mounted Units

1. General
  - a. Wall mounted units shall be completely factory assembled and tested. Included in the unit shall be factory wiring with on/off switch, piping, electronic proportional expansion valve, control circuit board, fan motor thermal protector, flare connections, condensate drain pan, self-diagnostics, auto-restart function, time delay fusing, and test run switch. The unit shall have an auto-swing louver which ensures efficient air distribution, which closes automatically when the unit stops. The local controller shall be able to adjust the discharge angle.
  - b. A mildew-proof, polystyrene air filter and condensate drain pan shall be included. The indoor units sound pressure shall be no more than 54 dB(A) at high speed measured at 3.3 feet from the unit.
  - c. Refer to drawings for required capacities.

2. Cabinet shall be zinc-coated bonderized steel finished with a baked enamel paint. Inlet grilles shall be attractively styled, high-impact polystyrene. Matching mounting brackets shall be provided.
3. Fans
  - a. Fan shall be tangential direct-drive blower type with air intake at the upper front face of the unit and discharge at the bottom front. Automatic, motor-driven vertical air sweep shall be provided standard.
  - b. Horizontal and vertical air sweep operations shall be user selectable.
  - c. Motors shall be open drip-proof, permanently lubricated ball bearing with inherent overload protection. Fan motors shall be 3-speed.
4. Coil shall be a 2-row copper tube with aluminum fins and galvanized steel tube sheets. Fins shall be bonded to the tubes by mechanical expansion. A drip pan under the coil shall have a drain connection for hose attachment to remove condensate. Condensate pan shall have internal trap and auxiliary drip pan under coil header. The drain pipe shall be able to be fitted from either left or right sides.
5. Electrical Requirements
  - a. Unit shall operate on 115 volt, 208 volt, or 230 volt, 60 Hz single-phase power supply as specified on the equipment schedule. Power and control connections shall have terminal block connections.
6. Controls
  - a. Controls shall consist of a microprocessor-based control system, which shall control space temperature, determine optimum fan speed, and run self-diagnostics. The space temperature control range shall be from 64F to 84F.
  - b. Provide hard wired wall-mounted local programmable controller for each unit, with features as specified in the "Controllers" paragraph below.
  - c. Controls shall be 24 volt, and shall be easily operated by the user from the wall-mounted local controller.

### 2.3 Controllers:

#### A. Local Controllers (Room Thermostats)

1. Wall mounted local remote controllers (thermostats) shall be provided to allow the user to change on/off, temperature setting, and fan speed setting for each fan coil unit. The room temperature shall be sensed at this wall mounted remote controller (thermostat) unless noted otherwise. The controller shall display a four-digit error code in the event of system abnormality/error.
2. The Local Controller shall be mounted into a standard 2" x 4" junction box.
3. Unit Display
  - a. The Local Remote Controller shall be a backlit LCD display with contrast adjustment.
  - b. The controller shall display On/Off Status, Operation Mode, Setpoint, and Fan Speed. The controller shall display temperature setpoint in one degree increments with a range of 60-90 degF. On/Off status shall be displayed with an LED.
  - c. Error codes shall be displayed in the event of system abnormality/error.
  - d. The following system temperatures shall be capable of being displayed to assist service personnel in troubleshooting:
    - 1) Return air temperature
    - 2) Liquid line temperature
    - 3) Gas line temperature
    - 4) Discharge air temperature (if available on the unit)
    - 5) Remote temperature sensor temperature (if applicable)
    - 6) Indoor space temperature setpoint
4. Operation
  - a. The controller shall be capable of controlling the following operations:
    - 1) On/Off, Operation Mode (Cool, Heat, Fan, Dry and Auto\*)
    - 2) Independent cooling and heating setpoints in the occupied mode
    - 3) Independent cooling setup and heating setback
    - 4) Fan speed

- 5) Airflow direction
  - 6) The controller shall be able to limit the user adjustable setpoint ranges individually for cooling and heating in the occupied period
  - 7) Lock out key settings
  - 8) Indoor unit group assignments.
5. Program Functions
- a. Controller shall support schedule settings with selectable weekly pattern options.
    - 1) Seven day week
    - 2) Weekday + weekend
    - 3) Weekday + Saturday + Sunday
    - 4) Independently settable Cooling and/or Heating setpoints when unit is on (occupied).
    - 5) Setup (Cooling) and Setback (Heating) setpoints when unit is off (unoccupied)
    - 6) A maximum of 5 operations schedulable per day
    - 7) Time setting in 1-minute increments.
  - b. The Controller shall support auto-changeover mode for both heat pump and heat recovery systems allowing the optimal room temperature to be maintained by automatically switching the indoor unit's mode between Cool and Heat according to the room temperature and temperature setpoint.
    - 1) Changeover to cooling mode shall occur at cooling setpoint + 1oF .
    - 2) Changeover to heating mode shall occur at heating setpoint - 1oF .
  - c. The Controller shall support an Auto-Off-Timer for temporarily enabling indoor unit operation during the unoccupied period.
    - 1) When the Off Timer is enabled and when the unit is manually turned on at the remote controller, the controller shall shut off the unit after a set time period.
    - 2) The time period shall be configurable in the controller menu with a range of 30-180 minutes in 10 minute increments.
  - d. .

#### 2.4 Refrigerant Piping:

- A. Refrigerant piping shall be copper tubing conforming to ANSI B31.5 and ASTM B280. Refrigerant piping systems and components shall be engineered, installed, tested and placed in operation in accordance with ASME B31.5, latest edition.
- B. Copper tubing shall be Type ACR, hard-drawn straight lengths. Fittings shall be copper, UL or ETL tested to UL 207, and certified to a working pressure of 600 psig. All joints shall be brazed using silver brazing alloy while flowing an inert gas such as dry nitrogen through the piping. Copper tubing that is downstream of branch controllers and .625" size and smaller may be Type ACR soft annealed coils for lengths under 25 ft if approved by the equipment manufacturer. Refer to 23 23 00 for additional information.
- C. Pipe arrangement, devices and sizing information shown on the drawings is limited due to variations in equipment manufacturers' requirements. The equipment supplier shall prepare project-specific drawings of each piping system showing numbers and sizes of piping, devices and accessories, coil circuitry, traps, double suction risers and other such detail required for the application shown on the drawings and as specified herein. Drawings shall be submitted to the Engineer for review with the equipment shop drawings.
- D. The equipment supplier shall provide piping installation instructions to the Contractor and supervision as needed to ensure that the piping system is installed in accordance with the equipment manufacturer's recommendations.
- E. Owner's access thru the cloud shall be free of charge for the condensing unit warranty period plus one year. Cost for extending the access period beyond that stated above shall be made available to the Owner via a formal contract proposal.



- F. Access shall be password protected, via IOS or Android or Windows operating systems, with secure outbound only data transmission of the following live information as a minimum via a Graphical Dashboard Display:
  - 1. Space Temperature
  - 2. Fan Coil Status
  - 3. Condensing Unit Status
  - 4. Alarms.
  - 5. Customizable email notifications.
  - 6. System and Data History
  - 7. Service Log History

2.5 The split systems shall be manufactured by Friedrich, Daikin, and Mitsubishi.

### **PART 3 - EXECUTION**

3.1 Installers shall have received training by the manufacturer of the systems being supplied for the project. If they have not received training the system manufacturer shall schedule and perform required installation training.

#### **3.2 Piping Installation**

- A. Pipe arrangement, devices and sizing information shown on the drawings is schematic in nature, limited due to variations in equipment manufacturers' requirements. The equipment supplier shall prepare project-specific drawings of each piping system showing numbers and sizes of piping, devices and accessories, coil circuitry, traps, double suction risers and other such detail required for the application shown on the drawings and as specified herein. Exact routing, and pipe quantities and sizing shall be per manufacturer's requirements. Refrigerant piping shall conform to ANSI B31.5 and ASTM B280. Refrigerant piping systems and components shall be engineered, installed, tested and placed in operation in accordance with ASME B31.5, latest edition. Drawings shall be submitted to the Engineer for review with the equipment shop drawings. Exact routing, and pipe quantities and sizing shall be per manufacturer's requirements.
- B. At time of equipment submittal approval a piping diagram shall be provided by the equipment manufacturer to the Installing Contractor for each split system. The equipment manufacturer shall review the piping diagram with the Installing Contractor.
- C. A copy of the Approved piping diagrams shall be kept at the jobsite.
- D. The Installing Contractor shall update the piping diagrams with any field changes such as re-routing, shortening, lengthening or changing diameter of a pipe segment, adding or eliminating elbows and or fittings, resizing adding or eliminating indoor units, changing the mounting height, or moving the location of a device or fitting during installation. Those changes shall be communicated to the equipment manufacturer PRIOR TO INSTALLATION. The equipment manufacturer shall review and provide written approval or required modifications prior to installation.
- E. The equipment manufacturer shall update their Piping Program to an "As-Built" program. Proper refrigerant charge shall be calculated and communicated to the Commissioning/Startup Technician along with the As-Built piping program.
- F. The equipment manufacturer's representative shall inspect the piping system prior to charging and start-up and document their approval or required changes.
- G. System shall be leak checked, evacuated and charged by the Installing Contractor. Refer to 23 23 00.

- 3.3 Control wiring shall be installed between indoor units and outdoor units in strict accordance with the manufacturer's instructions. All control wiring shall be low-voltage plenum rated type.
- 3.4 Furnish and install all controls, wiring and accessories for a complete and operational system.
- 3.5 Locate equipment so as to afford adequate service space.
- 3.6 Outdoor condensing units shall be installed in accordance with manufacturer's installation instructions. Install units plumb and level, firmly anchored in locations indicated, and maintain manufacturer's recommended clearances.
- 3.7 Roof mounted condensing units shall be installed a minimum of 10'-0" from any roof edge not protected with a code compliant guard rail regardless of location indicated on plans. Units shall be installed in accordance with manufacturer's installation instructions. Install units plumb and level, firmly anchored in locations indicated, and maintain manufacturer's recommended clearances. Set with Type C2 isolators and secured to roof equipment rails attached to the roof deck and flashed into the existing roofing system. All bases and curbs for roof mounted equipment shall be constructed and attached to the roof deck such that installed equipment can withstand 120 mph wind loads. Piping shall be connected utilizing flexible connectors.
- 3.8 Install fan coil units in accordance with manufacturer's installation instructions. Install units plumb and level, firmly anchored in locations indicated, and maintain manufacturer's recommended clearances. For gravity drained units, provide a drain pipe with trap from fan coil drain pans and extend piping to a floor drain or other point of discharge as shown and terminated per the Code. For fan coils fitted with condensate pumps, install pump and sensing devices in evaporator condensate drain piping, and provide and/or extend power and control and safety wiring, all in strict accordance with the manufacturer's instructions. Condensate piping shall be extended to a floor drain or other point of discharge as shown and terminated per the Code.
- 3.9 Install electrical devices furnished by manufacturer but not specified to be factory-mounted. Verify that electrical wiring installation is in accordance with manufacturer's submittal and installation requirements of Division-26. Do not proceed with equipment start-up until wiring installation is acceptable to equipment Installer.
- 3.10 The system shall be checked, started, tested, adjusted and commissioned by a factory trained service agent of the manufacturer prior to operation. The unit manufacturer will be responsible for the start-up, programming, and commissioning of the entire variable refrigerant volume system. Manufacturer shall test controls and demonstrate compliance with requirements. Replace damaged or malfunctioning controls and equipment.
- 3.11 Provide services of manufacturer's technical representative for 2 days to instruct Owner's personnel in operation and maintenance of units. Schedule training with Owner.
- 3.12 In addition to the adjustments and fine tuning, the Contractor shall include as a part of this contract the equivalent of three (3) man days of service technician time for work as may be specified by the Engineer.
- 3.13 The control equipment supplier shall provide 4 hours of instruction and training of the Owner's personnel regarding the hardware and software of the system. Software training shall include programs, methods of programming, control loops, scheduling and reports. Site training classes shall not be scheduled for longer than 4 hours duration except at the discretion of the Owner. Contractor shall videotape the demonstrations and make copies available to the Owner.

END OF SECTION

**23 82 39 UNIT HEATERS**

**PART 1 - GENERAL**

- 1.1 Unit heaters shall be electric propeller type units. Refer to the drawings for arrangement, type, capacity, motor characteristics and other requirements.
- 1.2 Provide electric components of terminal units which have been listed and labeled by UL.

**PART 2 - PRODUCTS**

- 2.1 Electric propeller unit heaters shall consist of:
  - A. Direct driven propeller fan and single speed permanent split capacitor motor with internal overload protection. Horizontal heaters shall have a wire fan guard.
  - B. Heating coil shall be finned steel sheaths helically wound, individually removable, with corrosion resistant finish. Horizontal heaters shall be equipped with adjustable louvers.
  - C. Electric power and control devices shall be factory mounted and wired in an enclosure and factory tested. These shall include a terminal block, integral, tamperproof, heating thermostat, contactors, overheat cutout, transformer for fan motor if voltage is not compatible with service feed, fuses and other devices to complete the package.
  - D. Cabinets shall be bonderized steel with a baked enamel finish.
  - E. Electric propeller unit heaters shall be manufactured by TPI Corporation (Ray-Wall, Markel, or Redd-i), Q-Mark/Chromalox or Modine.

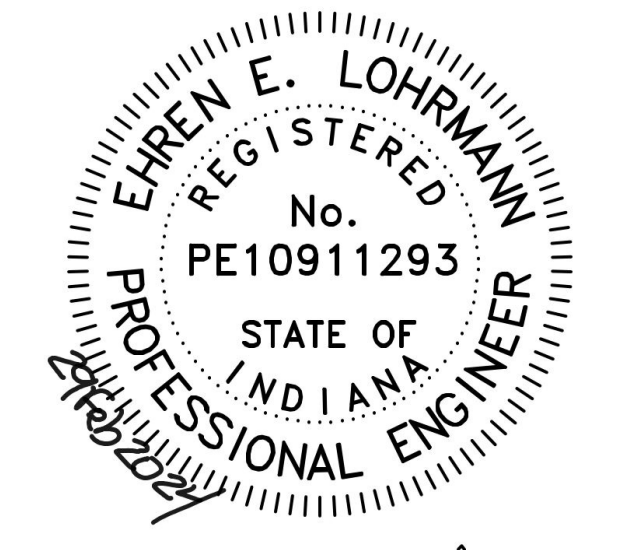
**PART 3 - EXECUTION**

- 3.1 Provide all required wiring between the unit and wall mounted thermostats, in conduit per Division 26 and the N.E.C..

END OF SECTION



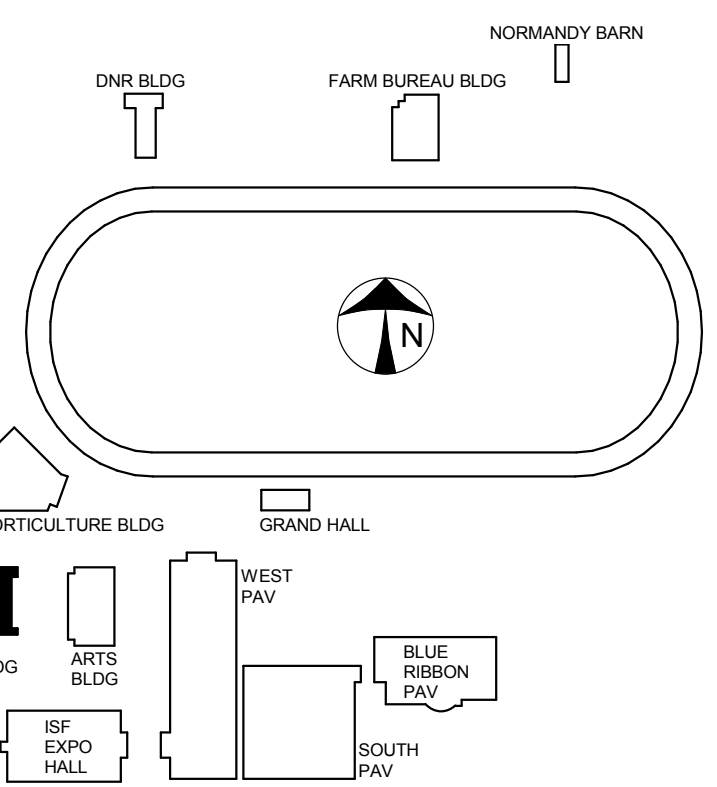
CONSULTANTS



*E. E. Lohrmann*

INDIANA STATE  
FAIRGROUNDS HVAC  
REPLACEMENTS  
OWNER  
INDIANA STATE  
FAIRGROUNDS  
1202 E. 38TH ST,  
INDIANAPOLIS, IN 46205

**KEY PLAN**  
NOT TO SCALE



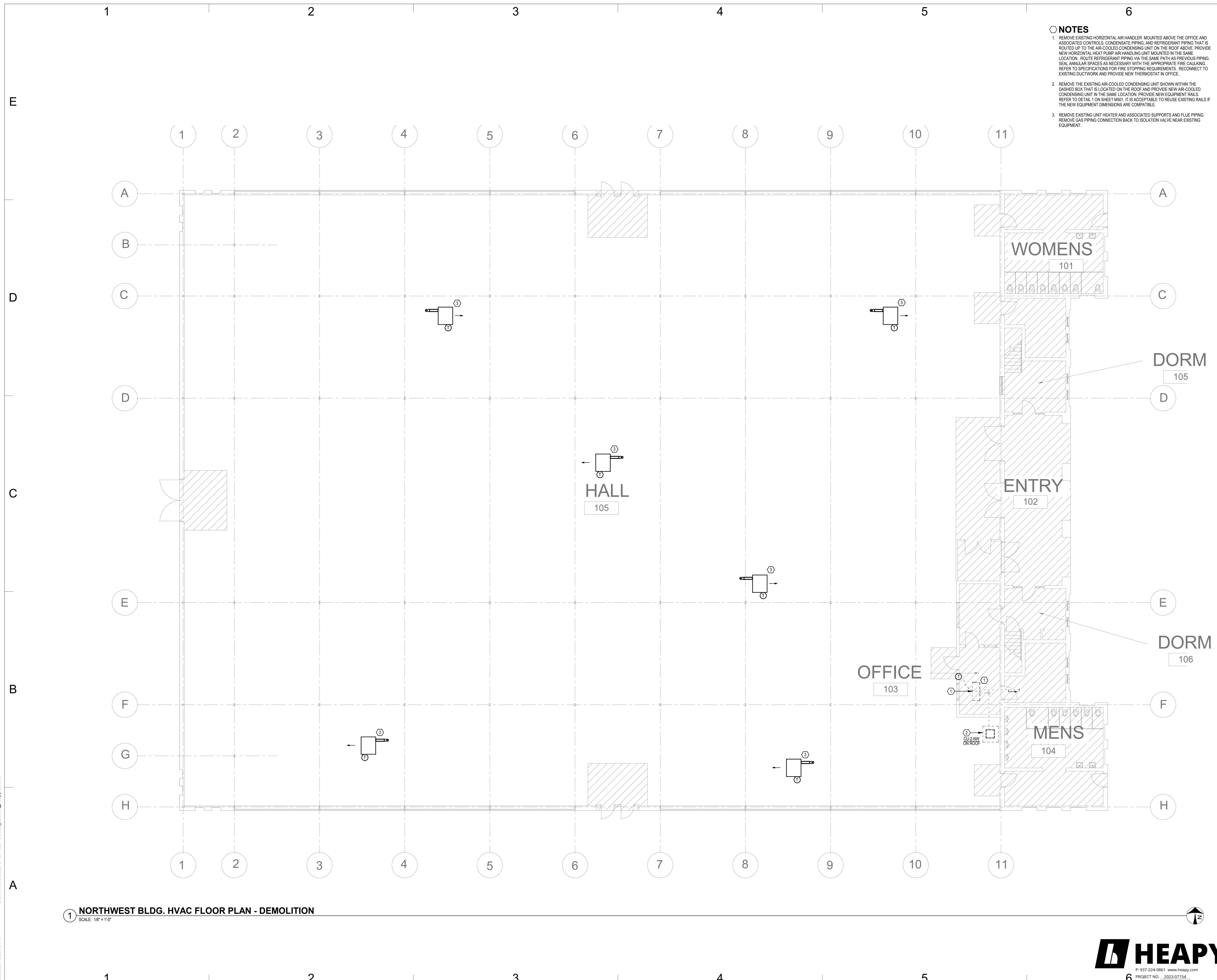
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SHEET TITLE  
**NORTHWEST BLDG. HVAC  
PLAN**

MD101

**NOTES**

- REMOVE EXISTING HORIZONTAL AIR HANDLER, MOUNTED ABOVE THE OFFICE AND ASSOCIATED CONTROLS, CONDENSATE PIPING, AND REFRIGERANT PIPING THAT IS ROUTED UP TO THE AIR-COOLED CONDENSING UNIT ON THE ROOF ABOVE. PROVIDE NEW HORIZONTAL HEAT PUMP AIR HANDLING UNIT MOUNTED IN THE SAME LOCATION. ROUTE REFRIGERANT PIPING VIA THE SAME PATH AS PREVIOUS PIPING. SEAL ANNULAR SPACES AS NECESSARY WITH THE APPROPRIATE FIRE CAULKING. REFER TO SPECIFICATIONS FOR FIRE STOPPING REQUIREMENTS. RECONNECT TO EXISTING DUCTWORK AND PROVIDE NEW THERMOSTAT IN OFFICE.
- REMOVE THE EXISTING AIR-COOLED CONDENSING UNIT SHOWN WITHIN THE DASHED BOX THAT IS LOCATED ON THE ROOF AND PROVIDE NEW AIR-COOLED CONDENSING UNIT IN THE SAME LOCATION. PROVIDE NEW EQUIPMENT RAILS. REFER TO DETAIL 1 ON SHEET M001. IT IS ACCEPTABLE TO REUSE EXISTING RAILS IF THE NEW EQUIPMENT DIMENSIONS ARE COMPATIBLE.
- REMOVE EXISTING UNIT HEATER AND ASSOCIATED SUPPORTS AND FLUE PIPING. REMOVE GAS PIPING CONNECTION BACK TO ISOLATION VALVE NEAR EXISTING EQUIPMENT.

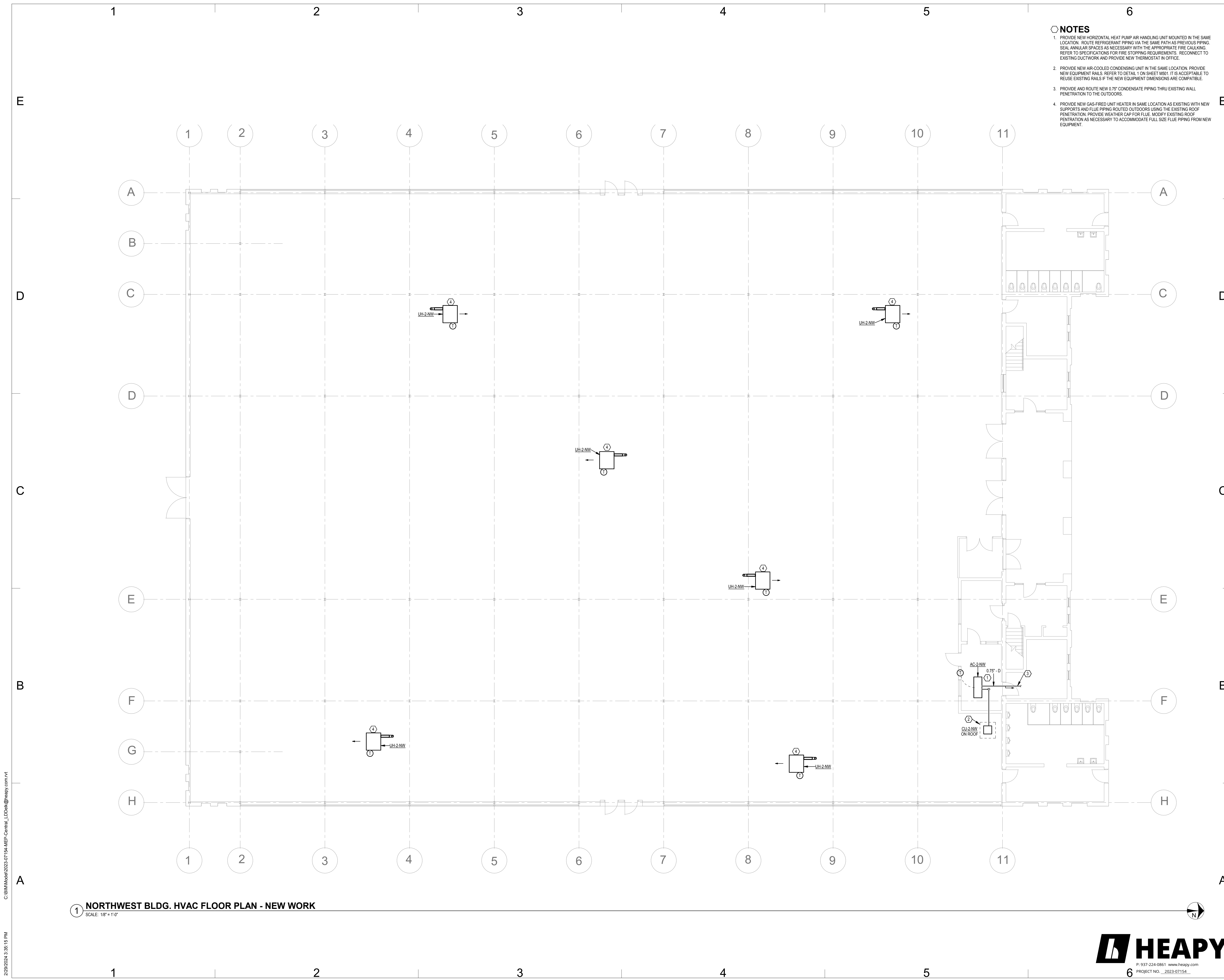


**1 NORTHWEST BLDG. HVAC FLOOR PLAN - DEMOLITION**  
SCALE: 1/8" = 1'-0"



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- NOTES**
1. PROVIDE NEW HORIZONTAL HEAT PUMP AIR HANDLING UNIT MOUNTED IN THE SAME LOCATION. ROUTE REFRIGERANT PIPING VIA THE SAME PATH AS PREVIOUS PIPING. SEAL ANNULAR SPACES AS NECESSARY WITH THE APPROPRIATE FIRE CAULKING. REFER TO SPECIFICATIONS FOR FIRE STOPPING REQUIREMENTS. RECONNECT TO EXISTING DUCTWORK AND PROVIDE NEW THERMOSTAT IN OFFICE.
  2. PROVIDE NEW AIR-COOLED CONDENSING UNIT IN THE SAME LOCATION. PROVIDE NEW EQUIPMENT RAILS. REFER TO DETAIL 1 ON SHEET M01. IT IS ACCEPTABLE TO REUSE EXISTING RAILS IF THE NEW EQUIPMENT DIMENSIONS ARE COMPATIBLE.
  3. PROVIDE AND ROUTE NEW 0.75" CONDENSATE PIPING THRU EXISTING WALL PENETRATION TO THE OUTDOORS.
  4. PROVIDE NEW GAS-FIRED UNIT HEATER IN SAME LOCATION AS EXISTING WITH NEW SUPPORTS AND FLUE PIPING ROUTED OUTDOORS USING THE EXISTING ROOF PENETRATION. PROVIDE WEATHER CAP FOR FLUE. MODIFY EXISTING ROOF PENETRATION AS NECESSARY TO ACCOMMODATE FULL SIZE FLUE PIPING FROM NEW EQUIPMENT.



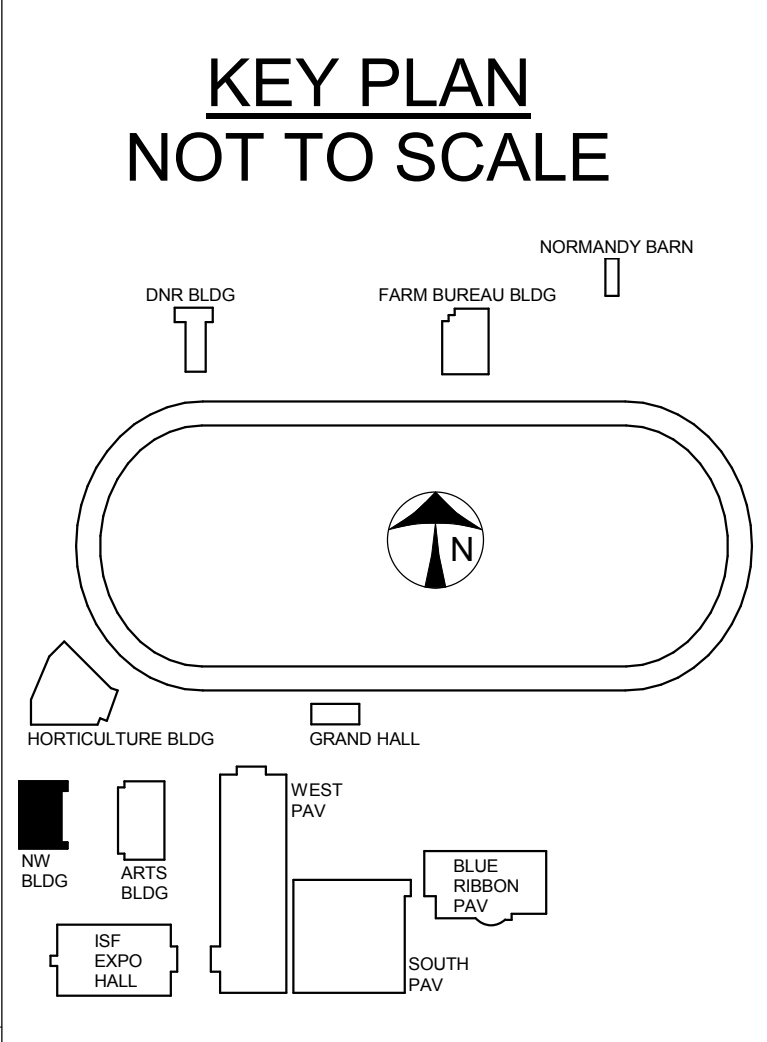
CONSULTANTS

**EHREN E. LOHRMAN**  
 REGISTERED PROFESSIONAL ENGINEER  
 No. PE10911293  
 STATE OF INDIANA

*E. E. Lohrman*

INDIANA STATE FAIRGROUNDS HVAC REPLACEMENTS

OWNER  
 INDIANA STATE FAIRGROUNDS  
 1202 E. 38TH ST,  
 INDIANAPOLIS, IN 46205



**1 NORTHWEST BLDG. HVAC FLOOR PLAN - NEW WORK**  
 SCALE: 1/8" = 1'-0"

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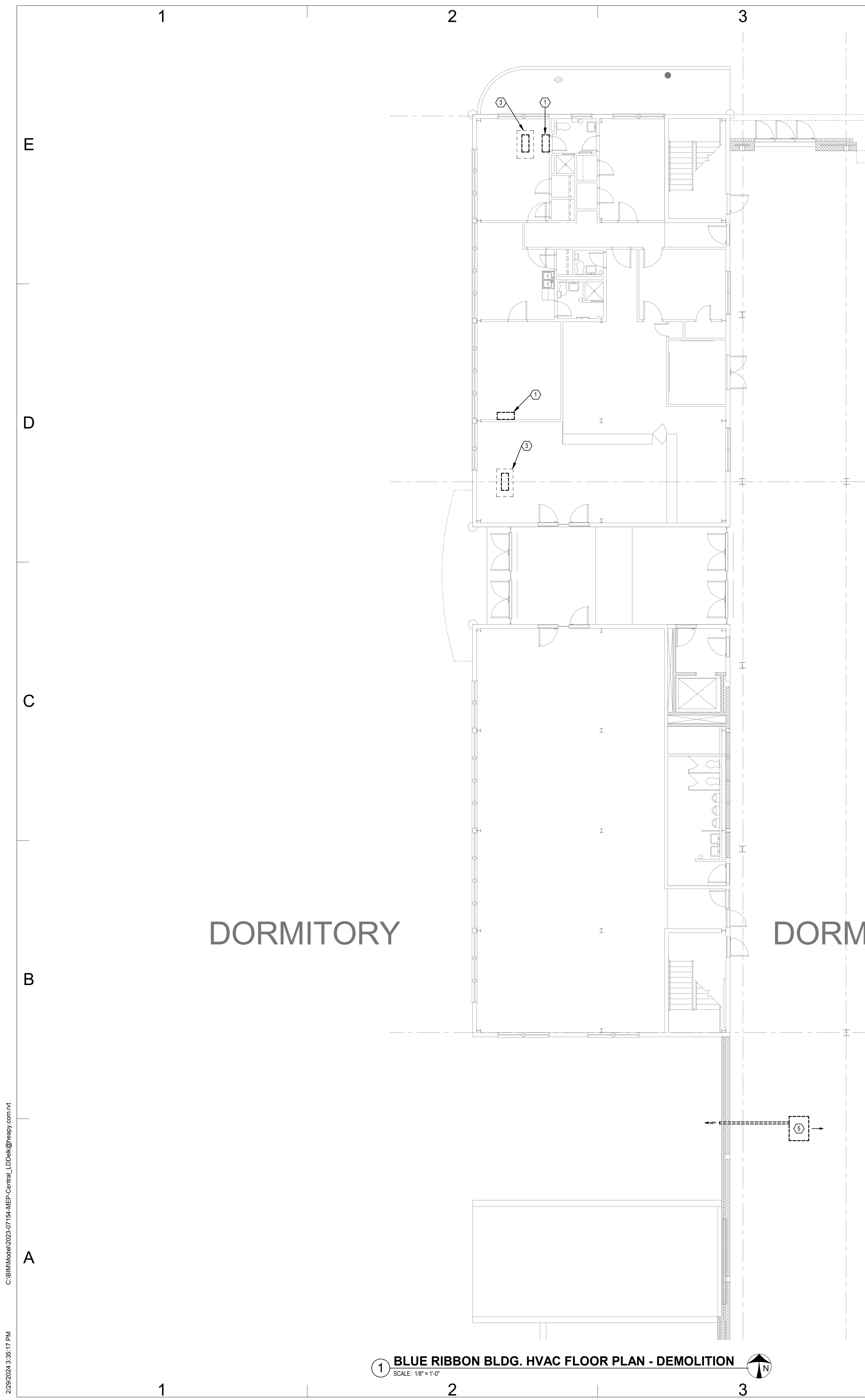
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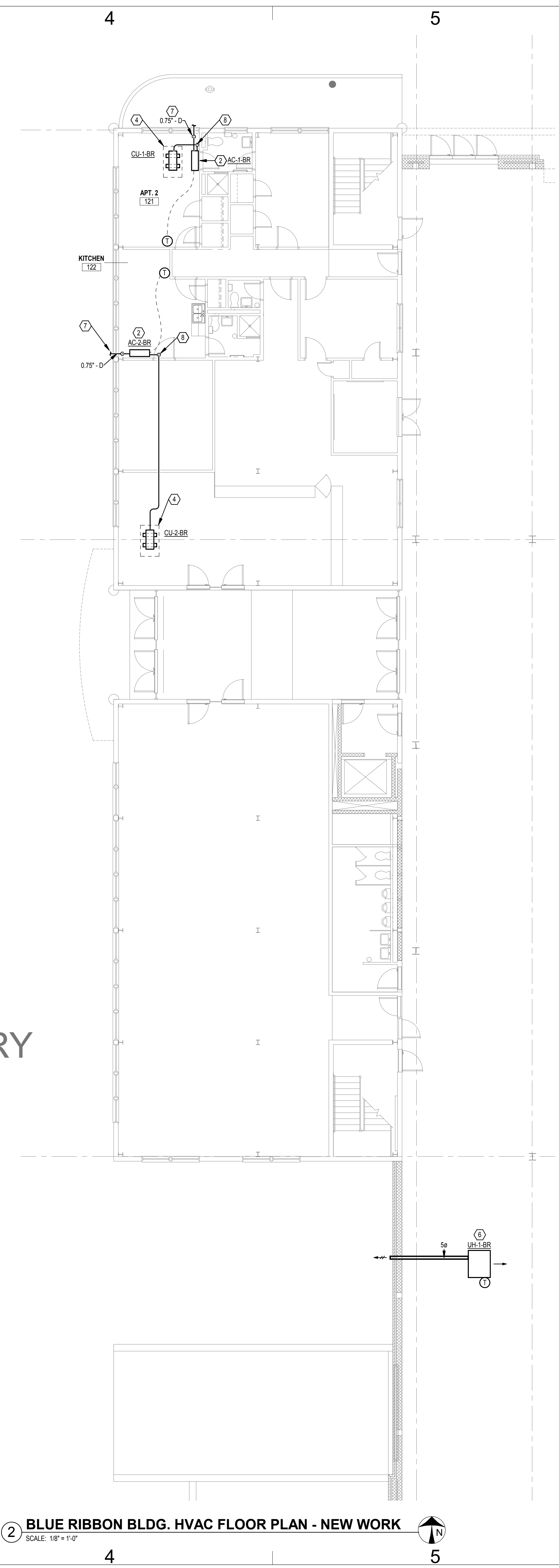
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 PROJECT NO. 2023-07154



1 BLUE RIBBON BLDG. HVAC FLOOR PLAN - DEMOLITION  
SCALE: 1/8" = 1'-0"

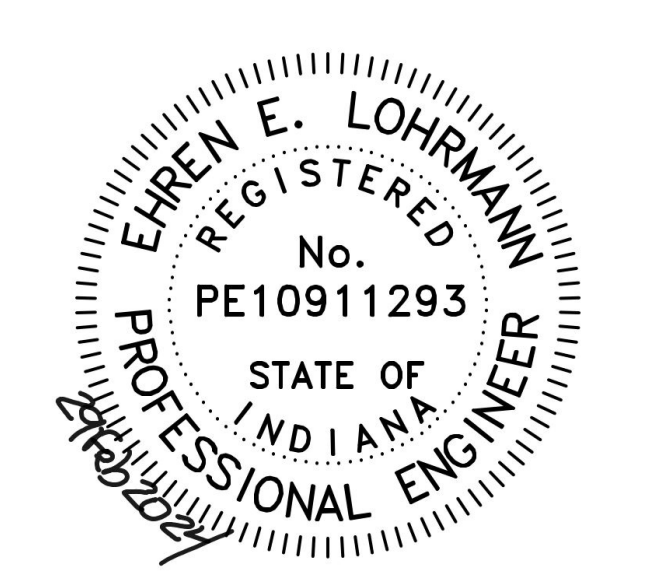


2 BLUE RIBBON BLDG. HVAC FLOOR PLAN - NEW WORK  
SCALE: 1/8" = 1'-0"

- NOTES**
- REMOVE EXISTING WALL MOUNTED DUCTLESS INDOOR UNIT AND ASSOCIATED CONTROLS, CONDENSATE PIPING, AND REFRIGERANT PIPING THAT IS ROUTED UP TO THE AIR-COOLED CONDENSING UNIT ON THE ROOF ABOVE.
  - PROVIDE NEW DUCTLESS SPLIT HEAT PUMP UNIT MOUNTED TIGHT TO BOTTOM OF CEILING. REFER TO EQUIPMENT SCHEDULE.
  - REMOVE THE EXISTING AIR-COOLED CONDENSING UNIT SHOWN WITHIN THE DASHED BOX THAT IS LOCATED ON THE ROOF.
  - PROVIDE NEW OUTDOOR AIR-COOLED HEAT PUMP UNIT FOR EACH INDOOR UNIT. PROVIDE NEW EQUIPMENT RAILS. REFER TO DETAIL 1 ON SHEET M01. IT IS ACCEPTABLE TO REUSE EXISTING RAILS IF THE NEW EQUIPMENT DIMENSIONS ARE COMPATIBLE.
  - REMOVE EXISTING UNIT HEATER LOCATED IN THE BASEMENT PARKING GARAGE AND ASSOCIATED SUPPORTS AND FLUE PIPING. REMOVE GAS PIPING CONNECTION BACK TO NEAREST ISOLATION VALVE.
  - PROVIDE NEW GAS-FIRED UNIT HEATER IN SAME LOCATION AS EXISTING WITH NEW SUPPORTS AND FLUE PIPING ROUTED OUTDOORS USING THE EXISTING WALL PENETRATION. PROVIDE WEATHER CAP FOR FLUE. MIMIC EXISTING WALL PENETRATION AS NECESSARY TO ACCOMMODATE FULL SIZE FLUE PIPING FROM NEW EQUIPMENT.
  - PROVIDE AND ROUTE NEW 0.75" CONDENSATE PIPING THRU EXISTING WALL PENETRATION TO A SPLASH BLOCK OUTSIDE.
  - NEW REFRIGERANT LINESET UP TO NEW OUTDOOR HEAT PUMP UNIT. LIQUID AND SUCTION LINE ARE MEANT TO BE ROUTED TOGETHER AND THEREFORE, ONLY A SINGLE LINE IS SHOWN ON PLAN FOR CLARITY. UTILIZE SAME ROUTE AND PENETRATIONS AS EXISTING REFRIGERANT PIPE ROUTING. SEAL ANNULAR SPACES AS NECESSARY WITH THE APPROPRIATE FIRE CALKING. REFER TO SPECIFICATIONS FOR FIRE STOPPING REQUIREMENTS. FINAL REFRIGERANT PIPE SIZING SHALL BE DETERMINED BY THE EQUIPMENT MANUFACTURER AFTER ACCOUNTING FOR FINAL PIPE ROUTE AND ALL OFFSETS AND CHANGES IN ELEVATION.



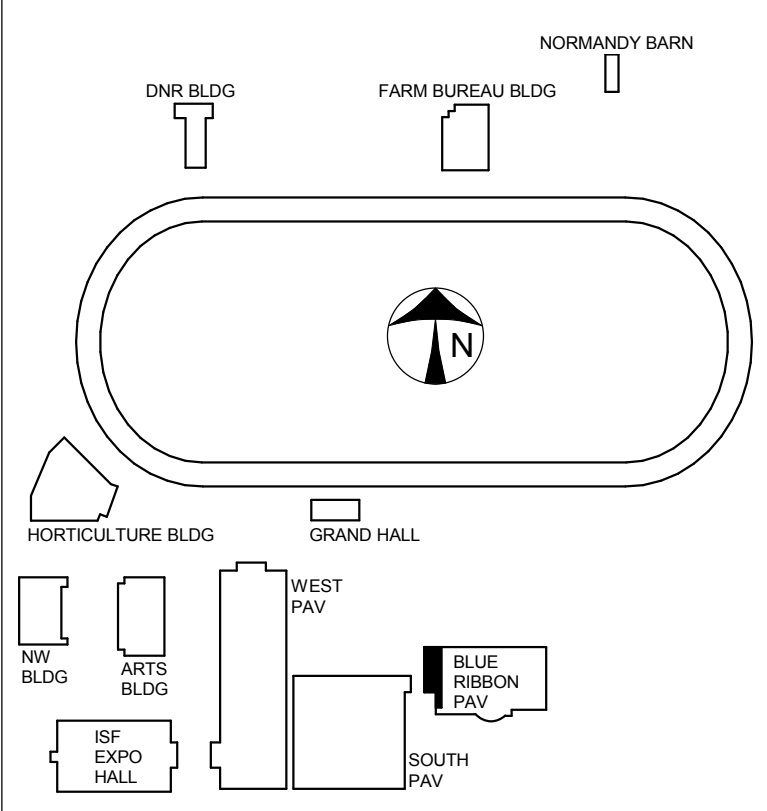
CONSULTANTS



*E. E. Lohrman*

INDIANA STATE FAIRGROUNDS HVAC REPLACEMENTS  
OWNER  
INDIANA STATE FAIRGROUNDS  
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INDIANAPOLIS, IN 46205

**KEY PLAN  
NOT TO SCALE**



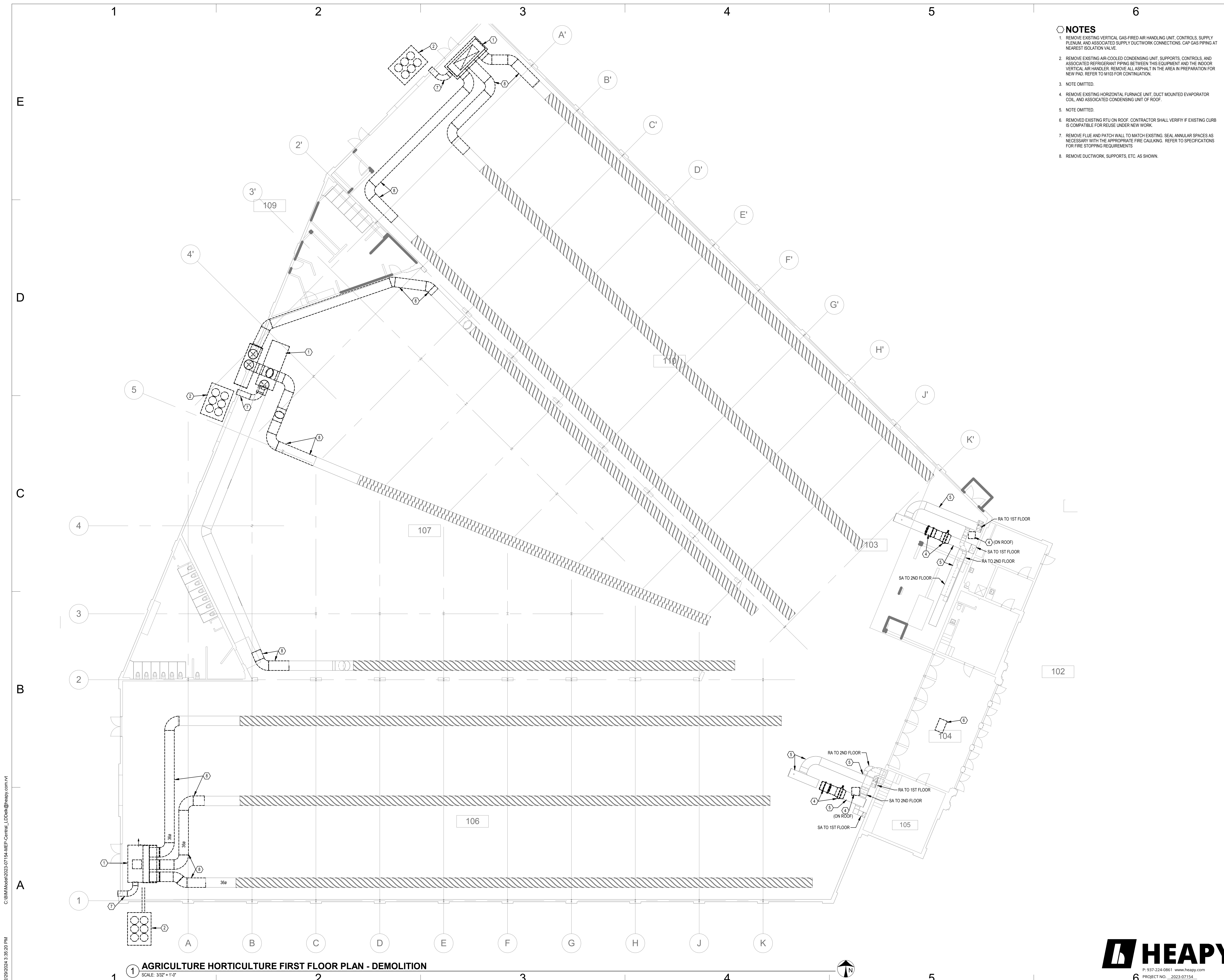
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SHEET TITLE  
**BLUE RIBBON PAVILLION  
HVAC PLANS**

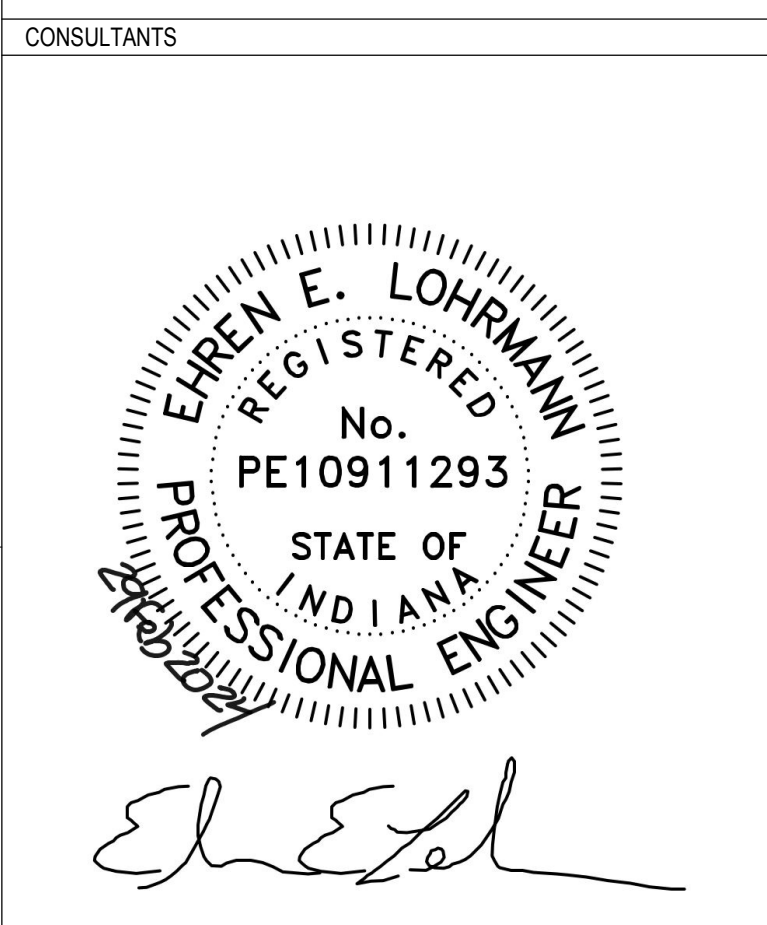
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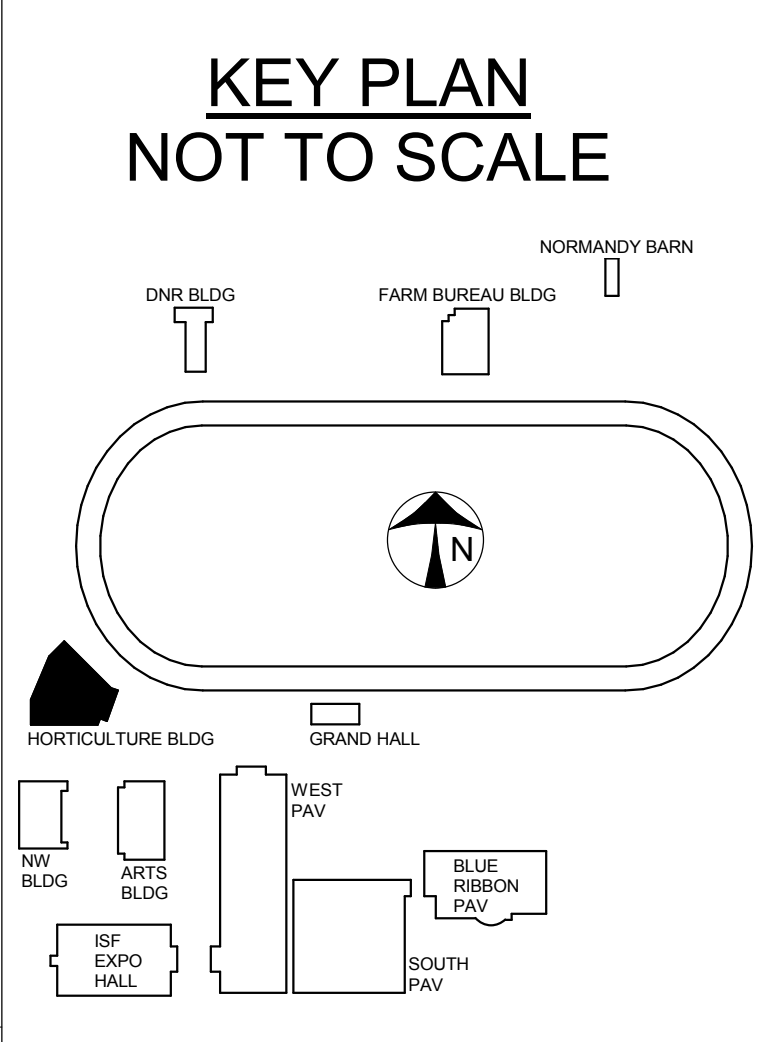
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- NOTES**
1. REMOVE EXISTING VERTICAL GAS-FIRED AIR HANDLING UNIT, CONTROLS, SUPPLY PLENUM, AND ASSOCIATED SUPPLY DUCTWORK CONNECTIONS, CAP GAS PIPING AT NEAREST ISOLATION VALVE.
  2. REMOVE EXISTING AIR-COOLED CONDENSING UNIT, SUPPORTS, CONTROLS, AND ASSOCIATED REFRIGERANT PIPING BETWEEN THIS EQUIPMENT AND THE INDOOR VERTICAL AIR HANDLER. REMOVE ALL ASPHALT IN THE AREA IN PREPARATION FOR NEW PAD. REFER TO M103 FOR CONTINUATION.
  3. NOTE OMITTED.
  4. REMOVE EXISTING HORIZONTAL FURNACE UNIT, DUCT MOUNTED EVAPORATOR COIL, AND ASSOCIATED CONDENSING UNIT OF ROOF.
  5. NOTE OMITTED.
  6. REMOVED EXISTING RTU ON ROOF. CONTRACTOR SHALL VERIFY IF EXISTING CURB IS COMPATIBLE FOR REUSE UNDER NEW WORK.
  7. REMOVE FLUE AND PATCH WALL TO MATCH EXISTING. SEAL ANNUAL SPACES AS NECESSARY WITH THE APPROPRIATE FIRE CAULKING. REFER TO SPECIFICATIONS FOR FIRE STOPPING REQUIREMENTS.
  8. REMOVE DUCTWORK, SUPPORTS, ETC. AS SHOWN.



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 OWNER  
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SHEET TITLE  
**AG-HORTICULTURE BLDG. HVAC - DEMOLITION**  
 MD103



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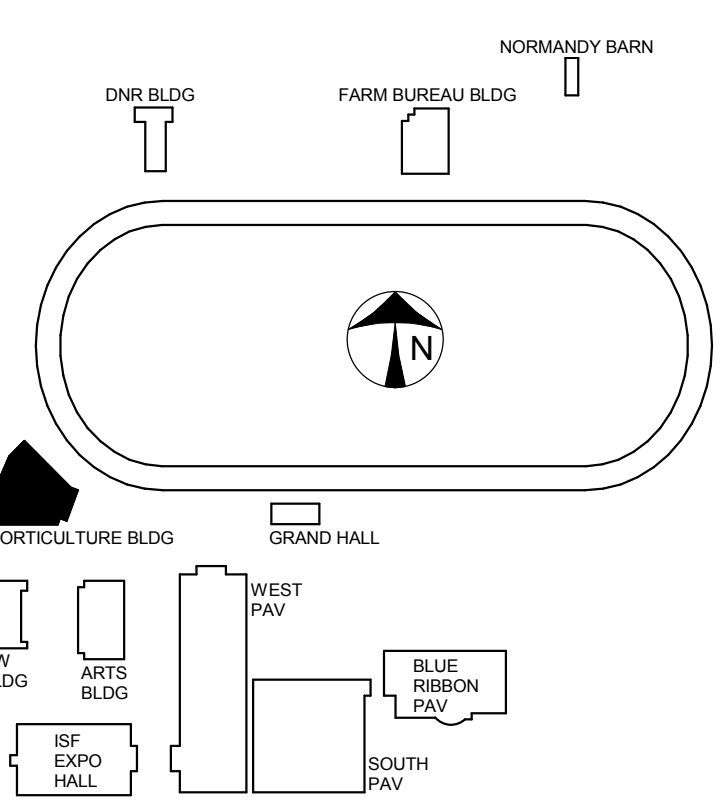
CONSULTANTS



*E. E. Edelman*

INDIANA STATE  
FAIRGROUNDS HVAC  
REPLACEMENTS  
INDIANA STATE  
FAIRGROUNDS  
1202 E. 38TH ST,  
INDIANAPOLIS, IN 46205

**KEY PLAN**  
NOT TO SCALE



MARK	DATE	DESCRIPTION

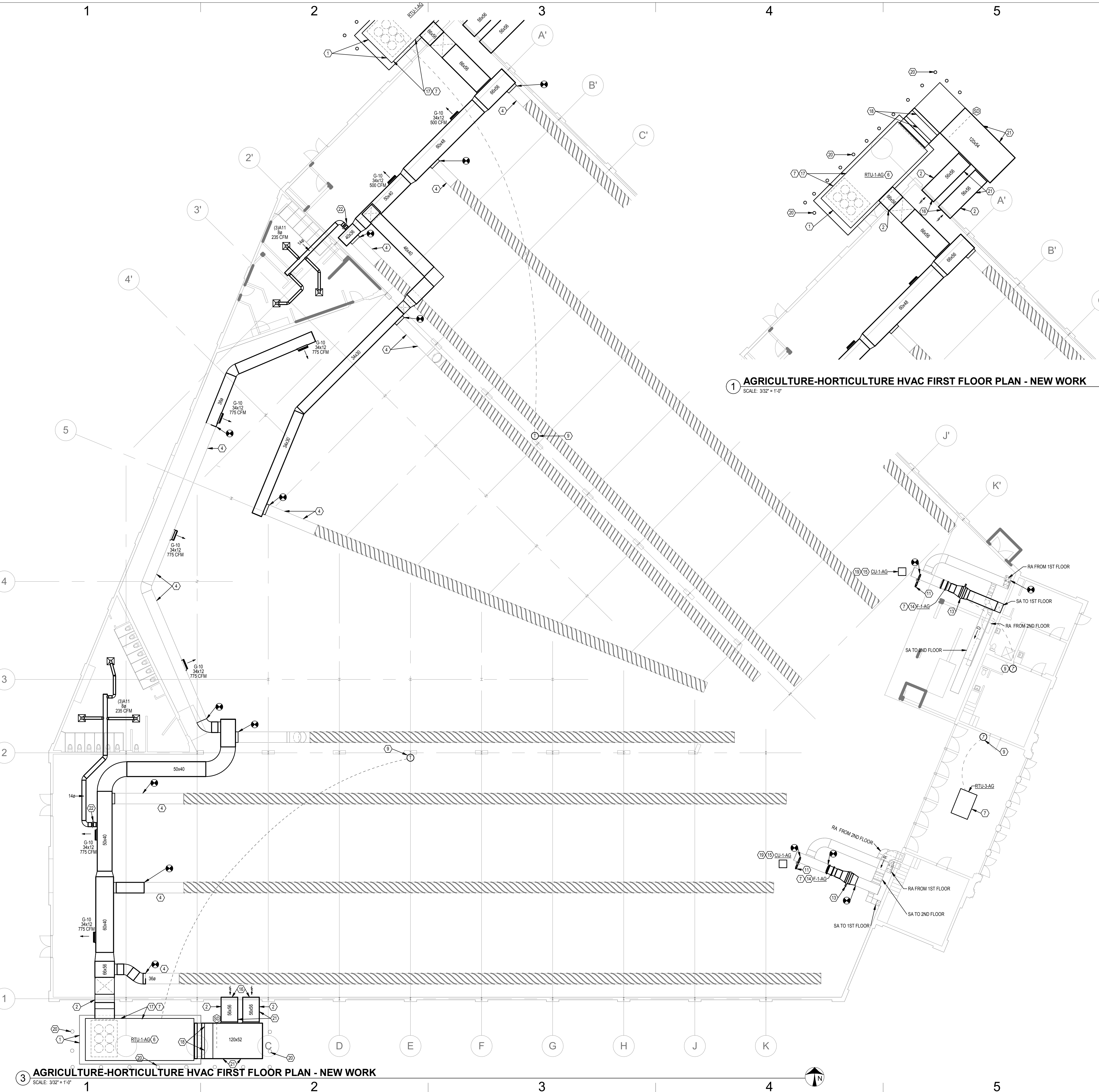
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**AG-HORTICULTURE  
BLDG. HVAC - NEW WORK**

M103

**NOTES**

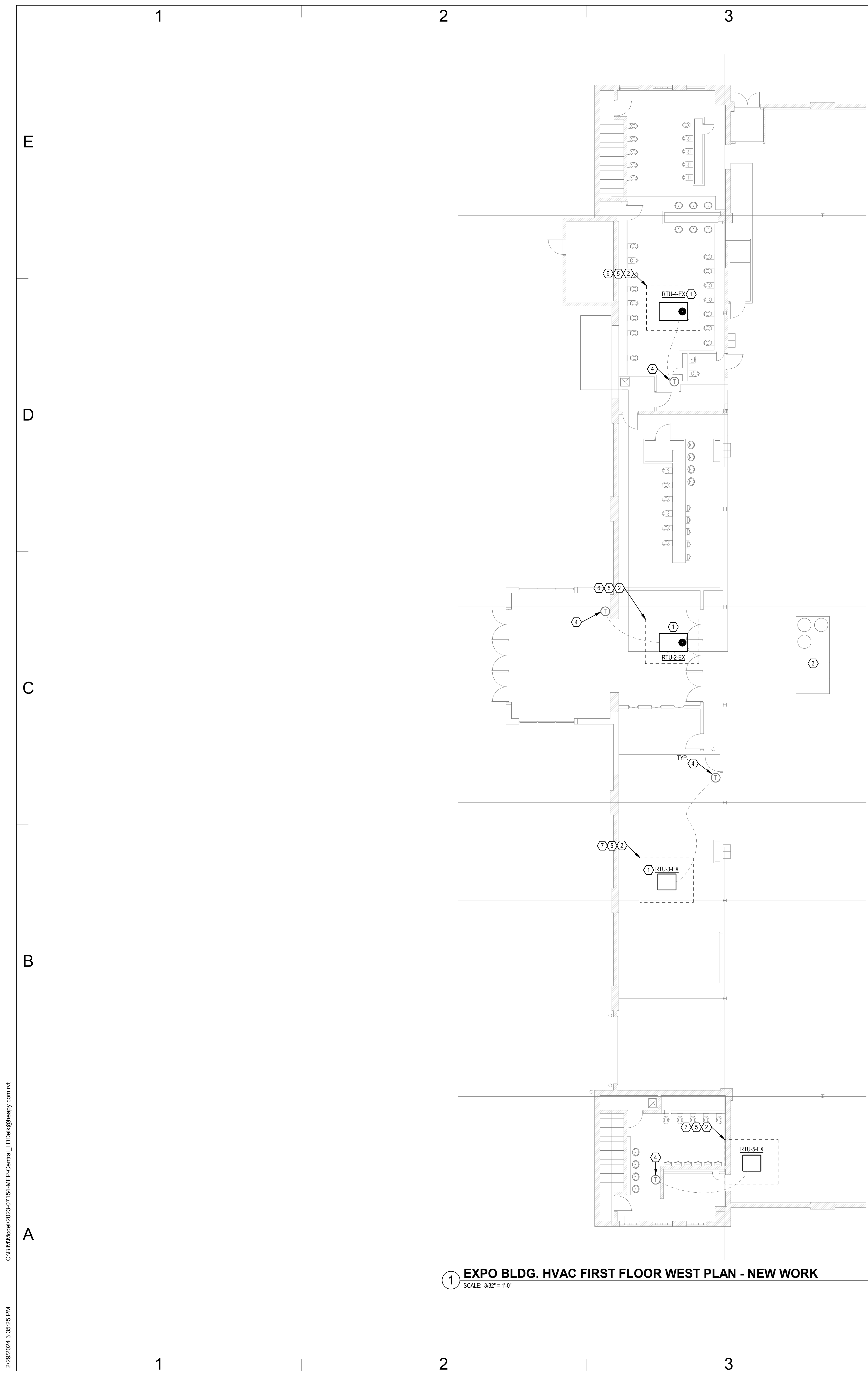
1. MOUNT NEW PACKAGED AIR HANDLING UNIT ON GRADE AS SHOWN WITH NEW CONCRETE PAD AND BOLLARDS BY GENERAL CONTRACTOR. UNIT SHALL SIT ON A 60" TALL PLENUM CURB TO ALLOW FOR SPECIFIC SUPPLY AND RETURN OPENINGS THAT WORK WITH SPACE CONSTRAINTS AND DUCTWORK REQUIREMENTS.
2. PROVIDE NEW WALL PENETRATION TO ACCOMMODATE NEW DUCTWORK THRU WALL. PROVIDE A WALL SLEEVE PER SPECIFICATIONS AND SEAL WEATHERTIGHT.
3. NOTE OMITTED.
4. FIELD VERIFY EXISTING ROUND DUCT DIMENSIONS.
5. NOTE OMITTED.
6. UNIT IS BEING PROVIDED WITH A PLENUM CURB TO ALLOW FOR SIDEWALL SUPPLY AND RETURN OPENINGS DIRECTLY INTO THE BUILDING. COORDINATE FINAL CURB PENETRATION HEIGHTS WITH FINAL CURB LAYOUT.
7. EXTEND NEW GAS PIPING FROM EXISTING GAS PIPE ISOLATION VALVE NEAR UNIT. ENSURE EXTERIOR DUCTWORK IS INSULATED AND COVERED WITH A PROTECTIVE JACKING PER SPECIFICATIONS. REFER TO EQUIPMENT SCHEDULE FOR NEW EQUIPMENT PERFORMANCE REQUIREMENTS. MODIFY EXISTING GAS PIPING AS REQUIRED AND EXTEND TO NEW UNIT. IF GAS PRESSURE IS ABOVE MANUFACTURER'S RECOMMENDED GAS PRESSURE, PROVIDE NATURAL GAS PRESSURE REGULATOR AND SET TO 8.5" W.C.
8. NOTE OMITTED.
9. PROVIDE NEW 7 DAY PROGRAMMABLE CONTROLLER WITH INTEGRAL THERMOSTAT. REVIEW INSTALLATION LOCATION IN THE FIELD WITH OWNER AND ENGINEER PRIOR TO INSTALLATION.
10. NOTE OMITTED.
11. ROUTE A 4" DUCT UP TO ROOF ABOVE AND TERMINATE WITH GOOSENECK. SEAL PENETRATION WATER TIGHT. BALANCE DAMPER TO 50 CFM.
12. NOTE OMITTED.
13. EVAPORATOR COIL  
INDOOR COIL PARAMETERS  
UNIT MODEL: CARRIER CNHP9617ALA  
SIZE: 3 TONS  
INDOOR COIL DIMENSIONS: 20.75" L 17.5" W 22" H  
UNIT WEIGHT: 50 LB  
EAT: 800F F DBWB  
LAT: 60.755.2 F DBWB  
CAPACITY: 33.8 MBH TOTAL AND 25.0 MBH SENSIBLE
14. F-1-AG  
FURNACE MODEL: CARRIER 90TP  
HEATING CAPACITY: 80,000 BTUH  
UNIT DIMENSIONS: 29.5" L 17.5" W 35" H  
UNIT WEIGHT: 145 LB  
EXTERNAL STATIC PRESSURE: 0.5" wg  
AIRFLOW: 1200 CFM  
ELECTRICAL: 115V-1P-60Hz 10.9 MCA 15 A MOCP
15. CU-1-AG  
CONDENSING UNIT MODEL: CARRIER 24PAT30W03  
ELECTRICAL: 208/230V-1P-60Hz 19.8 MCA 35 A MOCP  
COOLING AMBIENT CONDITION: 95 F DB
16. TERMINATE RETURN DUCTWORK WITH HEAVY GAUGE 1" MESH BIRD SCREEN. PROVIDE SUPPLEMENTAL STEEL SHAPES AS REQUIRED TO CREATE A RIGID MESH GRID.
17. INSTALL NEW PAD PER DETAIL 5 ON SHEET M501. PAD SHALL PROVIDE FOR A LEVEL SURFACE FOR MOUNTING OF CURB FOR PACKAGED UNIT TO SIT ON.
18. PROVIDE FILTER BANK PACK EQUAL TO CAMFIL FARR V-BANK. FILTER BANK SHALL BE 5 FILTERS WIDE AND 2 FILTERS DEEP BASED ON A 24"x24" NOMINAL FILTER. FILTER BANK SHALL BE 100%SF AND HAVE ACCESS DOORS ON EITHER SIDE FOR FILTER CHANGEOUT. PROVIDE MERV 8 FILTERS FOR FILTER BANK. FILTER BANK SHALL BE DESIGNED FOR 40,000 CFM AT MAXIMUM 500 FPM VELOCITY.
19. PROVIDE NEW OUTDOOR AIR-COOLED HEAT PUMP UNIT FOR EACH INDOOR UNIT. PROVIDE NEW EQUIPMENT RAILS. REFER TO DETAIL 1 ON SHEET M501.
20. LOCATE BOLLARDS AROUND UNIT FOR PROTECTION. COORDINATE BOLLARD LOCATION WITH ACCESS DOORS TO ALLOW ACCESS INTO THE UNIT FOR MAINTENANCE.
21. STRUCTURAL ENGINEER SHALL DESIGN UNISTRUT SUPPORT SYSTEM TO FOR DUCTWORK LOCATED OUTSIDE THE BUILDING.
22. PROVIDE BALANCING DAMPER IN DUCTWORK SERVING THE RESTROOM.

**1 AGRICULTURE-HORTICULTURE HVAC FIRST FLOOR PLAN - NEW WORK**  
SCALE: 3/32" = 1'-0"

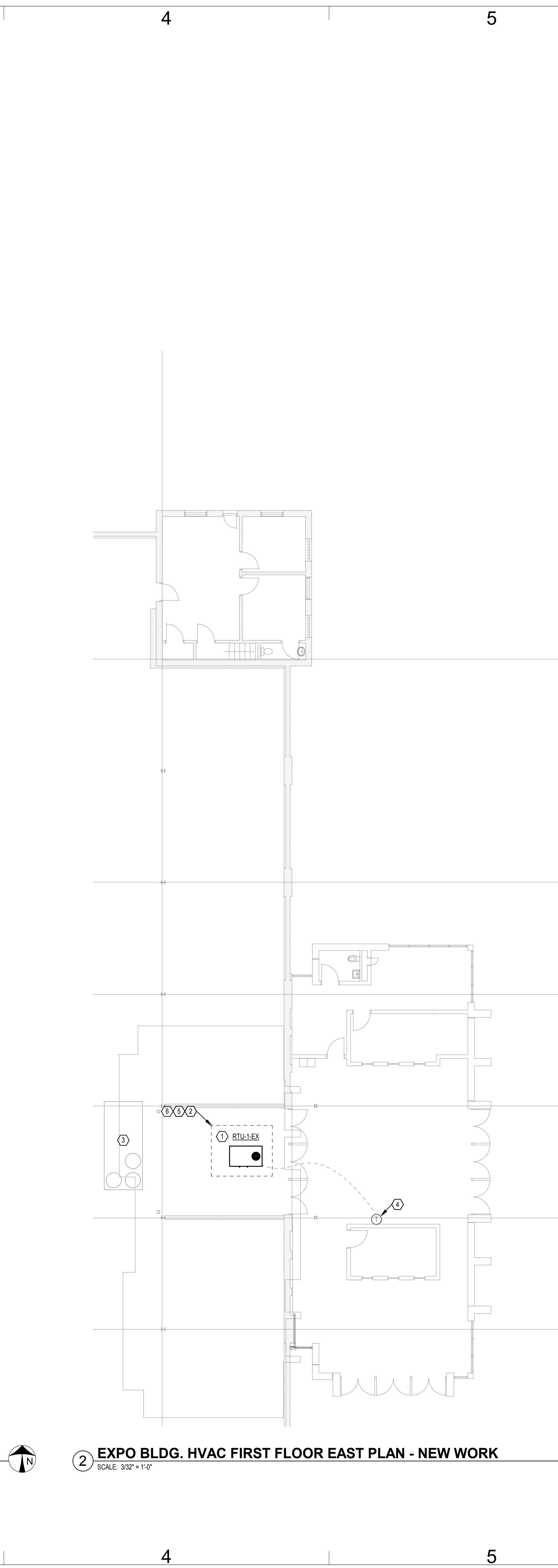


**3 AGRICULTURE-HORTICULTURE HVAC FIRST FLOOR PLAN - NEW WORK**  
SCALE: 3/32" = 1'-0"

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1 EXPO BLDG. HVAC FIRST FLOOR WEST PLAN - NEW WORK  
SCALE: 3/32" = 1'-0"



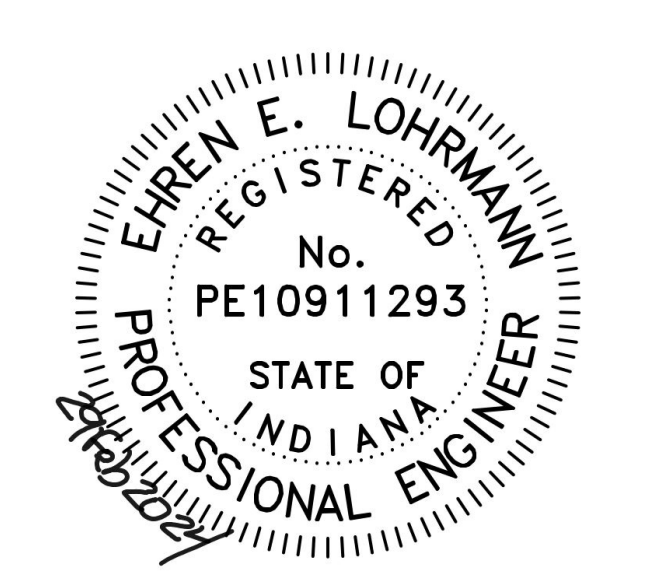
2 EXPO BLDG. HVAC FIRST FLOOR EAST PLAN - NEW WORK  
SCALE: 3/32" = 1'-0"

NOTES

1. REMOVE EXISTING PACKAGED ROOFTOP UNIT AND ASSOCIATED DUCT CONNECTION, CONTROLS, AND GAS PIPING TO ISOLATION VALVE. MAINTAIN EXISTING ROOF CURB. PROVIDE NEW PACKAGE ROOFTOP. PROVIDE ROOF CURB ADAPTER. MAKE DUCT MODIFICATIONS TO CONNECT NEW PACKAGED ROOFTOP UNIT TO EXISTING DUCTWORK. MODIFY EXISTING GAS PIPING AS REQUIRED AND EXTEND TO NEW UNIT. IF GAS PRESSURE IS ABOVE MANUFACTURER'S RECOMMENDED GAS PRESSURE, PROVIDE NATURAL GAS PRESSURE REGULATOR AND SET TO 8.5" W.C.
2. EQUIPMENT IS LOCATED ON THE ROOF ABOVE.
3. EXISTING EQUIPMENT TO REMAIN AND BE REUSED.
4. EXISTING THERMOSTAT TO REMAIN.
5. REUSE EXISTING THERMOSTAT. EXTEND CONTROL WIRING FROM EXISTING RTU CONNECTION TO NEW RTU CONTROL PANEL. CONTRACTOR SHALL VERIFY LOCATIONS OF EXISTING THERMOSTATS PRIOR TO REMOVING EXISTING THERMOSTAT.
6. RTU IS EXPECTED TO BE A DIRECT REPLACEMENT AND NO CURB ADAPTER REQUIRED. IF BASIS OF DESIGN UNIT IS NOT SELECTED, A CURB ADAPTER MAY BE REQUIRED AND COST CARRIED BY CONTRACTOR.
7. PROVIDE ROOF CURB ADAPTER FOR UNIT TO ALLOW FOR ALIGNMENT OF SUPPLY AND RETURN OPENINGS WITH EXISTING DUCTWORK LAYOUT.

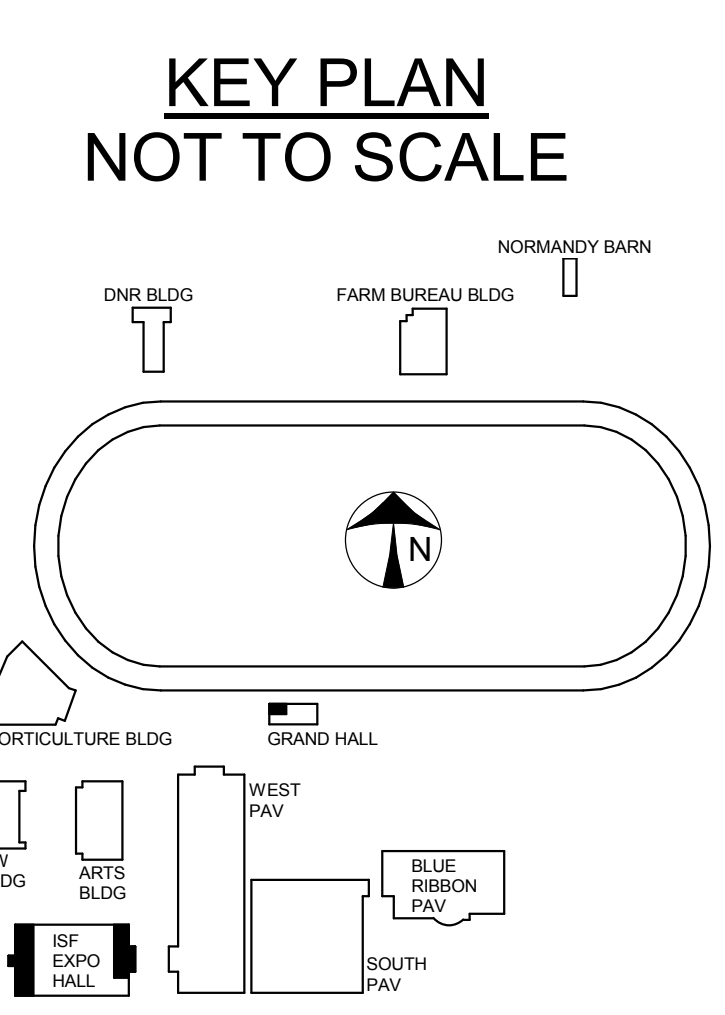


CONSULTANTS



*E. E. Lohrman*

INDIANA STATE FAIRGROUNDS HVAC REPLACEMENTS  
OWNER  
INDIANA STATE FAIRGROUNDS  
1202 E. 38TH ST,  
INDIANAPOLIS, IN 46205



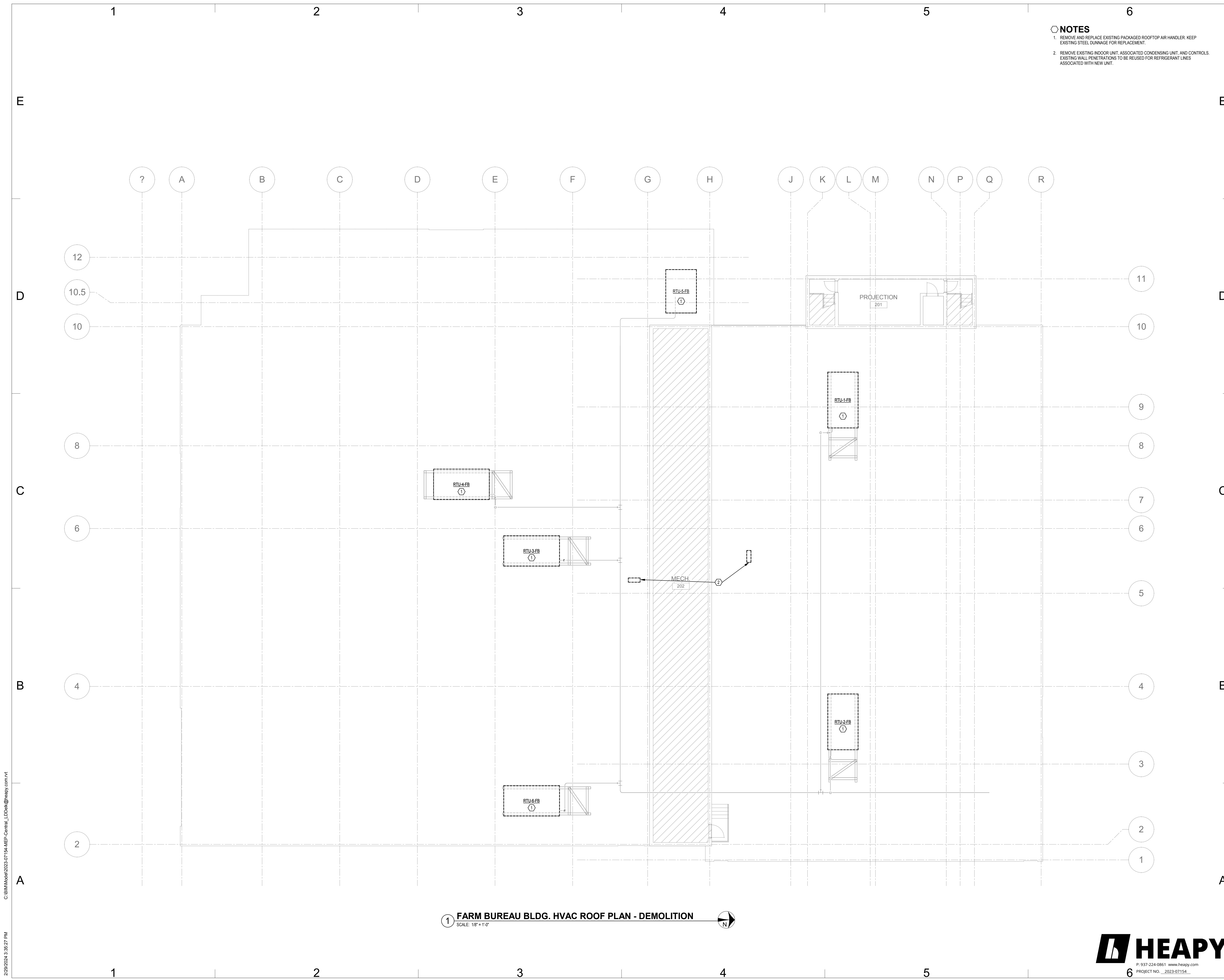
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SHEET TITLE  
EXPOSITION HALL HVAC FLOOR PLANS

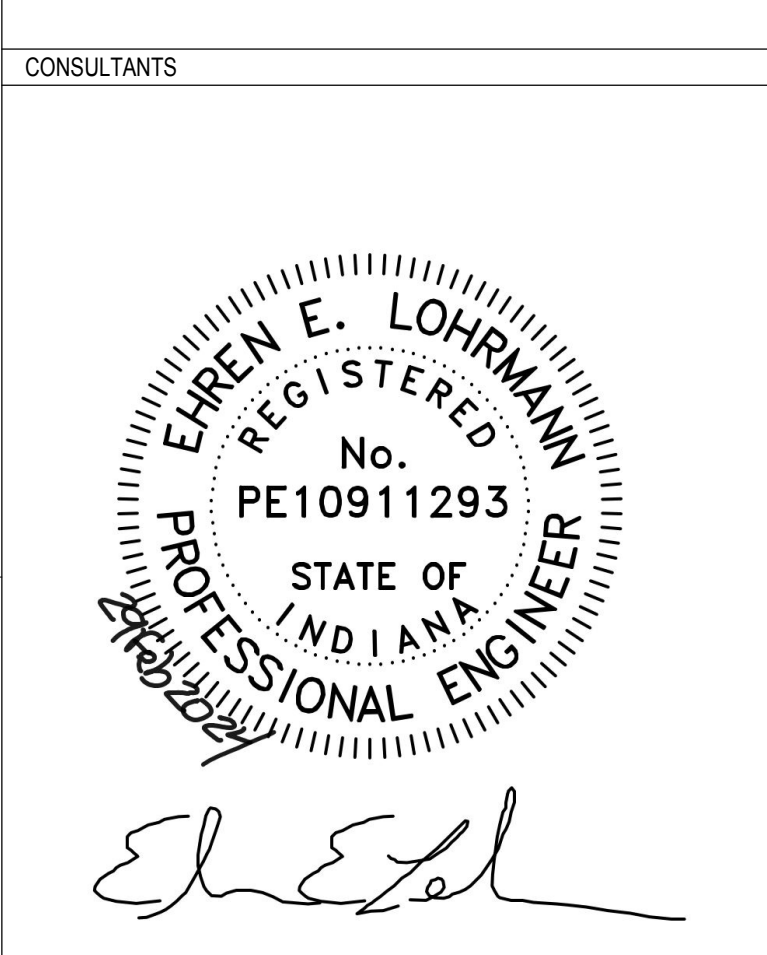
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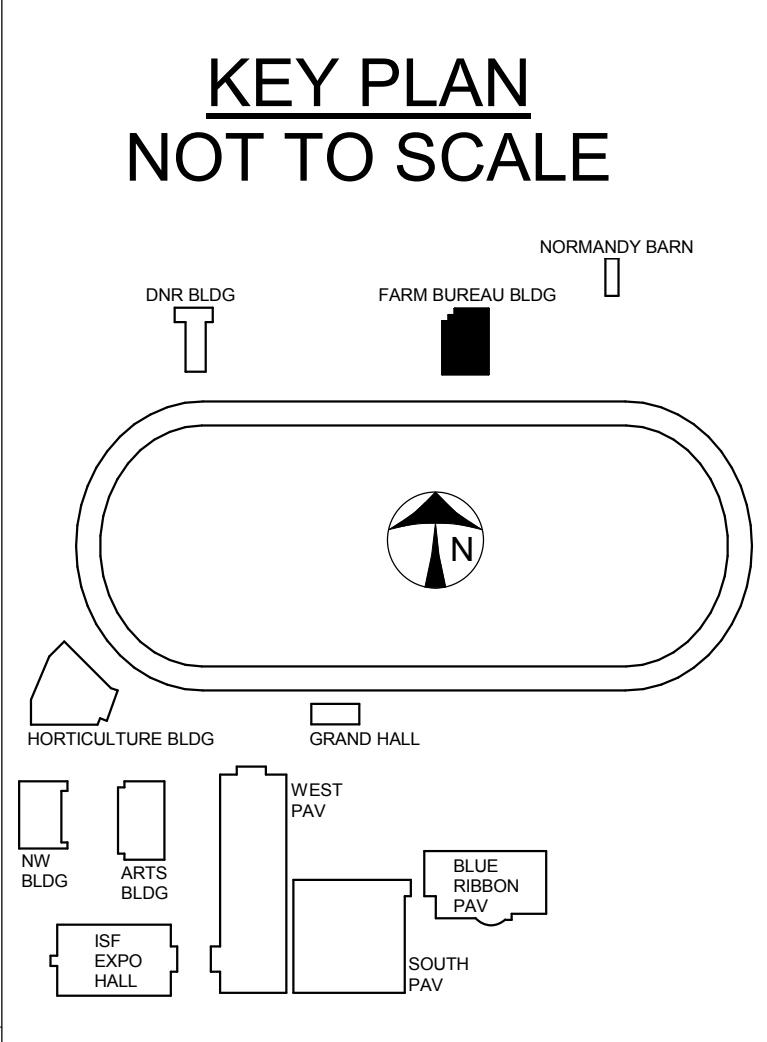


- NOTES**
- REMOVE AND REPLACE EXISTING PACKAGED ROOFTOP AIR HANDLER. KEEP EXISTING STEEL DUNNAGE FOR REPLACEMENT.
  - REMOVE EXISTING INDOOR UNIT, ASSOCIATED CONDENSING UNIT, AND CONTROLS. EXISTING WALL PENETRATIONS TO BE REUSED FOR REFRIGERANT LINES ASSOCIATED WITH NEW UNIT.



INDIANA STATE FAIRGROUNDS HVAC REPLACEMENTS

OWNER  
INDIANA STATE FAIRGROUNDS  
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INDIANAPOLIS, IN 46205



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**1 FARM BUREAU BLDG. HVAC ROOF PLAN - DEMOLITION**  
SCALE: 1/8" = 1'-0"



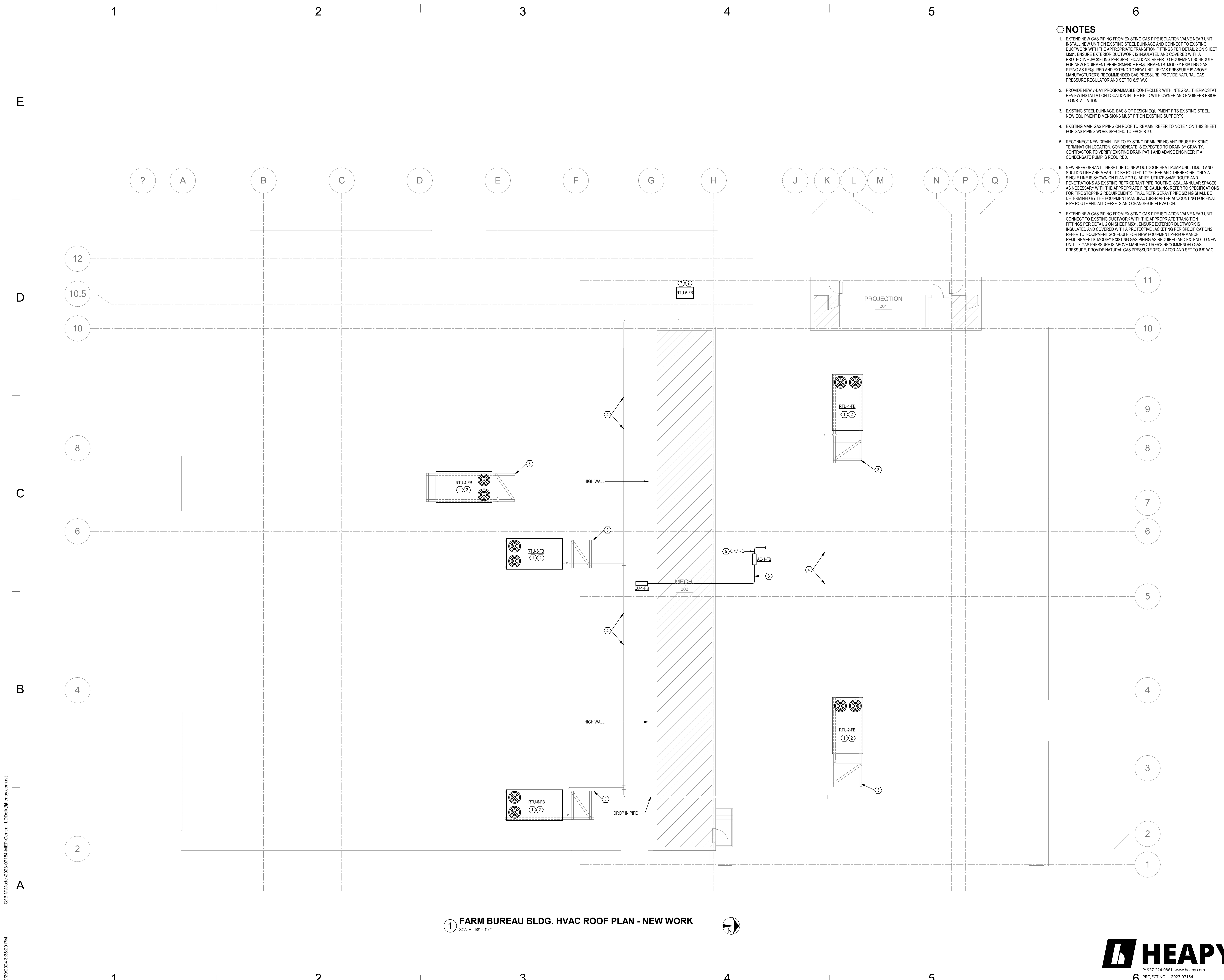
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MD105

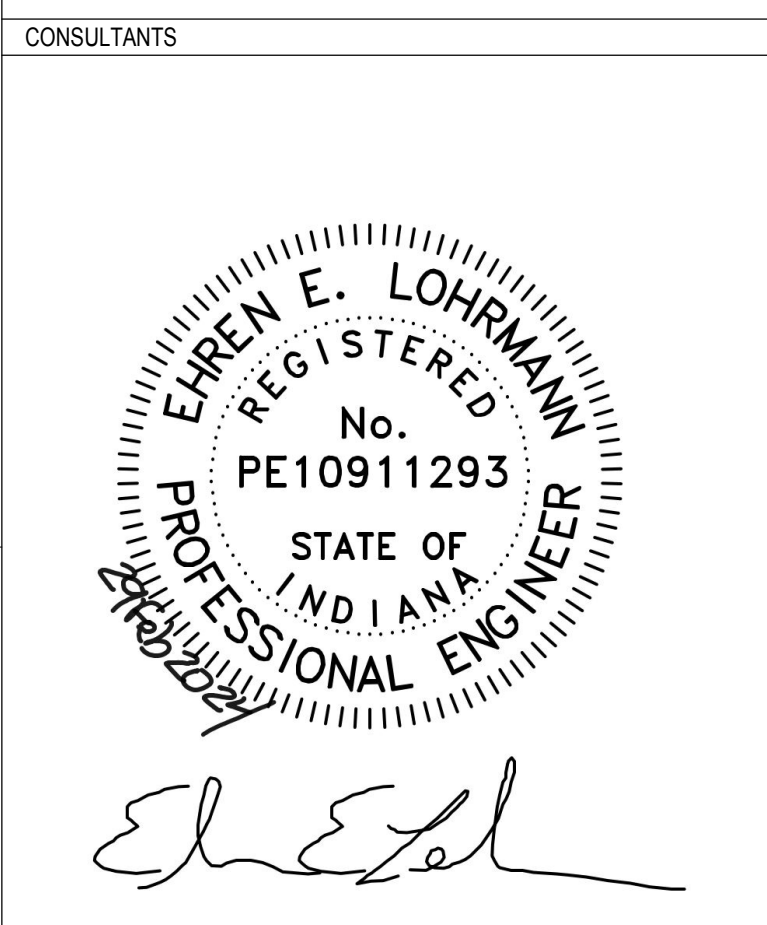
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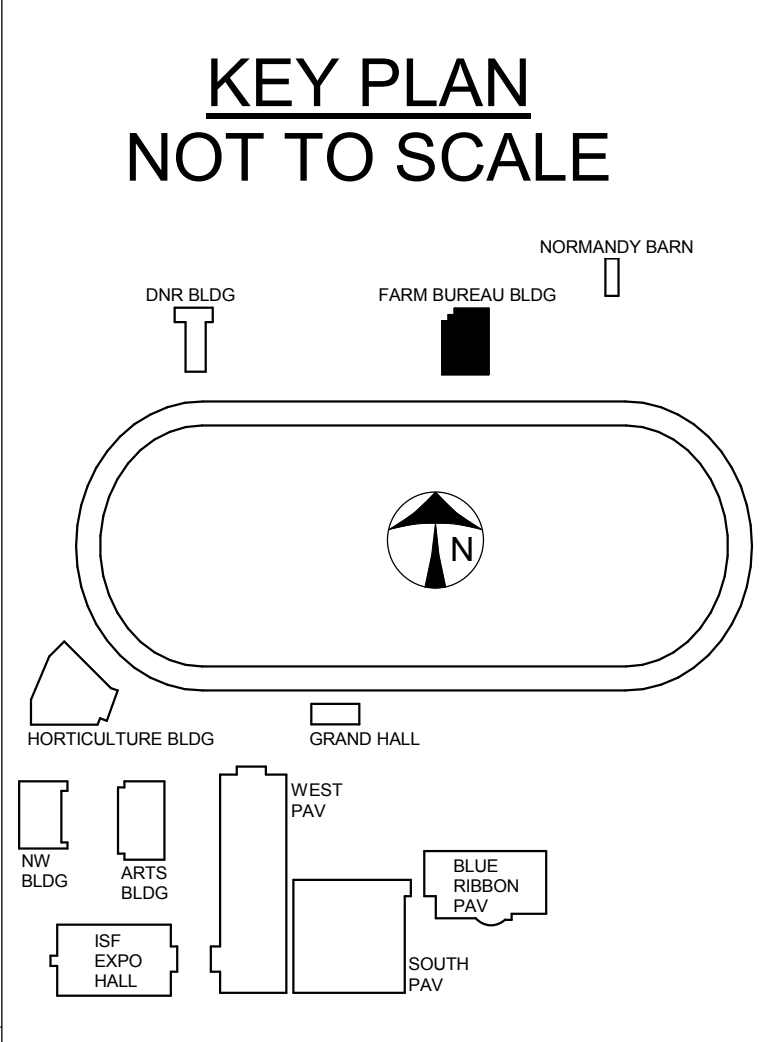




- NOTES**
- EXTEND NEW GAS PIPING FROM EXISTING GAS PIPE ISOLATION VALVE NEAR UNIT. INSTALL NEW UNIT ON EXISTING STEEL DUNNAGE AND CONNECT TO EXISTING DUCTWORK WITH THE APPROPRIATE TRANSITION FITTINGS PER DETAIL 2 ON SHEET M01. ENSURE EXTERIOR DUCTWORK IS INSULATED AND COVERED WITH A PROTECTIVE JACKETING PER SPECIFICATIONS. REFER TO EQUIPMENT SCHEDULE FOR NEW EQUIPMENT PERFORMANCE REQUIREMENTS. MODIFY EXISTING GAS PIPING AS REQUIRED AND EXTEND TO NEW UNIT. IF GAS PRESSURE IS ABOVE MANUFACTURER'S RECOMMENDED GAS PRESSURE, PROVIDE NATURAL GAS PRESSURE REGULATOR AND SET TO 8.5" W.C.
  - PROVIDE NEW 7 DAY PROGRAMMABLE CONTROLLER WITH INTEGRAL THERMOSTAT. REVIEW INSTALLATION LOCATION IN THE FIELD WITH OWNER AND ENGINEER PRIOR TO INSTALLATION.
  - EXISTING STEEL DUNNAGE BASIS OF DESIGN EQUIPMENT FITS EXISTING STEEL. NEW EQUIPMENT DIMENSIONS MUST FIT ON EXISTING SUPPORTS.
  - EXISTING MAIN GAS PIPING ON ROOF TO REMAIN. REFER TO NOTE 1 ON THIS SHEET FOR GAS PIPING WORK SPECIFIC TO EACH RTU.
  - RECONNECT NEW DRAIN LINE TO EXISTING DRAIN PIPING AND REUSE EXISTING TERMINATION LOCATION. CONDENSATE IS EXPECTED TO DRAIN BY GRAVITY. CONTRACTOR TO VERIFY EXISTING DRAIN PATH AND ADVISE ENGINEER IF A CONDENSATE PUMP IS REQUIRED.
  - NEW REFRIGERANT LINESET UP TO NEW OUTDOOR HEAT PUMP UNIT. LIQUID AND SUCTION LINE ARE MEANT TO BE ROUTED TOGETHER AND THEREFORE, ONLY A SINGLE LINE IS SHOWN ON PLAN FOR CLARITY. UTILIZE SAME ROUTE AND PENETRATIONS AS EXISTING REFRIGERANT PIPE ROUTING. SEAL ANNULAR SPACES AS NECESSARY WITH THE APPROPRIATE FIRE CAULKING. REFER TO SPECIFICATIONS FOR FIRE STOPPING REQUIREMENTS. FINAL REFRIGERANT PIPE SIZING SHALL BE DETERMINED BY THE EQUIPMENT MANUFACTURER AFTER ACCOUNTING FOR FINAL PIPE ROUTE AND ALL OFFSETS AND CHANGES IN ELEVATION.
  - EXTEND NEW GAS PIPING FROM EXISTING GAS PIPE ISOLATION VALVE NEAR UNIT. CONNECT TO EXISTING DUCTWORK WITH THE APPROPRIATE TRANSITION FITTINGS PER DETAIL 2 ON SHEET M01. ENSURE EXTERIOR DUCTWORK IS INSULATED AND COVERED WITH A PROTECTIVE JACKETING PER SPECIFICATIONS. REFER TO EQUIPMENT SCHEDULE FOR NEW EQUIPMENT PERFORMANCE REQUIREMENTS. MODIFY EXISTING GAS PIPING AS REQUIRED AND EXTEND TO NEW UNIT. IF GAS PRESSURE IS ABOVE MANUFACTURER'S RECOMMENDED GAS PRESSURE, PROVIDE NATURAL GAS PRESSURE REGULATOR AND SET TO 8.5" W.C.



INDIANA STATE FAIRGROUNDS HVAC REPLACEMENTS  
 OWNER  
 INDIANA STATE FAIRGROUNDS  
 1202 E. 38TH ST,  
 INDIANAPOLIS, IN 46205



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**1 FARM BUREAU BLDG. HVAC ROOF PLAN - NEW WORK**  
 SCALE: 1/8" = 1'-0"

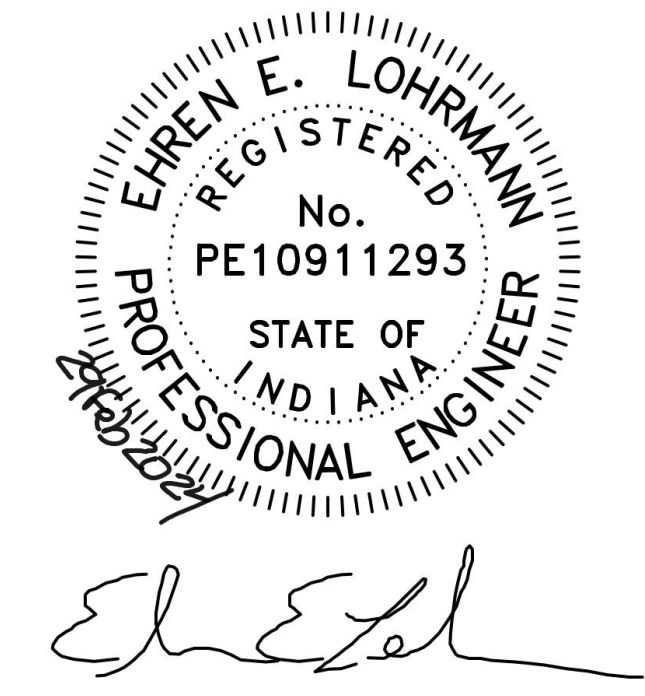


SHEET TITLE  
**FARM BUREAU BLDG. HVAC ROOF PLAN**  
 M105

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**NOTES**

- REMOVE AND REPLACE EXISTING OUTDOOR AIR-COOLED CONDENSING UNIT WITH NEW OUTDOOR HEAT PUMP UNIT. PROVIDE NEW 8" CONCRETE PAD FOR MOUNTING. REFER TO EQUIPMENT DATA BELOW.
- PROVIDE NEW 7-DAY PROGRAMMABLE THERMOSTAT. REVIEW INSTALLATION LOCATION IN THE FIELD WITH OWNER AND ENGINEER PRIOR TO INSTALLATION.
- EXISTING EQUIPMENT TO REMAIN AND BE REUSED.
- REMOVE AND REPLACE EXISTING INDOOR COIL AND EXISTING AIR HANDLER. USE EXISTING PENETRATIONS FOR REFRIGERANT PIPE ROUTING. REUSE EXISTING DRAIN PIPE ROUTING.
- PROVIDE DUCTWORK TRANSITION AS REQUIRED TO CONNECT TO EXISTING DUCTWORK.
- PROVIDE NEW REFRIGERANT PIPING TO CONDENSING UNIT.

**EQUIPMENT DATA**

1.5-TON NOMINAL UNITARY SPLIT OUTDOOR HEAT PUMP WITH INDOOR COIL.  
BASIS OF DESIGN: CARRIER OUTDOOR MODEL 25SPA AND INDOOR COIL MODEL F4D.

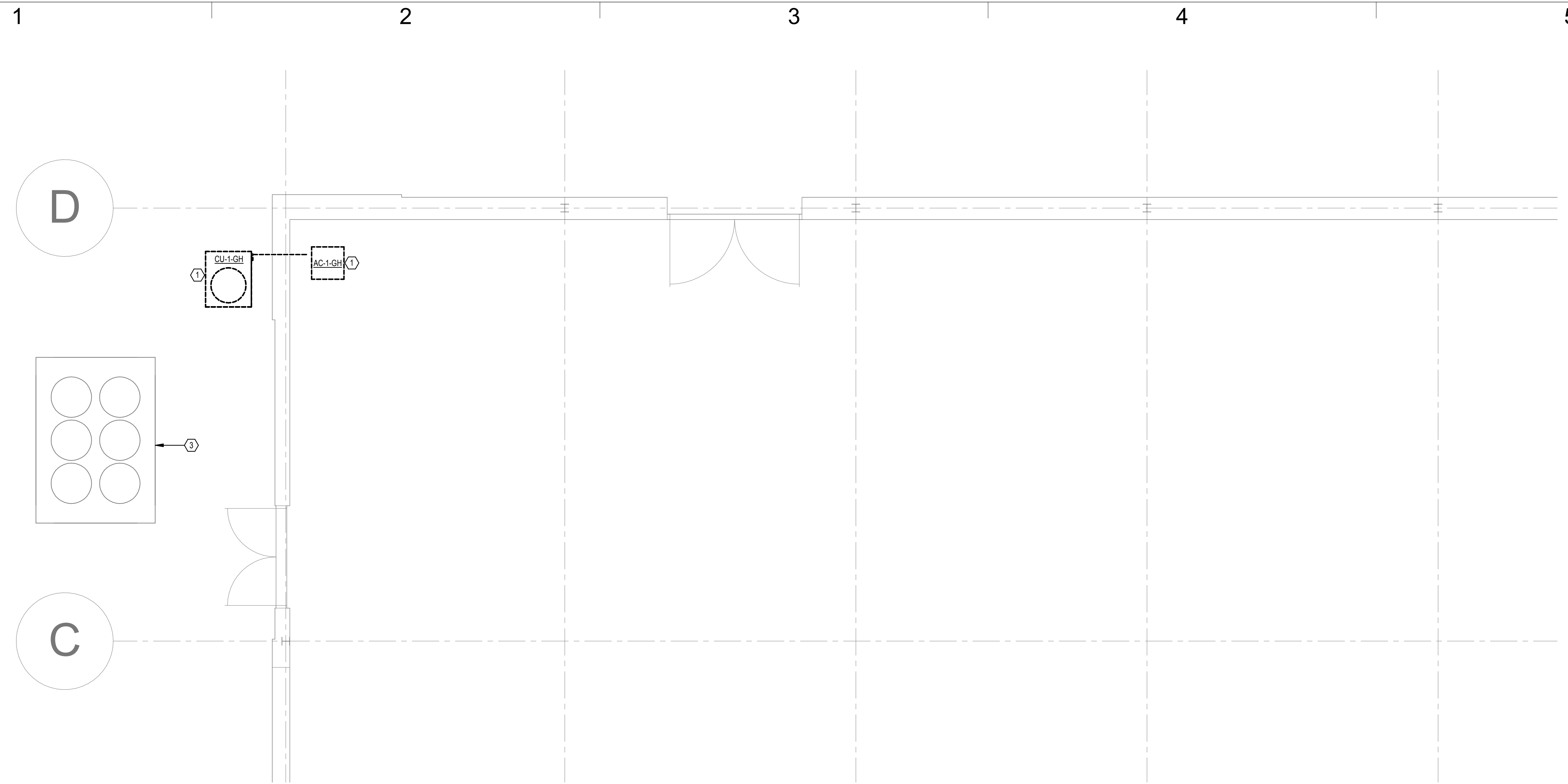
ELECTRICAL: 208 VOLT SINGLE PHASE POWER FOR ALL.

OUTDOOR UNIT POWER: 13.4A MCA, 20A MOCB  
INDOOR UNIT POWER: 2.9 MCA, 208V-1P  
SUPPLY FAN CFM: 600

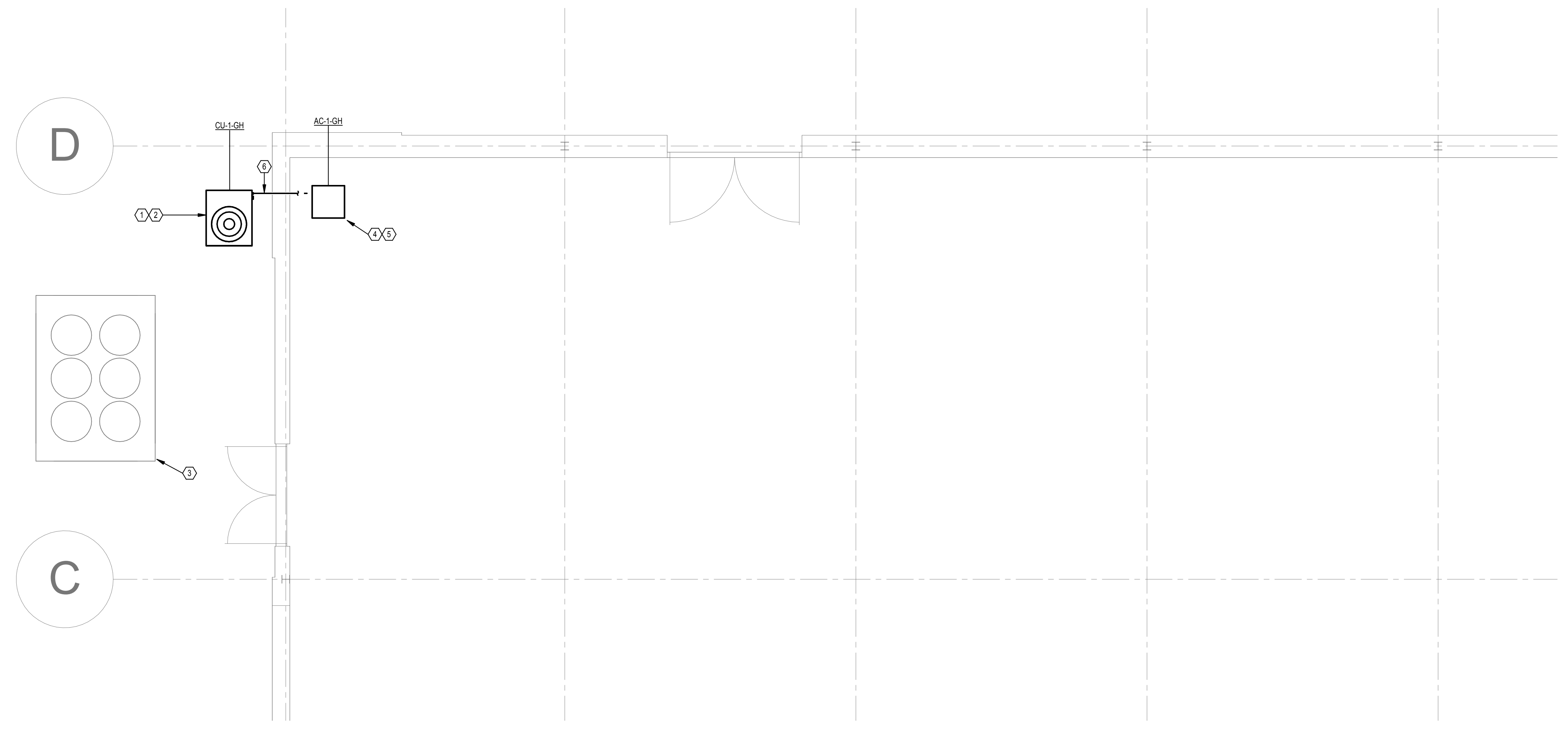
COOLING PERFORMANCE BASED ON 95°F AMBIENT AIR TEMPERATURE, 525 CFM, AND 80/67°F DBWB ENTERING AIR CONDITIONS:  
TOTAL COOLING CAPACITY: 18.2 MBH  
SENSIBLE COOLING CAPACITY: 11.7 MBH  
MIN. REQUIRED EER: 11.5  
MIN. REQUIRED SEER: 14.0

HEAT PUMP HEATING PERFORMANCE BASED ON 17°F AMBIENT AIR TEMPERATURE, 575 CFM, AND 70°F ENTERING AIR TEMPERATURE:  
HEATING CAP. AT 47°F: 19.3 MBH  
HEATING CAP. AT 17°F: 15.1 MBH  
MIN. REQUIRED COP AT 47°F: 3.7 COP  
MIN. REQUIRED COP AT 17°F: 2.4 COP

REFRIGERANT PIPING SIZING SHALL BE MANUFACTURER BASED UPON FINAL REFRIGERANT PIPE ROUTING, OFFSETS, AND LENGTHS. ESTIMATED LIQUID LINE SIZE IS 0.375" AND SUCTION LINE IS 0.875". PROVIDE ADDITIONAL REFRIGERANT CHARGE TO ACCOMMODATE ADDITIONAL REFRIGERANT PIPE LINE LENGTHS.

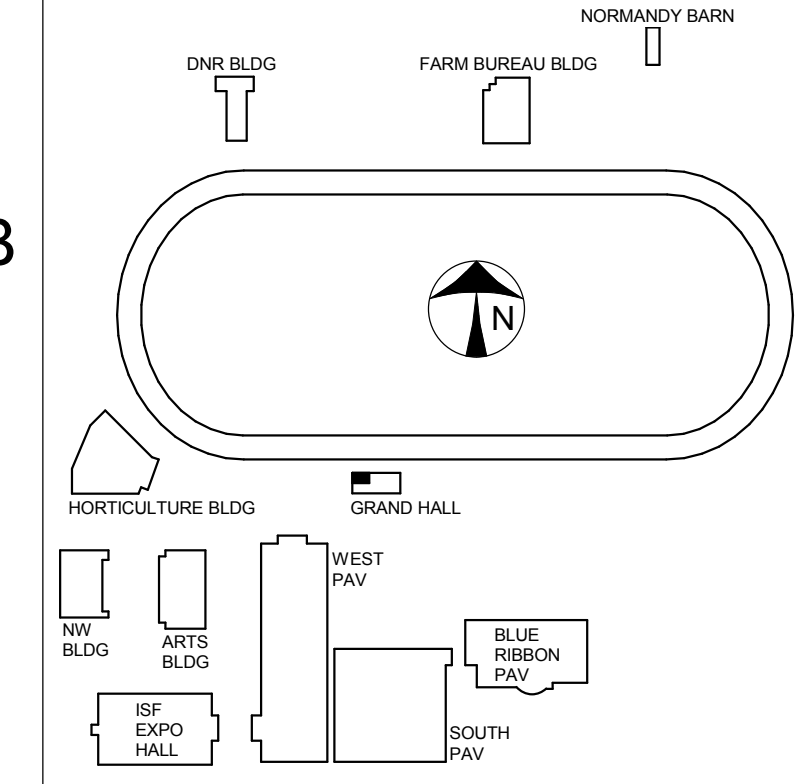


② GRAND HALL HVAC FIRST FLOOR PLAN - DEMOLITION  
SCALE: 1/4" = 1'-0"



① GRAND HALL HVAC FIRST FLOOR PLAN - NEW WORK  
SCALE: 1/4" = 1'-0"

**KEY PLAN**  
NOT TO SCALE



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SHEET TITLE  
**GRAND HALL BLDG. HVAC  
FIRST FLOOR PLAN**

M106

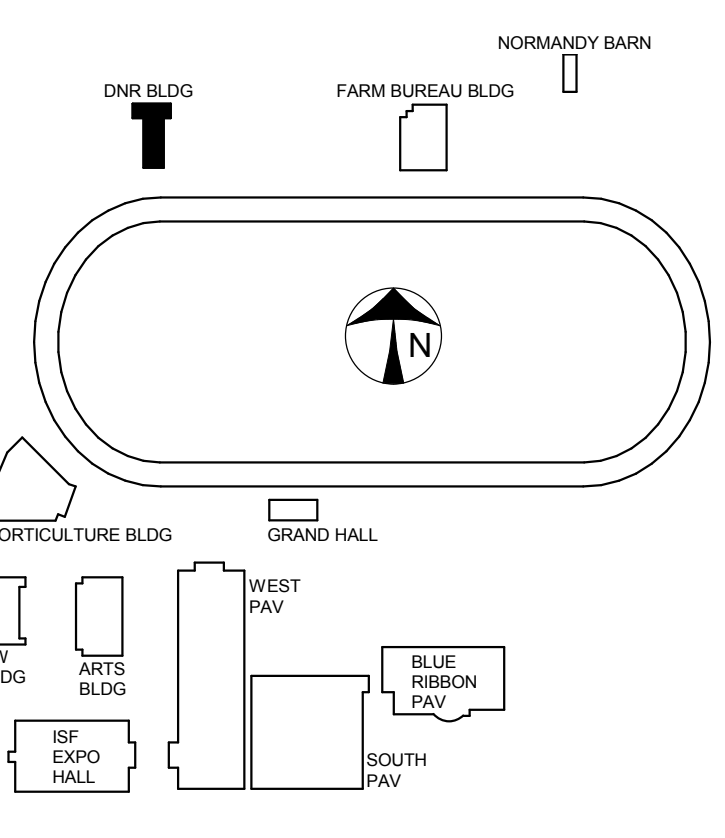
CONSULTANTS



*Elyse E. Lohrman*

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OWNER  
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FAIRGROUNDS  
1202 E. 38TH ST,  
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**KEY PLAN**  
NOT TO SCALE

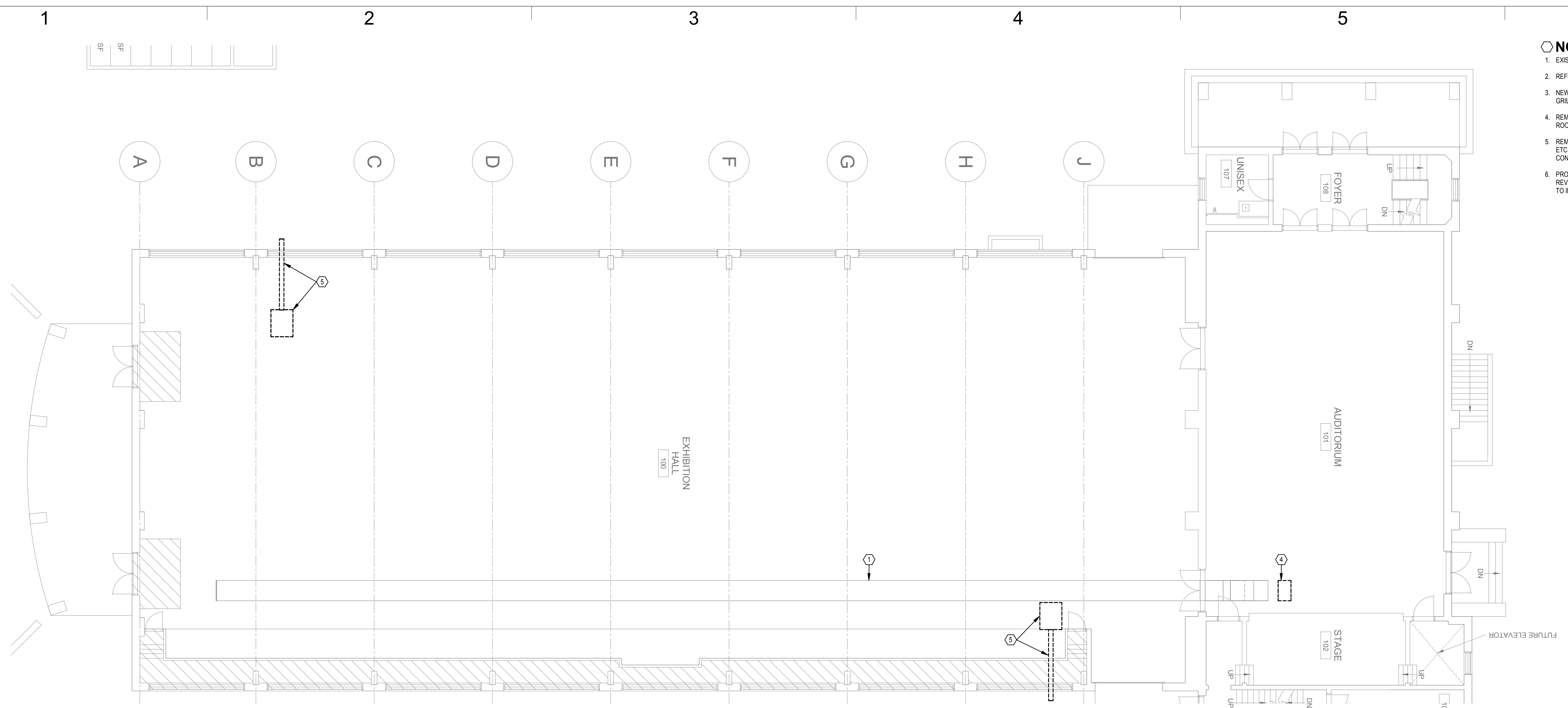


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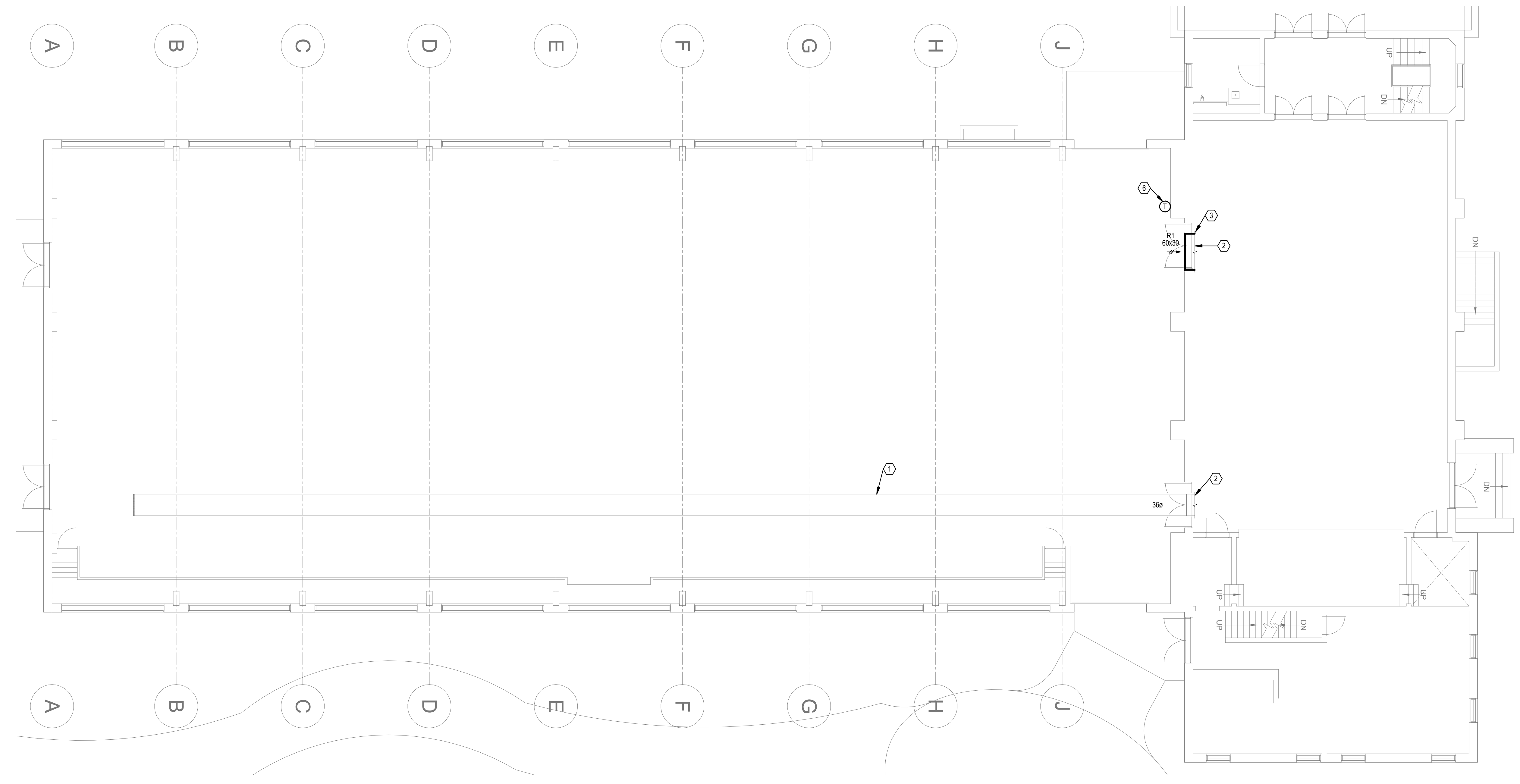
SHEET TITLE  
**DEPT. OF NATURE BLDG  
HVAC FIRST FLOOR PLAN**

M107.1

- NOTES**
- EXISTING DUCTWORK TO REMAIN.
  - REFER TO SHEET M107.2 FOR CONTINUATION OF DUCTWORK ON THE ROOF.
  - NEW WALL PENETRATION TO INSTALL RETURN DUCTWORK AND NEW RETURN GRILLES. SEAL PENETRATION WEATHER TIGHT.
  - REMOVE SECTION OF DUCTWORK AS REQUIRED TO MAKE NEW CONNECTION TO ROOFTOP UNIT.
  - REMOVE GAS FIRED UNIT HEATER, FLUE, AND ASSOCIATED CONTROLS, HANGERS, ETC. SEAL WALL PENETRATION TO MATCH EXISTING EXTERIOR WALL CONSTRUCTION.
  - PROVIDE NEW 7-DAY PROGRAMMABLE CONTROLLER WITH INTEGRAL THERMOSTAT. REVIEW INSTALLATION LOCATION IN THE FIELD WITH OWNER AND ENGINEER PRIOR TO INSTALLATION.



**2 DEPT. OF NATURE BLDG. HVAC FIRST FLOOR PLAN - DEMOLITION**  
SCALE: 1/8" = 1'-0"



**1 DEPT. OF NATURE BLDG. HVAC FIRST FLOOR PLAN - NEW WORK**  
SCALE: 1/8" = 1'-0"

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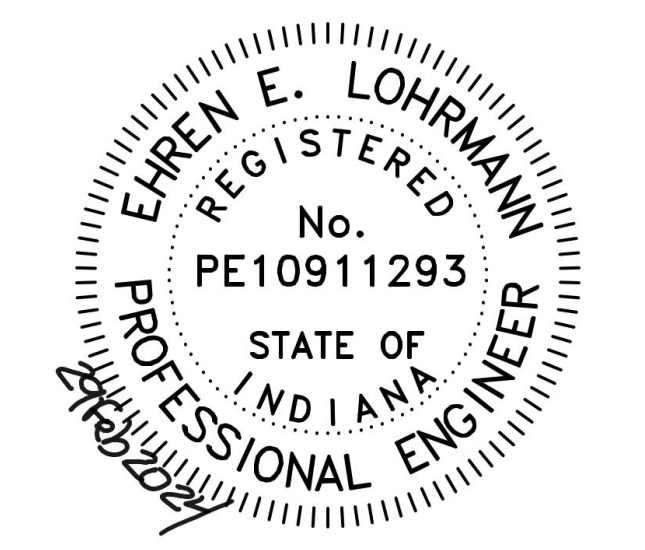
NOTES

- 1. EXTEND AND MODIFY EXISTING GAS PIPING AS REQUIRED AND EXTEND TO NEW UNIT. IF GAS PRESSURE IS ABOVE MANUFACTURER'S RECOMMENDED GAS PRESSURE, PROVIDE NATURAL GAS PRESSURE REGULATOR AND SET TO 8.5" W.C. PROVIDE CURB ADAPTOR FOR NEW EQUIPMENT AND CONNECT TO EXISTING DUCTWORK WITH THE APPROPRIATE TRANSITION FITTINGS PER DETAIL 2 ON SHEET M501. REFER TO EQUIPMENT SCHEDULE FOR NEW EQUIPMENT PERFORMANCE REQUIREMENTS.
- 2. EXISTING EQUIPMENT TO REMAIN. NOT IN SCOPE.
- 3. PROVIDE NEW EQUIPMENT 7-DAY PROGRAMMABLE CONTROLLER WITH INTEGRAL THERMOSTAT. REVIEW INSTALLATION LOCATION SHOWN ON PLANS WITH OWNER PRIOR TO INSTALLATION.
- 4. PROVIDE TRANSITION FITTING BETWEEN FULL SIZE OF EQUIPMENT CONNECTION AND EXISTING SUPPLY DUCTWORK. SUPPORT PER SMACNA. EXTERNALLY WRAP DUCTWORK, AND PROVIDE PROTECTIVE JACKETING PER SPECIFICATIONS. REPAIR AND REPLACE EXISTING INSULATION AS REQUIRED TO ENSURE A CONTINUOUS VAPOR BARRIER.
- 5. REFER TO SHEET M107.1 FOR CONTINUATION OF DUCTWORK.
- 6. SUPPORT NEW DUCT ON ROOF WITH DUCT SUPPORT SYSTEM EQUAL TO PATE MODEL DSS.
- 7. NEW GAS PIPING EXTENDED FROM EXISTING 2" PIPE AND ISOLATION VALVE. SUPPORT WITH MOLDED POLYCARBONATE PILLLOW BLOCK EQUAL TO ANVIL H-BLOCK.
- 8. REMOVE EXISTING PACKAGED ROOFTOP DEDICATED OUTDOOR AIR UNIT.

REVIEW IMPACT OF NEW RTU WITH STRUCTURAL ENGINEER PRIOR TO FINAL PLACEMENT OF UNIT



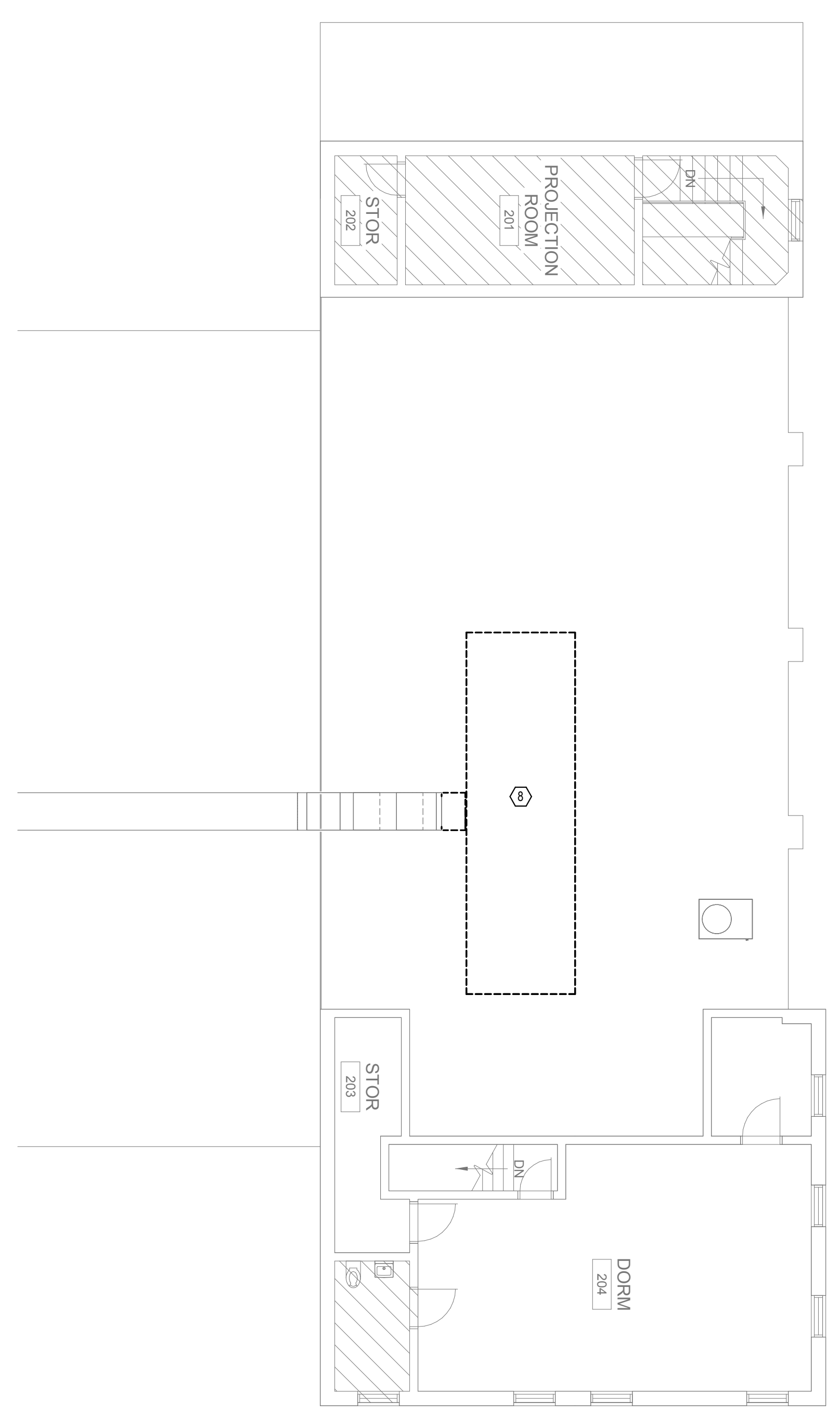
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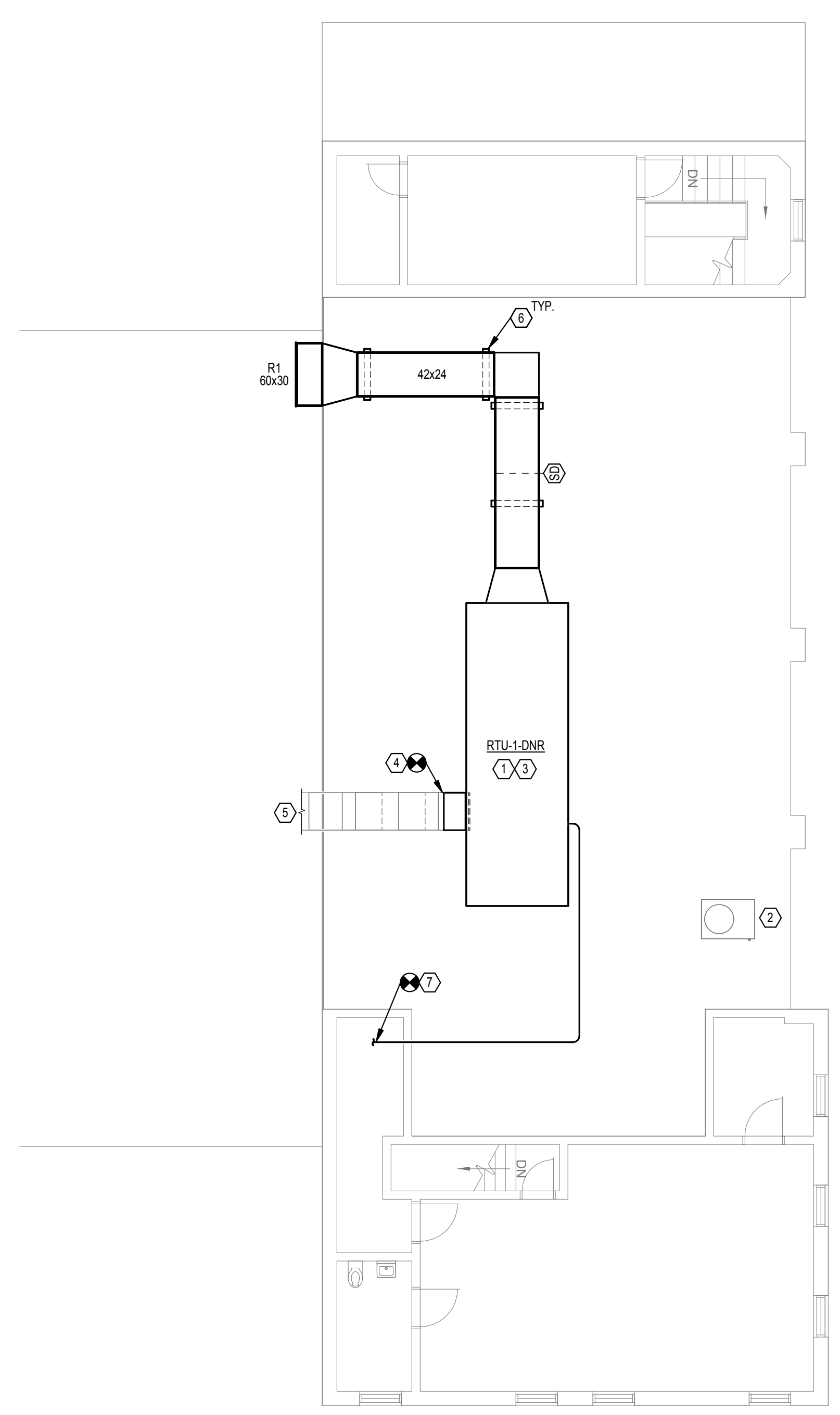
Signature of E. E. Lohrman

INDIANA STATE FAIRGROUNDS HVAC REPLACEMENTS

OWNER  
INDIANA STATE FAIRGROUNDS  
1202 E. 38TH ST,  
INDIANAPOLIS, IN 46205



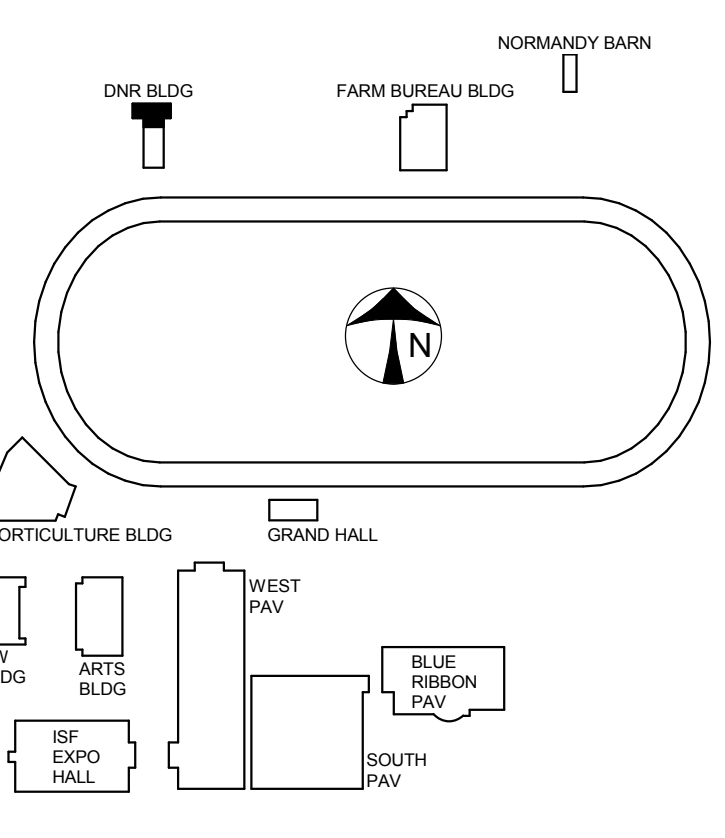
2 DEPT. OF NATURE HVAC SECOND FLOOR PLAN - DEMOLITION  
SCALE: 1/8" = 1'-0"



1 DEPT. OF NATURE HVAC SECOND FLOOR PLAN - NEW WORK  
SCALE: 1/8" = 1'-0"



KEY PLAN NOT TO SCALE



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SHEET TITLE  
DEPT. OF NATURE BLDG HVAC SECOND FLOOR PLAN

M107.2



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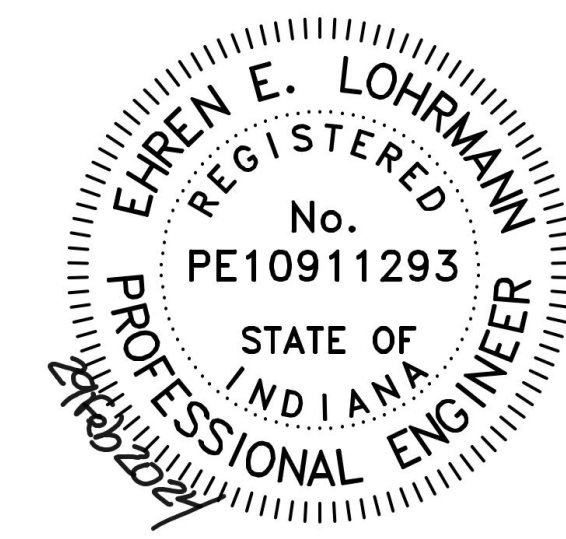
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& EVENT CENTER

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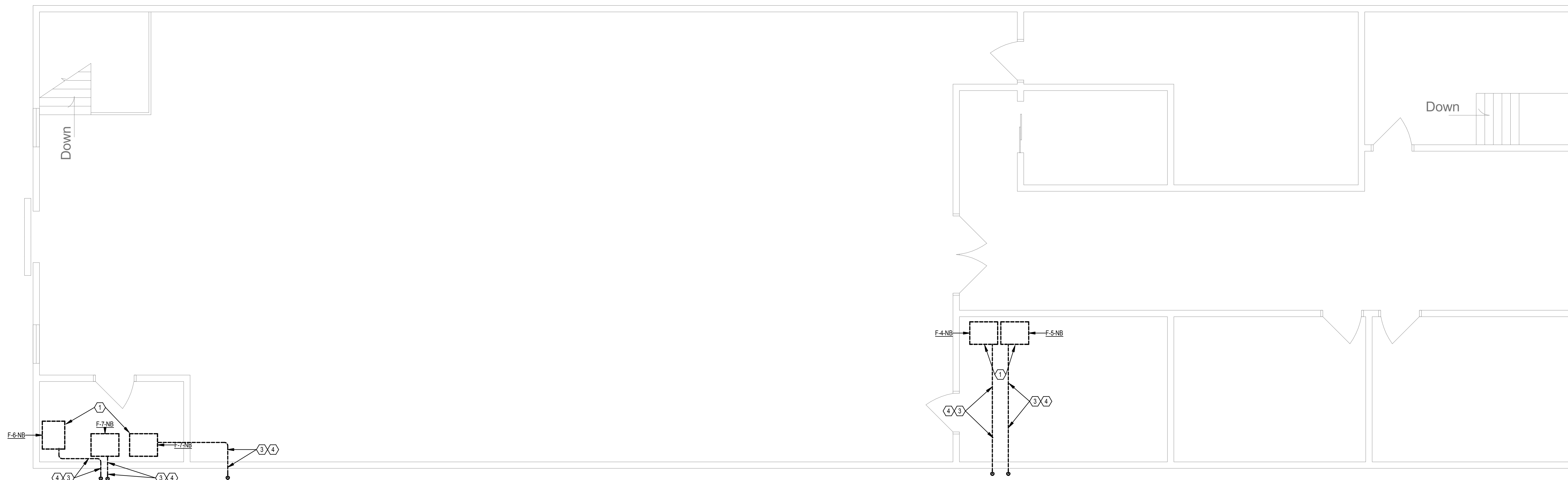


*E. E. Lohrman*

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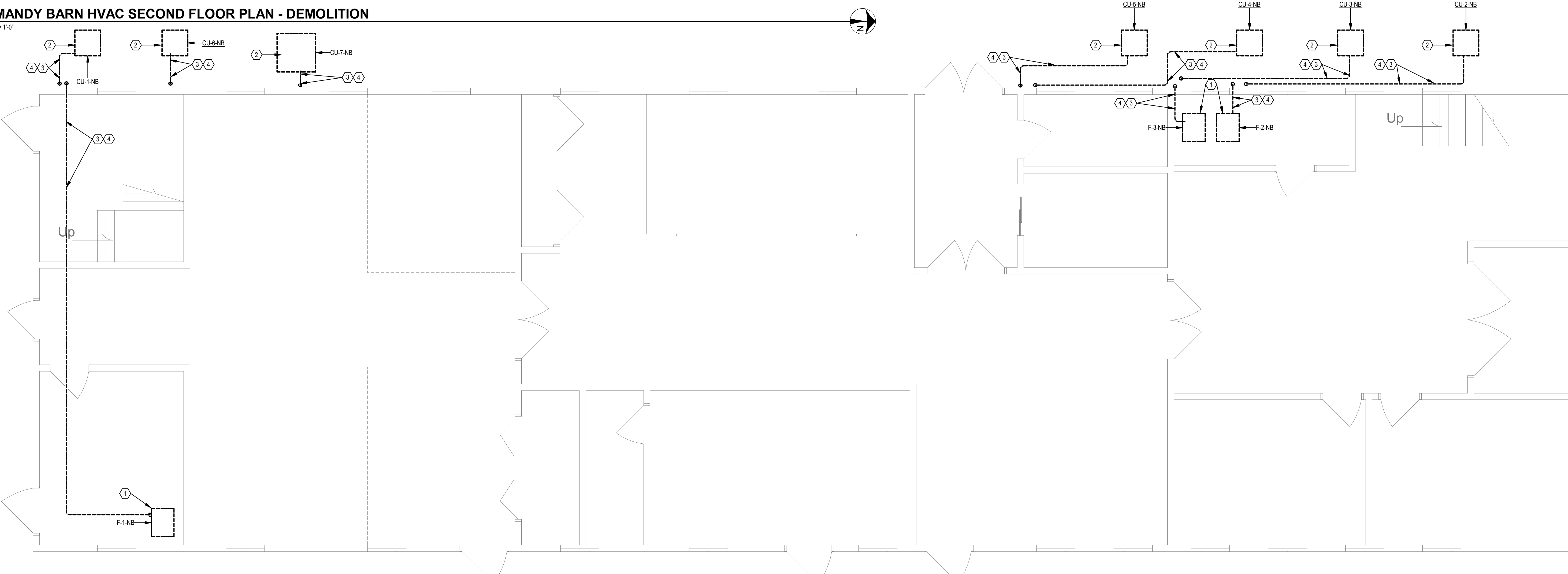
**NOTES**

1. REMOVE INDOOR GAS-FIRED FURNACE AC UNITS AND THEIR ASSOCIATED AIR-COOLED CONDENSING UNIT, REFRIGERANT PIPING, CONTROLS, SUPPORTS, GAS-PIPING, ETC. EXISTING SHEETMETAL TO REMAIN. PROVIDE NEW TRANSITION FITTINGS TO CONNECT NEW EQUIPMENT TO EXISTING DUCTWORK.
2. REMOVE AIR COOLED CONDENSING UNIT AND ASSOCIATED REFRIGERANT PIPING, SUPPORTS, AND CONTROLS.
3. REMOVE EXISTING REFRIGERANT PIPING AS SHOWN. EXISTING WALL PENETRATIONS AND PIPE ROUTING TO BE USED WHEREVER POSSIBLE. REFER TO NEW WORK PLAN. CONTRACTOR SHALL VERIFY EXACT ROUTING OF EACH SET OF REFRIGERANT PIPES AND PLAN TO REUSE PATHWAYS FOR NEW LINESETS.
4. REMOVE REFRIGERANT LIQUID AND SUCTION LINES AS SHOWN. REFRIGERANT PIPES ARE SHOWN AS A SINGLE LINE FOR EACH FURNACE/ CONDENSING UNIT FOR CLARITY.



**1 NORMANDY BARN HVAC SECOND FLOOR PLAN - DEMOLITION**

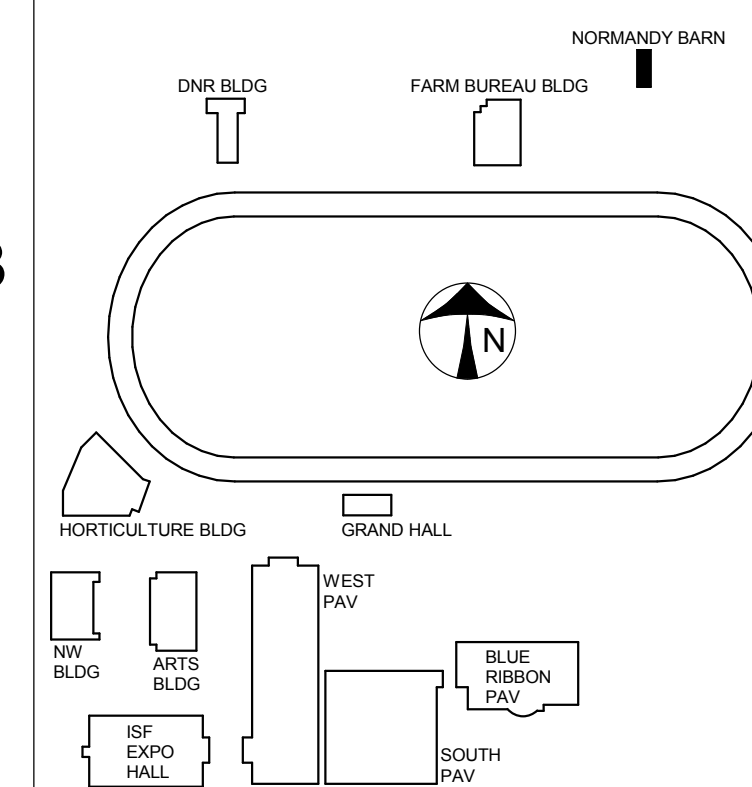
SCALE: 1/4" = 1'-0"



**2 NORMANDY BARN FIRST FLOOR PLAN - DEMOLITION**

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

**KEY PLAN  
NOT TO SCALE**



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SHEET TITLE  
**NORMANDY BARN HVAC  
FLOOR PLANS -  
DEMOLITION**

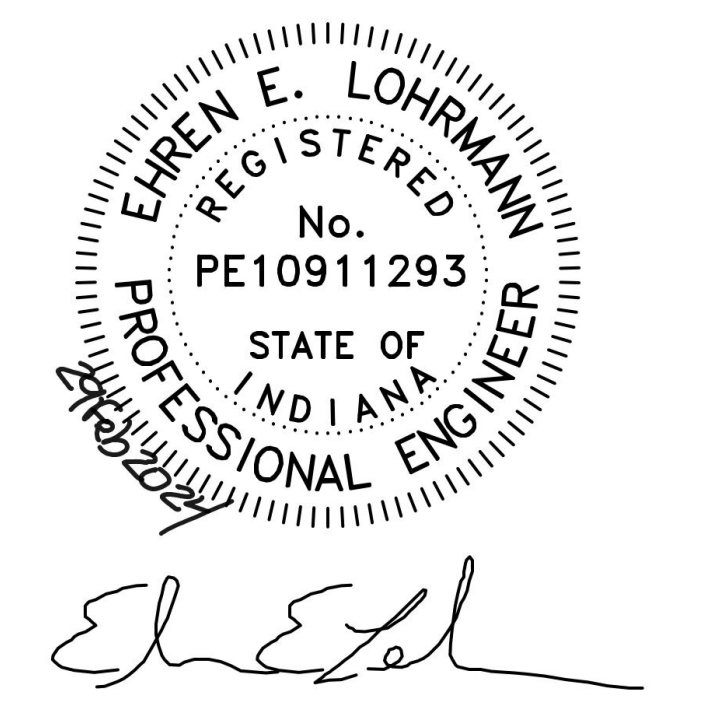
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**NOTES**

- REPLACE EACH OF THE 7 INDOOR GAS-FIRED AC UNITS AND THEIR ASSOCIATED AIR-COOLED CONDENSING UNIT, REFRIGERANT PIPING, CONTROLS, SUPPORTS, GAS-PIPING, ETC. REPLACE WITH NEW VRF SYSTEM AS SHOWN WITH NEW REFRIGERANT PIPING, SUPPORTS, CONDENSATE PUMP, AND LOCAL PROGRAMMABLE THERMOSTAT. CU-7-NB SERVES TWO INDOOR AC UNITS IN A TWIN CONFIGURATION.
- PROVIDE NEW EQUIPMENT 7-DAY PROGRAMMABLE CONTROLLER WITH INTEGRAL THERMOSTAT MOUNTED IN SAME LOCATION AS EXISTING THERMOSTAT. REVIEW INSTALLATION LOCATION IN THE FIELD WITH OWNER AND ENGINEER PRIOR TO INSTALLATION.
- UNIT MOUNTED ON GRADE SERVES SECOND FLOOR INDOOR UNITS. REFER TO SECOND FLOOR PLAN FOR PIPE ROUTING AND INDOOR UNIT LOCATIONS.
- UNIT MOUNTED ON GRADE SERVES FIRST FLOOR INDOOR UNITS. REFER TO FIRST FLOOR PLAN FOR PIPE ROUTING AND INDOOR UNIT LOCATIONS.
- PROVIDE 6x8" MODEL BVE BRICK VENT AND REMOVE BACKDRAFT DAMPER. AIR DEVICE SHALL BE UTILIZED TO PROVIDE FRESH AIR TO FURNACE. EACH FURNACE SHALL BE BALANCED TO 25 CFM. EXTEND DUCT TO FURNACE RETURN AIR FLENUM.
- NEW REFRIGERANT LINESET, LIQUID AND SUCTION LINE ARE MEANT TO BE ROUTED TOGETHER AND THEREFORE, ONLY A SINGLE LINE IS SHOWN ON PLAN FOR CLARITY. UTILIZE SAME ROUTE AND PENETRATIONS AS EXISTING REFRIGERANT PIPE ROUTING. SEAL ANNULAR SPACES AS NECESSARY WITH THE APPROPRIATE FIRE CAULKING. REFER TO SPECIFICATIONS FOR FIRE STOPPING REQUIREMENTS. FINAL REFRIGERANT PIPE SIZING SHALL BE DETERMINED BY THE EQUIPMENT MANUFACTURER AFTER ACCOUNTING FOR FINAL PIPE ROUTE AND ALL OFFSETS AND CHANGES IN ELEVATION.
- BALANCE DAMPER TO SPECIFIED 25 CFM.
- PROVIDE 6x8 BRICK VENT EQUAL TO GREENHECK BVE WITH OPTIONAL INSECT SCREEN. DO NOT PROVIDE STANDARD GRAVITY BACKDRAFT DAMPER WITH BRICK VENT. CONTRACTOR SHALL DECIDE THE OPTIMAL MOUNTING HEIGHT. EXTEND DUCT TO FURNACE RETURN AIR FLENUM.

**EQUIPMENT DATA**

**CU-1.4.5-NB & F-1.4.5-NB**  
2 STAGE AIR CONDITIONER 3 TON COOLING.  
BASIS OF DESIGN: CARRIER OUTDOOR MODEL 24TPA AND INDOOR MODEL CVPM.

**OUTDOOR UNIT:**  
ELECTRICAL: 208V-1P, 19.8A MCA, 35A MOCP  
UNIT LENGTH: 35 IN  
UNIT WIDTH: 35 IN  
UNIT HEIGHT: 32 IN  
UNIT SHIPPING WEIGHT: 227 lb

**INDOOR UNIT:**  
ELECTRICAL: 115V-1P, 10.1 MCA, 15 MOCP  
UNIT LENGTH: 21 IN  
UNIT WIDTH: 21 IN  
UNIT HEIGHT: 22 IN  
UNIT SHIPPING WEIGHT: 45 lb  
INDOOR COIL: MODEL CVPM SIZE 36

COOLING PERFORMANCE BASED ON 95°F AMBIENT AIR TEMPERATURE, 1200 CFM, AND 80/67°F DBWB ENTERING AIR CONDITIONS. 61.5/57.9 DBWB LEAVING AIR TEMPS.

TOTAL COOLING CAPACITY: 34.8 MBH  
SENSIBLE COOLING CAPACITY: 23.9 MBH  
COOLING CFM: 1200  
MIN. REQUIRED SEER: 12.5  
MIN. REQUIRED SEER: 16  
EXTERNAL STATIC PRESSURE: 0.5 wg

FURNACE MODEL: 59TP  
HEATING MAX: 58 MBH  
HEATING MIN: 38 MBH  
HIGH HEAT AIRFLOW: 1020 CFM  
LOW HEAT AIRFLOW: 770 CFM

**CU-2.3.6-NB & F-2.3.6.7-NB**  
2 STAGE AIR CONDITIONER 4 TON COOLING.  
BASIS OF DESIGN: CARRIER OUTDOOR MODEL 24TPA AND INDOOR MODEL CVPM.

**OUTDOOR UNIT:**  
ELECTRICAL: 208V-1P, 26.1 MCA, 40A MOCP  
UNIT LENGTH: 35 IN  
UNIT WIDTH: 35 IN  
UNIT HEIGHT: 39 IN  
UNIT SHIPPING WEIGHT: 284 lb

**INDOOR UNIT:**  
ELECTRICAL: 115V-1P, 13.1 MCA, 20A MOCP  
UNIT LENGTH: 21 IN  
UNIT WIDTH: 21 IN  
UNIT HEIGHT: 22 IN  
UNIT SHIPPING WEIGHT: 45 lb  
INDOOR COIL: MODEL CVPM SIZE 48

COOLING PERFORMANCE BASED ON 95°F AMBIENT AIR TEMPERATURE, 1200 CFM, AND 80/67°F DBWB ENTERING AIR TEMPS. 56.9/54.8 DBWB LEAVING AIR TEMPS.

TOTAL COOLING CAPACITY: 45.3 MBH  
SENSIBLE COOLING CAPACITY: 29.9 MBH  
COOLING CFM: 1200  
MIN. REQUIRED SEER: 12  
MIN. REQUIRED SEER: 15  
EXTERNAL STATIC PRESSURE: 0.5 wg

FURNACE MODEL: 59TP  
HEATING MAX: 78 MBH  
HEATING MIN: 51 MBH  
HEATING MAX AIRFLOW: 1396 CFM  
HEATING MIN AIRFLOW: 1055 CFM  
ELECTRICAL: 115V-1P, 13.1 MCA, 20A MOCP

**CU-7-NB**  
2 STAGE AIR CONDITIONER 10 TON COOLING.  
BASIS OF DESIGN: CARRIER OUTDOOR MODEL 38AUZ AND INDOOR MODEL CVPM.

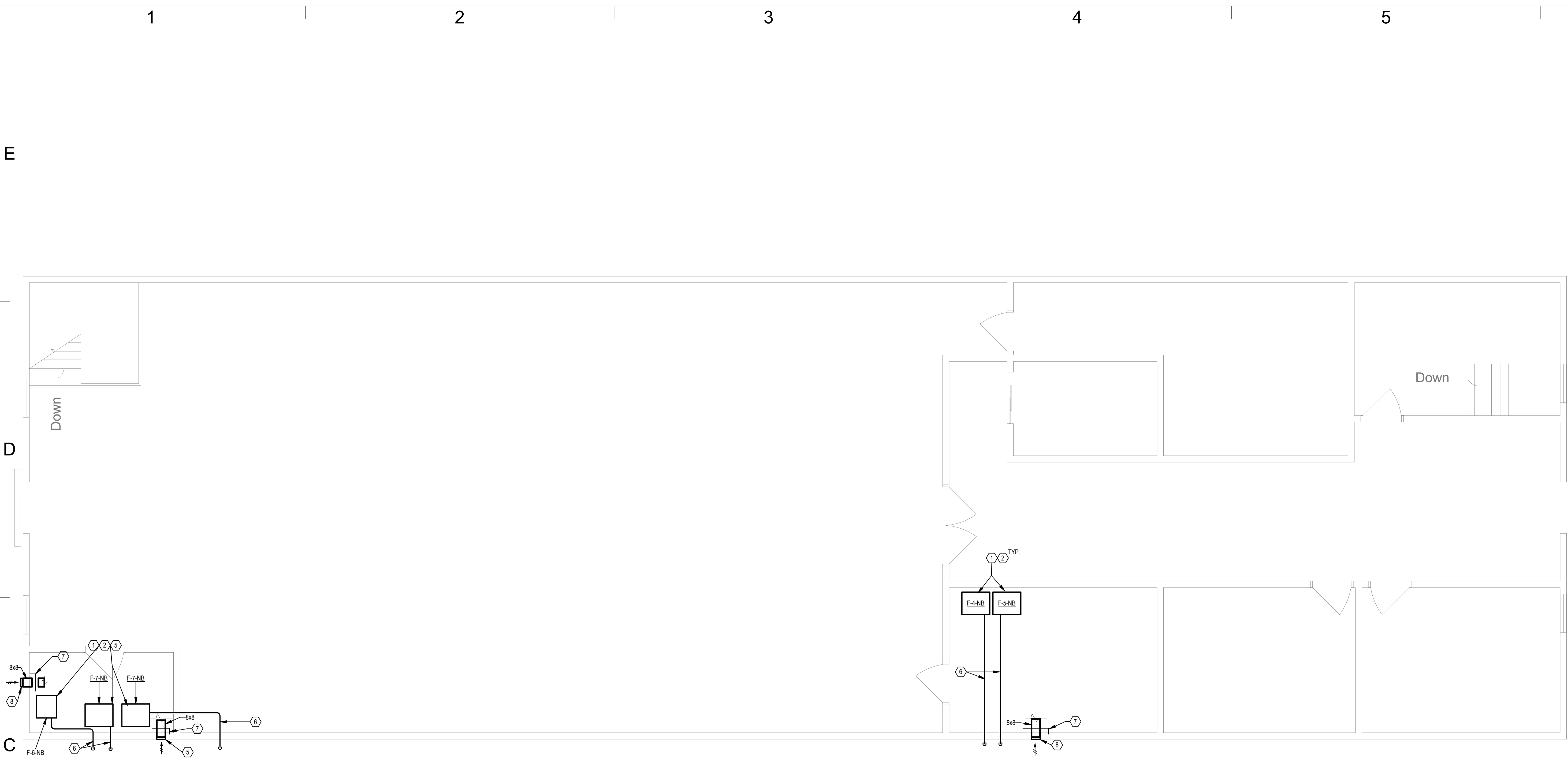
**OUTDOOR UNIT:**  
UNIT LENGTH: 60 IN  
UNIT WIDTH: 45 IN  
UNIT HEIGHT: 50 IN  
UNIT SHIPPING WEIGHT: 400 lb  
ELECTRICAL: 230V-3P, 45 MCA, 80A MOCP

COOLING PERFORMANCE BASED ON 95°F AMBIENT AIR TEMPERATURE

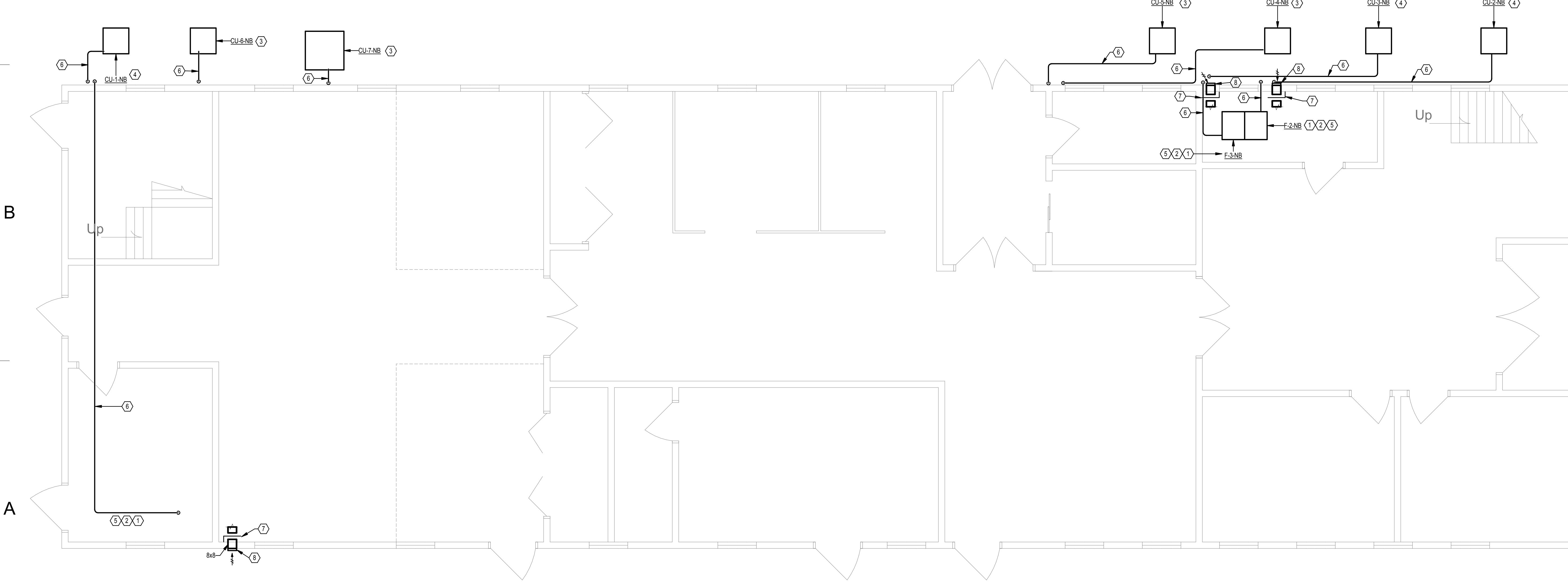
TOTAL COOLING CAPACITY: 113.8 MBH  
MIN. REQUIRED SEER: 11.2  
MIN. REQUIRED SEER: 15.5  
EXTERNAL STATIC PRESSURE: 0.5 wg

INDOOR COIL: COIL SERVES A TWIN FURNACE ARRANGEMENT AND SITS IN SHARED DUCTWORK ABOVE BOTH FURNACES.

BASIS OF DESIGN: CAVTCOIL SIZE 12  
AIRFLOW: 4000 CFM

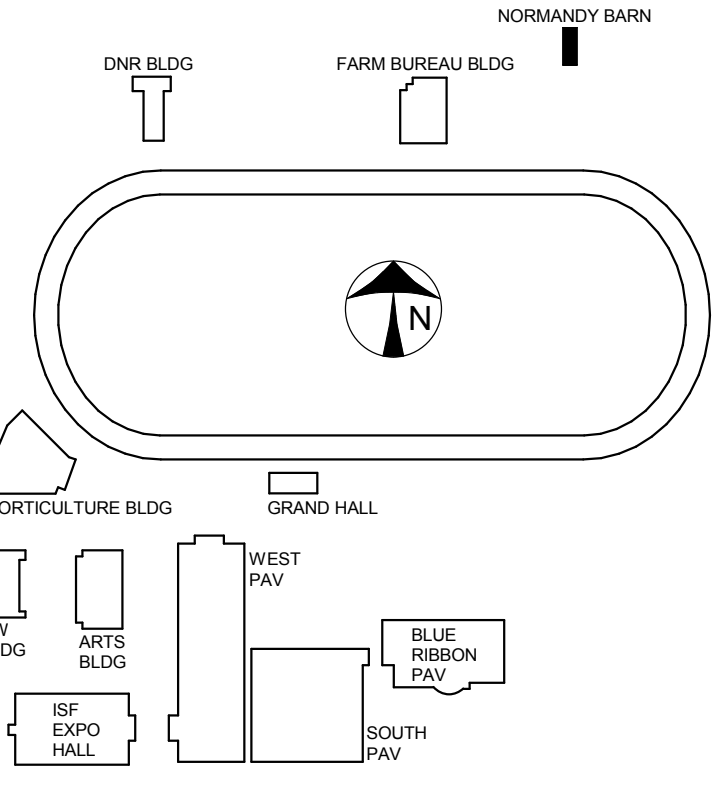


**1 NORMANDY BARN HVAC SECOND FLOOR PLAN - NEW WORK**  
SCALE: 1/4" = 1'-0"



**2 NORMANDY BARN FIRST FLOOR PLAN - DEMOLITION**  
SCALE: 1/4" = 1'-0"

**KEY PLAN**  
NOT TO SCALE



MARK	DATE	DESCRIPTION

SHEET TITLE

**NORMANDY BARN HVAC FLOOR PLANS - NEW WORK**

M108

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- NOTES**
1. REMOVE AND REPLACE EXISTING UNIT HEATER, ASSOCIATED SUPPORTS AND FLUE PIPING. REMOVE GAS PIPING CONNECTION BACK TO NEAREST ISOLATION VALVE.
  2. REMOVE AND REPLACE EXISTING PACKAGED ROOFTOP AIR HANDLER.
  3. EQUIPMENT IS LOCATED ON THE ROOF ABOVE.
  4. EXISTING EQUIPMENT TO REMAIN. NOT IN SCOPE.
  5. REMOVE EXISTING AIR HANDLING UNIT, ELECTRIC REHEAT COIL, AND ASSOCIATED CONDENSING UNIT.
  6. REMOVE WALL MOUNTED AXIAL FAN AND ASSOCIATED MOTORIZED DAMPER AND DUCTWORK. PENETRATION TO BE REUSED FOR NEW FANS AS SHOWN ON NEW WORK PLAN.



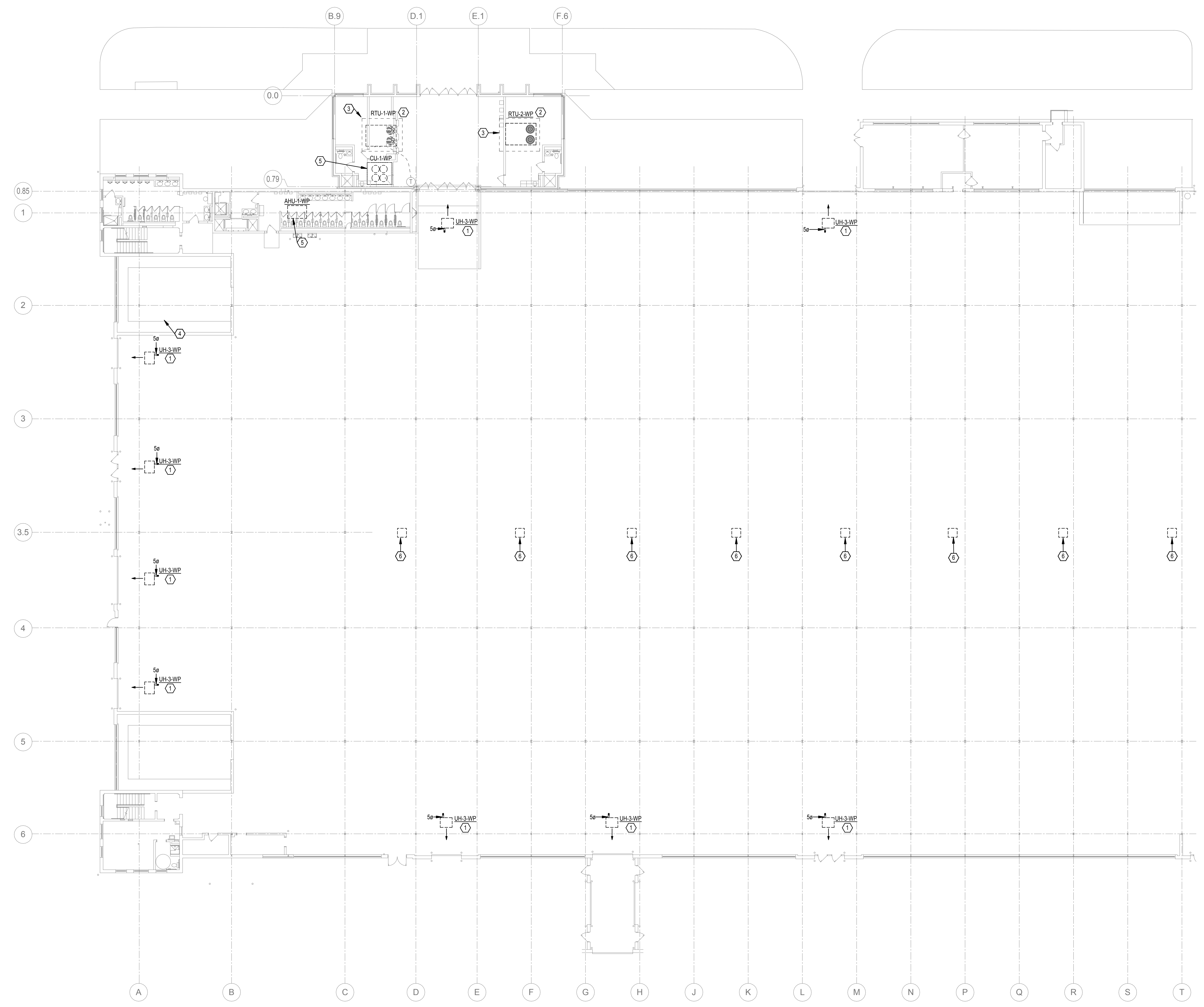
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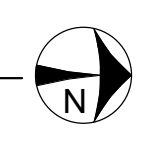
*E. E. Lohrman*

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 OWNER  
 INDIANA STATE FAIRGROUNDS  
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 INDIANAPOLIS, IN 46205

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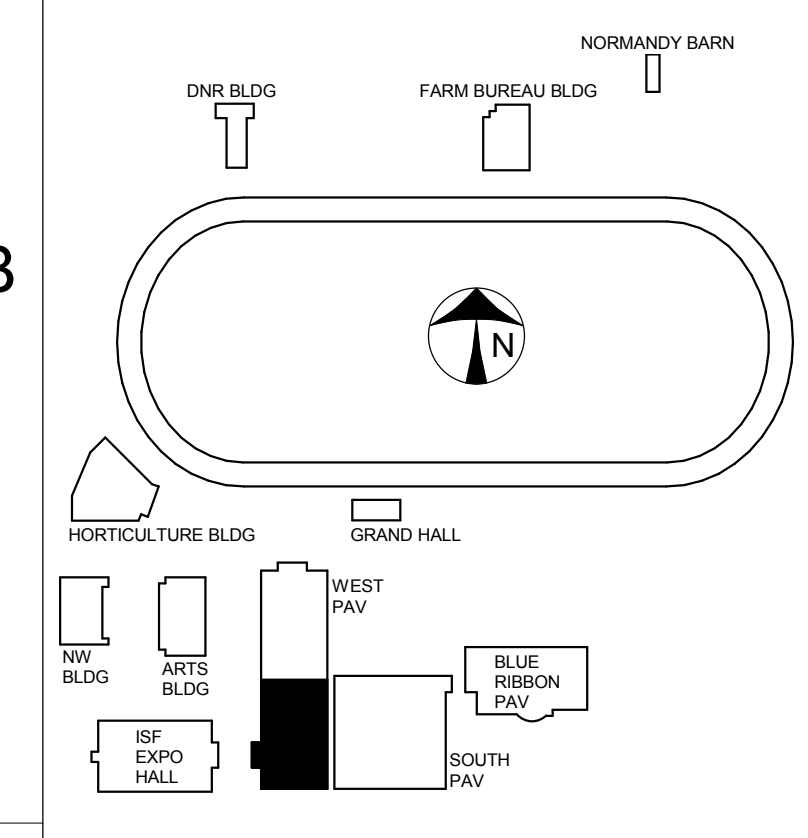


1 WEST PAVILION HVAC FLOOR PLAN - SOUTH - DEMOLITION  
 SCALE: 1/16" = 1'-0"



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**KEY PLAN  
 NOT TO SCALE**



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PROJECT NO:	2023-07154
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SHEET TITLE  
**WEST PAVILION HVAC  
 FLOOR PLAN - SOUTH**

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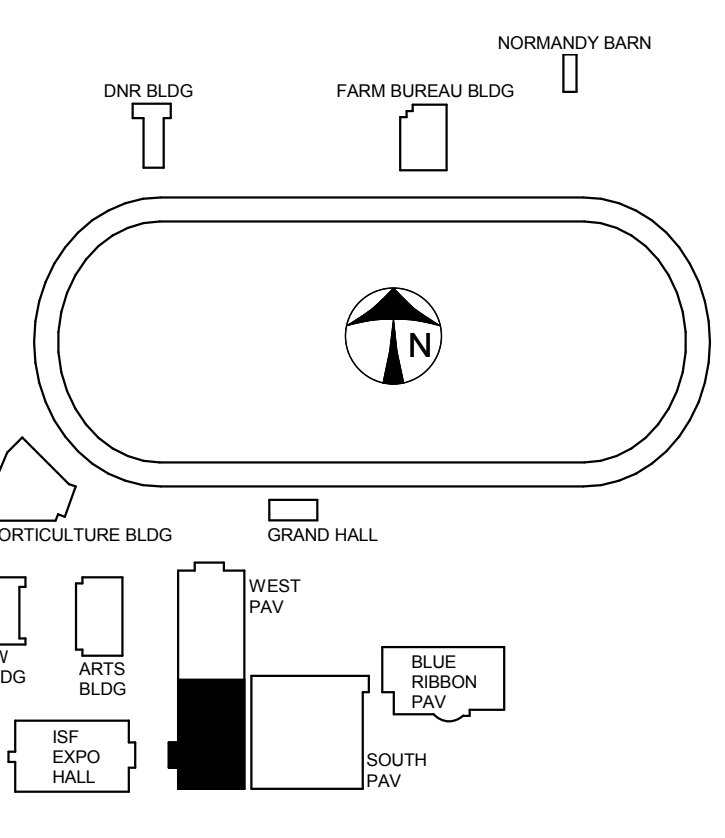
CONSULTANTS



*E. Lohrman*

INDIANA STATE  
FAIRGROUNDS HVAC  
REPLACEMENTS  
OWNER  
INDIANA STATE  
FAIRGROUNDS  
1202 E. 38TH ST,  
INDIANAPOLIS, IN 46205

**KEY PLAN  
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SHEET TITLE  
**WEST PAVILION HVAC  
FLOOR PLAN - SOUTH**

M109.1

**NOTES**

- PROVIDE NEW SUPPORTS AND FLUE PIPING ROUTED OUTDOORS USING THE EXISTING ROOF PENETRATION WITH RAIN CAP. MODIFY EXISTING ROOF PENETRATION AS NECESSARY TO ACCOMMODATE FULL SIZE FLUE PIPING FROM NEW EQUIPMENT. EXTEND NEW GAS PIPING FROM EXISTING ISOLATION VALVE PER DETAIL 4 ON SHEET M051.
- REPLACE EXISTING PACKAGED ROOFTOP AIR HANDLER. EXTEND NEW GAS PIPING FROM EXISTING GAS PIPE ISOLATION VALVE NEAR UNIT AND PROVIDE A SECONDARY GAS REGULATOR AS REQUIRED. PROVIDE CURB ADAPTOR FOR NEW EQUIPMENT AND CONNECT TO EXISTING DUCTWORK WITH THE APPROPRIATE TRANSITION. FITTINGS PER DETAIL 2 ON SHEET M051. REFER TO EQUIPMENT SCHEDULE FOR NEW EQUIPMENT PERFORMANCE REQUIREMENTS.
- EQUIPMENT IS LOCATED ON THE ROOF ABOVE.
- EXISTING EQUIPMENT TO REMAIN. NOT IN SCOPE.
- PROVIDE NEW EQUIPMENT 7-DAY PROGRAMMABLE CONTROLLER WITH INTEGRAL THERMOSTAT. REVIEW INSTALLATION LOCATION IN THE FIELD WITH OWNER AND ENGINEER PRIOR TO INSTALLATION.
- NEW HEAT PUMP AIR HANDLER HAS DUCTED SUPPLY AND RETURN. RETURN SHALL COME FROM DIRECTLY UNDER UNIT. CONTRACTOR SHALL CAREFULLY COORDINATE LOCATION OF NEW UNIT TO ALLOW FOR CONNECTION TO EXISTING SUPPLY DUCTWORK AND ADDITION OF RETURN AIR TO THE UNIT.

**EQUIPMENT DATA**

**AHU-1-WP**  
CARRIER MODEL 40RFG (6-TON UNIT)  
2400 CFM  
TOTAL COOLING CAPACITY: 71.4 MBH  
TOTAL SENSIBLE CAPACITY: 55.1 MBH  
ENTERING AIR TEMP: 65 F  
LEAVING AIR: 56.757.7 F DBWB

ACCESSORY HEATING: ELECTRIC HEAT  
ACCESSORY HEATING CAPACITY: 78.3 MBH  
ENTERING AIR TEMP: 65 F  
LEAVING AIR TEMP: 90.2 F  
25.0 kW

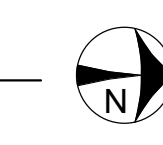
HEAT PUMP HEATING CAPACITY: 68.6 MBH  
HEATING ENTERING AIR TEMPERATURE: 70 F  
HEATING LEAVING AIR TEMPERATURE: 96.5 F

INDOOR ELECTRICAL DATA:  
230V 3P  
82.4 MCA  
INDOOR MOCP: 90 A

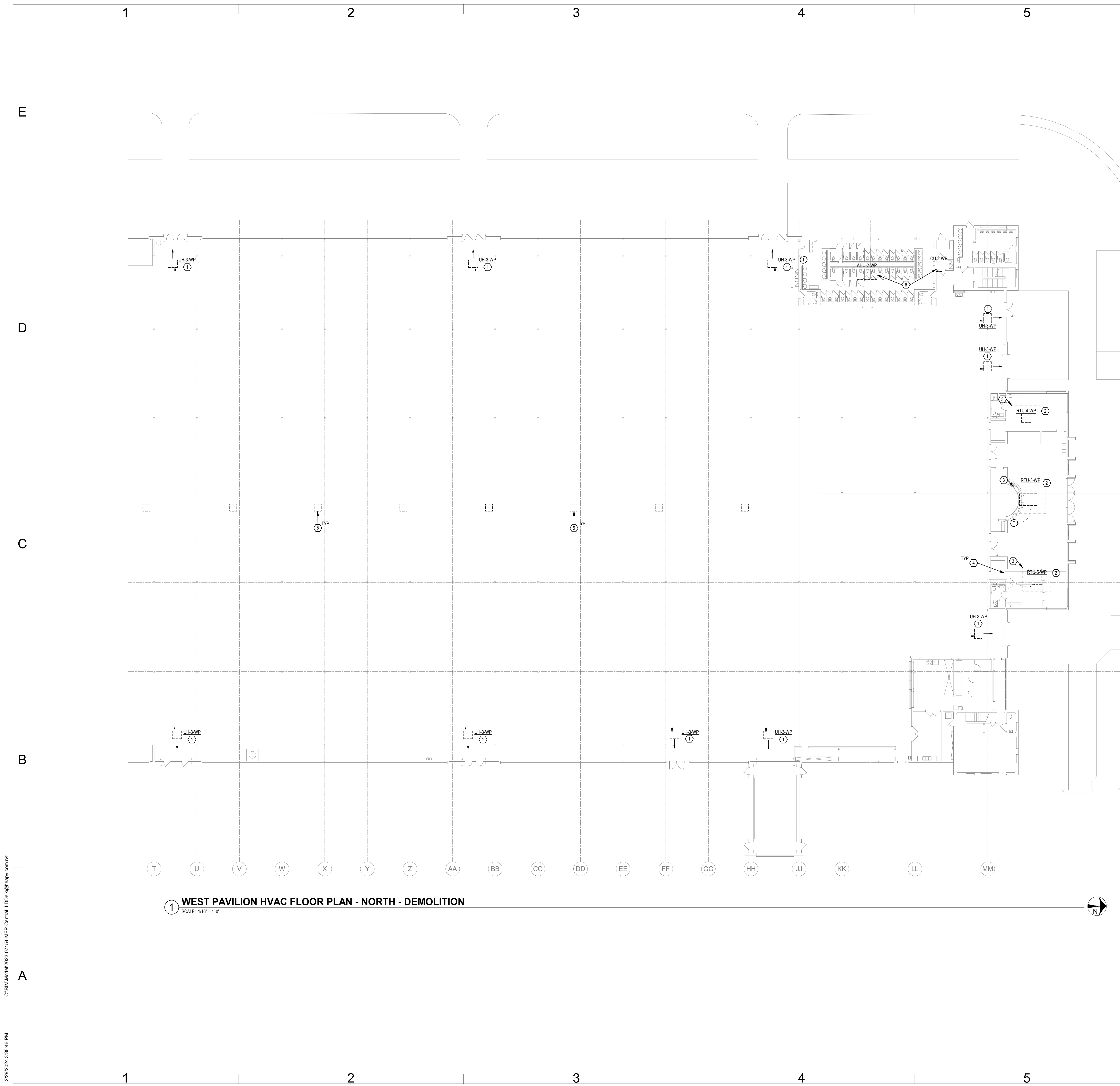
CU-1-WP  
OUTDOOR UNIT  
CARRIER MODEL 38 AUG  
230V-3P 25.0 MCA 30 MOCP



**1 WEST PAVILION HVAC FLOOR PLAN - SOUTH - NEW WORK**  
SCALE: 1/16" = 1'-0"



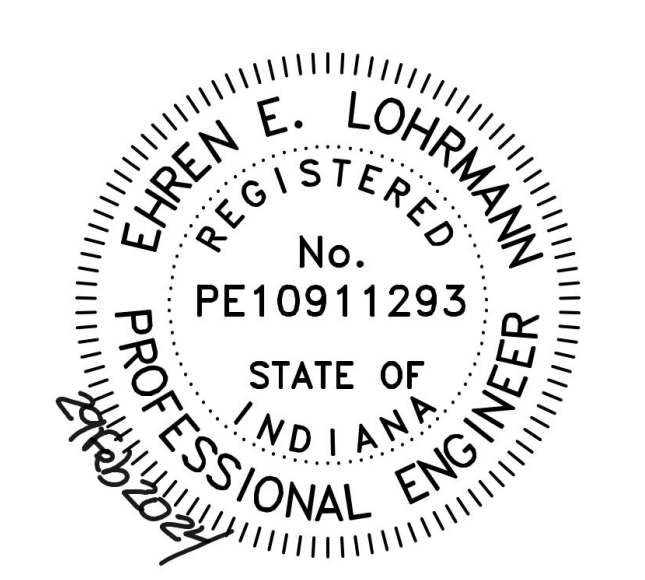
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- NOTES**
1. REPLACE EXISTING UNIT HEATER, ASSOCIATED SUPPORTS AND FLUE PIPING. REMOVE GAS PIPING CONNECTION BACK TO NEAREST ISOLATION VALVE. PROVIDE NEW SUPPORTS AND FLUE PIPING ROUTED OUTDOORS USING THE EXISTING ROOF PENETRATION WITH RAIN CAP. MODIFY EXISTING ROOF PENETRATION AS NECESSARY TO ACCOMMODATE FULL SIZE FLUE PIPING FROM NEW EQUIPMENT. EXTEND NEW GAS PIPING FROM EXISTING ISOLATION VALVE PER DETAIL 4 ON SHEET M501.
  2. REPLACE EXISTING PACKAGED ROOFTOP AIR HANDLER. EXTEND NEW GAS PIPING FROM EXISTING GAS PIPE ISOLATION VALVE NEAR UNIT AND PROVIDE A SECONDARY GAS REGULATOR AS REQUIRED. PROVIDE CURB ADaptor FOR NEW EQUIPMENT AND CONNECT TO EXISTING DUCTWORK WITH THE APPROPRIATE TRANSITION FITTINGS PER DETAIL 2 ON SHEET M501. REFER TO EQUIPMENT SCHEDULE FOR NEW EQUIPMENT PERFORMANCE REQUIREMENTS.
  3. EQUIPMENT IS LOCATED ON THE ROOF ABOVE.
  4. NOTE OMITTED.
  5. REMOVE WALL MOUNTED AXIAL FAN AND ASSOCIATED MOTORIZED DAMPER AND DUCTWORK. PENETRATION TO BE REUSED FOR NEW FANS AS SHOWN ON NEW WORK PLAN.
  6. REMOVE EXISTING AIR HANDLING UNIT, ELECTRIC REHEAT COIL, AND ASSOCIATED CONDENSING UNIT.



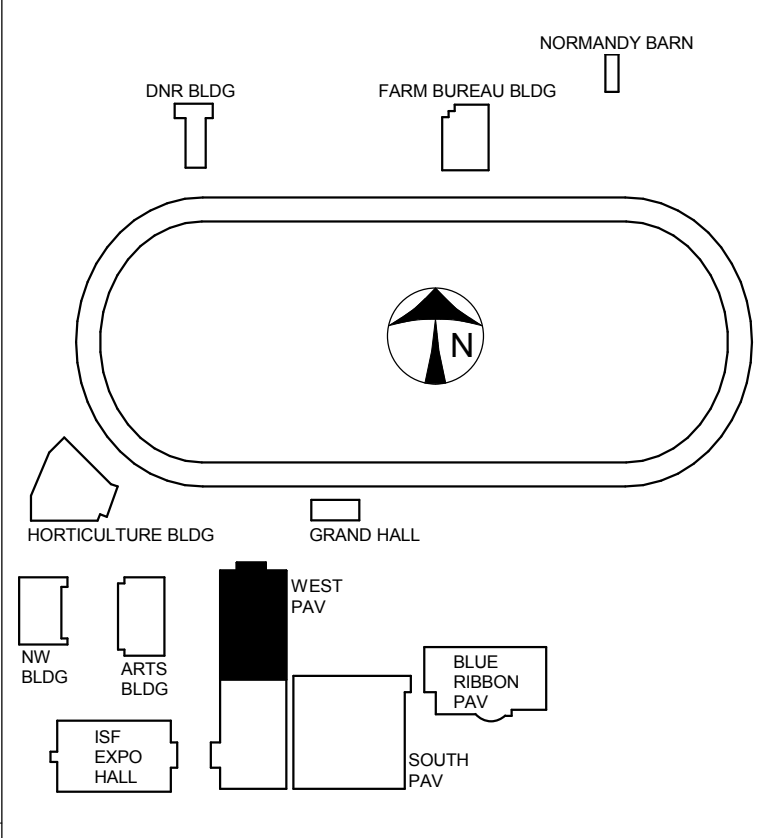
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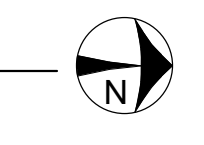
*E. E. Lohrman*

INDIANA STATE FAIRGROUNDS HVAC REPLACEMENTS  
 OWNER  
 INDIANA STATE FAIRGROUNDS  
 1202 E. 38TH ST,  
 INDIANAPOLIS, IN 46205

**KEY PLAN  
 NOT TO SCALE**



**1 WEST PAVILLION HVAC FLOOR PLAN - NORTH - DEMOLITION**  
 SCALE: 1/16" = 1'-0"



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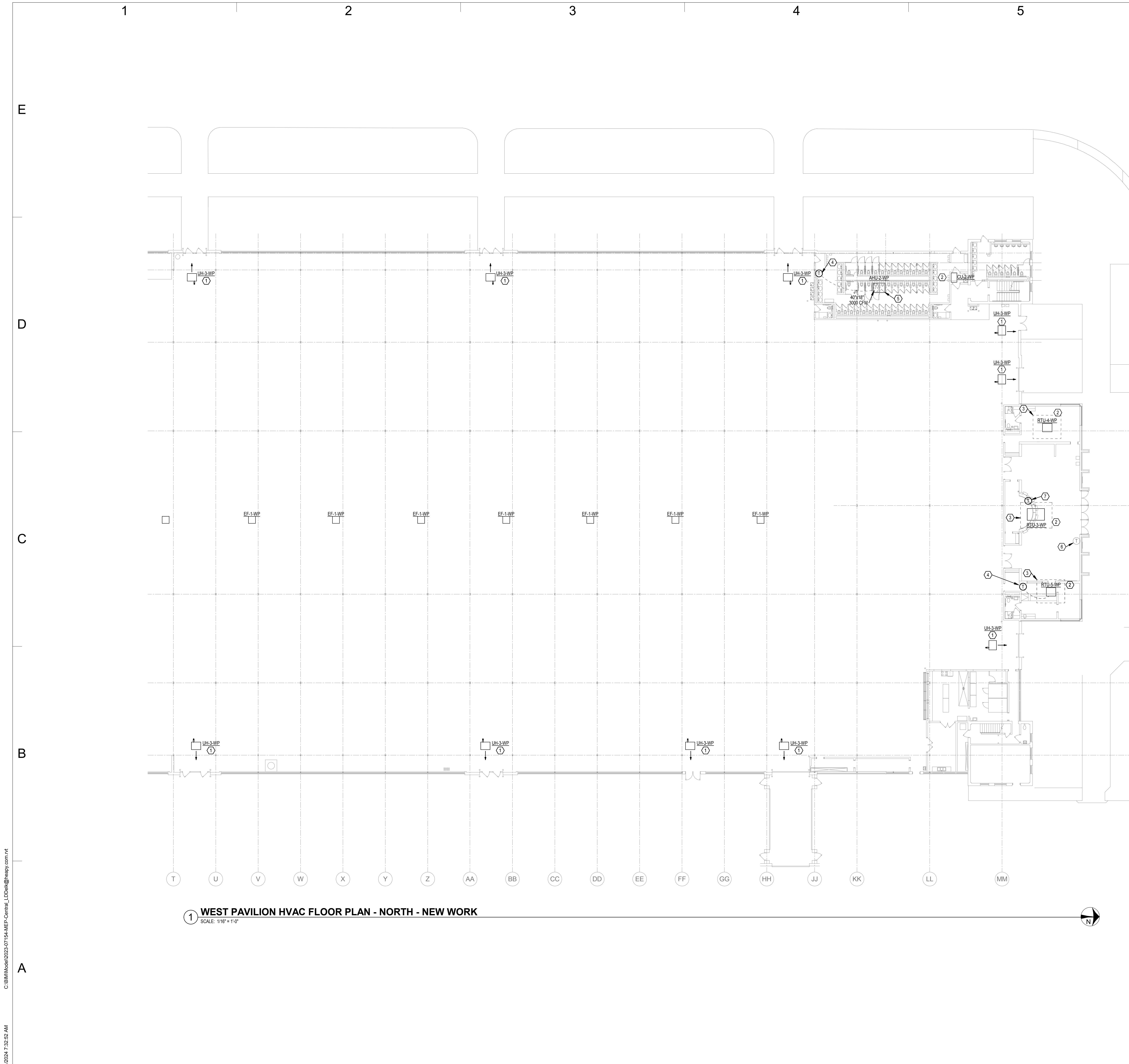
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**WEST PAVILLION HVAC FLOOR PLAN - NORTH**

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1 WEST PAVILLION HVAC FLOOR PLAN - NORTH - NEW WORK  
SCALE: 1/16" = 1'-0"

- NOTES**
- REPLACE EXISTING UNIT HEATER, ASSOCIATED SUPPORTS AND FLUE PIPING. REMOVE GAS PIPING CONNECTION BACK TO NEAREST ISOLATION VALVE. PROVIDE NEW SUPPORTS AND FLUE PIPING ROUTED OUTDOORS USING THE EXISTING ROOF PENETRATION WITH RAIN CAP. MODIFY EXISTING ROOF PENETRATION AS NECESSARY TO ACCOMMODATE FULL SIZE FLUE PIPING FROM NEW EQUIPMENT. EXTEND NEW GAS PIPING FROM EXISTING ISOLATION VALVE PER DETAIL 4 ON SHEET M551.
  - REPLACE EXISTING PACKAGED ROOFTOP AIR HANDLER. EXTEND NEW GAS PIPING FROM EXISTING GAS PIPE ISOLATION VALVE NEAR UNIT AND PROVIDE A SECONDARY GAS REGULATOR AS REQUIRED. PROVIDE CURB ADAPTOR FOR NEW EQUIPMENT AND CONNECT TO EXISTING DUCTWORK WITH THE APPROPRIATE TRANSITION FITTINGS PER DETAIL 2 ON SHEET M551. REFER TO EQUIPMENT SCHEDULE FOR NEW EQUIPMENT PERFORMANCE REQUIREMENTS.
  - EQUIPMENT IS LOCATED ON THE ROOF ABOVE.
  - PROVIDE NEW EQUIPMENT 7-DAY PROGRAMMABLE THERMOSTAT. REVIEW INSTALLATION LOCATION IN THE FIELD WITH OWNER AND ENGINEER PRIOR TO INSTALLATION.
  - NEW HEAT PUMP AIR HANDLER HAS DUCTED SUPPLY AND RETURN. RETURN SHALL COME DIRECTLY UNDER UNIT. CONTRACTOR SHALL CAREFULLY COORDINATE LOCATION OF NEW UNIT TO ALLOW FOR CONNECTION TO EXISTING SUPPLY DUCTWORK AND ADDITION OF RETURN AIR TO THE UNIT.
  - EXISTING THERMOSTAT SHALL REMAIN IN THE LOBBY FOR CONTROL OF NEW RTU. CONTRACTOR SHALL VERIFY LOCATION OF THERMOSTAT AND RE-USE IF LOCATED IN ANOTHER PLACE IN THE LOBBY. EXTEND CONTROL WIRING TO NEW RTU AS REQUIRED.
  - PROVIDE NEW THERMOSTAT IN THE TICKET BOOTH. THERMOSTAT SHALL CONTROL A NEW MOTORIZED DAMPER INSTALLED IN THE SUPPLY DUCTWORK THAT SERVES THE TICKET BOOTH. CONTRACTOR SHALL MEASURE SUPPLY DUCTWORK TO VERIFY SIZE AND TYPE (ROUND OR RECTANGULAR) FOR THE NEW DAMPER. THERMOSTAT SHALL MODULATE DAMPER BASED ON TICKET BOOTH DEVIATION FROM SETPOINT.

**EQUIPMENT DATA**

AHU-2-WP  
CARRIER MODEL 40RFQ (7.5-TON UNIT)  
3000 CFM  
TOTAL COOLING CAPACITY: 90.5 MBH  
TOTAL SENSIBLE CAPACITY: 85.7 MBH  
ENTERING AIR: 59/67 F DBWB  
LEAVING AIR: 59.7/57.5 F DBWB

ACCESSORY HEATING: ELECTRIC HEAT  
ACCESSORY HEATING CAPACITY: 78.3 MBH  
ENTERING AIR TEMP: 60F  
LEAVING AIR TEMP: 60.2F  
35.0 KW

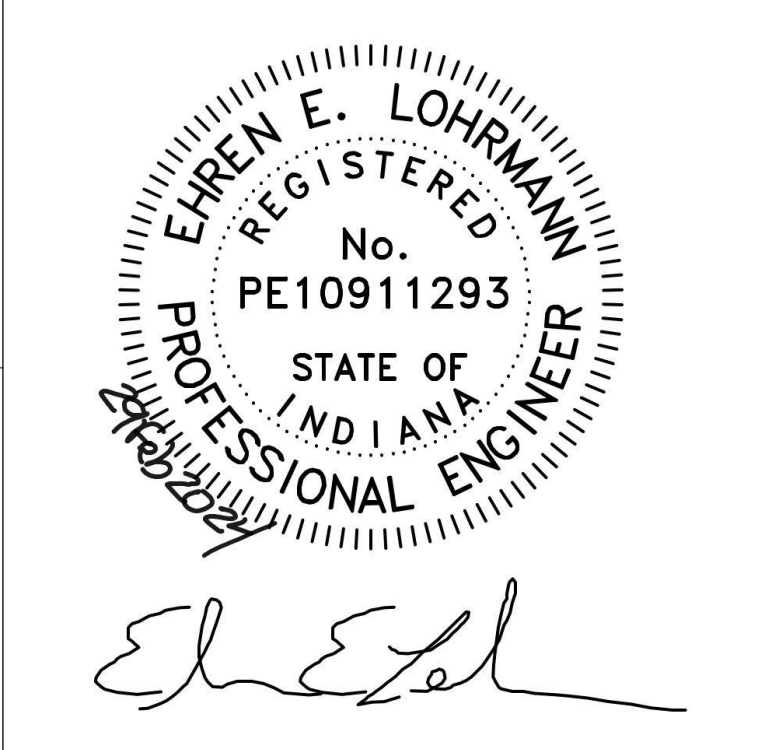
HEATING PUMP HEATING CAPACITY: 88.7 MBH  
HEATING ENTERING AIR TEMPERATURE: 70 F  
HEATING LEAVING AIR TEMPERATURE: 96.5 F

INDOOR ELECTRICAL DATA:  
230V-3P  
105.5 MCA  
INDOOR MOPP: 110 A

CU-2-WP  
OUTDOOR UNIT  
CARRIER MODEL 38 AUO  
230V-3P 35.0 MCA 50 MOPP

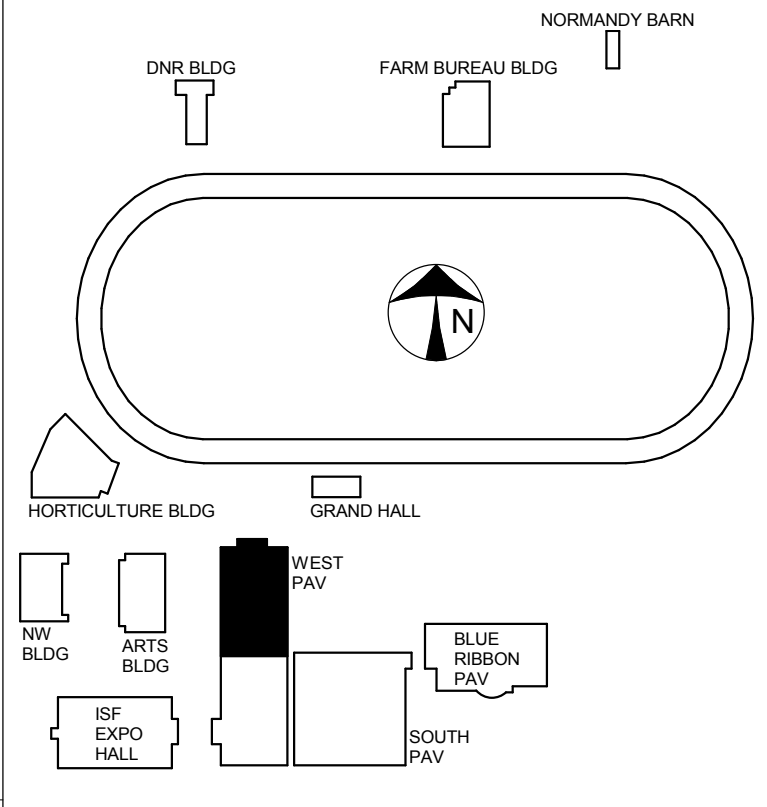


CONSULTANTS



INDIANA STATE FAIRGROUNDS HVAC REPLACEMENTS  
OWNER  
INDIANA STATE FAIRGROUNDS  
1202 E. 38TH ST,  
INDIANAPOLIS, IN 46205

**KEY PLAN  
NOT TO SCALE**



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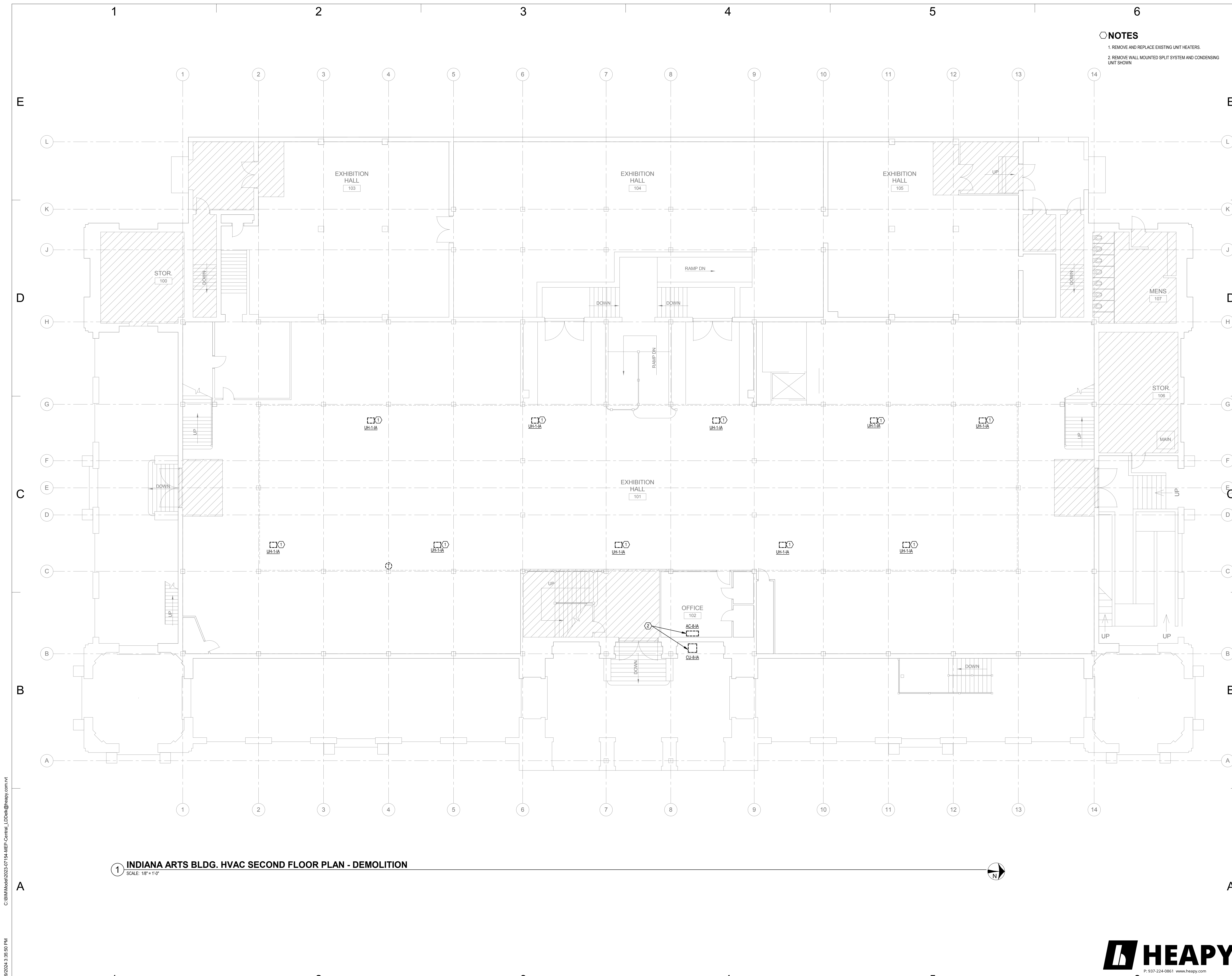
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**WEST PAVILLION HVAC FLOOR PLAN - NORTH**



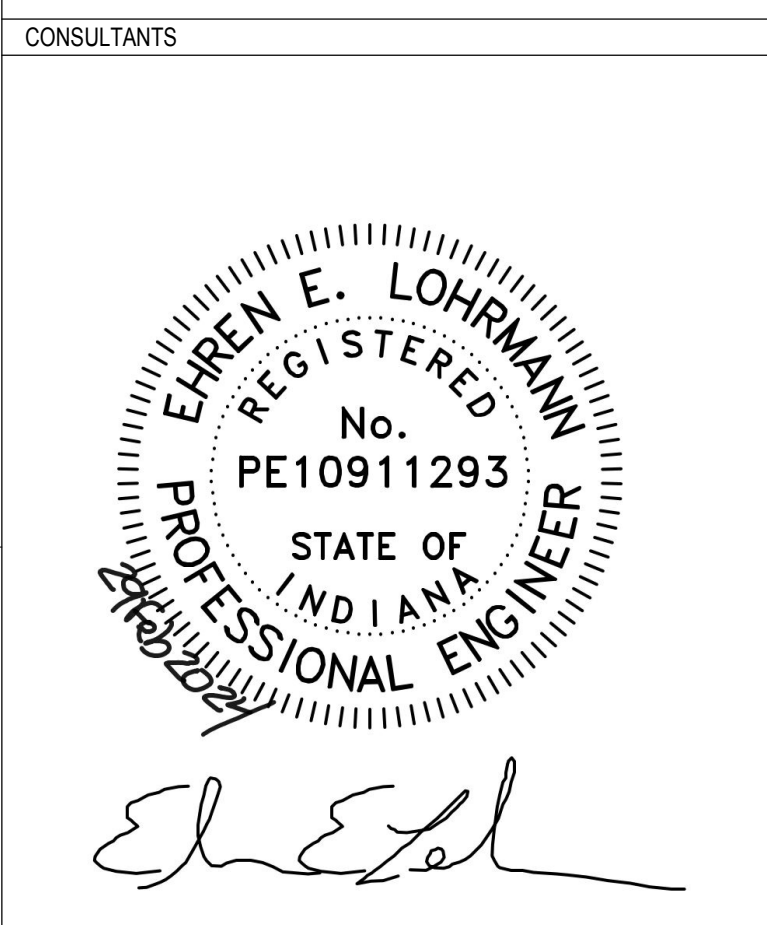
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PROJECT NO. 2023-07154

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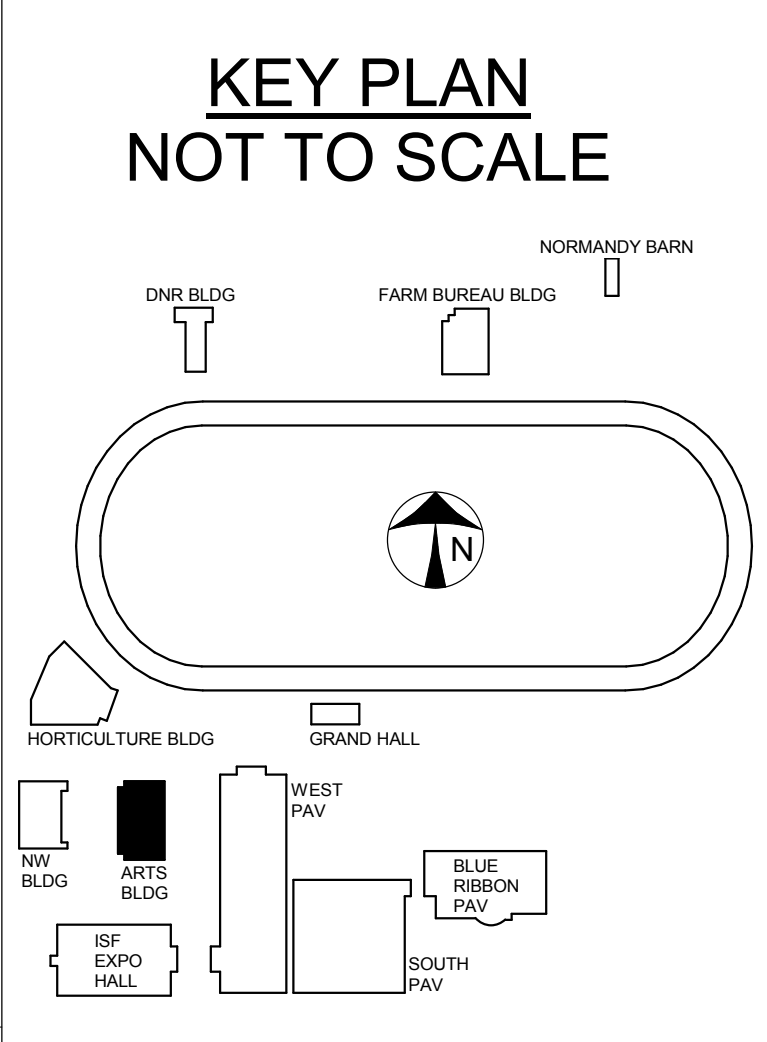
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**NOTES**  
 1. REMOVE AND REPLACE EXISTING UNIT HEATERS.  
 2. REMOVE WALL MOUNTED SPLIT SYSTEM AND CONDENSING UNIT SHOWN



**INDIANA STATE FAIRGROUNDS HVAC REPLACEMENTS**  
 OWNER: **INDIANA STATE FAIRGROUNDS**  
 1202 E. 38TH ST., INDIANAPOLIS, IN 46205



**INDIANA ARTS BLDG. HVAC SECOND FLOOR PLAN - DEMOLITION**  
 SCALE: 1/8" = 1'-0"

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PROJECT NO:	2023-07154	
REVIT FILE:	C:\BIM\A06\2023-07154-MEP-Central_LDD\mep.com.rvt	
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**INDIANA ARTS BUILDING HVAC SECOND FLOOR PLAN**

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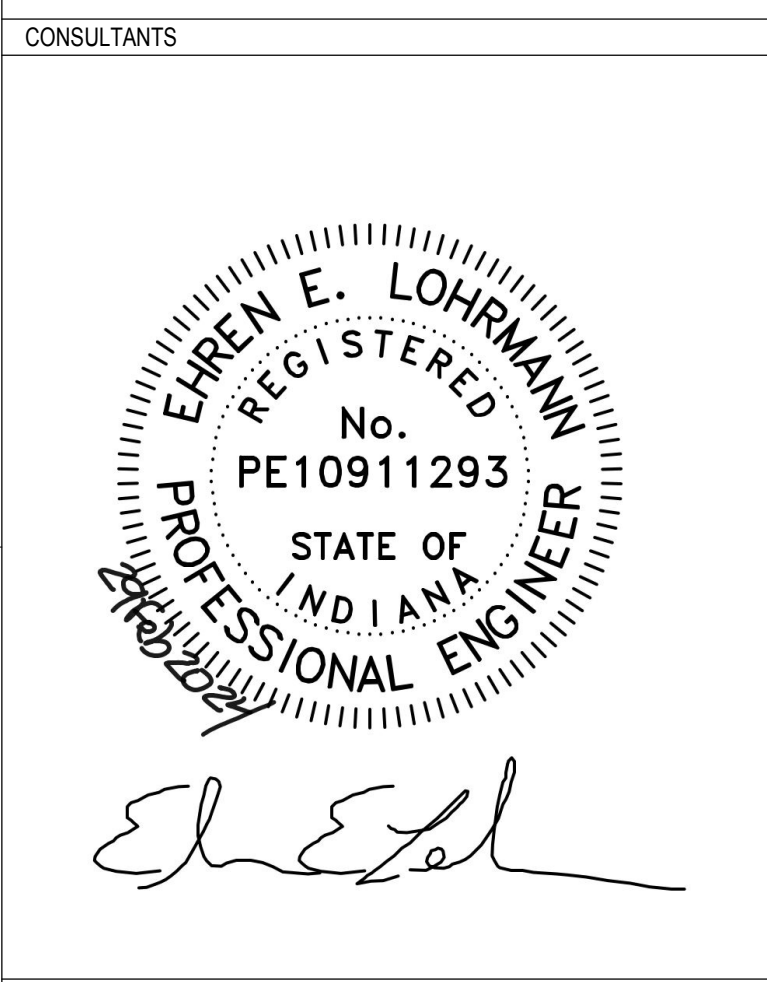
- NOTES**
- PROVIDE NEW LINE VOLTAGE THERMOSTAT FOR CONTROL OF ALL TEN INFRARED HEATERS IN UNISON.
  - UNIT SITS ON A LEDGE NEAR AN EXISTING STAIRWELL. COORDINATE EXACT DIMENSIONS WITH CONSTRAINTS PRIOR TO ORDERING.

**EQUIPMENT DATA**

AC-3A  
 INDOOR UNIT:  
 INDOOR UNIT IS POWERED FROM OUTDOOR UNIT  
 TOTAL COOLING CAPACITY: 14.5 MBH  
 SENSIBLE COOLING CAPACITY: 9.6 MBH  
 COOLING CFM: 335  
 INDOOR COIL: MODEL 40MAHQ

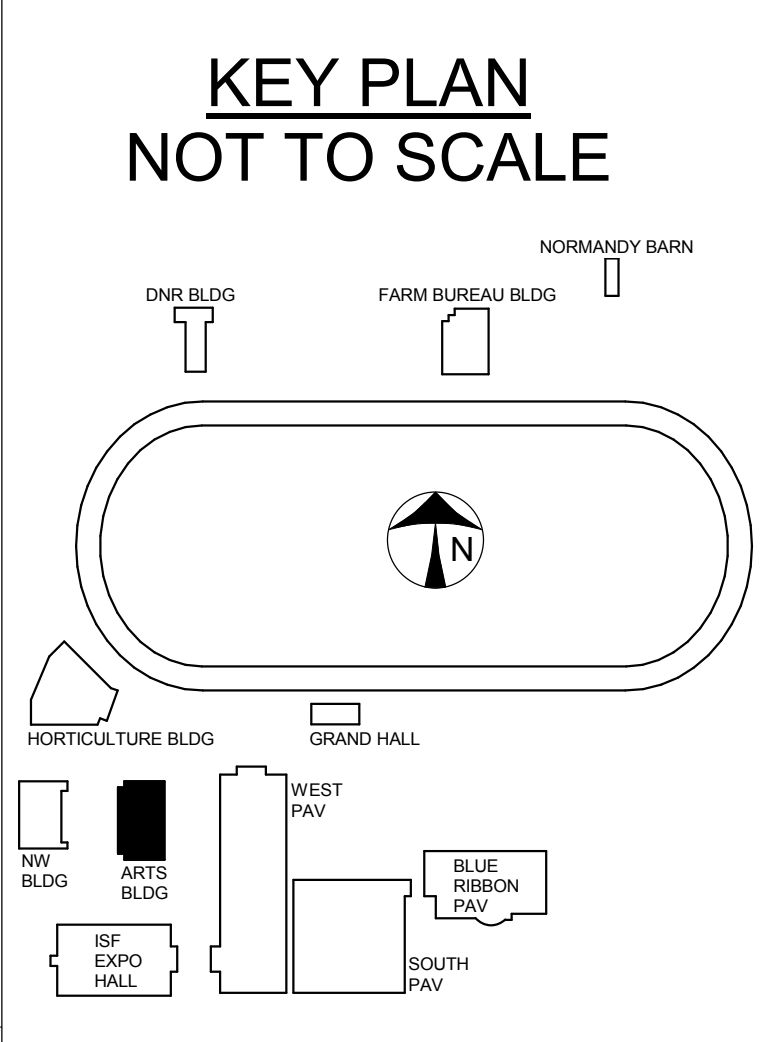
COOLING PERFORMANCE BASED ON 80°F AMBIENT AIR TEMPERATURE, 335 CFM, AND 80/67°F DB/WB ENTERING AIR TEMPS.

CU-3A  
 OUTDOOR UNIT:  
 ELECTRICAL 208V-1P, 15 MCA, 15A MOCP

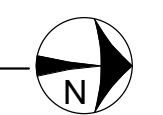


INDIANA STATE FAIRGROUNDS HVAC REPLACEMENTS

OWNER  
 INDIANA STATE FAIRGROUNDS  
 1202 E. 38TH ST,  
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1 INDIANA ARTS BLDG. HVAC SECOND FLOOR PLAN - NEW WORK  
 SCALE: 1/8" = 1'-0"



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SHEET TITLE  
 INDIANA ARTS BUILDING  
 HVAC SECOND FLOOR  
 PLAN

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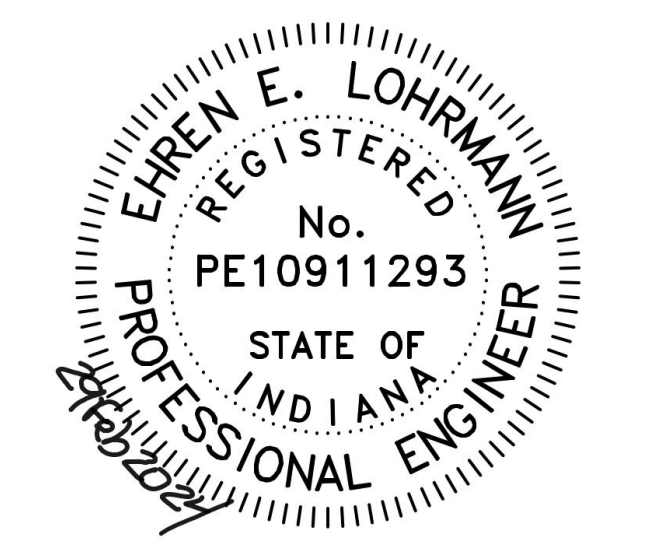


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INDIANA STATE  
**FAIRGROUNDS**  
& EVENT CENTER

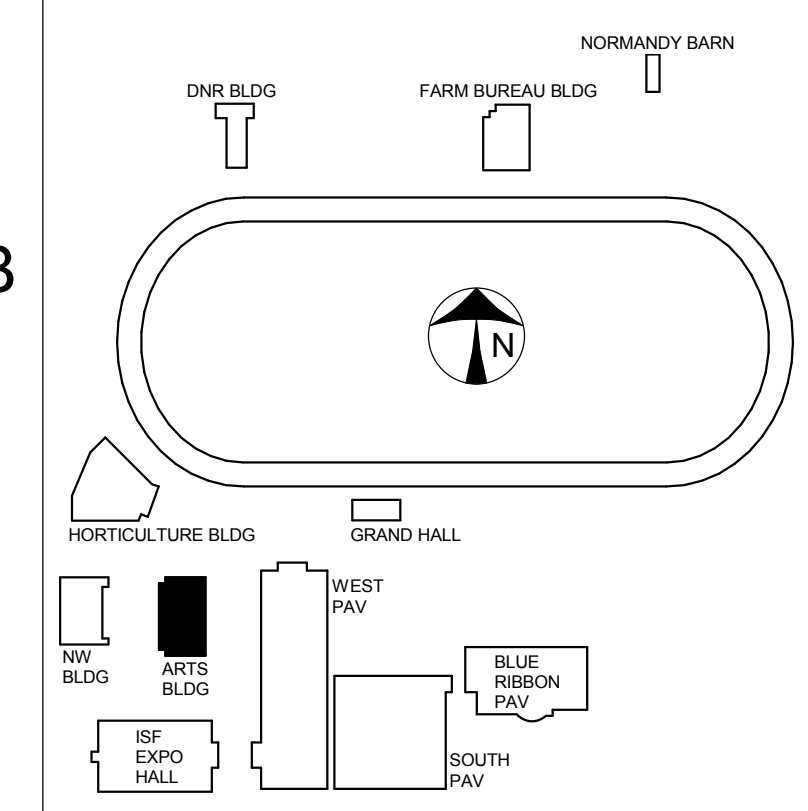
CONSULTANTS



*E. E. Lohrman*

INDIANA STATE  
FAIRGROUNDS HVAC  
REPLACEMENTS  
OWNER  
INDIANA STATE  
FAIRGROUNDS  
1202 E. 38TH ST,  
INDIANAPOLIS, IN 46205

**KEY PLAN**  
NOT TO SCALE



**NOTES**

1. REMOVE EXISTING CONDENSING UNIT AND ASSOCIATED INDOOR UNIT, CONTROLS, LINESET, ETC. EXISTING WALL PENETRATIONS TO BE REUSED FOR NEW REFRIGERANT PIPING. REPLACE EXISTING WOODEN EQUIPMENT RAILS AND PROVIDE NEW FOR SETTING CONDENSING UNIT.
2. REMOVE INDOOR DUCTED AIR HANDLING FURNACE. EXISTING DUCTWORK TO REMAIN AND BE MODIFIED ONLY AS REQUIRED FOR RECONNECTION TO NEW FURNACES.
3. REMOVE EXISTING WALL MOUNTED INDOOR UNIT AND ASSOCIATED REFRIGERANT PIPING, CONTROLS, ETC.
4. CONTRACTOR SHALL VERIFY WHERE ASSOCIATED THERMOSTAT IS LOCATED AND REMOVE. CONTRACTOR SHALL NOTE LOCATIONS FOR REUSE UNDER NEW WORK.



**INDIANA ARTS BLDG. THIRD FLOOR PLAN - DEMOLITION**

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



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SHEET TITLE  
**INDIANA ARTS BLDG.  
HVAC THIRD FLOOR PLAN**

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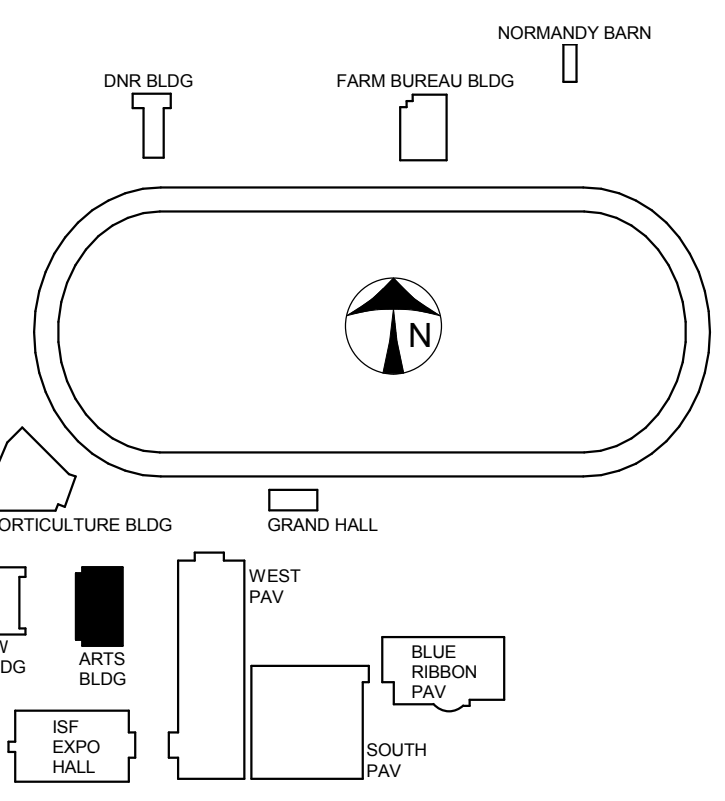
CONSULTANTS



*E. E. Lohrman*

INDIANA STATE  
FAIRGROUNDS HVAC  
REPLACEMENTS  
OWNER  
INDIANA STATE  
FAIRGROUNDS  
1202 E. 38TH ST,  
INDIANAPOLIS, IN 46205

**KEY PLAN**  
NOT TO SCALE



**NOTES**

1. PROVIDE NEW WOODEN EQUIPMENT RAILS FOR SUPPORTING CONDENSING UNIT.
2. PROVIDE NEW DUCTED AIR HANDLER UNIT SHALL BE PLACED IN THE SAME LOCATION AS EXISTING AIR HANDLER BEING REPLACED. CONTRACTOR SHALL PROVIDE DUCTWORK TRANSITIONS TO CONNECT TO EXISTING SUPPLY AND RETURN DUCTWORK.
3. CONTRACTOR SHALL PROVIDE NEW THERMOSTAT TO CONTROL NEW AIR HANDLING UNIT. EXISTING THERMOSTAT LOCATIONS WILL BE REUSED FOR NEW THERMOSTAT PLACEMENT.

**EQUIPMENT DATA**

CU-1,2,3,4,6,7-1A  
OUTDOOR UNIT: CARRIER FV4CNB005L00, 3-TON UNIT SIZE  
208V-1P-60Hz, 19.8 MCA, 35 A MOCP  
35"X25"X2" LxWxH, 230lb WEIGHT  
COOLING ENTERING AIR DRY BULB AMBIENT: 95 F

AC-1,2,3,4,6,7-1A  
INDOOR COIL:  
UNIT MODEL: CARRIER FV4CNB005L00, SIZE 005  
208V-1P-60Hz, 4.3 FLA, 15 MOCP  
NO HEAT  
COIL DIMENSIONS: 22" X 21" X 53" LxWxH  
WEIGHT: 175lb  
ENTERING AIR: 80/67 F DBWB  
LEAVING AIR TEMPERATURE: 60.3/58 F DBWB  
TOTAL EXTERNAL STATIC PRESSURE: 0.5"

CU-5-1A  
OUTDOOR UNIT:  
CARRIER MODEL 38MHB024CA3  
208V-1P-60Hz, 24.5 MCA 30A MOCP  
140lb WEIGHT  
COOLING ENTERING AIR DRY BULB AMBIENT: 92 F  
23.575 BTUH COOLING CAPACITY  
18.275 BTUH HEATING CAPACITY  
HEATING OUTDOOR TEMPERATURE: -2.6 F

AC-5-1A (TWO INDOOR UNITS TIED TO ONE OUTDOOR UNIT)  
INDOOR UNIT:  
CARRIER MODEL 40MAB012XA3 HIGH WALL TYPE  
ENTERING AIR: 80/67 DBWB  
TOTAL COOLING CAPACITY: 11,797 BTUH  
SENSIBLE COOLING CAPACITY: 9,549 BTUH  
HEATING CAPACITY: 8,137 BTUH  
UNIT(S) ARE POWERED FROM THE OUTDOOR UNIT

**INDIANA ARTS BLDG. THIRD FLOOR PLAN - NEW WORK**

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

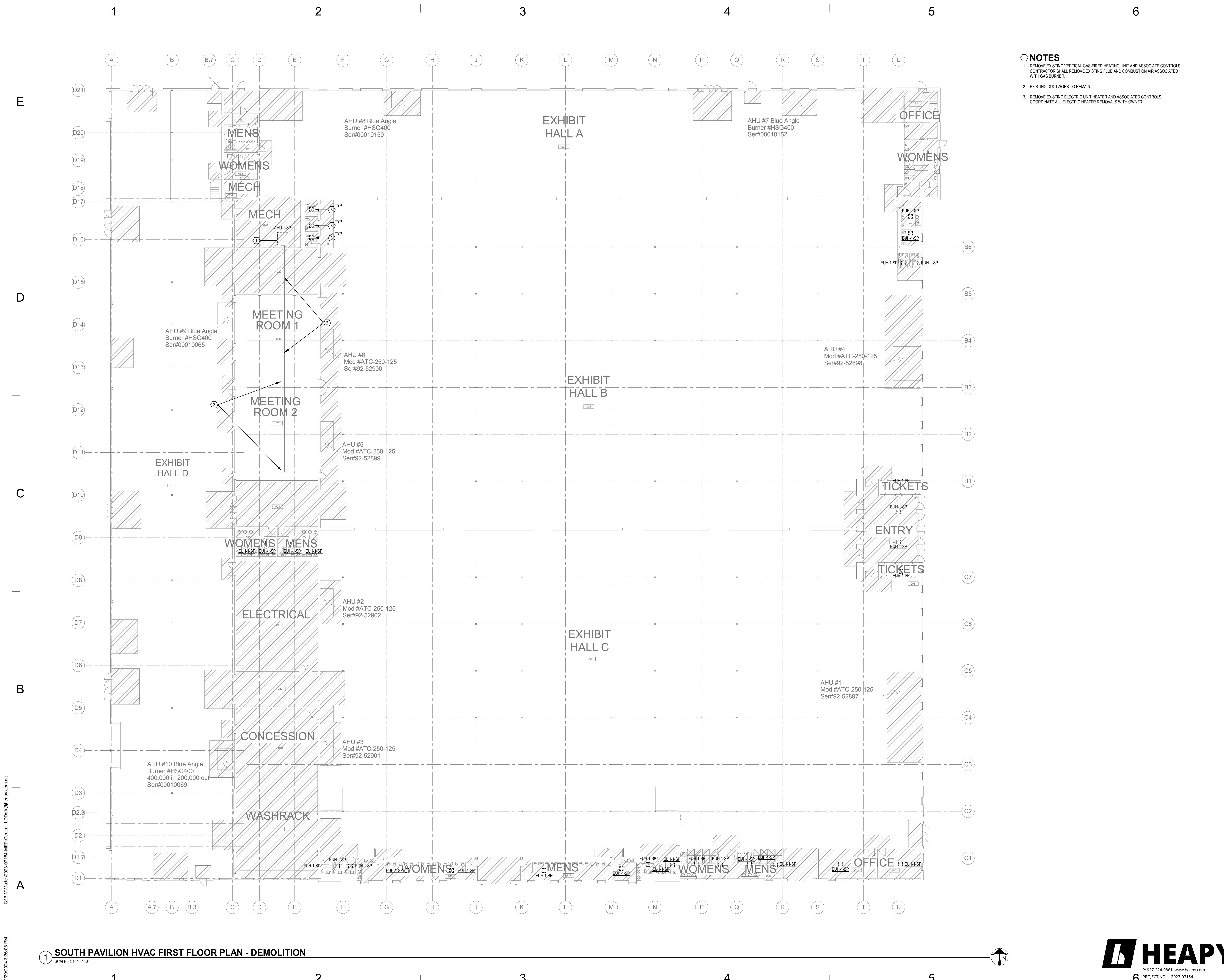


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SHEET TITLE  
**INDIANA ARTS BLDG.**  
**HVAC THIRD FLOOR PLAN**

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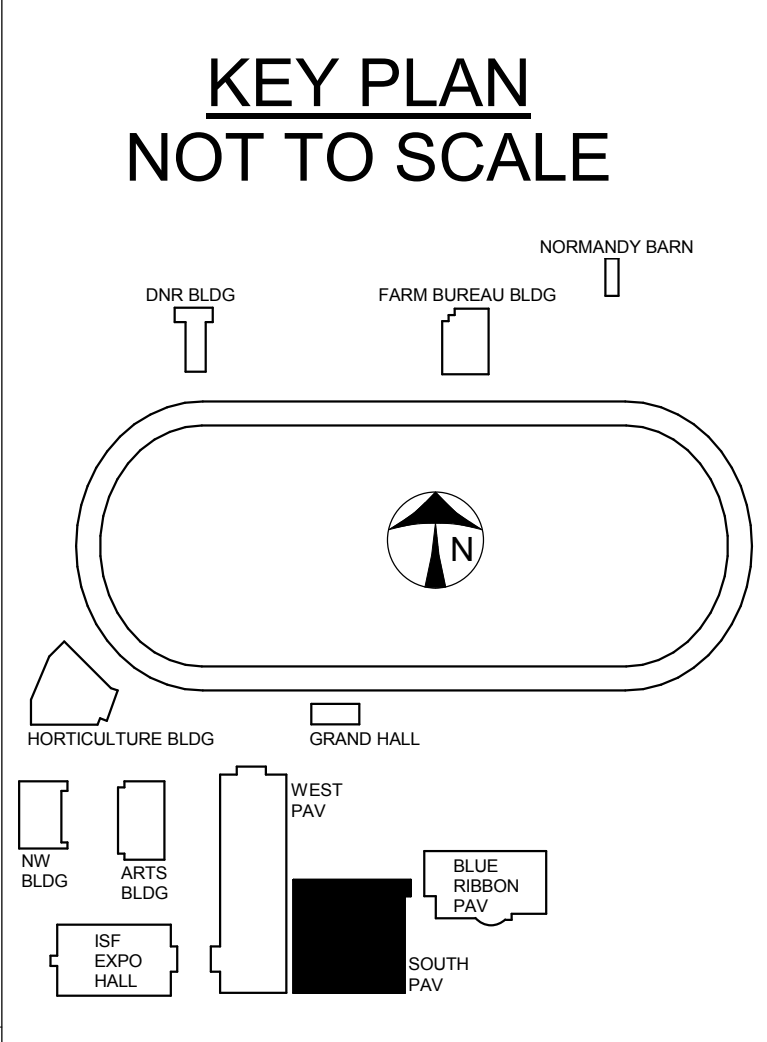
- NOTES**
1. REMOVE EXISTING VERTICAL GAS-FIRED HEATING UNIT AND ASSOCIATE CONTROLS. CONTRACTOR SHALL REMOVE EXISTING FLUE AND COMBUSTION AIR ASSOCIATED WITH GAS BURNER.
  2. EXISTING DUCTWORK TO REMAIN.
  3. REMOVE EXISTING ELECTRIC UNIT HEATER AND ASSOCIATED CONTROLS. COORDINATE ALL ELECTRIC HEATER REMOVALS WITH OWNER.



CONSULTANTS

*E. E. Lohrman*

INDIANA STATE FAIRGROUNDS HVAC REPLACEMENTS  
 OWNER: INDIANA STATE FAIRGROUNDS  
 1202 E. 38TH ST,  
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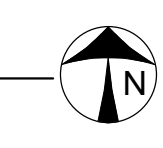


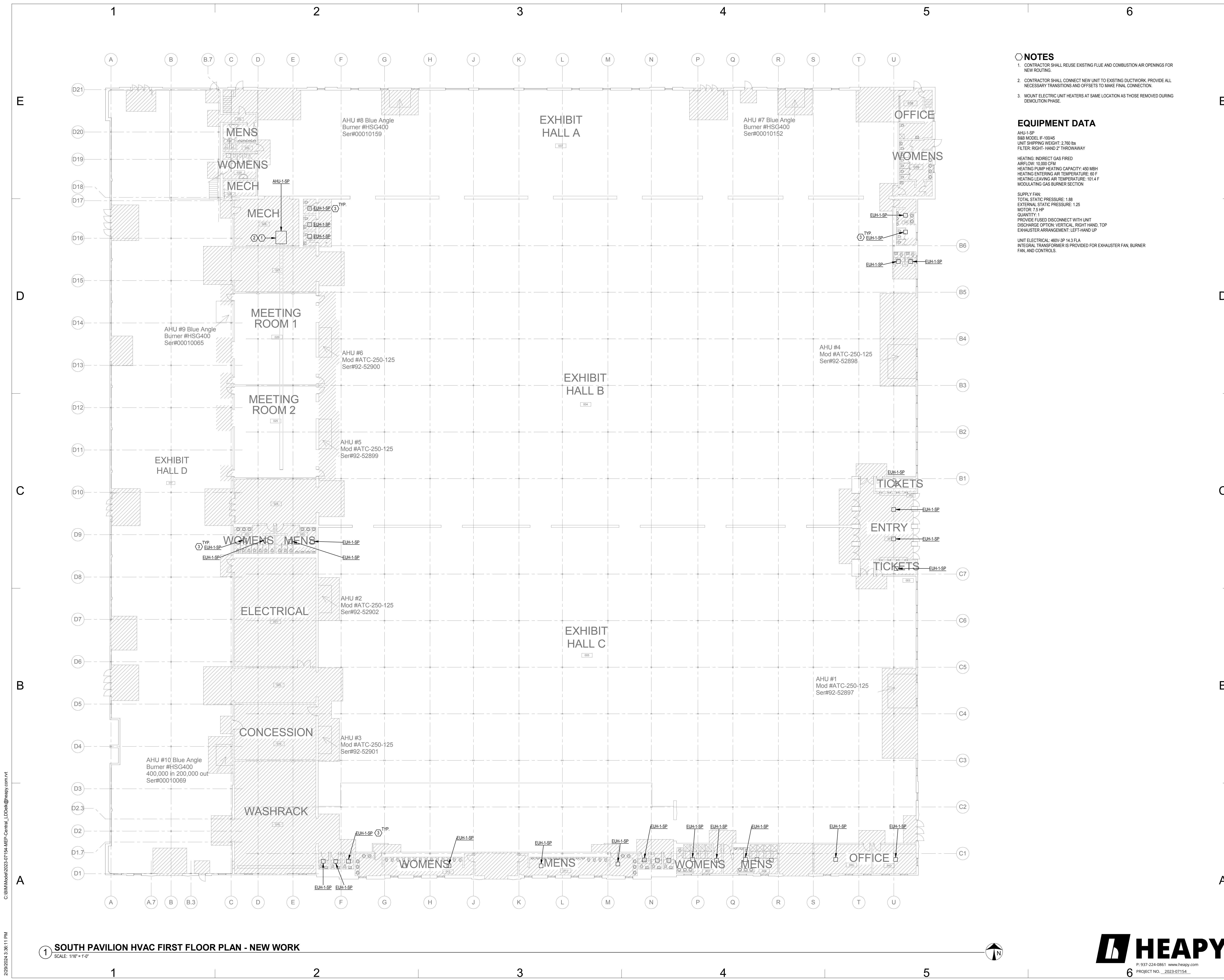
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SHEET TITLE  
**SOUTH PAVILION – DEMOLITION**  
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**1 SOUTH PAVILION HVAC FIRST FLOOR PLAN - DEMOLITION**  
 SCALE: 1/16" = 1'-0"





- NOTES**
- CONTRACTOR SHALL REUSE EXISTING FLUE AND COMBUSTION AIR OPENINGS FOR NEW ROUTING.
  - CONTRACTOR SHALL CONNECT NEW UNIT TO EXISTING DUCTWORK; PROVIDE ALL NECESSARY TRANSITIONS AND OFFSETS TO MAKE FINAL CONNECTION.
  - MOUNT ELECTRIC UNIT HEATERS AT SAME LOCATION AS THOSE REMOVED DURING DEMOLITION PHASE.

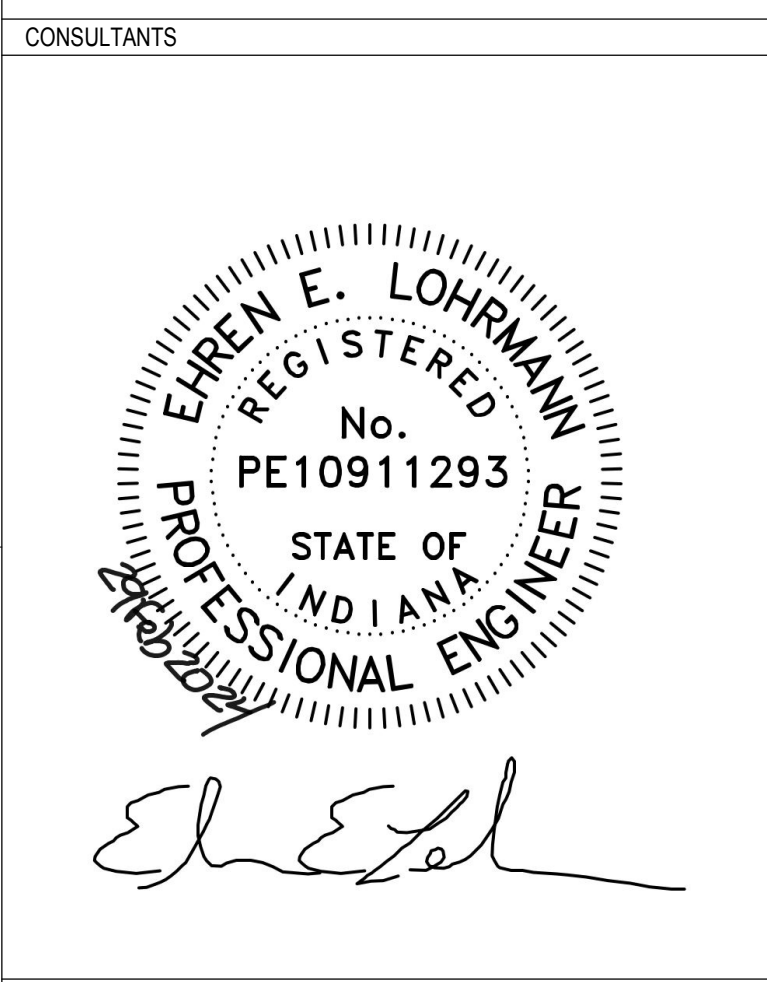
**EQUIPMENT DATA**

AHU-1-SP  
 B&B MODEL #10645  
 UNIT SHIPPING WEIGHT: 2,760 lbs  
 FILTER: RIGHT-HAND 2" THROWAWAY

HEATING: INDIRECT GAS FIRED  
 AIRFLOW: 10,000 CFM  
 HEATING PUMP HEATING CAPACITY: 450 MBH  
 HEATING ENTERING AIR TEMPERATURE: 60 F  
 HEATING LEAVING AIR TEMPERATURE: 101.4 F  
 MODULATING GAS BURNER SECTION

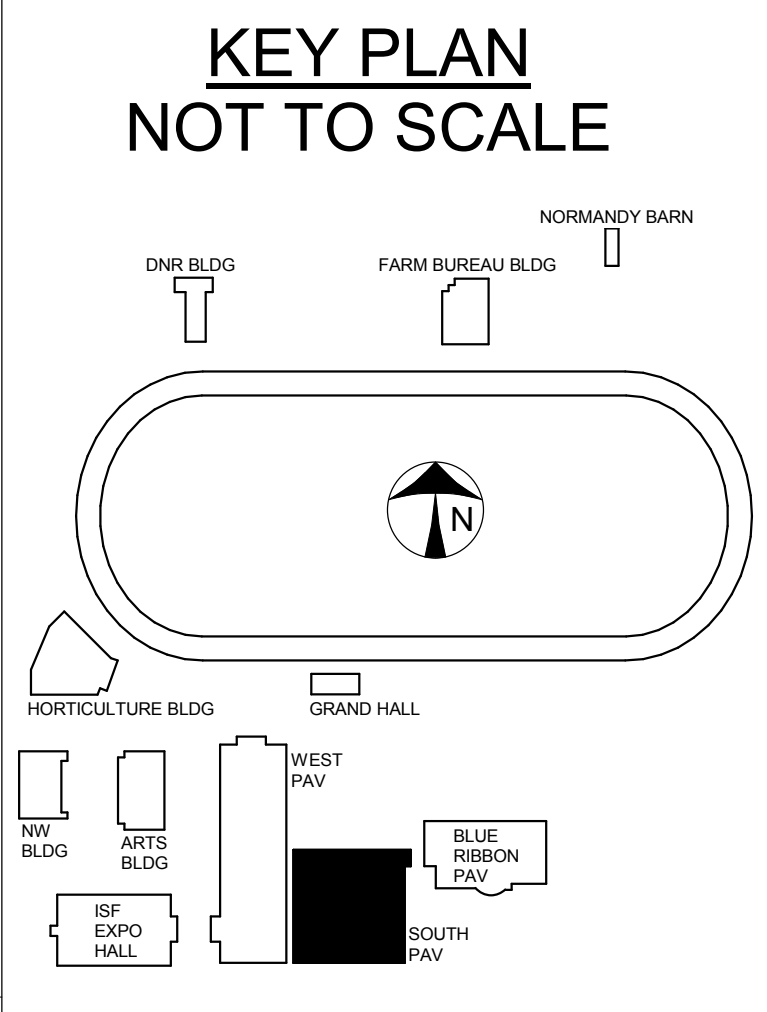
SUPPLY FAN  
 TOTAL STATIC PRESSURE: 1.88  
 EXTERNAL STATIC PRESSURE: 1.25  
 MOTOR: 7.5 HP  
 QUANTITY: 1  
 PROVIDE FUSED DISCONNECT WITH UNIT  
 DISCHARGE OPTION: VERTICAL, RIGHT HAND, TOP  
 EXHAUSTER ARRANGEMENT: LEFT-HAND UP

UNIT ELECTRICAL: 460V-3P 14.3 FLA  
 INTEGRAL TRANSFORMER IS PROVIDED FOR EXHAUSTER FAN, BURNER  
 FAN AND CONTROLS.



INDIANA STATE FAIRGROUNDS HVAC REPLACEMENTS

OWNER:  
 INDIANA STATE FAIRGROUNDS  
 1202 E. 38TH ST,  
 INDIANAPOLIS, IN 46205



MARK	DATE	DESCRIPTION
PROJECT NO:	2023-07154	
REVIT FILE:	C:\BIM\Aeol\2023-07154-MEP-Central_LDD\ek@heapy.com.rvt	
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CHKD BY:	PMT	
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SHEET TITLE  
**SOUTH PAVILION – NEW WORK**

M111

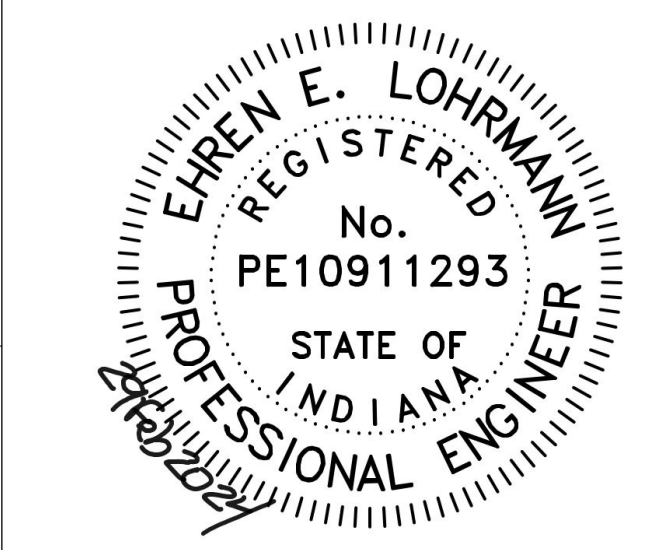
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**1 SOUTH PAVILION HVAC FIRST FLOOR PLAN - NEW WORK**  
 SCALE: 1/16" = 1'-0"





CONSULTANTS



*E. E. Lohrman*

INDIANA STATE FAIRGROUNDS HVAC REPLACEMENTS  
OWNER  
INDIANA STATE FAIRGROUNDS  
1202 E. 38TH ST,  
INDIANAPOLIS, IN 46205

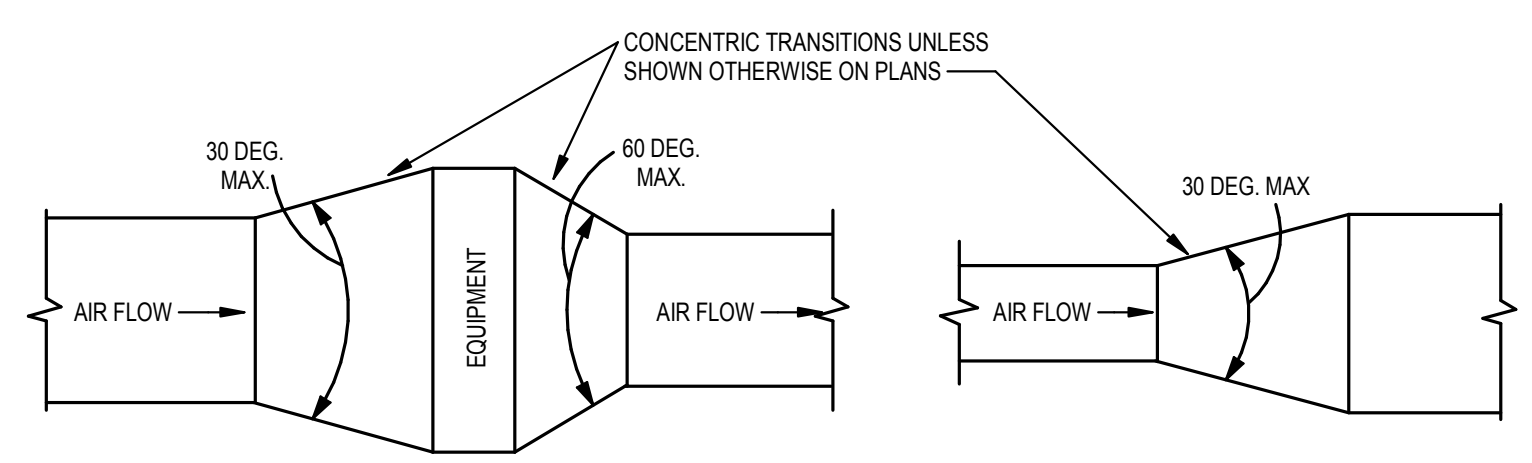
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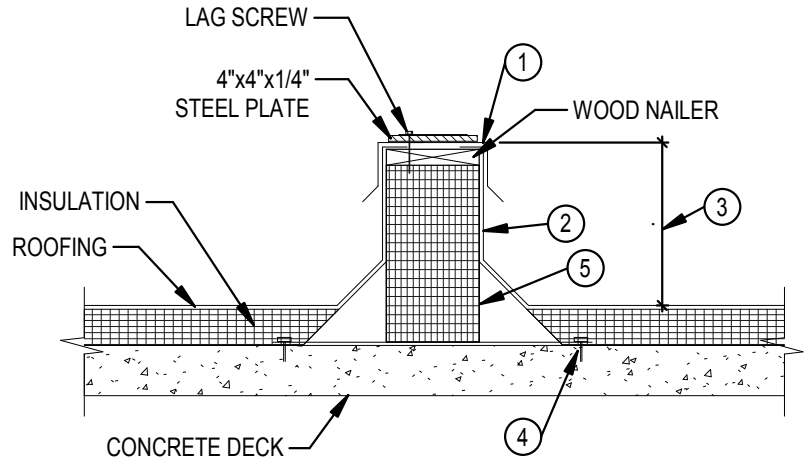
SHEET TITLE  
**DETAILS**  
M501

**NOTES**

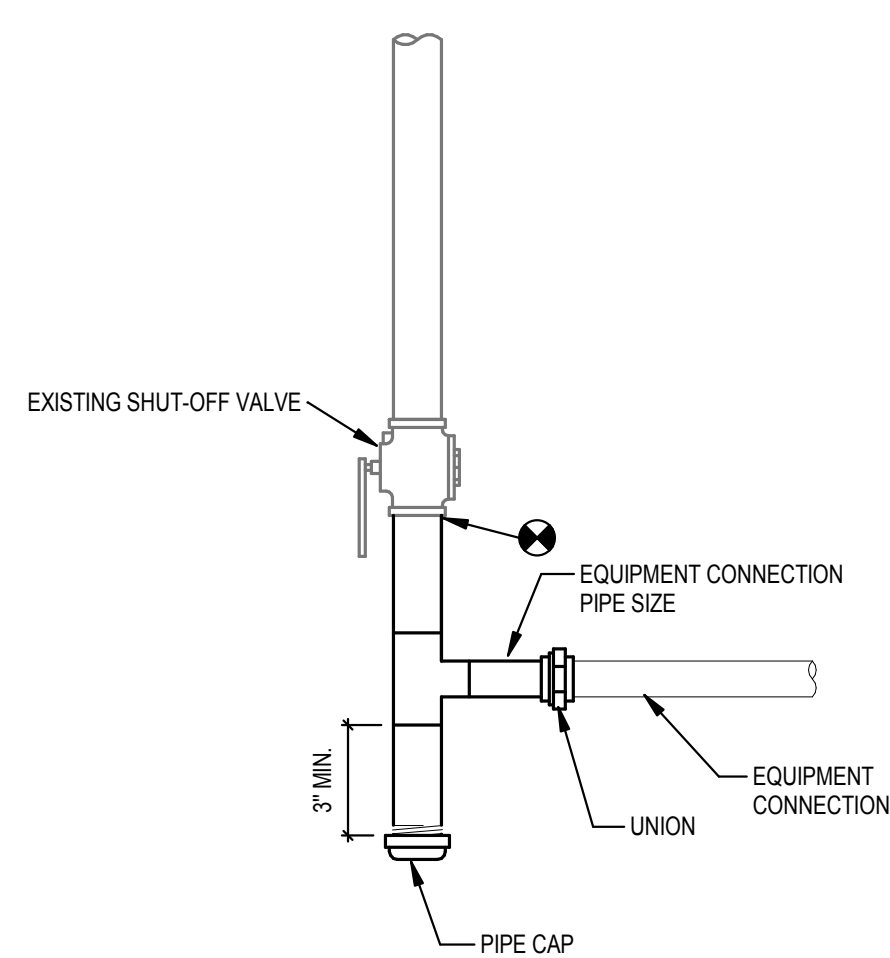
1. DRAIN PIPE SAME SIZE AS UNIT DRAIN PAN CONNECTION
2. UNIT ROOF CURB: VERIFY REQUIRED HEIGHT FOR DRAIN PIPE AND TRAP INSTALLATION. PROVIDE CURB OF ADEQUATE HEIGHT TO ATTAIN REQUIRED DIMENSION.
3. TEE WITH CLEANOUT PLUG
4. CENTERLINE - TO - CENTERLINE DIMENSION NOT LESS THAN SUPPLY FAN T.S.P. (N.W.G.) + 1 INCH.
5. CENTERLINE - TO - CENTERLINE DIMENSION SHALL BE 50% OF DIMENSION FOUND IN (4) ABOVE.
6. SPLASH BLOCK.



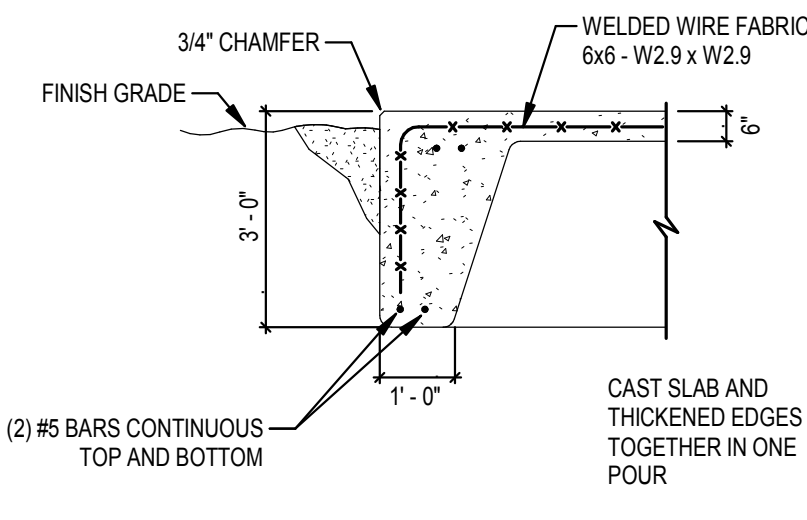
NOTE:  
A. UNLESS OTHERWISE INDICATED ON PLANS, MAXIMUM ANGLES SHOWN SHALL APPLY.  
B. TRANSITION ANGLES IN AND OUT OF FANS SHALL BE 50% OF THOSE SHOWN ABOVE.



**1 ROOF EQUIPMENT SUPPORT**  
SCALE: NONE

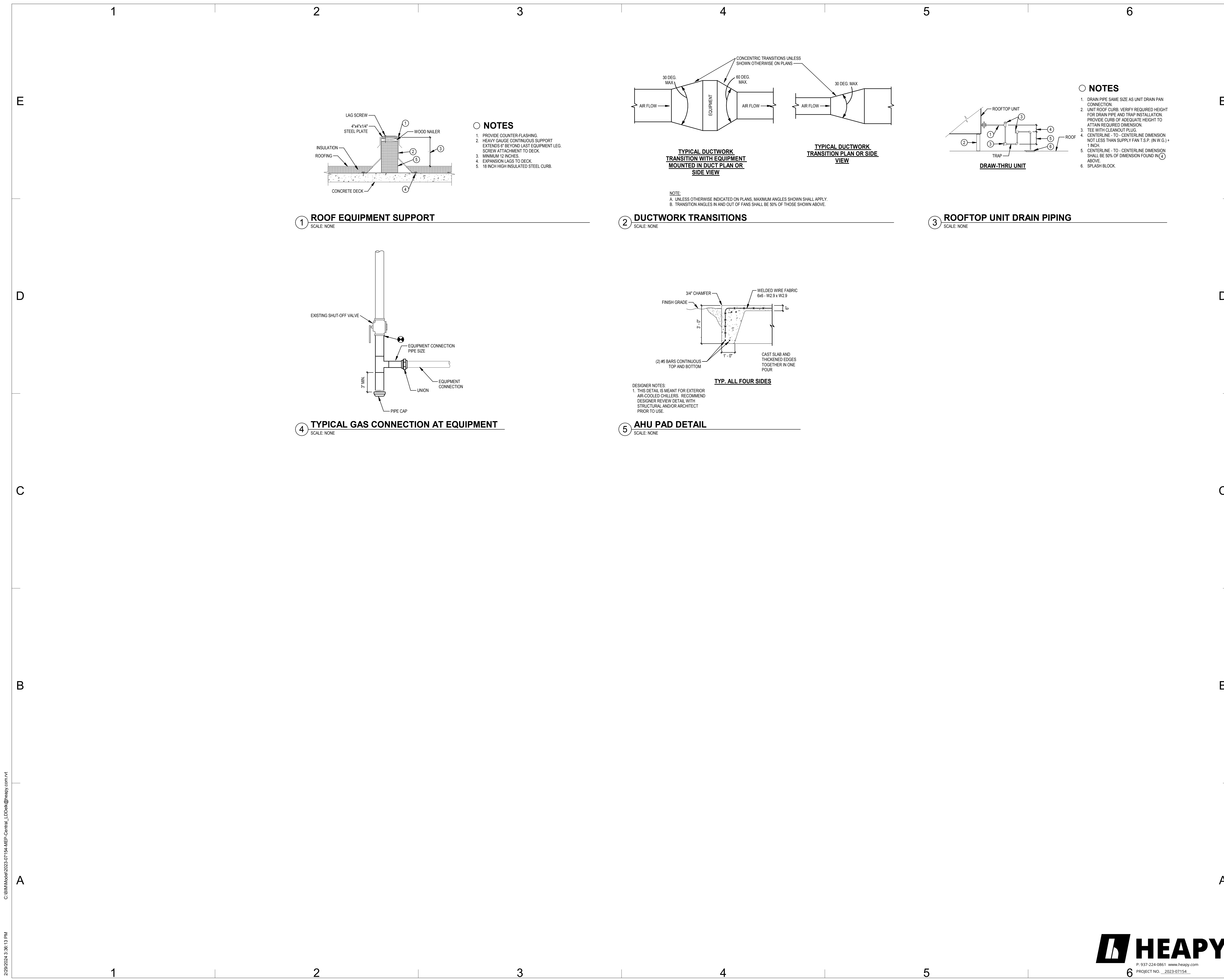


**4 TYPICAL GAS CONNECTION AT EQUIPMENT**  
SCALE: NONE



DESIGNER NOTES:  
1. THIS DETAIL IS MEANT FOR EXTERIOR AIR-COOLED CHILLERS. RECOMMEND DESIGNER REVIEW DETAIL WITH STRUCTURAL AND/OR ARCHITECT PRIOR TO USE.

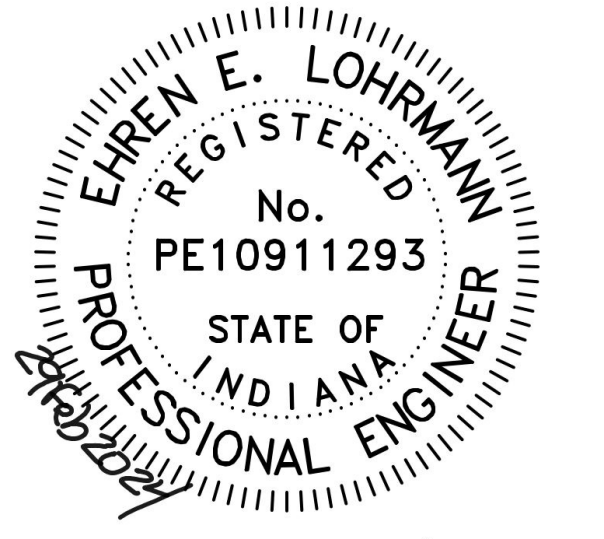
**5 AHU PAD DETAIL**  
SCALE: NONE







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*E. E. Lohrman*

INDIANA STATE  
FAIRGROUNDS HVAC  
REPLACEMENTS  
INDIANA STATE  
FAIRGROUNDS  
1202 E. 38TH ST,  
INDIANAPOLIS, IN 46205

OWNER

**GENERAL NOTES-  
AUTOMATIC TEMPERATURE CONTROLS**

- A A COMPLETE SYSTEM OF AUTOMATIC TEMPERATURE CONTROLS SHALL BE INSTALLED AS REQUIRED TO ACCOMPLISH THE SEQUENCE OF CONTROL FOR VARIOUS ITEMS OF EQUIPMENT AND SYSTEMS DESCRIBED HEREINAFTER. THE SYSTEM SHALL BE A DIRECT DIGITAL CONTROL SYSTEM UTILIZING ELECTRIC OR PNEUMATIC ACTUATION AS DEFINED IN THE SPECIFICATIONS.
- B THE CONTROL DIAGRAMS AND INFORMATION CONTAINED WITHIN ARE TO SHOW DESIGN INTENT. IT IS THE CONTROL SYSTEM SUPPLIER'S RESPONSIBILITY TO DEVELOP DETAILED AND COMPLETE CONTROL DIAGRAMS AND SHOP DRAWINGS TO ACCOMPLISH THE SPECIFIED SEQUENCES.
- C THE POINTS LIST IS SHOWN AS AN AID TO THE CONTRACTOR INDICATING THE MINIMUM POINTS REQUIRED FOR CONTROL AND MONITORING. ALL INPUT AND OUTPUT POINTS, AND THEIR REQUIRED INTERFACE AND ACCESSORY HARDWARE, SHALL BE PROVIDED FOR A COMPLETE AND FUNCTIONAL CONTROL SYSTEM. IF OR WHEN ADDITIONAL POINTS ARE REQUIRED TO ACCOMPLISH THE SEQUENCES OF CONTROL SPECIFIED, THESE POINTS, ALONG WITH ADDITIONAL DIRECT DIGITAL CONTROL PANE(S) (IF REQUIRED), SHALL ALSO BE PROVIDED.
- D BULB WELLS FOR TEMPERATURE SENSING AS INDICATED SHALL BE PROVIDED BY THE HVAC CONTRACT. PIPING WORK SHALL INCLUDE PROPERLY SIZED WELDOLET OR THREADED FITTINGS PLACED AS DIRECTED BY THE CONTROL SYSTEM SUPPLIER.
- E ELECTRICAL WORK INCLUDES A POWER SOURCE TO THE MOTOR STARTERS. PROVIDE ALL HVAC POWER SOURCES REQUIRED BEYOND THESE STARTERS OR BEYOND SOURCES EXPLICITLY SHOWN ON THE ELECTRICAL DRAWINGS. THIS SHALL INCLUDE BUT NOT BE LIMITED TO WIRING, CONDUIT, TRANSFORMERS, RELAYS AND FUSES.

**LEGEND-  
AUTOMATIC TEMPERATURE CONTROLS**

- AFMS AIR FLOW MEASURING STATION
- VFD VARIABLE FREQUENCY DRIVE (ADJUSTABLE FREQUENCY MOTOR CONTROLLER)
- MS MOTOR STARTER
- CON CONTACTOR
- TCP LOCAL TEMPERATURE CONTROL PANEL
- PSH PRESSURE SAFETY - HIGH
- PSL PRESSURE SAFETY - LOW
- SD SMOKE DETECTOR
- M DAMPER OR VALVE ACTUATOR - MODULATING
- M DAMPER OR VALVE ACTUATOR - 2-POSITION
- R RELAY
- UV UV LIGHT
- PUMP
- FAN
- COOLING COIL
- HEATING COIL
- HUMIDIFIER
- FILTER
- ENERGY RECOVERY WHEEL
- OPPOSED BLADE CONTROL DAMPER
- PARALLEL BLADE CONTROL DAMPER
- SMOKE DAMPER
- MIN OA / ECON DAMPER
- DX COIL
- WALL MOUNTED DEVICE
- DUCT INSERTION DEVICE
- PIPE INSERTION OR IMMERSION DEVICE WITH WELL
- AVERAGING SENSOR OR DEVICE
- OUTDOOR SENSOR OR DEVICE, SHIELDED
- X x Y FAN ARRAY, "X" FANS VERTICAL x "Y" FANS HORIZONTAL

**LEGEND-  
AUTOMATIC TEMPERATURE CONTROLS**

- XX-01 CONTROL POINT - SEE POINTS SCHEDULE
- AI ANALOG INPUT
- AO ANALOG OUTPUT
- BI BINARY INPUT
- BO BINARY OUTPUT
- PI PULSED INPUT
- OAT OUTSIDE AIR TEMPERATURE
- MAT MIXED AIR TEMPERATURE
- RAT RETURN AIR TEMPERATURE
- SAT SUPPLY AIR TEMPERATURE
- CCAT COOLING COIL LEAVING AIR TEMPERATURE
- HCAT HEATING COIL LEAVING AIR TEMPERATURE
- OHY OUTSIDE AIR HUMIDITY
- RAH RETURN AIR HUMIDITY
- SAH SUPPLY AIR HUMIDITY
- NC NORMALLY CLOSED (CLOSES ON LOSS OF POWER)
- NO NORMALLY OPEN (OPENS ON LOSS OF POWER)
- L LOW
- H HIGH
- C COMMON
- 2-WAY AUTOMATIC 2-POSITION CONTROL VALVE
- 3-WAY AUTOMATIC 2-POSITION CONTROL VALVE
- 2-WAY AUTOMATIC MODULATING CONTROL VALVE
- 3-WAY AUTOMATIC MODULATING CONTROL VALVE
- DIFFERENTIAL PRESSURE SENSOR
- DIFFERENTIAL PRESSURE SWITCH
- CARBON DIOXIDE SENSOR
- CARBON MONOXIDE SENSOR
- CURRENT SENSOR TRANSMITTER
- ELECTRONIC TO PNEUMATIC TRANSDUCER
- FLOW METER TRANSMITTER
- HUMIDITY SENSOR
- LEVEL CONTROLLER
- LEVEL TRANSMITTER
- PRESSURE SENSOR
- STATIC PRESSURE SENSOR
- TEMPERATURE SENSOR
- WATER FLOW SENSOR
- WATER LEVEL SENSOR
- CURRENT SWITCH
- END SWITCH
- FLOW SWITCH
- HUMIDISTAT
- OCCUPANCY SENSOR
- PRESSURE SWITCH, HIGH LIMIT
- PRESSURE SWITCH, LOW LIMIT
- TEMPERATURE LOW LIMIT (FREEZE STAT)
- ROOM THERMOSTAT
- WATER LEVEL SWITCH
- EMERGENCY SHUT-OFF STATION

**1 ATC LEGEND**  
SCALE: NONE

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PROJECT NO:	2023-07154	
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SHEET TITLE  
**CONTROLS LEGEND**

M701

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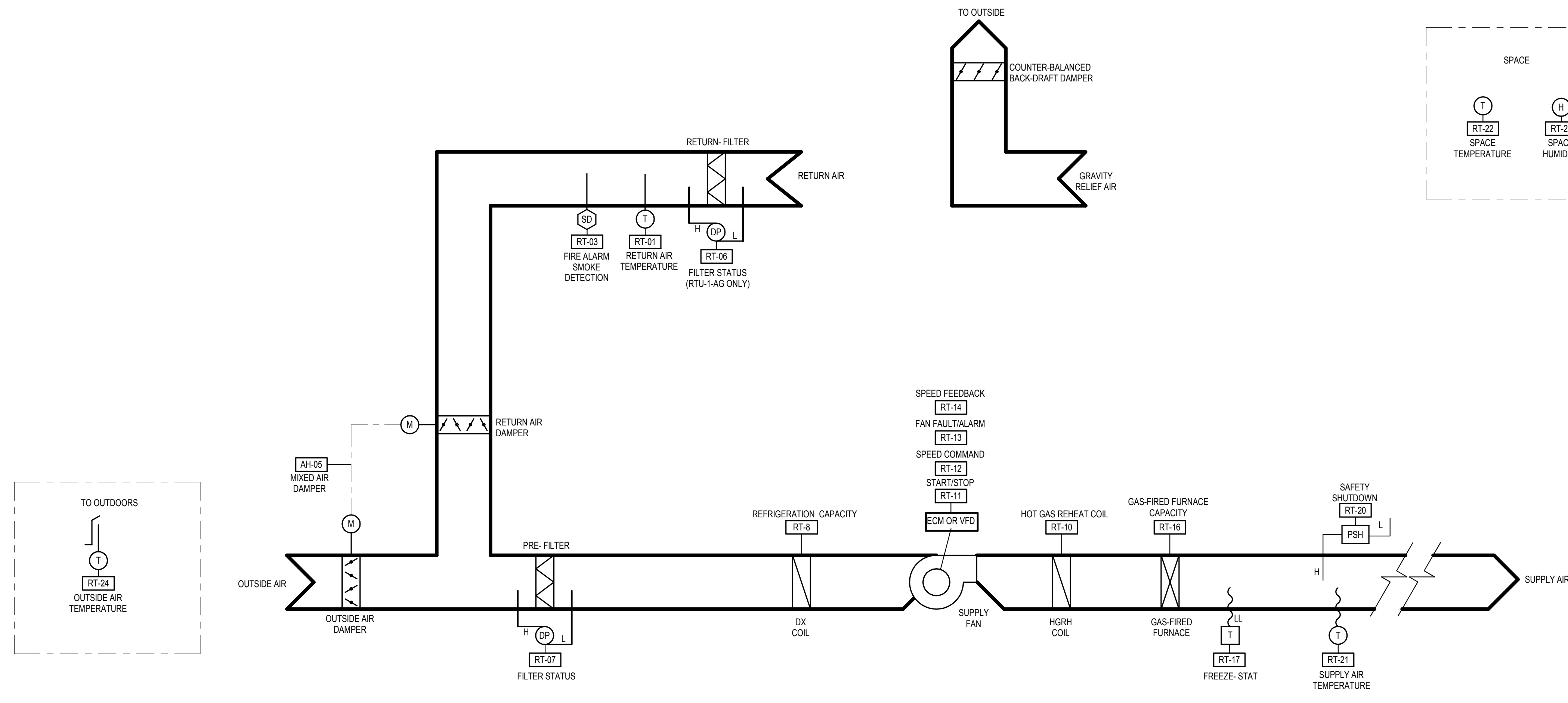


*E. Lohrman*

INDIANA STATE  
**FAIRGROUNDS HVAC**  
REPLACEMENTS  
INDIANA STATE  
**FAIRGROUNDS**  
1202 E. 38TH ST,  
INDIANAPOLIS, IN 46205

**RTU SEQUENCES**

- A. RTU CONTROLLER(S) SEQUENCES OF OPERATION**
- ALL SEQUENCES SHALL COMPLY WITH ASHRAE STANDARD 90.1-2010.
  - THE RTU OCCUPANCY SCHEDULE SHALL RESIDE WITHIN THE RTU CONTROLLER, EDITABLE VIA THE BAS.
    - ALTERNATIVE SCHEDULING OPTION: IF THE SCHEDULE RESIDING IN THE RTU CONTROLLER IS NOT EDITABLE BY THE BAS, THE SCHEDULE MAY RESIDE IN THE BAS WITH THE BAS SENDING A "NEXT STATE" OCCUPIED/ UNOCCUPIED DATETIME SIGNAL TO THE RTU CONTROLLER SO THE RTU CONTROLLER CAN MANAGE OPTIMAL START (MORNING WARM-UP / COOL-DOWN, NIGHT SETBACK, NIGHT SET-UP FUNCTIONS AND OCCUPIED FUNCTIONS. IF NETWORK COMMUNICATION IS LOST, THE RTU CONTROLLER SHALL DETERMINE MODES BASED ON HISTORICAL DATA. EXACT DETAILS SHALL BE COORDINATED WITH THE BAS.
  - NIGHT SETBACK HEATING MODE SHALL BE INITIATED WHILE THE RTU IS IN UNOCCUPIED MODE TO KEEP THE REPRESENTATIVE SPACE TEMPERATURE ABOVE THE NIGHT SETBACK TEMPERATURE SETPOINT (60 DEGF DEFAULT, ADJUSTABLE).
  - NIGHT SET-UP COOLING MODE SHALL BE INITIATED WHILE THE RTU IS IN UNOCCUPIED MODE TO KEEP THE REPRESENTATIVE SPACE TEMPERATURE AND HUMIDITY BELOW THE NIGHT SET-UP TEMPERATURE SETPOINT (60 DEGF DEFAULT, ADJUSTABLE) AND RH BELOW 60% (ONLY ON LISTED RTUS) (ADJUSTABLE). THE REPRESENTATIVE SPACE TEMPERATURE AND RH WILL BE DETERMINED BY SPACE THERMOSTAT / HUMIDITY SENSOR AND COMMUNICATED TO THE RTU CONTROLLER.
  - AN ADAPTIVE OPTIMAL START PROGRAM SHALL START THE UNIT IN MORNING WARM-UP OR COOL-DOWN IN ADVANCE OF THE SCHEDULED "OCCUPIED" TIME TO ENSURE PROPER SPACE TEMPERATURE AT OCCUPANCY TIME. MORNING WARM-UP SHALL END WHEN THE REPRESENTATIVE SPACE TEMPERATURE IS ABOVE 65 DEGF (ADJUSTABLE). MORNING COOL-DOWN SHALL END WHEN THE REPRESENTATIVE SPACE TEMPERATURE IS BELOW 75 DEGF (ADJUSTABLE). THE REPRESENTATIVE SPACE TEMPERATURE WILL BE DETERMINED BY THE SPACE THERMOSTAT AND COMMUNICATED TO THE RTU CONTROLLER.
  - SAFETIES SHALL SHUT DOWN THE UNIT IN AN ORDERLY FASHION AND ALARM THE BAS.
  - THE AIR HANDLING UNIT COMPONENTS (DX COIL, GAS HEATER, ECONOMIZER, FAN SPEED, ETC) SHALL BE SEQUENCED TO SATISFY THE "OCCUPIED" DISCHARGE AIR TEMPERATURE SETPOINT SET BY THE BAS. SUPPLY AIR TEMPERATURE SETPOINT FOR "WARM-UP" CYCLES SHALL BE 90 DEGF (ADJUSTABLE VIA THE BAS), AND 54 DEGF DURING "COOL-DOWN" CYCLES (ADJUSTABLE VIA THE BAS).
  - MINIMUM OUTSIDE AIR SHALL BE BALANCED DURING RTU SETUP. PROVIDE ADDITIONAL 10 PERCENT OUTSIDE AIR FLOW WHEN BALANCING WITH CLEAN FILTERS TO ACCOUNT FOR CHANGING FILTER PRESSURE DROP.
  - ECONOMIZER CONTROL SHALL BE DRY BULB SEQUENCE WITH AN "OFF" SETPOINT OF 60 DEGF DB OUTSIDE AIR TEMPERATURE. ECONOMIZER SHALL BE DISABLED WHEN OUTSIDE AIR TEMPERATURE FALLS BELOW 35 DEGF DB. MIXED AIR DAMPERS SHALL MODULATE TO MAINTAIN SUPPLY AIR TEMPERATURE.
  - SUPPLY FAN SYSTEM SPEED SHALL MODULATE BETWEEN 20 PERCENT OF TOTAL SUPPLY AIRFLOW AND TOTAL SUPPLY AIRFLOW TO MAINTAIN THE SPACE SETPOINT.
  - DX COIL - IF THE RTU FAN SYSTEM IS "ON" AND THE ECONOMIZER IS ACTIVE AND AT 100 PERCENT (OUTSIDE AIR DAMPERS FULL OPEN) AND RTU SUPPLY AIR TEMPERATURE IS ABOVE SETPOINT, THE SOLENOID VALVES AND COMPRESSOR STEPPING SPEED SHALL BE SEQUENCED TO MAINTAIN A CONSTANT 55 DEGF SUPPLY AIR TEMPERATURE. IF THE RTU FAN SYSTEM IS "ON" AND THE ECONOMIZER IS NOT ACTIVE AND THE RTU SUPPLY AIR TEMPERATURE IS ABOVE SETPOINT, THE SOLENOID VALVES AND COMPRESSOR STEPPING SPEED SHALL BE SEQUENCED TO SATISFY THE SETPOINT. PROVIDE ON AND OFF TIME DELAYS BETWEEN STEPS. USE SUPPLY FAN DRIVE SPEED INTERLOCK ALARM STATE, AS SPECIFIED IN POINTS LIST SCHEDULE, FOR INTERLOCK THRU SOFTWARE TO KEEP COOLING OFF UNLESS THE SUPPLY FAN SYSTEM IS OPERATING.
  - GAS HEATER - MODULATE TO MAINTAIN DISCHARGE AIR SETPOINT.
  - ONLY FOR LISTED RTUS WITH HOT GAS REHEAT COIL: IF SPACE HUMIDITY RISES ABOVE 60% RH, UNIT SHALL ENTER INTO A DEHUMIDIFICATION MODE AND UTILIZE THE ASSOCIATED HOT GAS REHEAT COIL TO TEMPER AIR TO MAINTAIN SPACE SETPOINT.
- B. SEQUENCES OF OPERATION**
- ALL SEQUENCES SHALL COMPLY WITH ASHRAE STANDARD 90.1-2010.
  - OCCUPIED / UNOCCUPIED SCHEDULE SHALL BE DETERMINED BY THE OWNER, RESIDE IN THE BAS, AND PASSED TO THE RTU CONTROLLER.
  - REFER TO RTU SEQUENCES ABOVE FOR ALTERNATIVE SCHEDULING OPTION AS DETERMINED BY THE RTU VENDOR.
  - THE OUTDOOR AIR TEMPERATURE AND HUMIDITY FOR THE NETWORK SHALL BE PASSED TO THE RTU CONTROLLER FOR ECONOMIZER CALCULATION PURPOSES AS SPECIFIED IN THE RTU SEQUENCES.
  - "REPRESENTATIVE SPACE TEMPERATURE" IS THE RTU ASSOCIATED THERMOSTAT AND SHALL BE COMMUNICATED TO THE RTU CONTROLLER AS SPECIFIED IN THE RTU SEQUENCES.
  - "REPRESENTATIVE SPACE HUMIDITY" (ONLY FOR LISTED RTUS) SHALL BE DETERMINED BY AN RH SENSOR MOUNTED IN A REPRESENTATIVE COMMON AREA AND COMMUNICATED TO THE RTU CONTROLLER AS SPECIFIED IN THE RTU SEQUENCES.
  - UNOCCUPIED SPACE TEMPERATURE SETPOINTS AND SUPPLY AIR TEMPERATURE SETPOINTS SHALL BE COMMUNICATED TO THE RTU CONTROLLER AS SPECIFIED IN THE RTU SEQUENCES AS SPECIFIED IN THE RTU SEQUENCES.
  - MINIMUM OUTSIDE AIR CFM FOR OCCUPIED MODE SHALL BE COMMUNICATED TO THE RTU CONTROLLER AS SPECIFIED IN THE RTU SEQUENCES.
  - GENERAL BUILDING EXHAUST FANS SHALL ONLY OPERATE DURING OCCUPIED HOURS BUT SHALL BE SEPARATE START/STOP POINTS.



**ROOFTOP UNIT CONTROLS DIAGRAM**  
SCALE: NONE

**ALL ROOFTOP UNITS (SEE NOTES FOR SLIGHT DIFFERENCES BETWEEN UNITS)**

**GENERAL NOTES:**

- POINT TYPE IS IN REFERENCE TO "POINT BY".
- MANUFACTURER SHALL PROVIDE SUPPLEMENTAL CONTROLLERS / DEVICES AS REQUIRED TO PROVIDE THE SPECIFIED SEQUENCES, POINTS, AND BAS INTEGRATION AS INDICATED BELOW.
- POINTS COMMUNICATED TO RTU CONTROLLER FROM BAS ARE TO BE BY THE BAS.
- VFD POINTS SHALL BE DONE THROUGH HARDWIRE CONNECTION WHEN POSSIBLE. WHEN NOT POSSIBLE POINTS THROUGH INTEGRATION ARE ACCEPTABLE.

**NOTES:**

- COORDINATE SMOKE DETECTION ALARM SIGNAL FROM FIRE ALARM SYSTEM SMOKE DETECTOR BY DIV 26/28.
- IN ADDITION TO BEING A (B) SAFETIES SHALL BE WIRED INTO THE FAN STARTERS (VFD'S) STARTER CIRCUIT SUCH THAT THE SAFETY SHALL FUNCTION WHETHER THE SELECTOR SWITCH IS IN THE "HAND" OR "AUTOMATIC" POSITION.
- RTU FAULT SHALL INDICATE WHEN THE RTU HAS SHUT-DOWN IN ALARM FOR ANY REASON.
- SHALL BE MULTI-STATE POINT CONTAINING AT A MINIMUM, OCCUPIED, UNOCCUPIED, MORNING WARM-UP.
- BAS SHALL MONITOR AND INITIATE AN ALARM ON COMMUNICATION FAILURE.
- ONLY REQUIRED FOR RTU-1,4,6, RTU-1,0, NR, RTU-1,2,3,4,6,FB.
- "REPRESENTATIVE" HUMIDITY SHALL BE USED BY THE RTU FOR NIGHT SETBACK DEHUMIDIFICATION MODE.
- LOCATE WHERE SHOWN ON PLANS. EXTEND CONTROL WIRING ACCORDINGLY.

POINT NO.	RT-01	RT-02	RT-03	RT-04	RT-05	RT-06	RT-07	RT-08	RT-09	RT-10	RT-11	RT-12	RT-13	RT-14	RT-15	RT-16	RT-17	RT-18	RT-19	RT-20	RT-21	RT-22	RT-23	RT-24	RT-25	RT-26	RT-27	RT-28	RT-29	RT-30	RT-31	RT-32	RT-33	RT-34	RT-35	RT-36	RT-37
POINT NAME	RETURN AIR TEMPERATURE	RETURN AIR SMOKE DETECTION	SUPPLY AIR TEMPERATURE SETPOINT	MIXED AIR DAMPERS	RETURN FILTER STATUS (RTU-1,4,6-ONLY)	PRE-FILTER STATUS	DX REFRIGERATION CAPACITY	NIGHT SETBACK SPACE HEATING SETPOINT	HOT GAS REHEAT COIL	SUPPLY FAN START/STOP	SUPPLY FAN SPEED COMMAND	SUPPLY FAN FAULT/ALARM	SUPPLY FAN SPEED FEEDBACK	NIGHT SET-UP SPACE COOLING SETPOINT	GAS-FIRED FURNACE CAPACITY	FREESTAT	MORNING WARM-UP SUPPLY AIR TEMPERATURE SETPOINT	MORNING COOL-DOWN SUPPLY AIR TEMPERATURE SETPOINT	SUPPLY HIGH DUCT PRESSURE SAFETY SHUT-DOWN	SUPPLY AIR TEMPERATURE	REPRESENTATIVE SPACE TEMPERATURE	SPACE HUMIDITY	OUTSIDE AIR TEMPERATURE	OCCUPANCY MODE REQUEST	RTU FAULT STATUS	OCCUPANCY MODE STATUS	CONTROLLER COMMUNICATION										
TYPE	AI	BI	AO	AO	BI	BI	AO	AO	AO	BO	AO	BI	AI	AO	AO	BI	AO	AO	BI	AI	AO	AO	AO	AO	AO	BO	AO										
POINT BY RTU CONTROLLER	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
POINT COMMUNICATED TO BAS BY RTU CONTROLLER	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
POINT COMMUNICATED TO RTU CONTROLLER FROM BAS			*						*					*			*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
ALARM	HIGH/LOW	ON TRIP			ON TRIP	ON TRIP						ON TRIP	SS - ON (VARIABLE VFD)			ON TRIP				ON TRIP	HIGH/LOW					ON TRIP	ON MISMATCH										
NOTES		1,2								6,7						2				2		10	8														

**1 ROOFTOP UNIT(S) CONTROLS DIAGRAM**  
SCALE: NONE

MARK	DATE	DESCRIPTION

PROJECT NO: 2023-07154  
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 DRAWN BY: LDD  
 CHK'D BY: PMT  
 PROJECT STATUS: FOR PERMIT  
 ISSUE DATE: 02/29/2024  
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SHEET TITLE  
**RTU CONTROLS**

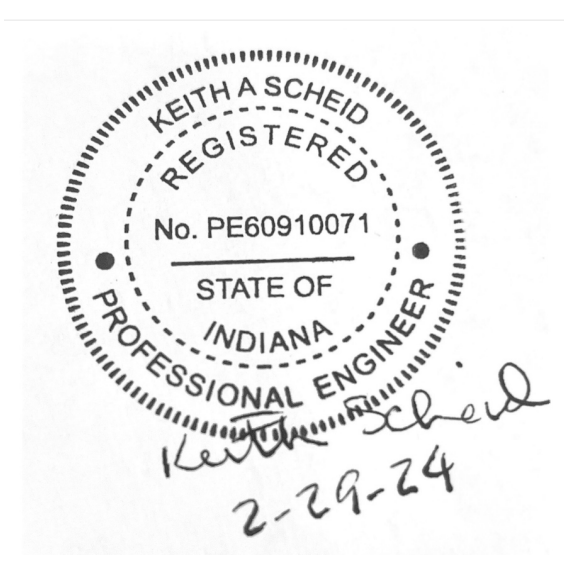


GENERAL NOTES

- A. PROVIDE A GROUND WIRE WITH ALL FEEDERS AND BRANCH CIRCUITS.
C. CONDUITS SHALL BE SIZED FOR .75" MINIMUM.
D. THE ELECTRICAL CONTRACTOR SHALL RE-SUPPORT ANY EXISTING WIRING OR CONDUITS REQUIRING SUPPORT.
E. PROVIDE UNISTRUT SUPPORTS FROM THE FLOOR FOR DISCONNECT SWITCHES AND MOTOR STARTERS AT EQUIPMENT IN MECHANICAL AREAS, WHERE REQUIRED.
F. EACH BIDDER SHALL VISIT THE SITE DURING THE BID PERIOD TO REVIEW EXISTING AND NEW FEEDER ROUTING.
H. REMOVAL PLANS MAY NOT NECESSARILY SHOW ALL ITEMS REQUIRED TO BE REMOVED. EACH BIDDER SHALL VISIT THE SITE PRIOR TO BID TO DETERMINE THE FULL EXTENT OF REMOVALS REQUIRED. MAINTAIN CIRCUIT CONTINUITY OF EXISTING CIRCUITS CUT OFF BY REMOVALS. VERIFY CIRCUITS PRIOR TO REMOVAL.
J. ALL JUNCTION BOXES, ETC. ARE TO BE FLUSH MOUNTED UNLESS OTHERWISE NOTED.
L. FIRESTOP ALL PENETRATIONS THRU WALLS.
P. REMOVAL OF ELECTRICAL ITEMS SHALL INCLUDE REMOVALS BACK TO THE EXISTING ELECTRICAL PANEL.
Q. THIS CONTRACTOR SHALL VERIFY AVAILABILITY OF SPARE BREAKERS AND SPACE FOR NEW BREAKERS WITHIN EXISTING PANELS. INCLUDE IN BID ANY MODIFICATIONS TO EXISTING PANELS REQUIRED FOR THE ADDITION OF THIS NEW CIRCUITRY WITHIN THE REMOVAL AREAS.
W. THIS CONTRACTOR SHALL COORDINATE WITH THE OWNER IN REGARD TO REMOVALS. CONTRACTOR SHALL SALVAGE EQUIPMENT AS DIRECTED BY THE OWNER AND STORE IN A LOCATION DESIGNATED BY OWNER. ALL OTHER EQUIPMENT AND MATERIALS NOT SALVAGED SHALL BE REMOVED FROM THE PREMISE.
X. SIZING AND QUANTITY OF ALL SYSTEM WIRES AND CONDUITS SHALL BE PER MANUFACTURER'S OR SUPPLIER'S RECOMMENDATIONS.
EE. IF ANY ASBESTOS IS FOUND IN THE COURSE OF REMOVALS NOTIFY OWNER. ASBESTOS REMOVAL IS BY OWNER.
FF. ALL ABANDONED EXTRANEOUS CONDUITS, SUPPORTS, CONTROLS, ETC. SHALL BE REMOVED.
II. FIELD VERIFY EXISTING CONDITIONS, INCLUDING CONDUIT AND EQUIPMENT SIZES, SERVICES AND LOCATIONS, PRIOR TO PERFORMING WORK.
UU. BRANCH CIRCUIT WIRE SIZING CHART TO BE UTILIZED AS GUIDELINE FOR VOLTAGE DROP COMPENSATION, INCREASE CONDUIT SIZING PER WIRE SIZE.
A) 20A-120V CIRCUITS:
#12 WIRE - 60FT. LENGTH MAX.
#10 WIRE - 84FT. LENGTH MAX.
#8 WIRE - 137FT. LENGTH MAX.
#6 WIRE - 218FT. LENGTH MAX.
B) 20A-277V CIRCUITS:
#12 WIRE - 138FT. LENGTH MAX.
#10 WIRE - 219FT. LENGTH MAX.
#8 WIRE - 318FT. LENGTH MAX.
#6 WIRE - 504FT. LENGTH MAX.
CCC. ROOF PENETRATIONS SHALL BE KEPT TO AN ABSOLUTE MINIMUM.
MMM. ELECTRICAL CONTRACTOR SHALL PERMANENTLY MARK PANEL AND CIRCUIT DESIGNATIONS ON ALL ELECTRICAL JUNCTION BOXES.
VVV. ANY EXPOSED CONDUITS WITHIN THE FINISHED PORTIONS OF THE BUILDING SHALL BE PRIME PAINTED BY THIS CONTRACTOR FOR FINISH PAINTING BY THE GC.
A3. ALL EMPTY CONDUITS SHALL BE INSTALLED WITH PULL WIRE.
A7. ALL NEW AND EXISTING PANELBOARDS AFFECTED BY THIS PROJECT SHALL BE PROVIDED WITH A NEW TYPE WRITTEN DIRECTORY.
A11. EXISTING CONDITIONS SHOWN ON THESE DRAWINGS ARE TAKEN FROM ORIGINAL DRAWINGS AND FIELD INVESTIGATION. ALL EXISTING CONDITIONS MUST BE VERIFIED PRIOR TO BID. FIELD CONDITIONS SHALL GOVERN.
A13. LABEL ALL CIRCUIT BREAKERS MADE SPARE DUE TO REMOVALS AS "SPARE" TO SERVE FUTURE LOADS AND LEAVE IN "OFF" POSITIONS.
A14. ALL ELECTRICAL INTERRUPTIONS OF SERVICES SHALL BE MADE WHEN THE LOAD IS AT A MINIMUM AND SHALL BE SCHEDULED FOR OTHER THAN NORMAL WORKING HOURS. THE ELECTRICAL CONTRACTOR SHALL INCLUDE NECESSARY COST FOR OVERTIME LABOR WITHIN ALL BIDS. COORDINATE ALL POWER INTERRUPTIONS WITH THE OWNER AT LEAST TWO WEEKS IN ADVANCE OF THE OUTAGE. PROVIDE A DESCRIPTION OF THE OUTAGE, DURATION OF THE OUTAGE AND BACKUP PLAN TO RE-ENERGIZE POWER.
A15. ELECTRICAL CONTRACTOR SHALL BE RESPONSIBLE FOR ALL CUTTING AND PATCHING OF ASSOCIATED ELECTRICAL WORK UNDER THIS CONTRACT. ALL PATCHING SHALL MATCH EXISTING FINISHES AND BE DONE BY CRAFTSMAN SKILLED IN THE WORK. ALL CUTTING AND PATCHING SHALL BE SUBJECT TO APPROVAL BY THE ARCHITECT, ENGINEER OR OWNER.
A16. INCLUDE IN BID THREE 225AMP, 120/208V 3PH-4W, (2KKAIC), MLO, 42 POLE PANELBOARDS EACH WITH 12-18"IP CBs, 12-20"IP CBs, 6-25"IP CBs, 6-30"IP CBs, 6-35"IP CBs. PROVIDE ONE 225A, 277/480V-3PH-4W, (42KKAIC), MLO, 42 POLE PANELBOARD WITH 30-30"IP CBs AND 12-20"IP CBs. INCLUDE WITH PANELBOARDS, 225A (CU) 4W & GND FEEDER IN 2" EMT CONDUIT. COMPLETE INSTALLATION PER SPECIFICATIONS. CAREFULLY DETERMINE WHICH BUILDING BENEFITS THE MOST WITH THE NEW PANEL INSTALLATION. ANY PANELBOARD NOT USED WILL BE TURNED OVER TO THE OWNER FOR OWNER STOCK.
A17. THIS CONTRACTOR SHALL TRACE (RING) CIRCUITS BACK TO PANELBOARDS AND CIRCUIT BREAKERS FOR THIS WORK. REPLACE EXISTING BREAKERS AS NEEDED WITH SAME MANUFACTURER AND TYPE WITH MATCHING AIC.
A18. THIS CONTRACTOR SHALL ENGAGE A LICENSED DIV 28 SIEMENS FIRE ALARM CONTRACTOR TO PROVIDE RETURN AIR SMOKE DETECTION FOR THE DESIGNATED HVAC UNITS FOR BUILDING ALARM AND UNIT SHUT-DOWN. MATCH EXISTING SIEMENS FIRE ALARM SYSTEM EQUIPMENT FOR LI COMPLIANCE. ALL FIRE ALARM WIRING SHALL BE IN RED CONDUIT. DEMONSTRATE COMPLIANT OPERATION.



CONSULTANTS



INDIANA STATE FAIRGROUNDS HVAC REPLACEMENTS
INDIANA STATE FAIRGROUNDS
1202 E. 38TH ST, INDIANAPOLIS, IN 46205

OWNER

MARK DATE DESCRIPTION

PROJECT NO: 2023-07154

REVIT FILE: C:\BIMModel\2023-07154-MEP-Central\_ELL0VET\@heapy.com\nt

DRAWN BY: ELL

CHKD BY: GLC

PROJECT STATUS: FOR PERMIT

ISSUE DATE: 02/29/2024

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SHEET TITLE

LEGEND, GENERAL NOTES, & SHEET INDEX

E001

Table with 2 columns: SHEET NUMBER and SHEET NAME. Lists sheets E001 through E111 with their respective titles and locations.

ABBREVIATIONS

Table listing various abbreviations and their meanings, such as AAC - AREA ALARM PANEL - MEDICAL GAS, ACC - ACCESS, ADJ - ADJUSTABLE, AF - ARC FAULT CIRCUIT INTERRUPTER, etc.

FIRE ALARM SYMBOLS

Table listing fire alarm symbols and their descriptions, including FIRE ALARM CONTROL PANEL, REMOTE ANNUNCIATOR PANEL, NOTIFICATION APPLIANCE CIRCUIT EXTENDER PANEL, etc.

ELECTRICAL SYMBOLS

Table listing electrical symbols and their descriptions, including DASH SYMBOL INDICATES PARTICULAR OUTLET OR DEVICE TO BE REMOVED AND CIRCUITRY MADE CONTINUOUS WHERE REQUIRED, EXISTING OUTLET OR DEVICE TO REMAIN, MAINTAIN EXISTING CIRCUITRY, etc.

GENERAL FLOOR PLAN NOTES

Table listing general floor plan notes and symbols, such as B E2 - DETAIL: B = DETAIL DESIGNATION, SECTION: 1 = SECTION DESIGNATION, ELEVATION: 1 = ELEVATION DESIGNATION, etc.

NOTE: ALL SYMBOLS AND ABBREVIATIONS ARE SUBJECT TO MODIFICATIONS ON OTHER DRAWINGS.

ALL SYMBOLS OR ABBREVIATIONS MIGHT NOT NECESSARILY BE USED ON THIS PROJECT.

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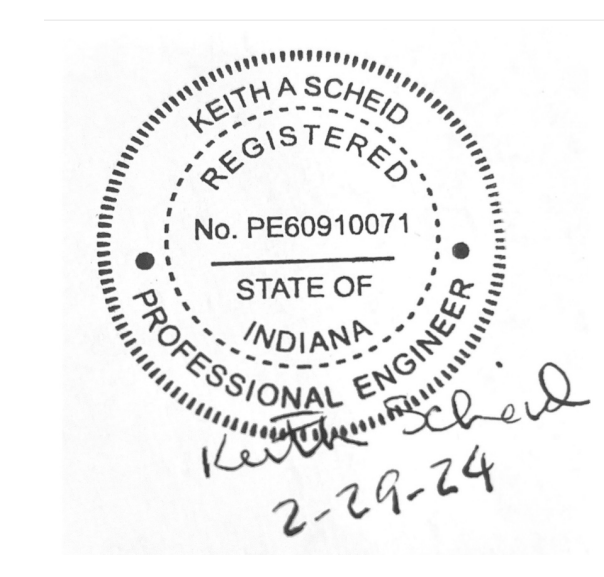


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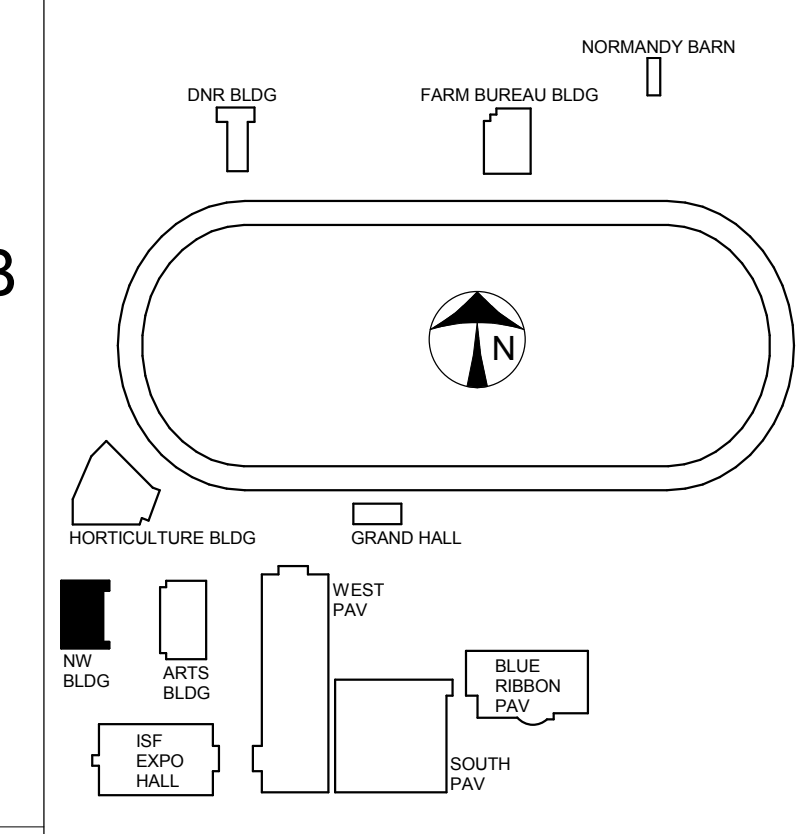


CONSULTANTS



INDIANA STATE  
**FAIRGROUNDS HVAC  
REPLACEMENTS**  
OWNER  
INDIANA STATE  
**FAIRGROUNDS**  
1202 E. 38TH ST,  
INDIANAPOLIS, IN 46205

**KEY PLAN  
NOT TO SCALE**

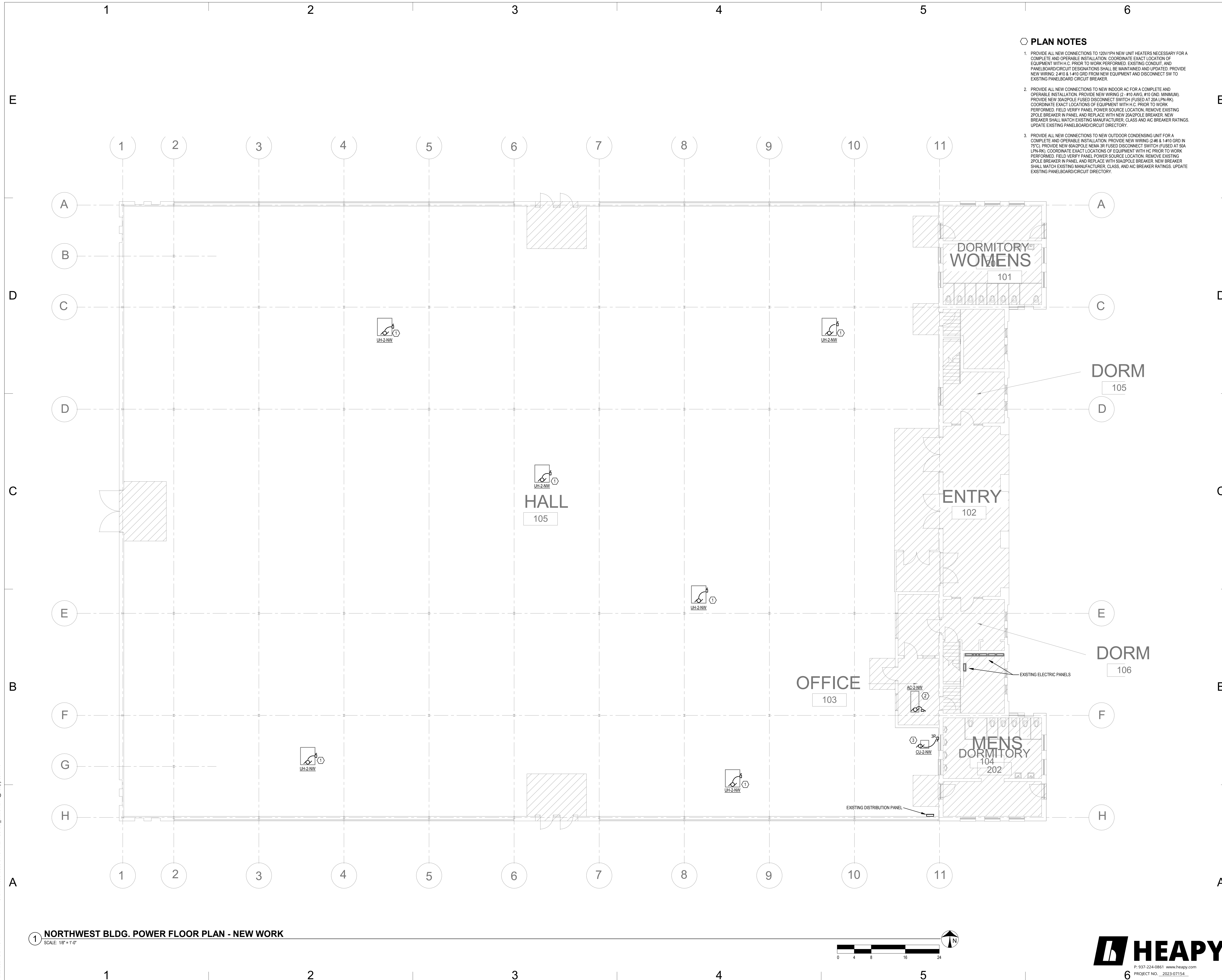


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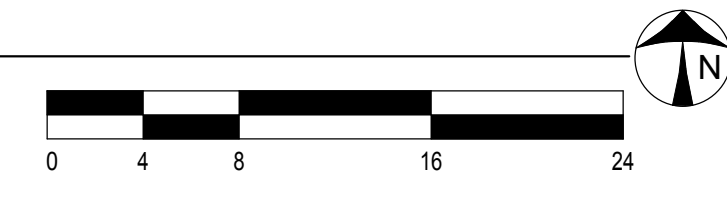
SHEET TITLE  
**NORTHWEST BLDG.  
ELECTRICAL PLAN**

E101

- PLAN NOTES**
1. PROVIDE ALL NEW CONNECTIONS TO 120V/1PH NEW UNIT HEATERS NECESSARY FOR A COMPLETE AND OPERABLE INSTALLATION. COORDINATE EXACT LOCATION OF EQUIPMENT WITH H.C. PRIOR TO WORK PERFORMED. EXISTING CONDUIT, AND PANELBOARD/CIRCUIT DESIGNATIONS SHALL BE MAINTAINED AND UPDATED. PROVIDE NEW WIRING: 2#10 & 1#10 GRD FROM NEW EQUIPMENT AND DISCONNECT SW TO EXISTING PANELBOARD/CIRCUIT BREAKER.
  2. PROVIDE ALL NEW CONNECTIONS TO NEW INDOOR AC FOR A COMPLETE AND OPERABLE INSTALLATION. PROVIDE NEW WIRING (2-#10 AWG, #10 GND, MINIMUM). PROVIDE NEW 50A/2POLE FUSED DISCONNECT SWITCH (FUSED AT 20A, 1P/N/RK). COORDINATE EXACT LOCATIONS OF EQUIPMENT WITH H.C. PRIOR TO WORK PERFORMED. FIELD VERIFY PANEL POWER SOURCE LOCATION. REMOVE EXISTING 2POLE BREAKER IN PANEL AND REPLACE WITH NEW 20A/2POLE BREAKER. NEW BREAKER SHALL MATCH EXISTING MANUFACTURER, CLASS AND AC BREAKER RATINGS. UPDATE EXISTING PANELBOARD/CIRCUIT DIRECTORY.
  3. PROVIDE ALL NEW CONNECTIONS TO NEW OUTDOOR CONDENSING UNIT FOR A COMPLETE AND OPERABLE INSTALLATION. PROVIDE NEW WIRING (2-#6 & 1-#10 GRD IN 75°C). PROVIDE NEW 60A/2POLE NEMA 3R FUSED DISCONNECT SWITCH (FUSED AT 50A 1P/N/RK). COORDINATE EXACT LOCATIONS OF EQUIPMENT WITH H.C. PRIOR TO WORK PERFORMED. FIELD VERIFY PANEL POWER SOURCE LOCATION. REMOVE EXISTING 2POLE BREAKER IN PANEL AND REPLACE WITH 50A/2POLE BREAKER. NEW BREAKER SHALL MATCH EXISTING MANUFACTURER, CLASS, AND AC BREAKER RATINGS. UPDATE EXISTING PANELBOARD/CIRCUIT DIRECTORY.

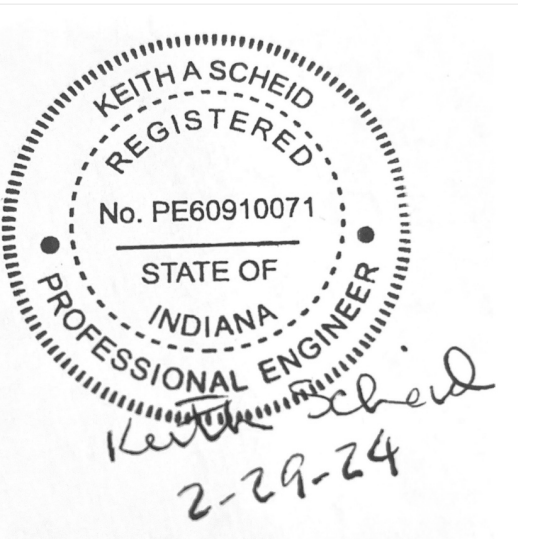


**1 NORTHWEST BLDG. POWER FLOOR PLAN - NEW WORK**  
SCALE: 1/8" = 1'-0"



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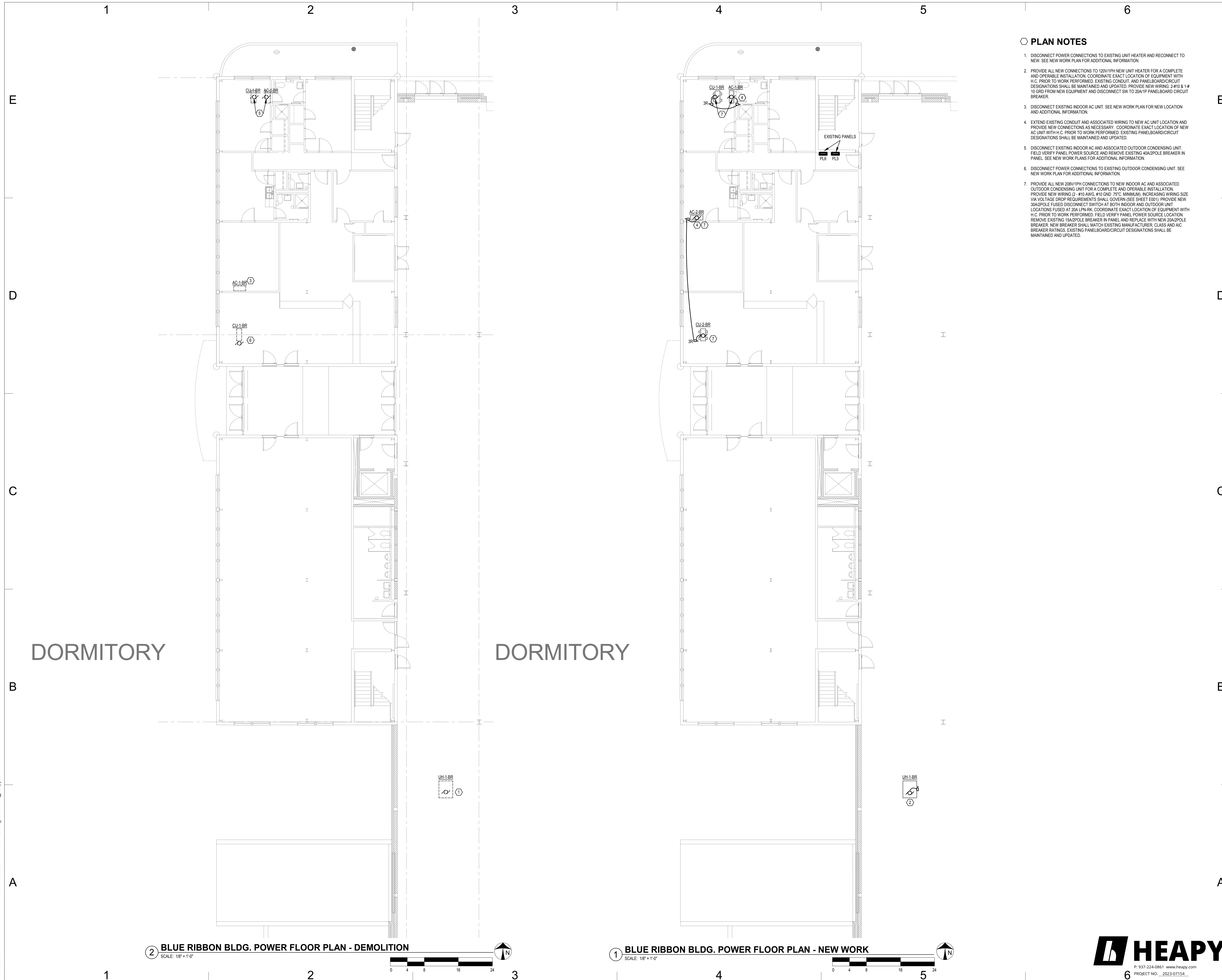
CONSULTANTS



INDIANA STATE  
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OWNER  
INDIANA STATE  
FAIRGROUNDS  
1202 E. 38TH ST,  
INDIANAPOLIS, IN 46205

**PLAN NOTES**

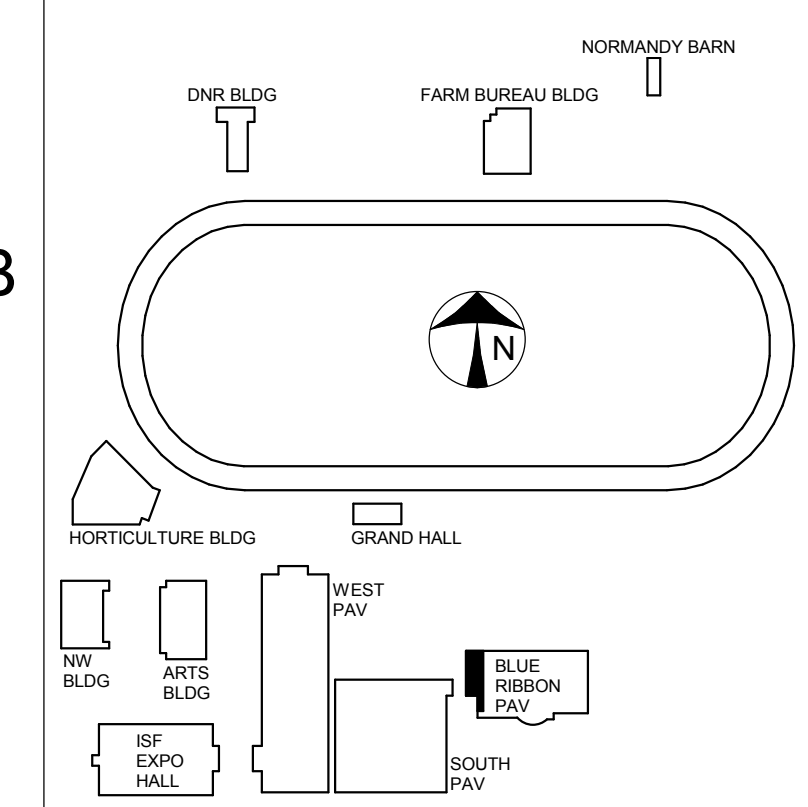
1. DISCONNECT POWER CONNECTIONS TO EXISTING UNIT HEATER AND RECONNECT TO NEW. SEE NEW WORK PLAN FOR ADDITIONAL INFORMATION.
2. PROVIDE ALL NEW CONNECTIONS TO 120V/1PH NEW UNIT HEATER FOR A COMPLETE AND OPERABLE INSTALLATION. COORDINATE EXACT LOCATION OF EQUIPMENT WITH H.C. PRIOR TO WORK PERFORMED. EXISTING CONDUIT AND PANELBOARD/CIRCUIT DESIGNATIONS SHALL BE MAINTAINED AND UPDATED. PROVIDE NEW WIRING: 2-#10 & 1-#10 GND FROM NEW EQUIPMENT AND DISCONNECT SW TO 20A/1P PANELBOARD CIRCUIT BREAKER.
3. DISCONNECT EXISTING INDOOR AC UNIT. SEE NEW WORK PLAN FOR NEW LOCATION AND ADDITIONAL INFORMATION.
4. EXTEND EXISTING CONDUIT AND ASSOCIATED WIRING TO NEW AC UNIT LOCATION AND PROVIDE NEW CONNECTIONS AS NECESSARY. COORDINATE EXACT LOCATION OF NEW AC UNIT WITH H.C. PRIOR TO WORK PERFORMED. EXISTING PANELBOARD/CIRCUIT DESIGNATIONS SHALL BE MAINTAINED AND UPDATED.
5. DISCONNECT EXISTING INDOOR AC AND ASSOCIATED OUTDOOR CONDENSING UNIT. FIELD VERIFY PANEL, POWER SOURCE AND REMOVE EXISTING 40A/2POLE BREAKER IN PANEL. SEE NEW WORK PLANS FOR ADDITIONAL INFORMATION.
6. DISCONNECT POWER CONNECTIONS TO EXISTING OUTDOOR CONDENSING UNIT. SEE NEW WORK PLAN FOR ADDITIONAL INFORMATION.
7. PROVIDE ALL NEW 208V/1PH CONNECTIONS TO NEW INDOOR AC AND ASSOCIATED OUTDOOR CONDENSING UNIT FOR A COMPLETE AND OPERABLE INSTALLATION. PROVIDE NEW WIRING (2-#10 AWG, #10 GND, 75°C MINIMUM, INCREASING WIRING SIZE VIA VOLTAGE DROP REQUIREMENTS SHALL GOVERN (SEE SHEET E001)). PROVIDE NEW 30A/2POLE FUSED DISCONNECT SWITCH AT BOTH INDOOR AND OUTDOOR UNIT LOCATIONS FUSED AT 20A LPH-RK. COORDINATE EXACT LOCATION OF EQUIPMENT WITH H.C. PRIOR TO WORK PERFORMED. FIELD VERIFY PANEL POWER SOURCE LOCATION. REMOVE EXISTING 15A/2POLE BREAKER IN PANEL AND REPLACE WITH NEW 20A/2POLE BREAKER. NEW BREAKER SHALL MATCH EXISTING MANUFACTURER, CLASS AND AIC BREAKER RATINGS. EXISTING PANELBOARD/CIRCUIT DESIGNATIONS SHALL BE MAINTAINED AND UPDATED.



**2 BLUE RIBBON BLDG. POWER FLOOR PLAN - DEMOLITION**  
SCALE: 1/8" = 1'-0"

**1 BLUE RIBBON BLDG. POWER FLOOR PLAN - NEW WORK**  
SCALE: 1/8" = 1'-0"

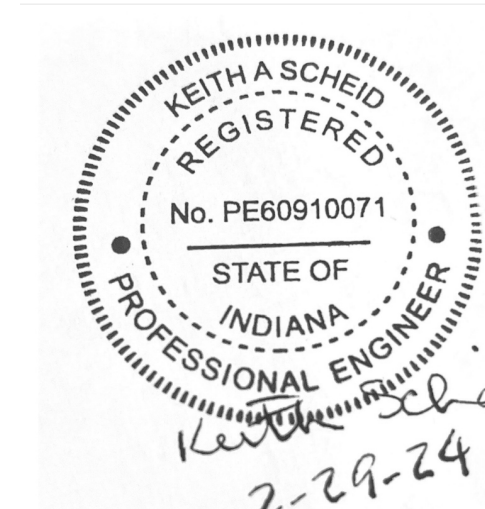
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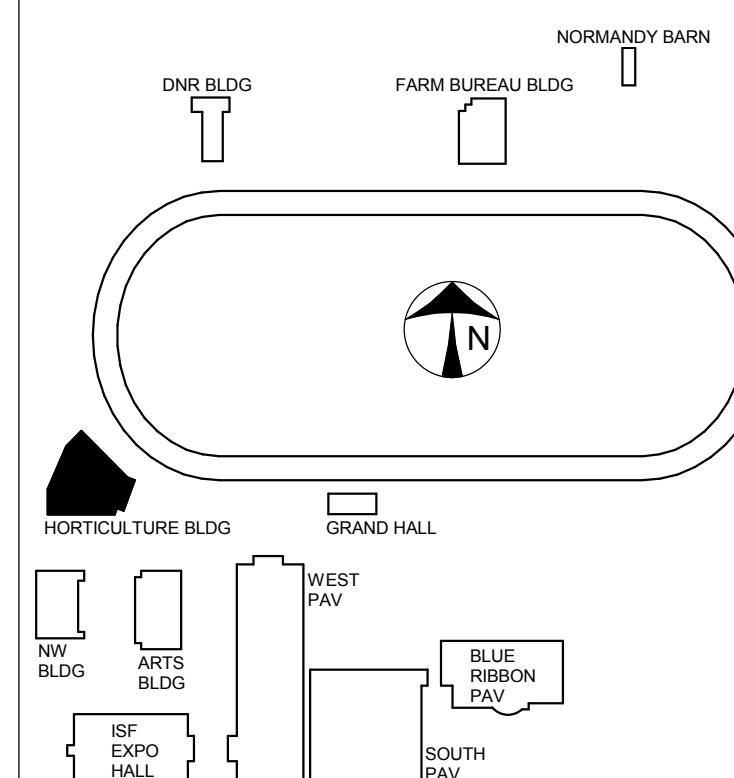
SHEET TITLE  
**BLUE RIBBON PAVILLION  
ELECTRICAL PLANS**

CONSULTANTS



INDIANA STATE  
FAIRGROUNDS HVAC  
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INDIANA STATE  
FAIRGROUNDS  
1202 E. 38TH ST,  
INDIANAPOLIS, IN 46205

**KEY PLAN**  
NOT TO SCALE



MARK	DATE	DESCRIPTION

SHEET TITLE  
**AG-HORTICULTURE  
BLDG. ELECTRICAL -  
NEW WORK**

E103

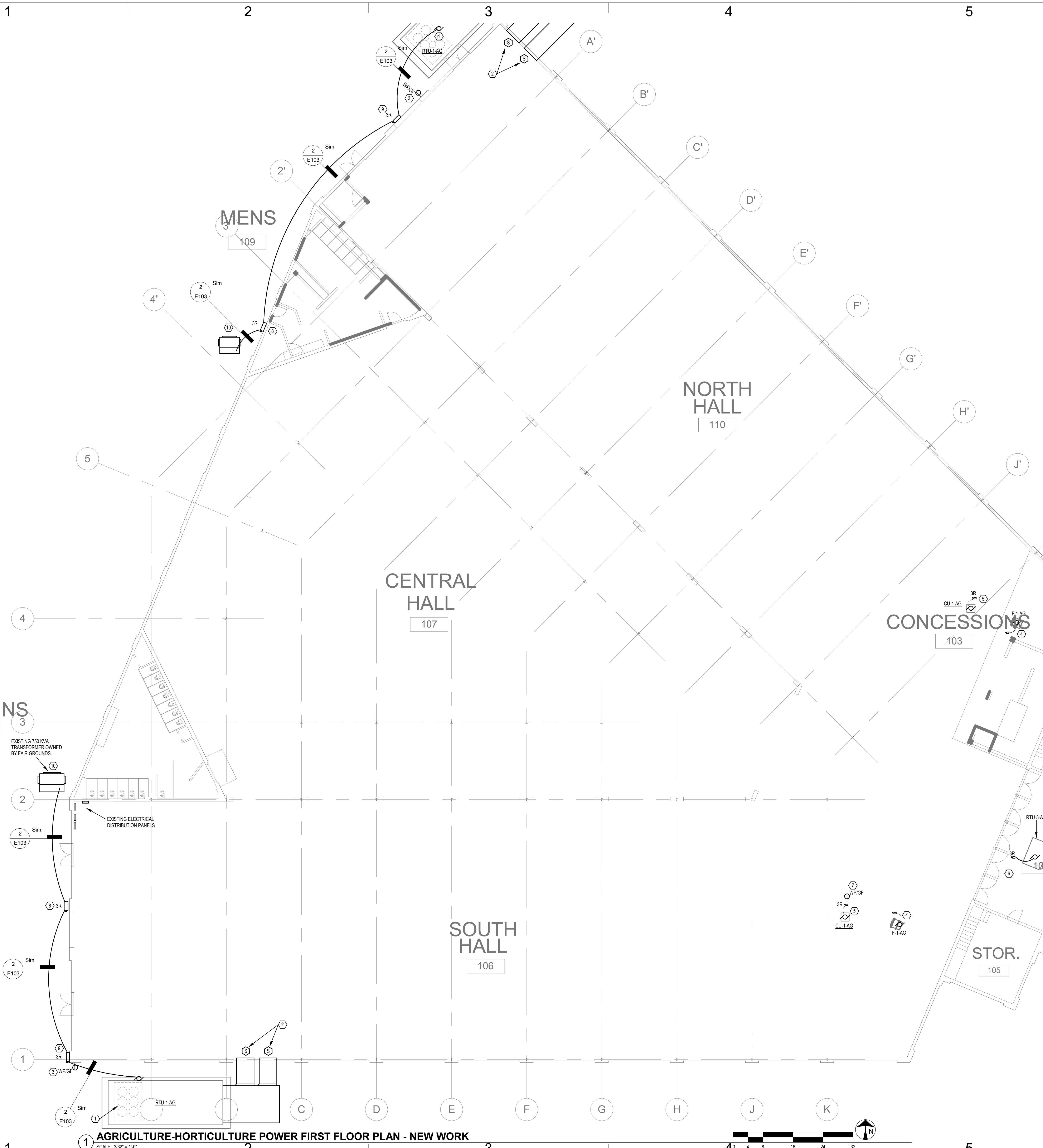
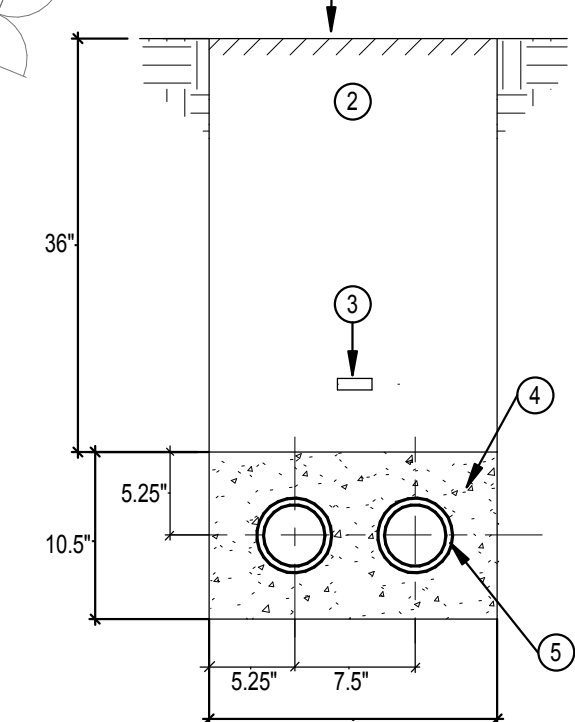
**PLAN NOTES**

- PROVIDE ALL NEW CONNECTIONS TO NEW PACKAGE AIR HANDLING UNIT FOR A COMPLETE AND OPERABLE INSTALLATION. PROVIDE NEW FEEDER, 2 SETS OF (3-#800KMMIL CU) & 1-#10 GRD IN 4" CT. PROVIDE NEW 800A/3POLE 3R DISCONNECT SWITCH AT OUTDOOR UNIT LOCATION. COORDINATE EXACT LOCATIONS OF EQUIPMENT WITH H.C. PRIOR TO WORK PERFORMED. FIELD VERIFY PANEL POWER SOURCE LOCATION FOR EXISTING HVAC EQUIPMENT TO BE REMOVED. REMOVE EXISTING CONNECTIONS TO 500A/3POLE (BREAKER OR SWITCH) IN PANEL.
- MINIMUM OF TWO SMOKE DETECTORS MOUNTED ON RETURN AIR GRILLE COORDINATED WITH H.C. FOR DETECTOR SUPPORT STRUCTURE. SMOKE DETECTORS SHALL BE MOUNTED ON RED 1"50" BACKINGS WITH RED CONDUIT ROUTED TO EXISTING SIEMENS FIRE ALARM CONTROL PANEL. SMOKE DETECTORS SHALL BE 2% TYPE TO MATCH EXISTING FACP MANUFACTURER AND UL LISTING. ARRANGE ON GRILLE FOR EQUAL AND CODE COVERAGE PER NFPA 72. SMOKE DETECTION SHALL SOUND ALARM AND SHUT DOWN HVAC UNIT.
- CIRCUIT RECEPTACLE TO NEAREST 120/208V PANELBOARD 200A/1P NEW OR SPARE EXISTING CIRCUIT BREAKER. NEW BREAKER SHALL MATCH EXISTING PANEL MANUFACTURER, CLASS, AND AIC RATING. EXISTING PANELBOARD/CIRCUIT DESIGNATIONS SHALL BE UPDATED.
- NEMA 3R 20A/1P TOGGLE TYPE DISCONNECT SW MOUNTED ON UNISTRUT SUPPORT ATTACHED TO ROOF STRUCTURE THROUGH ROOF PITCH POCKET OR OTHER APPROVED MEANS BY ROOF CONTRACTOR. CIRCUIT TO EQUIPMENT AND DESIGNATED 120/208V PANEL 15A/1P SPARE OR NEW CIRCUIT BREAKER WITH 2-#12 & 1-#12 GRD IN 75°C. NEW BREAKER SHALL MATCH EXISTING PANEL MANUFACTURER, CLASS AND AIC RATING. EXISTING PANELBOARD/CIRCUIT DESIGNATIONS SHALL BE UPDATED.
- NEMA 3R 60A/2P FUSIBLE DISCONNECT SW, FUSED AT 55A (LPH-RI). CIRCUIT TO EQUIPMENT AND DESIGNATED 120/208V PANEL 35A/2P SPARE OR NEW CIRCUIT BREAKER WITH 2-#8 & 1-#10 GRD IN 75°C. NEW BREAKER SHALL MATCH EXISTING PANEL MANUFACTURER, CLASS AND AIC RATING. EXISTING PANELBOARD/CIRCUIT DESIGNATIONS SHALL BE UPDATED.
- NEMA 3R 60A/2P DISCONNECT SW, CIRCUIT TO EQUIPMENT AND DESIGNATED 120/208V PANEL 60A/2P SPARE OR NEW CIRCUIT BREAKER WITH 3-#4 & 1-#8 GRD IN 10°C. NEW BREAKER SHALL MATCH EXISTING PANEL MANUFACTURER, CLASS AND AIC RATING. EXISTING PANELBOARD/CIRCUIT DESIGNATIONS SHALL BE UPDATED.
- MOUNT WP/IGF RECEPTACLE TO UNISTRUT DISCONNECT SW SUPPORT. CIRCUIT RECEPTACLE TO NEAREST 120/208V PANELBOARD 200A/1P NEW OR SPARE EXISTING CIRCUIT BREAKER. NEW BREAKER SHALL MATCH EXISTING PANEL MANUFACTURER, CLASS AND AIC RATING. EXISTING PANELBOARD/CIRCUIT DESIGNATIONS SHALL BE UPDATED.
- NEW 800A/3POLE SERVICE ENTRANCE RATED FUSIBLE DISCONNECT SWITCH (FUSED AT 800AMPS W/RC-C). PROVIDE GROUND ROD AND 30 COPPER GROUNDING ELECTRODE CONDUCTOR CONNECTED TO GROUND ROD, WATER SERVICE, BUILDING STEEL, ELECTRODES. RUN 2 SETS OF (3-#600 KMMIL COPPER CONDUCTORS & 1-#10GRD) 4" CT TO UNIT DISCONNECT SWITCH. RUN 2 SETS OF (3-#600KMMIL COPPER CONDUCTORS IN 4" CT) TO PAD MOUNTED TRANSFORMER. MOUNT SERVICE ENTRANCE WEATHER PROOF SPD ON TOP OF DISCONNECT SWITCH. SEE DIV 26 SPECIFICATIONS.
- NEW 800A/3POLE NON-FUSIBLE DISCONNECT. RUN 2 SETS OF (3-#600 KMMIL COPPER CONDUCTORS & 1-#10GRD IN 4" CT) TO HVAC UNIT. PROVIDE CONNECTIONS TO NEW PACKAGE AIR HANDLING UNIT FOR A COMPLETE AND OPERABLE INSTALLATION. COORDINATE EXACT LOCATIONS OF EQUIPMENT WITH THE H.C. PRIOR TO WORK PERFORMED. FIELD VERIFY THE PANEL POWER SOURCE LOCATION FOR EXISTING HVAC EQUIPMENT TO BE REMOVED. REMOVE EXISTING CONNECTIONS TO EXISTING 500A/3P CIRCUIT BREAKER OR SWITCH IN PANEL.
- REARRANGE EXISTING LUGS ON TRANSFORMER TO ACCOMMODATE TWO ADDITIONAL CONDUCTORS PER PHASE. PROVIDE CABLE LENGTHS ROUTED THROUGH EXISTING CT WINDOWS OF SUFFICIENT LENGTHS SO NO WEIGHT OF THE CABLE IS PLACED ON THE TRANSFORMER SPRADES.

**DETAIL NOTES**

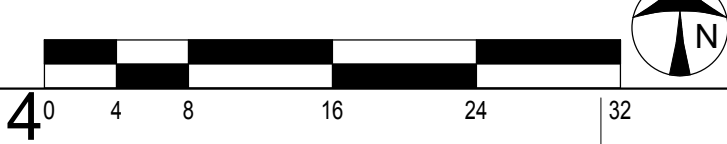
- FINISHED GRADE
- BACK FILL COMPACTED TO 95%.
- 6" WIDE ELECTRICAL WARNING TAPE 18" ABOVE DUCT
- CONCRETE ENCASUREMENT 3500 PSI
- 4" INSIDE DIAMETER SCHEDULE 40 PVC CONDUIT

**DUCT SECTION - SERVICE**



**AGRICULTURE-HORTICULTURE POWER FIRST FLOOR PLAN - NEW WORK**

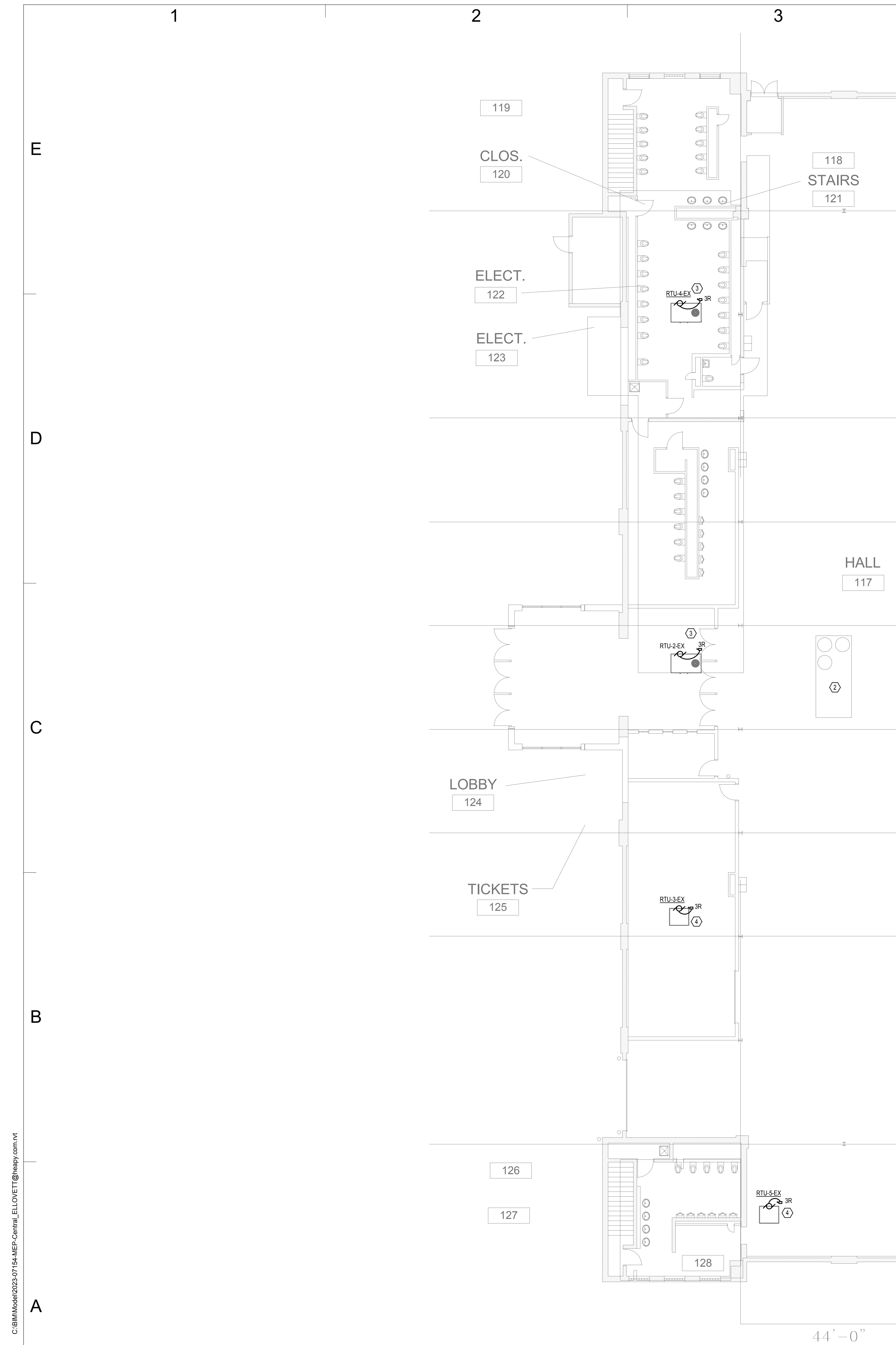
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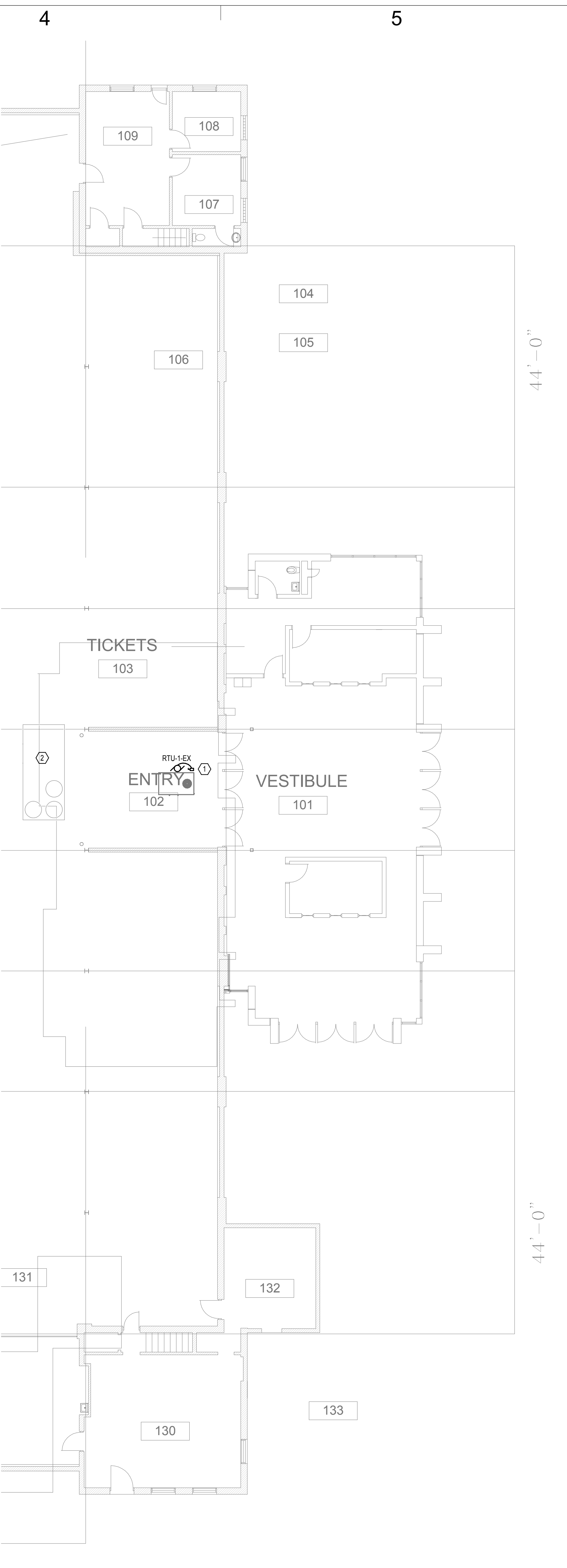
P: 937-224-0861 www.heapy.com  
PROJECT NO. 2023-07154

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1 EXPO BLDG. POWER FIRST FLOOR WEST PLAN - NEW WORK  
SCALE: 3/32" = 1'-0"



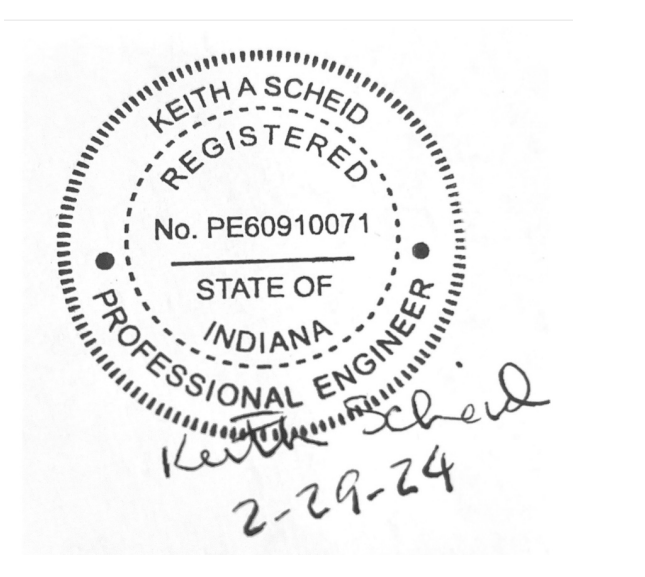
2 EXPO BLDG. POWER FIRST FLOOR EAST PLAN - NEW WORK  
SCALE: 3/32" = 1'-0"

PLAN NOTES

- EXISTING RTU WILL BE REPLACED WITH NEW RTU. ASSIST HC IN DEMOLITION. REMOVE POWER AND ELECTRICAL CONNECTIONS. INSTALL NEW ELECTRICAL CONNECTIONS. 30A/2P NEMA 3R DISCONNECT SW AND RUN FEEDER (3-#10 & 1-#10GRD IN 75°C) TO 40A/2P EXISTING OR NEW CIRCUIT BREAKER IN EXISTING ELECTRICAL PANELBOARD. NEW BREAKER SHALL MATCH EXISTING PANEL MANUFACTURER, CLASS AND AIC RATING. PANELBOARD/CIRCUIT DESIGNATIONS SHALL BE UPDATED.
- EXISTING HVAC EQUIPMENT TO REMAIN.
- EXISTING RTU WILL BE REPLACED WITH NEW RTU. ASSIST HC IN DEMOLITION. REMOVE POWER AND ELECTRICAL CONNECTIONS. INSTALL NEW ELECTRICAL CONNECTIONS. 30A/2P NEMA 3R DISCONNECT SW AND RUN FEEDER (3-#10 & 1-#10GRD IN 75°C) TO 30A/2P EXISTING OR NEW CIRCUIT BREAKER IN EXISTING ELECTRICAL PANELBOARD. NEW BREAKER SHALL MATCH EXISTING PANEL MANUFACTURER, CLASS AND AIC RATING. PANELBOARD/CIRCUIT DESIGNATIONS SHALL BE UPDATED.
- EXISTING RTU WILL BE REPLACED WITH NEW RTU. ASSIST HC IN DEMOLITION. REMOVE POWER AND ELECTRICAL CONNECTIONS. INSTALL NEW ELECTRICAL CONNECTIONS. 30A/2P NEMA 3R DISCONNECT SW AND RUN FEEDER (2-#10 & 1-#10GRD IN 75°C) TO 25A/2P EXISTING OR NEW CIRCUIT BREAKER IN EXISTING ELECTRICAL PANELBOARD. NEW BREAKER SHALL MATCH EXISTING PANEL MANUFACTURER, CLASS AND AIC RATING. PANELBOARD/CIRCUIT DESIGNATIONS SHALL BE UPDATED.

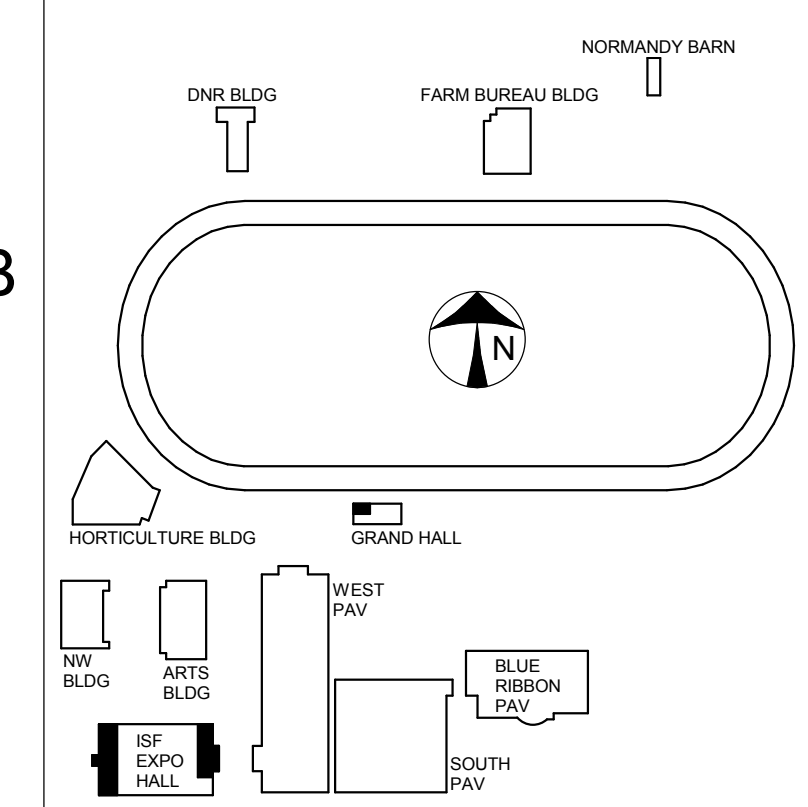


CONSULTANTS



INDIANA STATE FAIRGROUNDS HVAC REPLACEMENTS  
OWNER: INDIANA STATE FAIRGROUNDS  
1202 E. 38TH ST,  
INDIANAPOLIS, IN 46205

KEY PLAN NOT TO SCALE

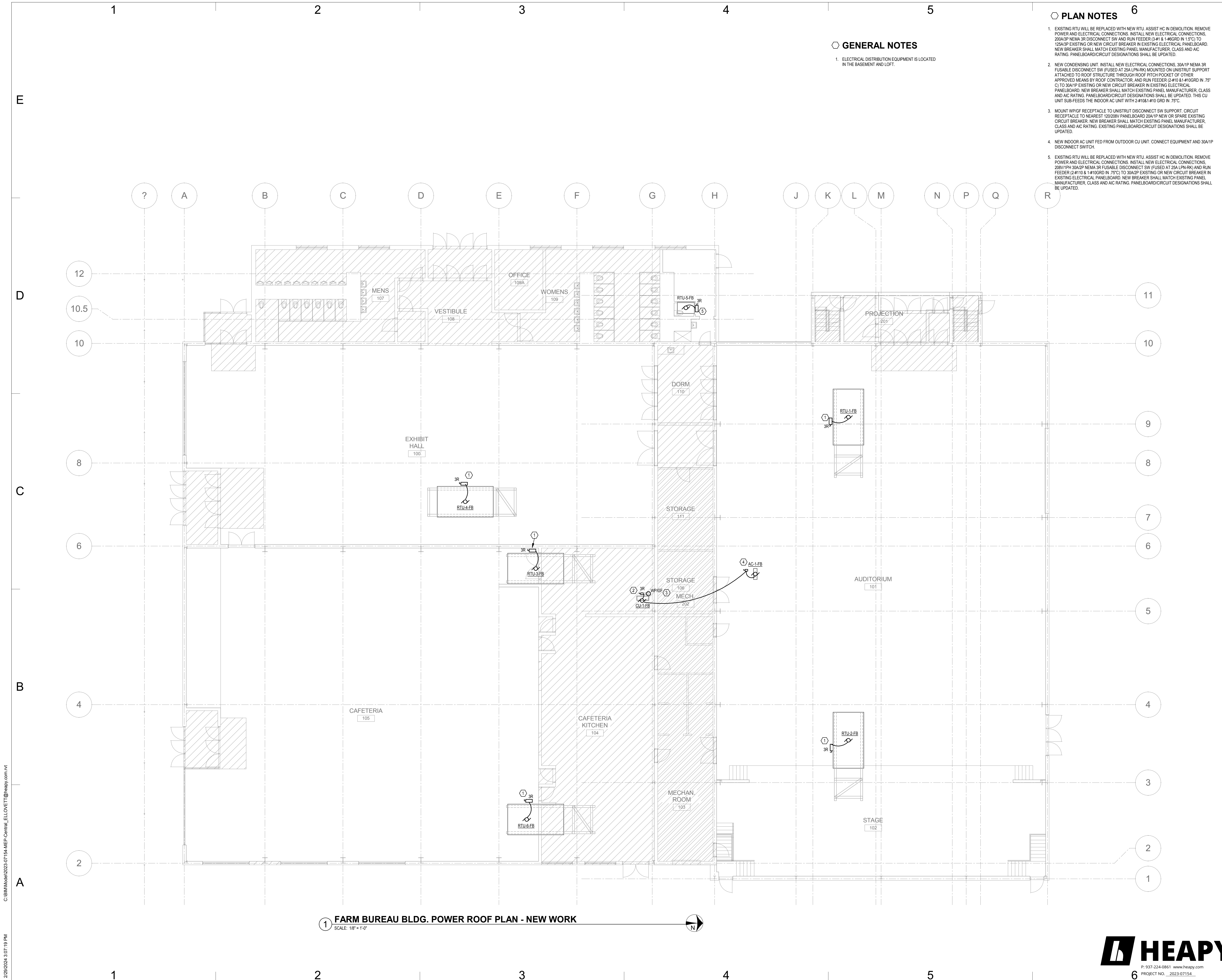


MARK	DATE	DESCRIPTION

SHEET TITLE  
EXPOSITION HALL ELECTRICAL FLOOR PLANS  
E104



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**GENERAL NOTES**

1. ELECTRICAL DISTRIBUTION EQUIPMENT IS LOCATED IN THE BASEMENT AND LOFT.

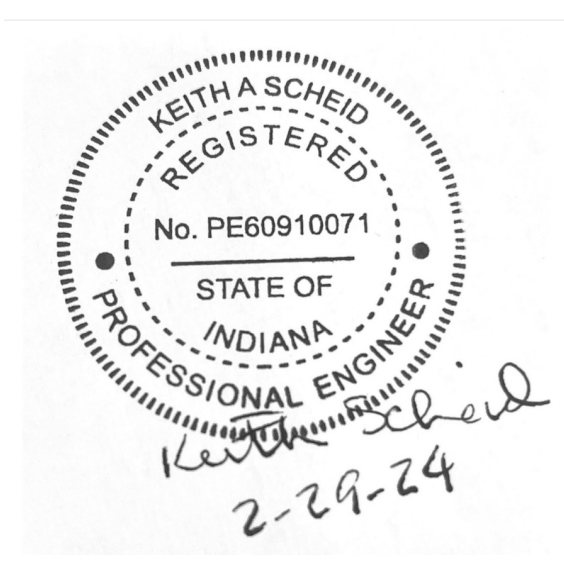
**PLAN NOTES**

- EXISTING RTU WILL BE REPLACED WITH NEW RTU. ASSIST HC IN DEMOLITION. REMOVE POWER AND ELECTRICAL CONNECTIONS. INSTALL NEW ELECTRICAL CONNECTIONS. 200AMP NEMA 3R DISCONNECT SW AND RUN FEEDER (3#1 & 1#6GRD IN 1"50" TO 125AMP EXISTING OR NEW CIRCUIT BREAKER IN EXISTING ELECTRICAL PANELBOARD. NEW BREAKER SHALL MATCH EXISTING PANEL MANUFACTURER, CLASS AND AIC RATING. PANELBOARD/CIRCUIT DESIGNATIONS SHALL BE UPDATED.
- NEW CONDENSING UNIT. INSTALL NEW ELECTRICAL CONNECTIONS. 30A1P NEMA 3R FUSIBLE DISCONNECT SW (FUSED AT 25A LPN-RK) MOUNTED ON UNISTRUT SUPPORT ATTACHED TO ROOF STRUCTURE THROUGH ROOF PITCH POCKET OF OTHER APPROVED MEANS BY ROOF CONTRACTOR, AND RUN FEEDER (2#10 & 1#10GRD IN 75" O) TO 30A1P EXISTING OR NEW CIRCUIT BREAKER IN EXISTING ELECTRICAL PANELBOARD. NEW BREAKER SHALL MATCH EXISTING PANEL MANUFACTURER, CLASS AND AIC RATING. PANELBOARD/CIRCUIT DESIGNATIONS SHALL BE UPDATED. THIS CU UNIT SUB-FEEDS THE INDOOR AC UNIT WITH 2#10&1#10 GRD IN 75" C.
- MOUNT WP/GF RECEPTACLE TO UNISTRUT DISCONNECT SW SUPPORT. CIRCUIT RECEPTACLE TO NEAREST 120/208V PANELBOARD 20A1P NEW OR SPARE EXISTING CIRCUIT BREAKER. NEW BREAKER SHALL MATCH EXISTING PANEL MANUFACTURER, CLASS AND AIC RATING. EXISTING PANELBOARD/CIRCUIT DESIGNATIONS SHALL BE UPDATED.
- NEW INDOOR AC UNIT FED FROM OUTDOOR CU UNIT. CONNECT EQUIPMENT AND 30A1P DISCONNECT SWITCH.
- EXISTING RTU WILL BE REPLACED WITH NEW RTU. ASSIST HC IN DEMOLITION. REMOVE POWER AND ELECTRICAL CONNECTIONS. INSTALL NEW ELECTRICAL CONNECTIONS. 200AMP NEMA 3R FUSIBLE DISCONNECT SW (FUSED AT 25A LPN-RK) AND RUN FEEDER (2#10 & 1#10GRD IN 75" O) TO 30A2P EXISTING OR NEW CIRCUIT BREAKER IN EXISTING ELECTRICAL PANELBOARD. NEW BREAKER SHALL MATCH EXISTING PANEL MANUFACTURER, CLASS AND AIC RATING. PANELBOARD/CIRCUIT DESIGNATIONS SHALL BE UPDATED.

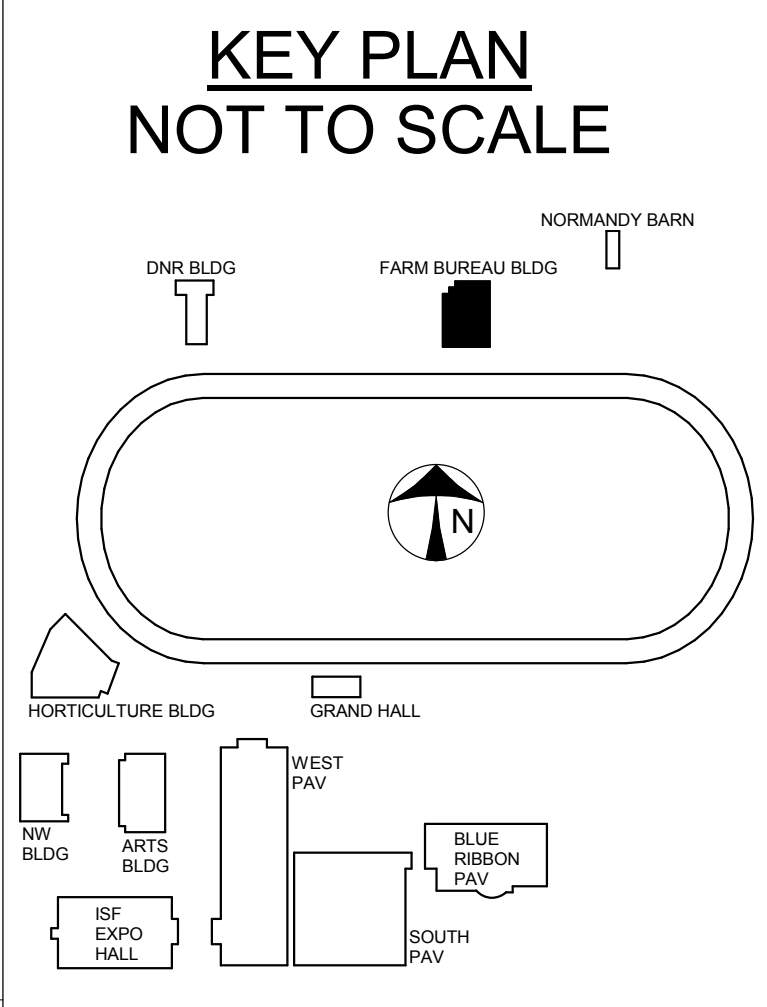
**1 FARM BUREAU BLDG. POWER ROOF PLAN - NEW WORK**  
SCALE: 1/8" = 1'-0"



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**INDIANA STATE FAIRGROUNDS HVAC REPLACEMENTS**  
OWNER  
**INDIANA STATE FAIRGROUNDS**  
1202 E. 38TH ST,  
INDIANAPOLIS, IN 46205



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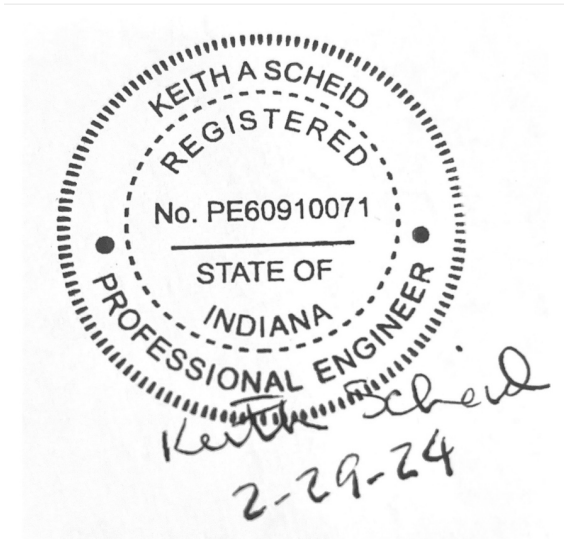
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CHKD BY:	GLC
PROJECT STATUS:	FOR PERMIT
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SHEET TITLE  
**FARM BUREAU BLDG. ELECTRICAL ROOF PLAN**  
E105

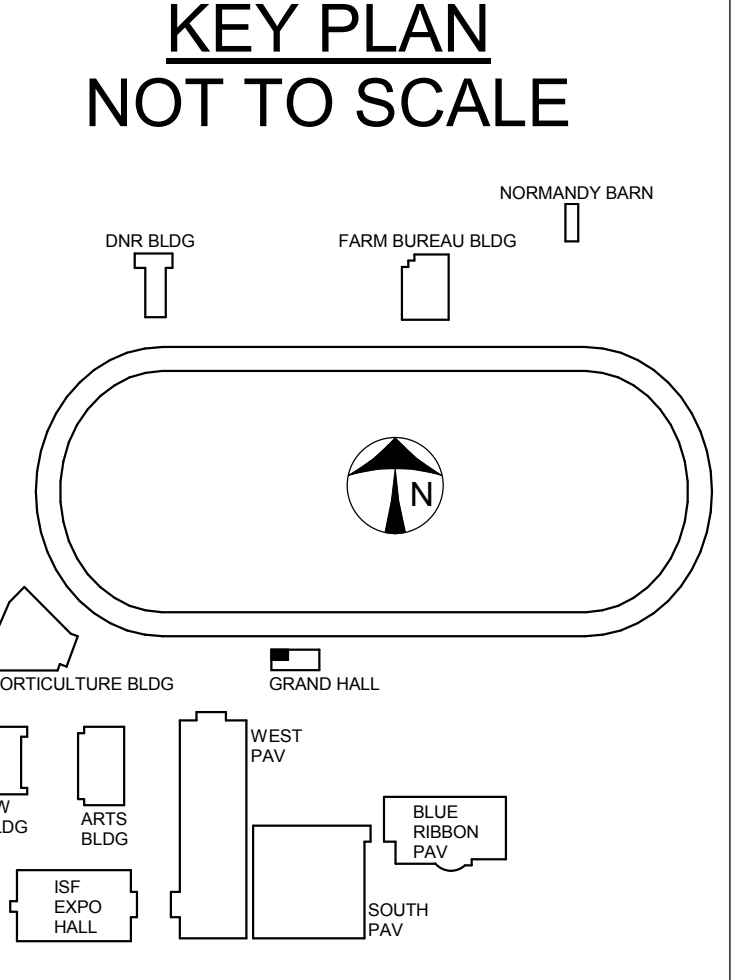


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INDIANA STATE FAIRGROUNDS HVAC REPLACEMENTS  
 OWNER  
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 1202 E. 38TH ST,  
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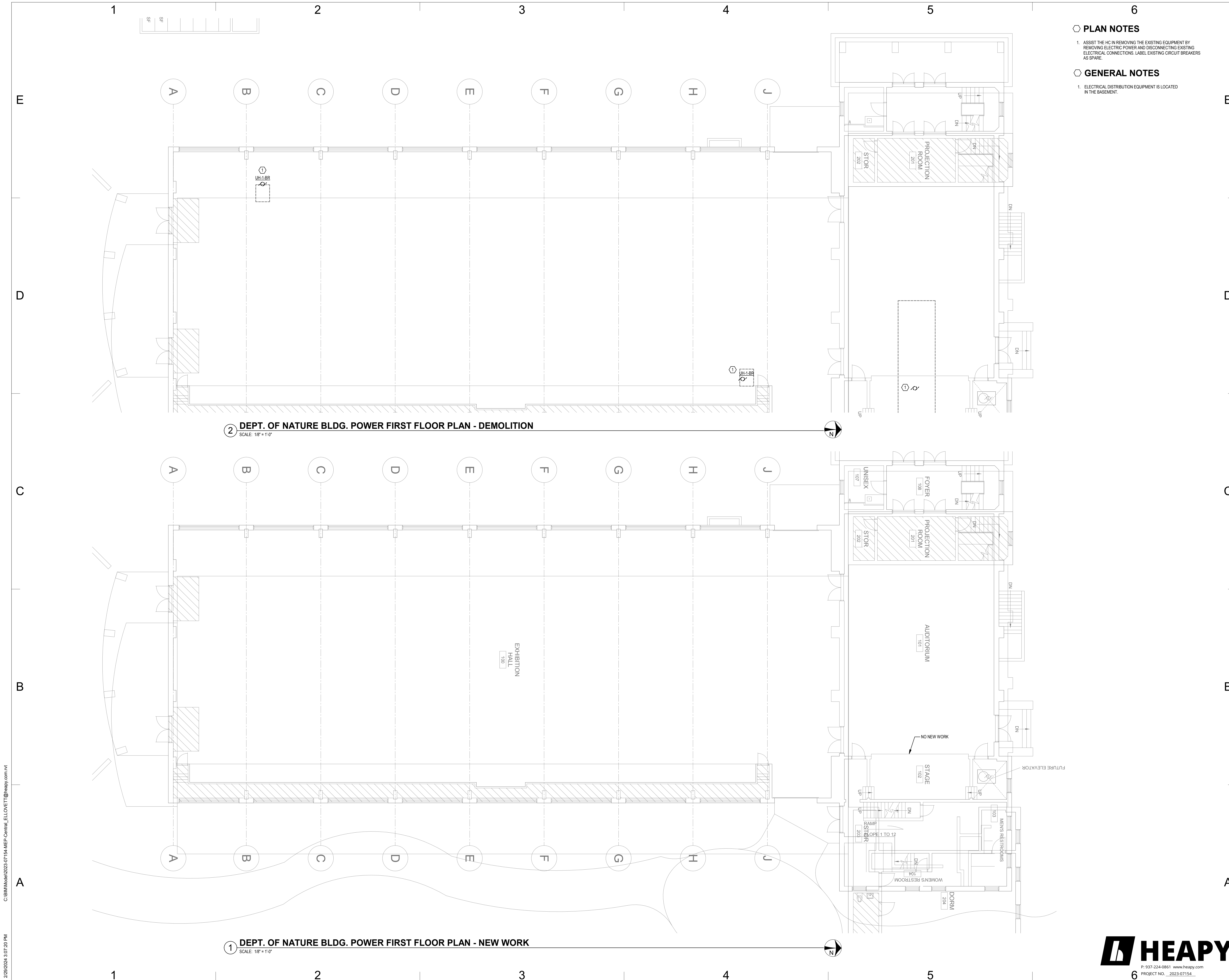
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SHEET TITLE  
**GRAND HALL BLDG.  
 ELECTRICAL FIRST  
 FLOOR PLAN**  
 E106

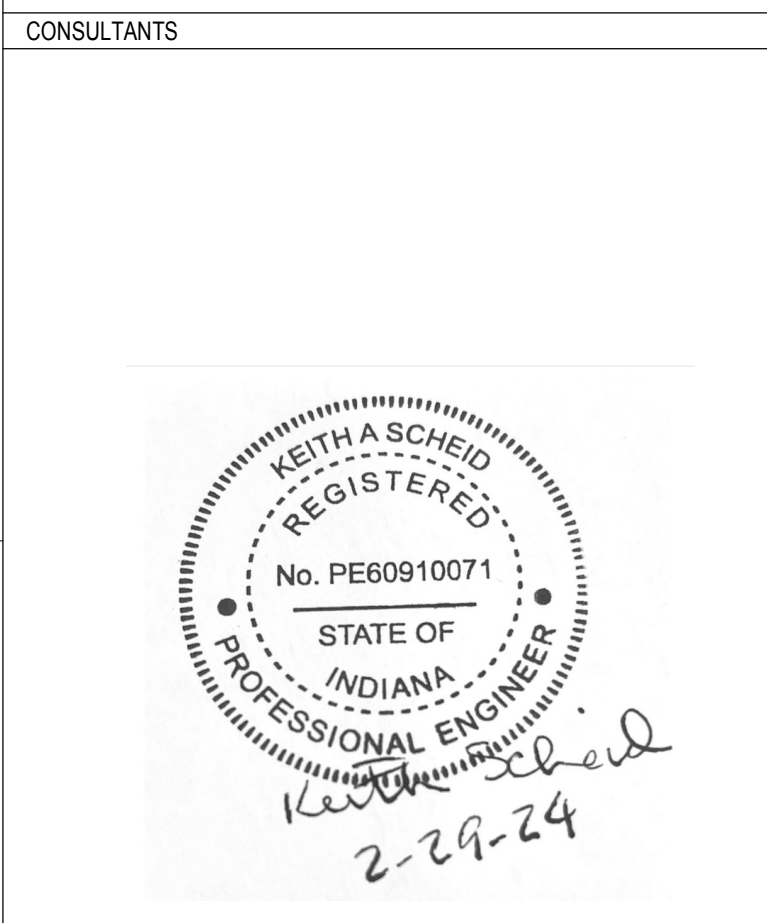
- PLAN NOTES
- EXISTING EQUIPMENT TO REMAIN. NO NEW WORK.
  - EXISTING CONDENSING UNIT AND INDOOR FAN COIL TO BE REMOVED.
  - EXISTING CONDENSING UNIT WILL BE REPLACED WITH NEW HEAT PUMP. INDOOR FAN COIL WILL ALSO BE REPLACED. ASSIST HC IN DEMOLITION. REMOVE POWER AND ELECTRICAL CONNECTIONS. INSTALL NEW ELECTRICAL CONNECTIONS. 200V/1PH/3Ø/2P NEMA 3R FUSIBLE DISCONNECT SW (FUSED AT 20A LPN-RK) AND RUN FEEDER (2-#10 & 1-#10GRD IN 75' C) TO 20A2P EXISTING OR NEW CIRCUIT BREAKER IN EXISTING ELECTRICAL PANELBOARD. NEW BREAKER SHALL MATCH EXISTING PANEL MANUFACTURER, CLASS AND AIC RATING. PANELBOARD/CIRCUIT DESIGNATIONS SHALL BE UPDATED.
  - EXISTING INDOOR AC UNIT WILL BE REPLACED WITH NEW INDOOR AC UNIT. ASSIST HC IN DEMOLITION. REMOVE POWER AND ELECTRICAL CONNECTIONS. INSTALL NEW ELECTRICAL CONNECTIONS. 200V/1PH/3Ø/2P DISCONNECT SW AND RUN FEEDER (2-#12 & 1-#12GRD IN 75' C) TO 15A2P EXISTING OR NEW CIRCUIT BREAKER IN EXISTING ELECTRICAL PANELBOARD. NEW BREAKER SHALL MATCH EXISTING PANEL MANUFACTURER, CLASS AND AIC RATING. PANELBOARD/CIRCUIT DESIGNATIONS SHALL BE UPDATED.

2 GRAND HALL POWER FIRST FLOOR PLAN - DEMOLITION  
 SCALE: 1/4" = 1'-0"

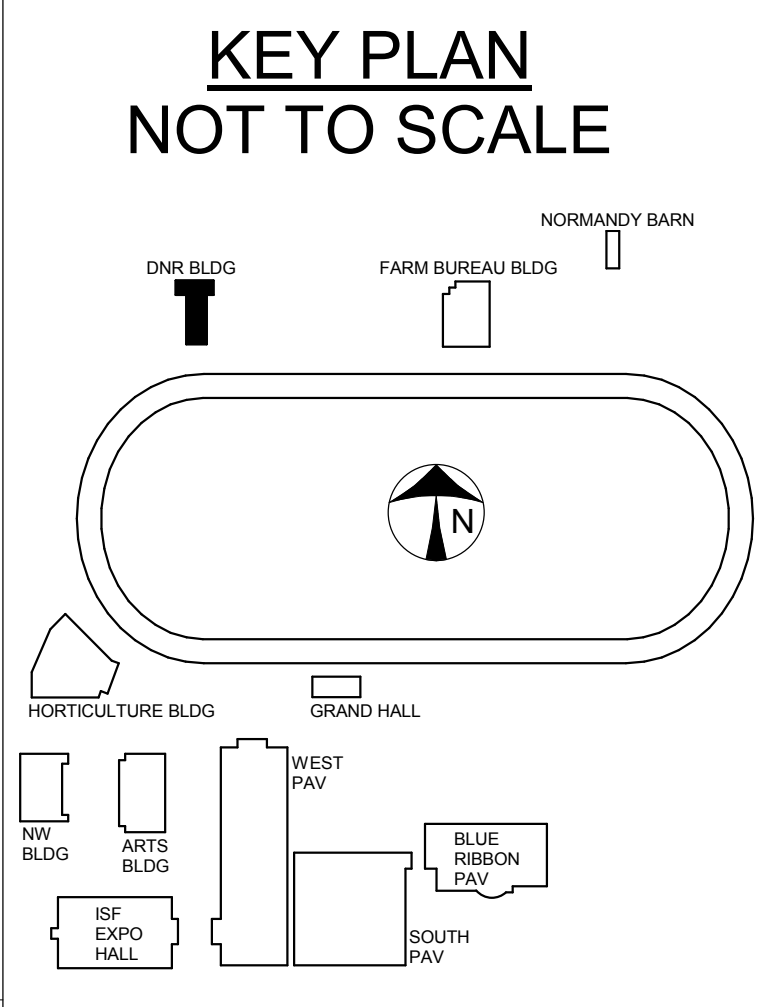
1 GRAND HALL POWER FIRST FLOOR PLAN - NEW WORK  
 SCALE: 1/4" = 1'-0"



- PLAN NOTES**
- ASSIST THE HC IN REMOVING THE EXISTING EQUIPMENT BY REMOVING ELECTRIC POWER AND DISCONNECTING EXISTING ELECTRICAL CONNECTIONS. LABEL EXISTING CIRCUIT BREAKERS AS SPARE.
- GENERAL NOTES**
- ELECTRICAL DISTRIBUTION EQUIPMENT IS LOCATED IN THE BASEMENT.



INDIANA STATE  
FAIRGROUNDS HVAC  
REPLACEMENTS  
OWNER  
INDIANA STATE  
FAIRGROUNDS  
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PROJECT NO:	2023-07154
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DRAWN BY:	ELL
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SHEET TITLE:	DEPT. OF NATURE BLDG ELECTRICAL FIRST FLOOR PLAN
	E107.1

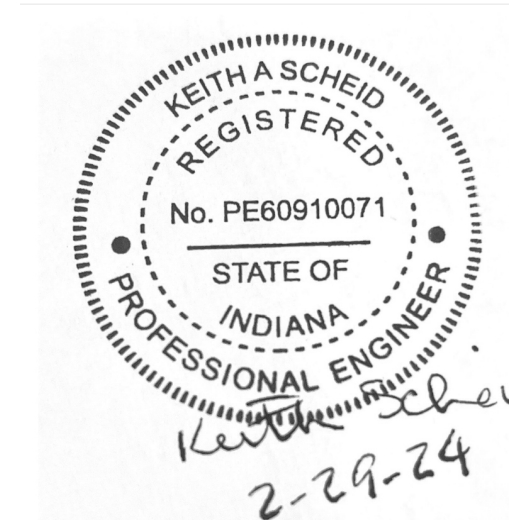


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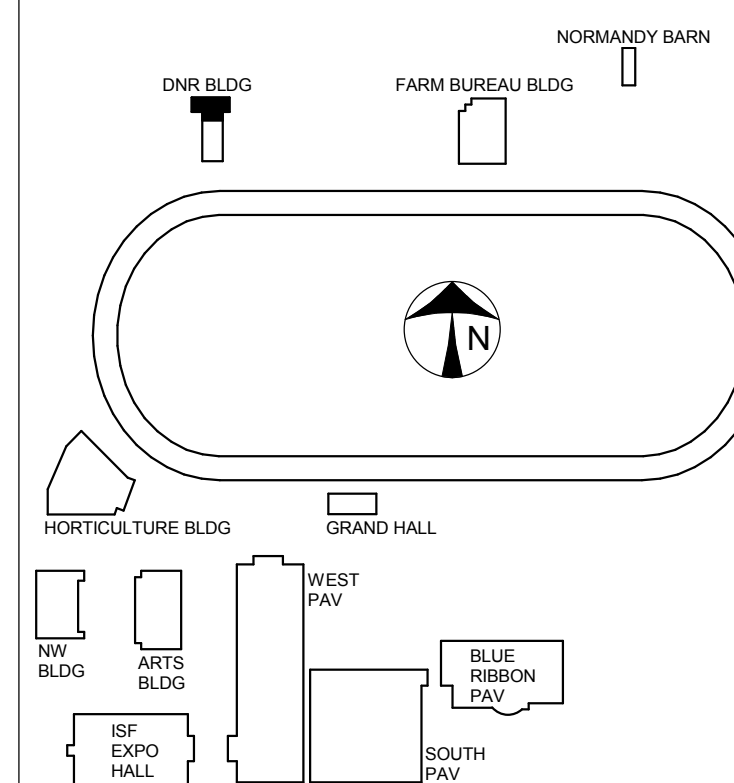


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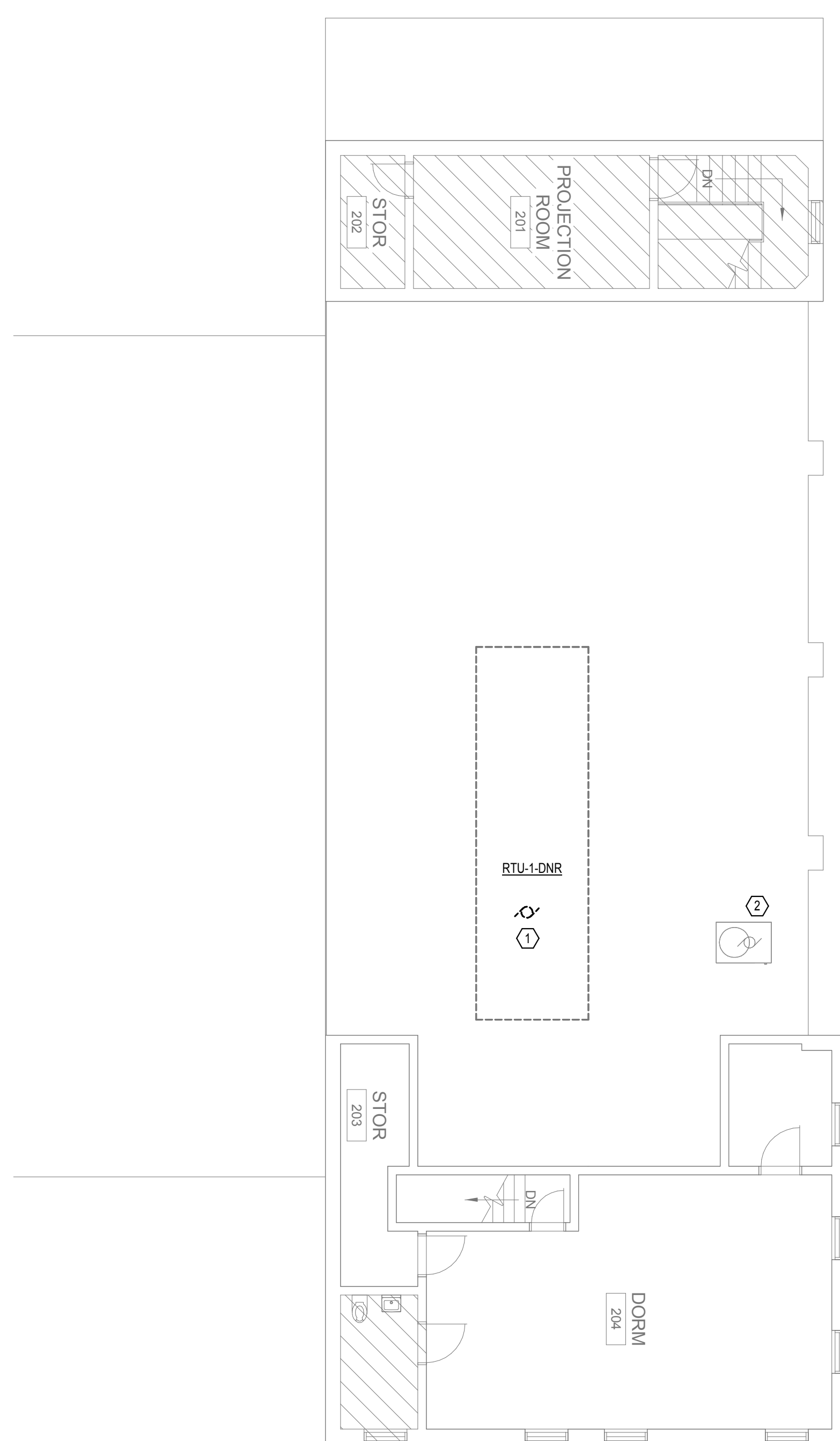
INDIANA STATE FAIRGROUNDS HVAC REPLACEMENTS  
INDIANA STATE FAIRGROUNDS  
1202 E. 38TH ST,  
INDIANAPOLIS, IN 46205

KEY PLAN  
NOT TO SCALE

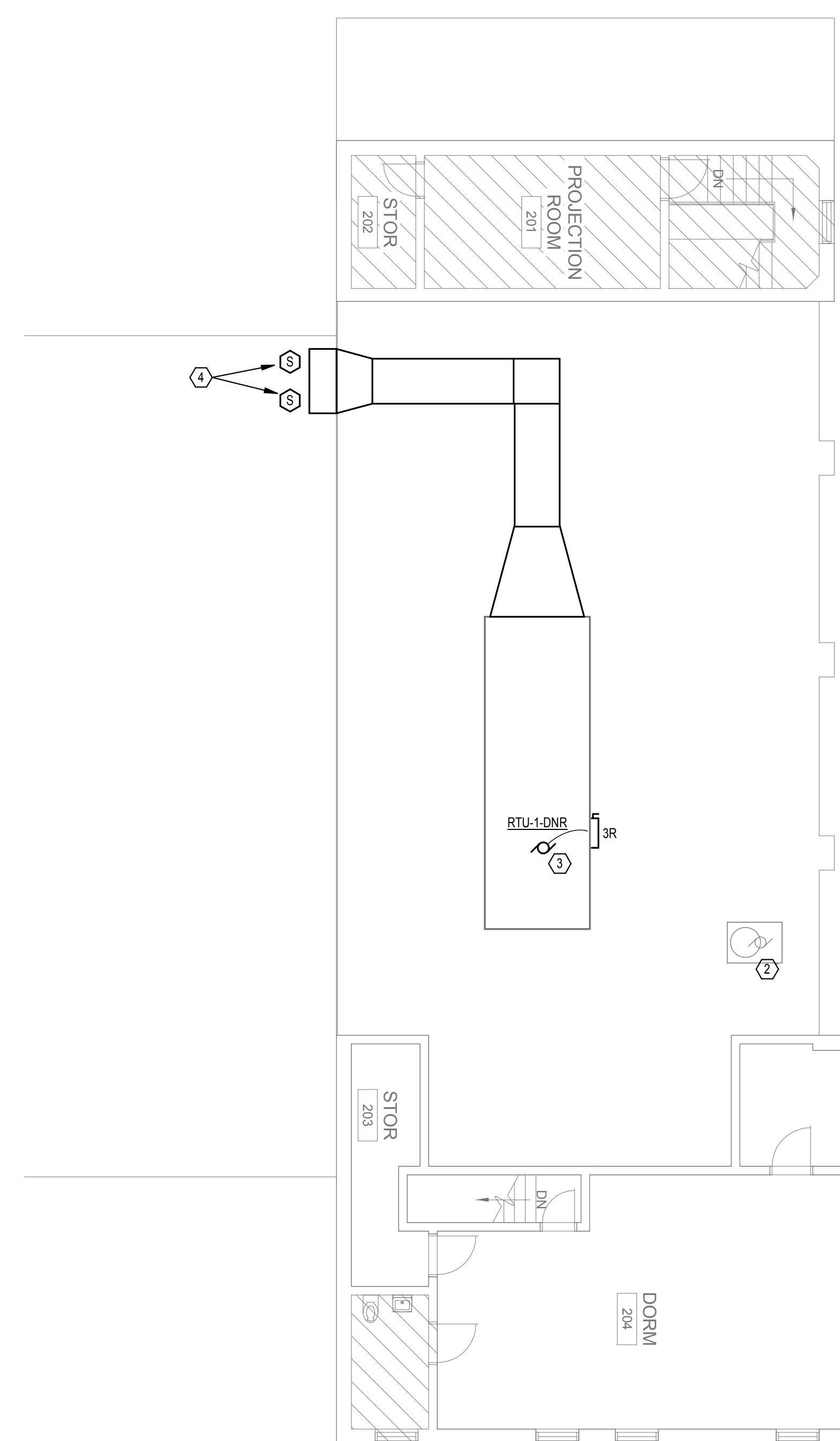


PLAN NOTES

- ASSIST THE HC IN REMOVING THE EXISTING EQUIPMENT BY REMOVING ELECTRIC POWER AND DISCONNECTING EXISTING ELECTRICAL CONNECTIONS.
- EXISTING EQUIPMENT TO REMAIN, NO NEW WORK.
- PROVIDE ALL NEW ELECTRICAL CONNECTION TO THE NEW RTU FOR A COMPLETE AND OPERATIONAL INSTALLATION. PROVIDE A NEW FEEDER FROM NEW NEMA 3R 400A/SP 208V/3PH DISCONNECT SW TO DISTRIBUTION PANEL WITH 3-#10 & 1-#6 GROUND IN 2.5" CONDUIT. COORDINATE EXACT EQUIPMENT LOCATIONS WITH HC PRIOR TO ROUNDING. CIRCUIT TO EQUIPMENT AND DESIGNATED 120/208V PANEL 225A/SP SPARE OR NEW CIRCUIT BREAKER. NEW BREAKER SHALL MATCH EXISTING PANEL MANUFACTURER, CLASS AND AIC RATINGS. EXISTING PANELBOARD/CIRCUIT DESIGNATIONS SHALL BE UPDATED.
- MINIMUM OF TWO SMOKE DETECTORS MOUNTED ON RETURN AIR GRILLE. COORDINATED WITH HC FOR DETECTOR SUPPORT STRUCTURE. SMOKE DETECTORS SHALL BE MOUNTED ON RED "FS" BACKBOXES WITH RED CONDUIT ROUTED TO EXISTING FIRE ALARM CONTROL PANEL. SMOKE DETECTORS SHALL BE 2% TYPE TO MATCH EXISTING FACP MANUFACTURER AND UL LISTING. ARRANGE ON GRILLE FOR EQUAL AND CODE COVERAGE PER NFPA 72.



2 DEPT. OF NATURE POWER SECOND FLOOR PLAN - DEMOLITION  
SCALE: 1/8" = 1'-0"



1 DEPT. OF NATURE POWER SECOND FLOOR PLAN - NEW WORK  
SCALE: 1/8" = 1'-0"

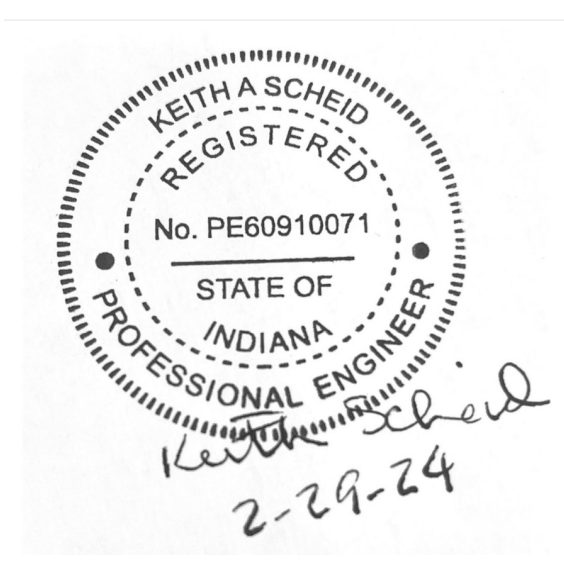
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SHEET TITLE  
DEPT. OF NATURE BLDG  
ELECTRICAL SECOND  
FLOOR PLAN

E107.2



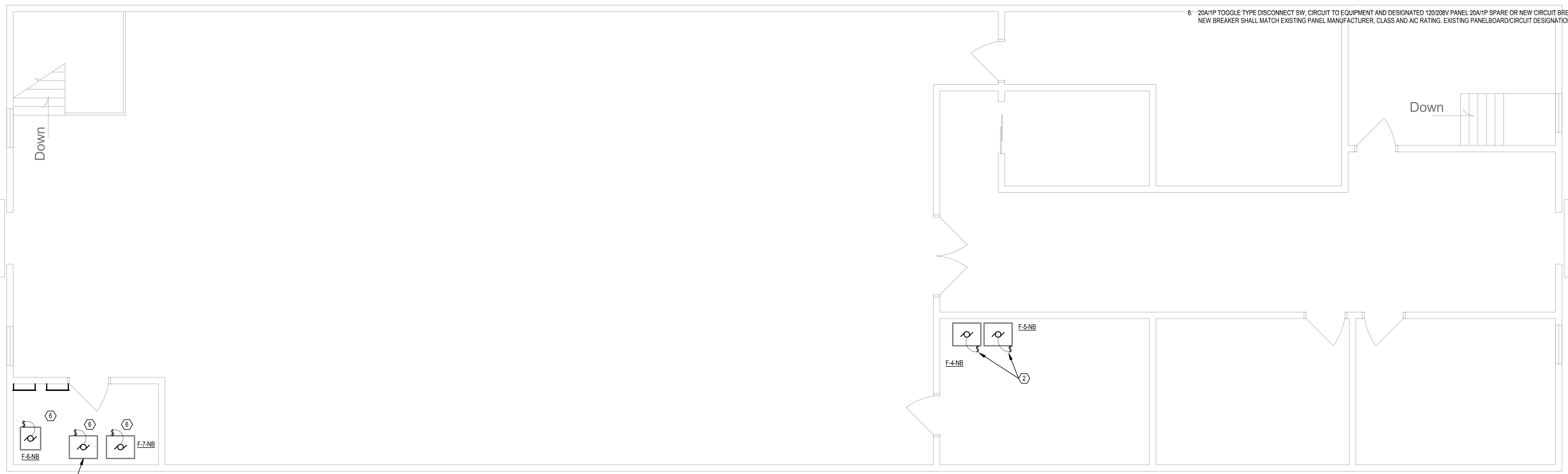
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**INDIANA STATE  
FAIRGROUNDS HVAC  
REPLACEMENTS**  
OWNER  
**INDIANA STATE  
FAIRGROUNDS  
1202 E. 38TH ST,  
INDIANAPOLIS, IN 46205**

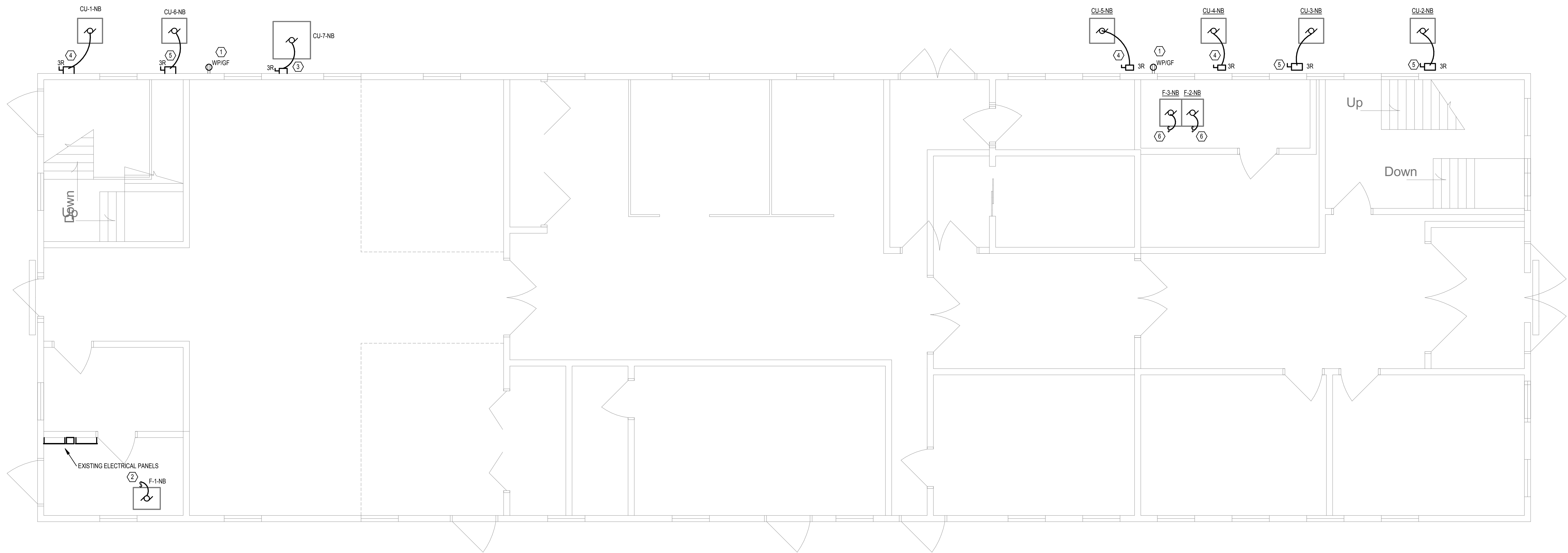
**PLAN NOTES**

1. CIRCUIT RECEPTACLE TO NEAREST 120/208V PANELBOARD 20A1P NEW OR SPARE EXISTING CIRCUIT BREAKER. NEW BREAKER SHALL MATCH EXISTING PANEL MANUFACTURER, CLASS AND IEC RATING. EXISTING PANELBOARD/CIRCUIT DESIGNATIONS SHALL BE UPDATED.
2. 20A1P TOGGLE TYPE DISCONNECT SW. CIRCUIT TO EQUIPMENT AND DESIGNATED 120/208V PANEL 15A1P SPARE OR NEW CIRCUIT BREAKER WITH 2-#12 GRD IN 75°C. NEW BREAKER SHALL MATCH EXISTING PANEL MANUFACTURER, CLASS AND IEC RATING. EXISTING PANELBOARD/CIRCUIT DESIGNATIONS SHALL BE UPDATED.
3. NEMA 3R 60A3P DISCONNECT SW. CIRCUIT TO EQUIPMENT AND DESIGNATED 120/208V PANEL 60A3P SPARE OR NEW CIRCUIT BREAKER WITH 3-#6 & 1-#10 GRD IN 1.0°C. NEW BREAKER SHALL MATCH EXISTING PANEL MANUFACTURER, CLASS AND IEC RATING. EXISTING PANELBOARD/CIRCUIT DESIGNATIONS SHALL BE UPDATED.
4. NEMA 3R 60A2P DISCONNECT SW. CIRCUIT TO EQUIPMENT AND DESIGNATED 120/208V PANEL 35A2P SPARE OR NEW CIRCUIT BREAKER WITH 2-#6 & 1-#10 GRD IN 75°C. NEW BREAKER SHALL MATCH EXISTING PANEL MANUFACTURER, CLASS AND IEC RATING. EXISTING PANELBOARD/CIRCUIT DESIGNATIONS SHALL BE UPDATED.
5. NEMA 3R 60A2P DISCONNECT SW. CIRCUIT TO EQUIPMENT AND DESIGNATED 120/208V PANEL 40A2P SPARE OR NEW CIRCUIT BREAKER WITH 2-#6 & 1-#10 GRD IN 75°C. NEW BREAKER SHALL MATCH EXISTING PANEL MANUFACTURER, CLASS AND IEC RATING. EXISTING PANELBOARD/CIRCUIT DESIGNATIONS SHALL BE UPDATED.
6. 20A1P TOGGLE TYPE DISCONNECT SW. CIRCUIT TO EQUIPMENT AND DESIGNATED 120/208V PANEL 20A1P SPARE OR NEW CIRCUIT BREAKER WITH 2-#12 & 1-#12 GRD IN 75°C. NEW BREAKER SHALL MATCH EXISTING PANEL MANUFACTURER, CLASS AND IEC RATING. EXISTING PANELBOARD/CIRCUIT DESIGNATIONS SHALL BE UPDATED.



**1 NORMANDY BARN POWER SECOND FLOOR PLAN - NEW WORK**

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

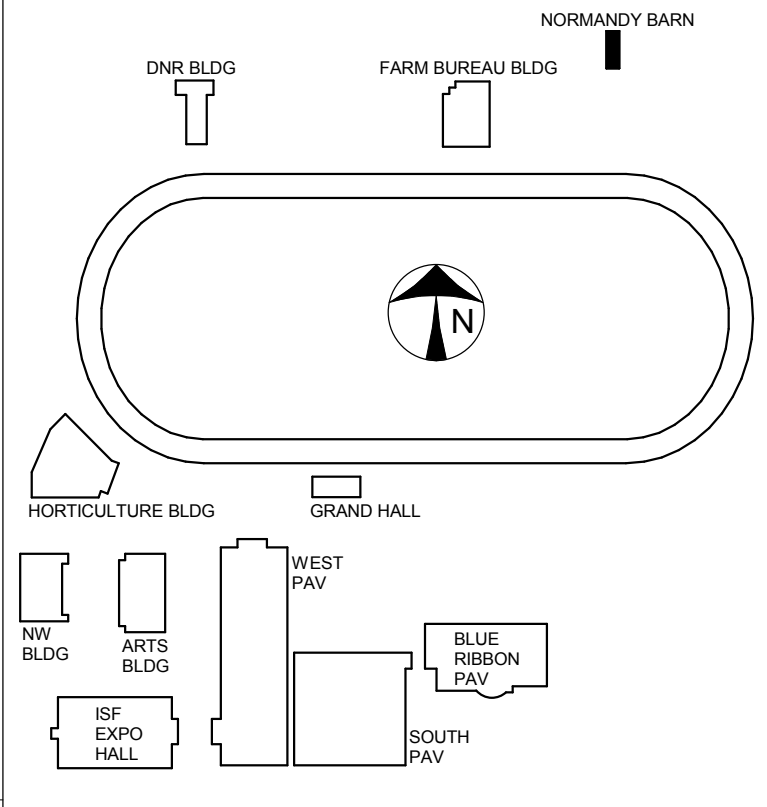


**2 NORMANDY BARN POWER FIRST FLOOR PLAN - NEW WORK**

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

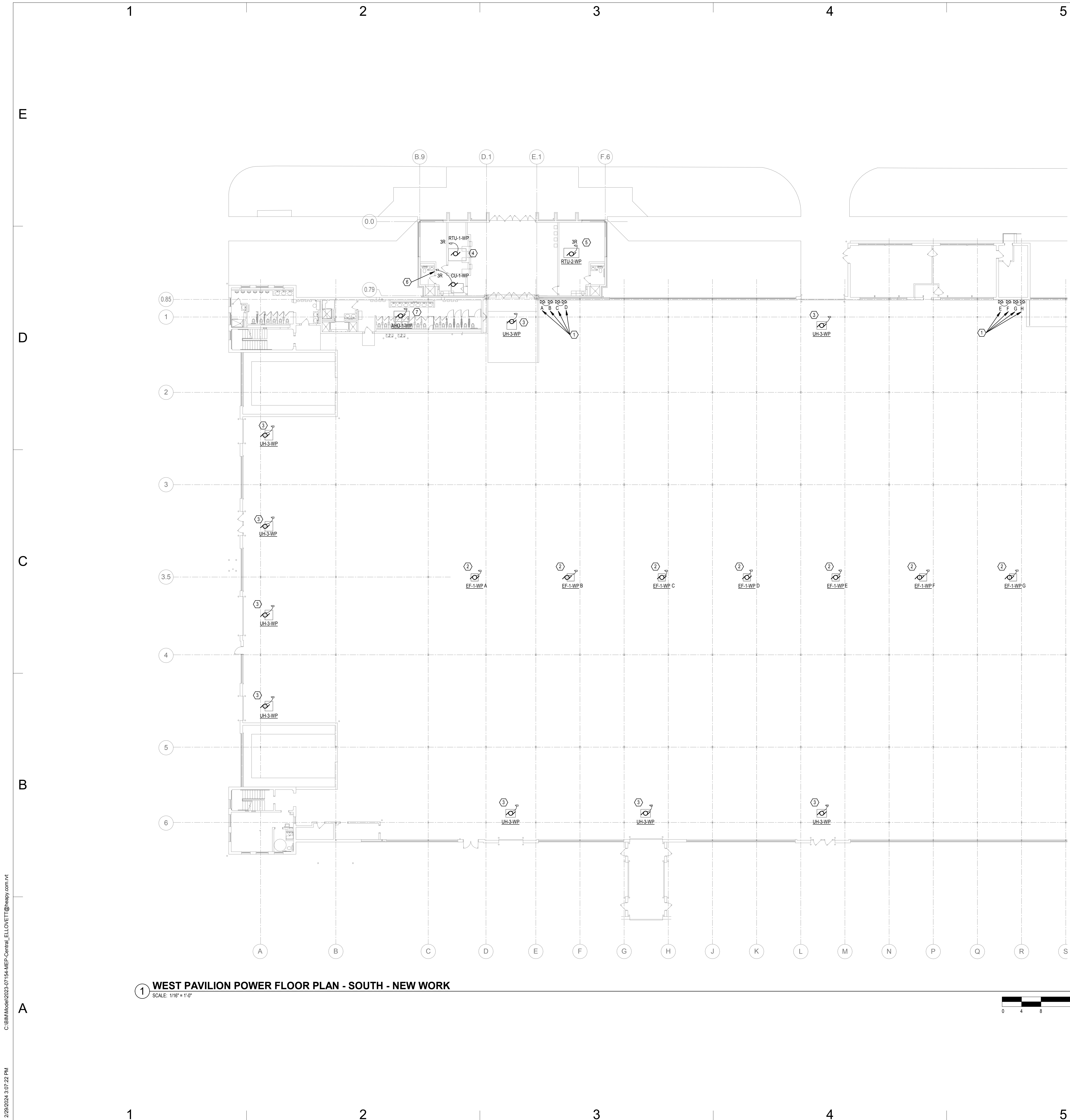


**KEY PLAN  
NOT TO SCALE**



MARK	DATE	DESCRIPTION

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<b>NORMANDY BARN ELECTRICAL FLOOR PLANS - NEW WORK</b>	
<b>E108</b>	

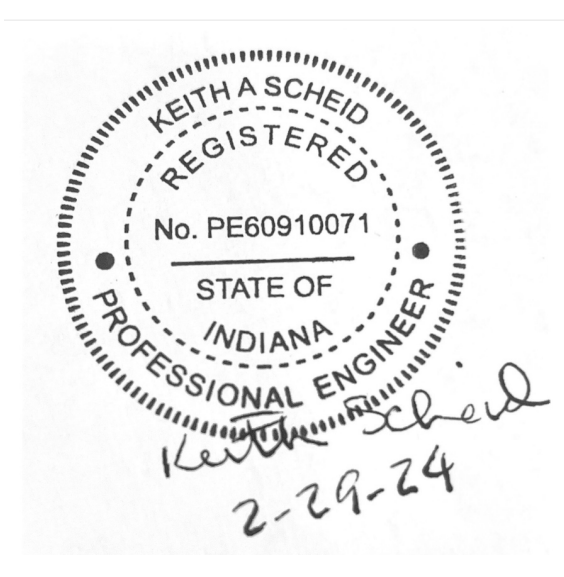


**PLAN NOTES**

1. 10 FUSIBLE MOTOR STARTER DISCONNECT SW (208V-3PH FUSED AT 15 A - LFN-RK) MOUNTED WHERE DIRECTED BY OWNER. (E-1) UNH. SERVES EXHAUST FANS AT ROOF. CONNECT TWO MOTOR STARTERS TOGETHER ON LINE SIDE AND CIRCUIT TO PANEL. 40A/3P CIRCUIT BREAKER WITH 3-#8 & 1-#10GRD-IN. 75°C. NEW BREAKER SHALL MATCH EXISTING PANEL MANUFACTURER, CLASS AND AIC RATING. PANELBOARD/CIRCUIT DESIGNATIONS SHALL BE UPDATED.
2. CIRCUIT EXHAUST FAN TO 10 MOTOR STARTER DISCONNECT SW WITH 3-#10 & 1-#10GRD-IN. 75°C.
3. CONNECT NEW 120V-1PH UNIT HEATER TO EXISTING PANEL AND CIRCUIT BREAKER SERVING EXISTING UNIT HEATER TO BE REMOVED WITH NEW 2-#10 & 1-#10GRD-IN EXISTING CONDUIT. REMOVE EXISTING WIRING.
4. EXISTING RTU WILL BE REPLACED WITH NEW RTU. ASSIST HC IN DEMOLITION. REMOVE POWER AND ELECTRICAL CONNECTIONS. INSTALL NEW ELECTRICAL CONNECTIONS. 60A/3P NEMA 3R FUSIBLE DISCONNECT SW (FUSED AT 60A - LFN-RK) AND RUN FEEDER (3-#10 & 1-#10GRD IN 1" O.D.) TO 30A/3P EXISTING OR NEW CIRCUIT BREAKER OR FUSIBLE SW (60A - LFN-RK FUSES) IN EXISTING ELECTRICAL PANELBOARD OR SWITCHBOARD. NEW BREAKER SHALL MATCH EXISTING PANEL MANUFACTURER, CLASS AND AIC RATING. PANELBOARD/CIRCUIT DESIGNATIONS SHALL BE UPDATED.
5. EXISTING RTU WILL BE REPLACED WITH NEW RTU. ASSIST HC IN DEMOLITION. REMOVE POWER AND ELECTRICAL CONNECTIONS. INSTALL NEW ELECTRICAL CONNECTIONS. 30A/3P NEMA 3R DISCONNECT SW AND RUN FEEDER (3-#8 & 1-#10GRD IN. 75° C) TO 30A/3P EXISTING OR NEW CIRCUIT BREAKER OR FUSIBLE SW (30A - LFN-RK FUSES) IN EXISTING ELECTRICAL PANELBOARD OR SWITCHBOARD. NEW BREAKER SHALL MATCH EXISTING PANEL MANUFACTURER, CLASS AND AIC RATING. PANELBOARD/CIRCUIT DESIGNATIONS SHALL BE UPDATED.
6. NEW CONDENSING UNIT. INSTALL NEW ELECTRICAL CONNECTIONS. 30A/3P NEMA 3R DISCONNECT SW MOUNTED ON UNISTRUT SUPPORT ATTACHED TO ROOF STRUCTURE THROUGH ROOF PITCH POCKET OR OTHER APPROVED MEANS BY ROOF CONTRACTOR. AND RUN FEEDER (3-#10 & 1-#10GRD IN 1" O.D.) TO 30A/3P EXISTING OR NEW CIRCUIT BREAKER OR 30A/3P FUSIBLE SW (30A - LFN-RK FUSES) IN EXISTING ELECTRICAL PANELBOARD OR SWITCHBOARD. NEW BREAKER SHALL MATCH EXISTING PANEL MANUFACTURER, CLASS AND AIC RATING. PANELBOARD/CIRCUIT DESIGNATIONS SHALL BE UPDATED. MAKE ELECTRICAL CONNECTIONS TO 250W ELECTRIC HEATING UNIT FROM AHU POWER INPUT.
7. EXISTING AHU WILL BE REPLACED WITH NEW AHU. ASSIST HC IN DEMOLITION. REMOVE POWER AND ELECTRICAL CONNECTIONS. INSTALL NEW ELECTRICAL CONNECTIONS. 100A/3P DISCONNECT SW AND RUN FEEDER (3-#2 & 1-#8GRD IN 1.25" O.D.) TO 100A/3P EXISTING OR NEW CIRCUIT BREAKER OR 100A/3P FUSIBLE SW (100A - LFN-RK FUSES) IN EXISTING ELECTRICAL PANELBOARD OR SWITCHBOARD. NEW BREAKER SHALL MATCH EXISTING PANEL MANUFACTURER, CLASS AND AIC RATING. PANELBOARD/CIRCUIT DESIGNATIONS SHALL BE UPDATED.

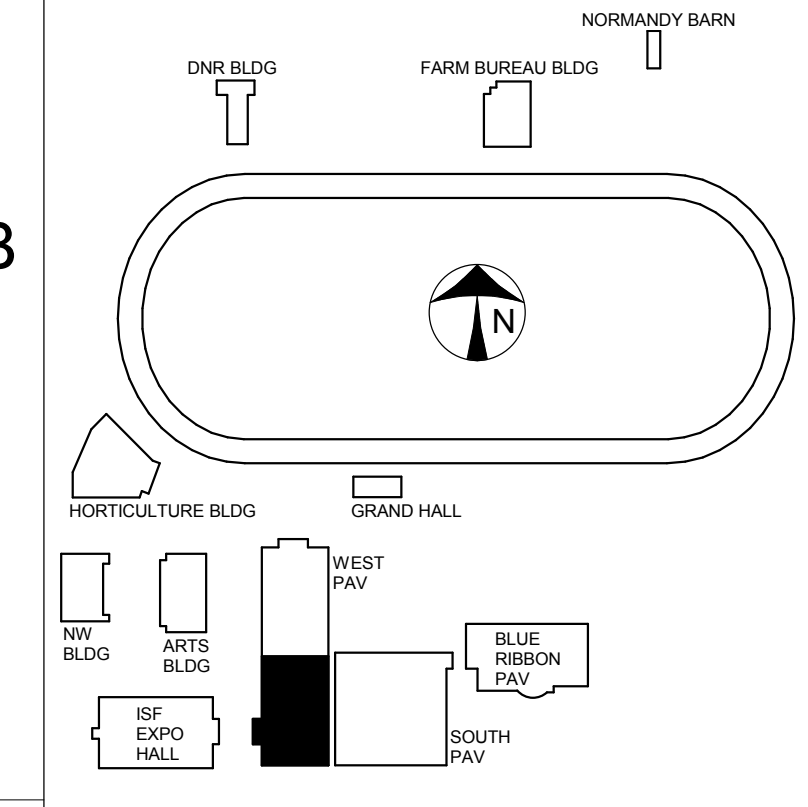


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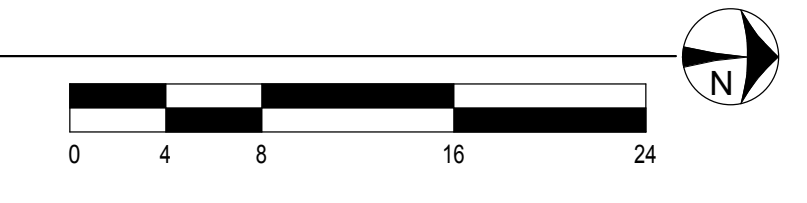


**INDIANA STATE FAIRGROUNDS HVAC REPLACEMENTS**  
 OWNER  
**INDIANA STATE FAIRGROUNDS**  
 1202 E. 38TH ST,  
 INDIANAPOLIS, IN 46205

**KEY PLAN NOT TO SCALE**



**1 WEST PAVILION POWER FLOOR PLAN - SOUTH - NEW WORK**  
 SCALE: 1/16" = 1'-0"



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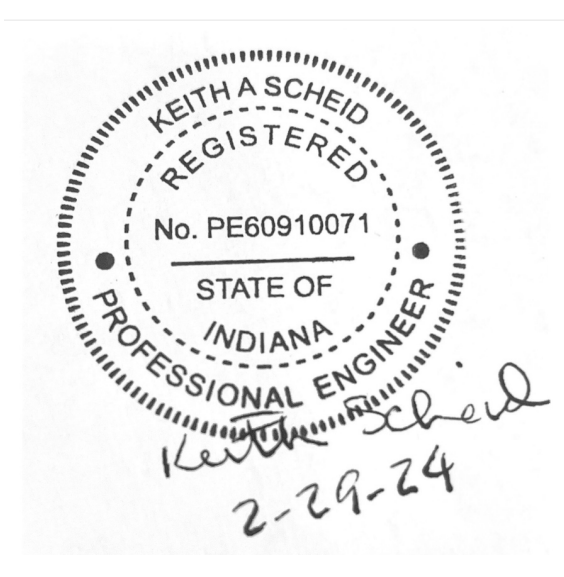
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 E109.1



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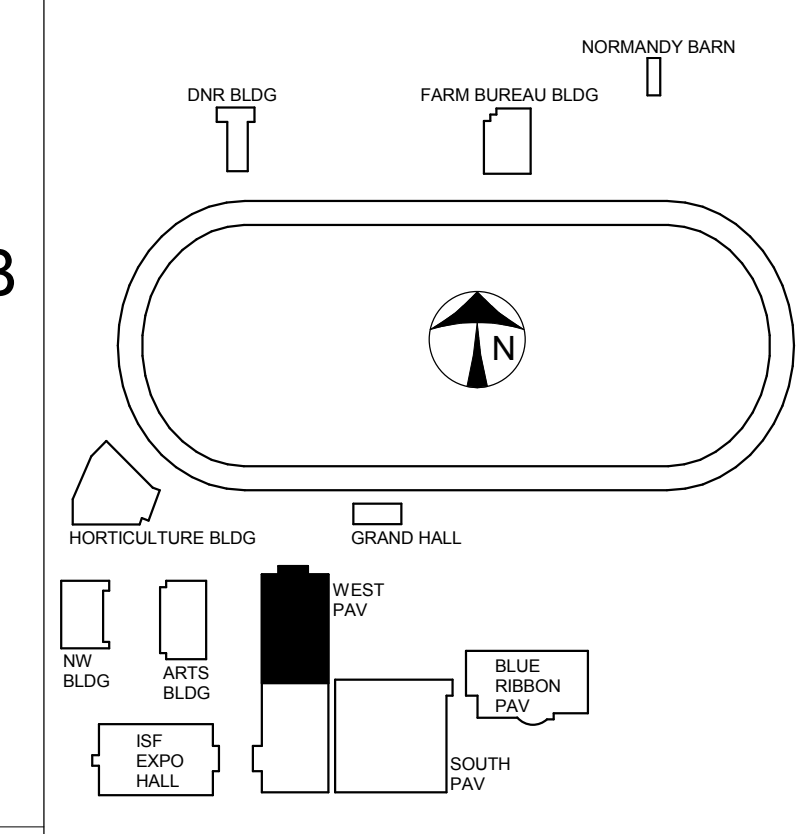
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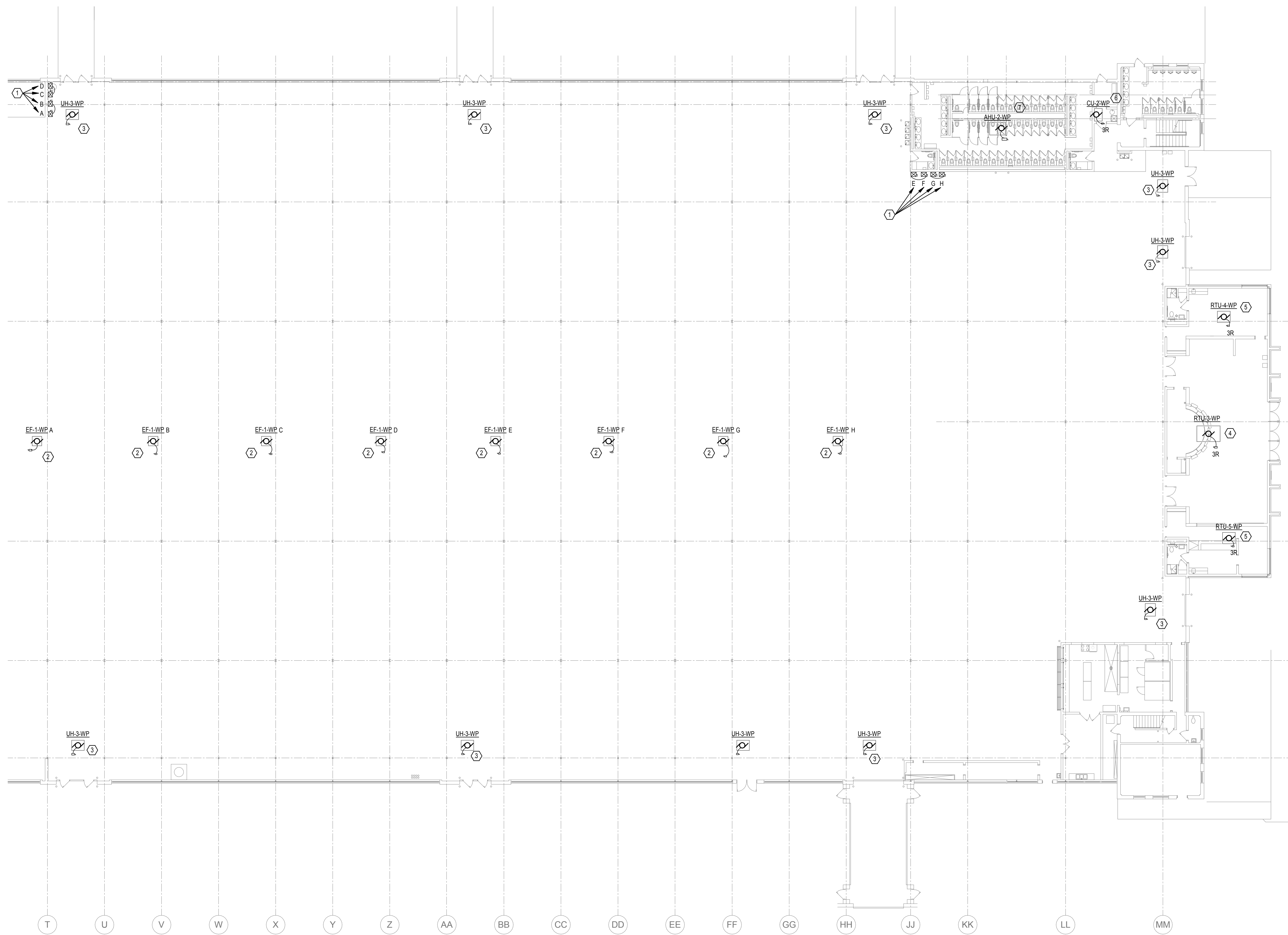
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INDIANA STATE  
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INDIANAPOLIS, IN 46205

**KEY PLAN**  
NOT TO SCALE

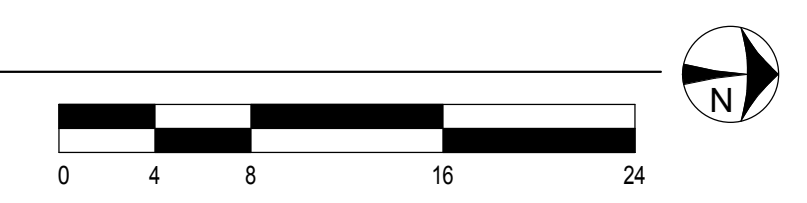


**PLAN NOTES**

- 10 FUSIBLE MOTOR STARTER DISCONNECT SW (200V-3PH FUSED AT 15 A - LPN-RK) MOUNTED WHERE DIRECTED BY OWNER. (5' 0" MIN). SERVES EXHAUST FANS AT ROOF. CONNECT TWO MOTOR STARTERS TOGETHER ON LINE SIDE AND CIRCUIT TO PANEL 40A3P CIRCUIT BREAKER WITH 3-A8 & 1-#10GRD-IN 75°C. NEW BREAKER SHALL MATCH EXISTING PANEL MANUFACTURER, CLASS AND AIC RATING. PANELBOARD/CIRCUIT DESIGNATIONS SHALL BE UPDATED.
- CIRCUIT EXHAUST FAN TO 10 MOTOR STARTER DISCONNECT SW WITH 3-#10 & 1-#10GRD-IN 75°C.
- CONNECT NEW 120V-1PH UNIT HEATER TO EXISTING PANEL AND CIRCUIT BREAKER SERVING EXISTING UNIT HEATER TO BE REMOVED WITH NEW 2-#10 & 1-#10GRD-IN EXISTING CONDUIT. REMOVE EXISTING WIRING.
- EXISTING RTU WILL BE REPLACED WITH NEW RTU. ASSIST HC IN DEMOLITION. REMOVE POWER AND ELECTRICAL CONNECTIONS. INSTALL NEW ELECTRICAL CONNECTIONS. 100A2P NEMA 3R DISCONNECT SW AND RUN FEEDER (3-#4 & 1-#6GRD IN 1.25" O.D.) TO 80A3P EXISTING OR NEW CIRCUIT BREAKER OR FUSIBLE SW (80A - LPN-RK FUSES) IN EXISTING ELECTRICAL PANELBOARD OR SWITCHBOARD. NEW BREAKER SHALL MATCH EXISTING PANEL MANUFACTURER, CLASS AND AIC RATING. PANELBOARD/CIRCUIT DESIGNATIONS SHALL BE UPDATED.
- EXISTING RTU WILL BE REPLACED WITH NEW RTU. ASSIST HC IN DEMOLITION. REMOVE POWER AND ELECTRICAL CONNECTIONS. INSTALL NEW ELECTRICAL CONNECTIONS. 30A3P NEMA 3R DISCONNECT SW AND RUN FEEDER (2-#6 & 1-#10GRD IN 75° C) TO 25A2P EXISTING OR NEW CIRCUIT BREAKER OR FUSIBLE SW (25A - LPN-RK FUSES) IN EXISTING ELECTRICAL PANELBOARD OR SWITCHBOARD. NEW BREAKER SHALL MATCH EXISTING PANEL MANUFACTURER, CLASS AND AIC RATING. PANELBOARD/CIRCUIT DESIGNATIONS SHALL BE UPDATED.
- NEW CONDENSING UNIT. INSTALL NEW ELECTRICAL CONNECTIONS. 60A3P NEMA 3R DISCONNECT SW MOUNTED ON UNISTRUT SUPPORT ATTACHED TO ROOF STRUCTURE THROUGH ROOF PITCH POCKET OR OTHER APPROVED MEANS BY ROOF CONTRACTOR, AND RUN FEEDER (3-#6 & 1-#10GRD IN 1.0" O.D.) TO 60A3P EXISTING OR NEW CIRCUIT BREAKER OR 60A3P FUSIBLE SW (60A - LPN-RK FUSES) IN EXISTING ELECTRICAL PANELBOARD OR SWITCHBOARD. NEW BREAKER SHALL MATCH EXISTING PANEL MANUFACTURER, CLASS AND AIC RATING. PANELBOARD/CIRCUIT DESIGNATIONS SHALL BE UPDATED.
- EXISTING AHU WILL BE REPLACED WITH NEW AHU. ASSIST HC IN DEMOLITION. REMOVE POWER AND ELECTRICAL CONNECTIONS. INSTALL NEW ELECTRICAL CONNECTIONS. 200A3P DISCONNECT SW AND RUN FEEDER (3-#4 & 1-#6GRD IN 1.25" O.D.) TO 110A3P EXISTING OR NEW CIRCUIT BREAKER OR 200A3P FUSIBLE SW (110A - LPN-RK FUSES) IN EXISTING ELECTRICAL PANELBOARD OR SWITCHBOARD. NEW BREAKER SHALL MATCH EXISTING PANEL MANUFACTURER, CLASS AND AIC RATING. PANELBOARD/CIRCUIT DESIGNATIONS SHALL BE UPDATED. MAKE ELECTRICAL CONNECTIONS TO SERW ELECTRIC HEATING UNIT FROM AHU POWER INPUT.



**1 WEST PAVILION POWER FLOOR PLAN - NORTH - NEW WORK**  
SCALE: 1/16" = 1'-0"



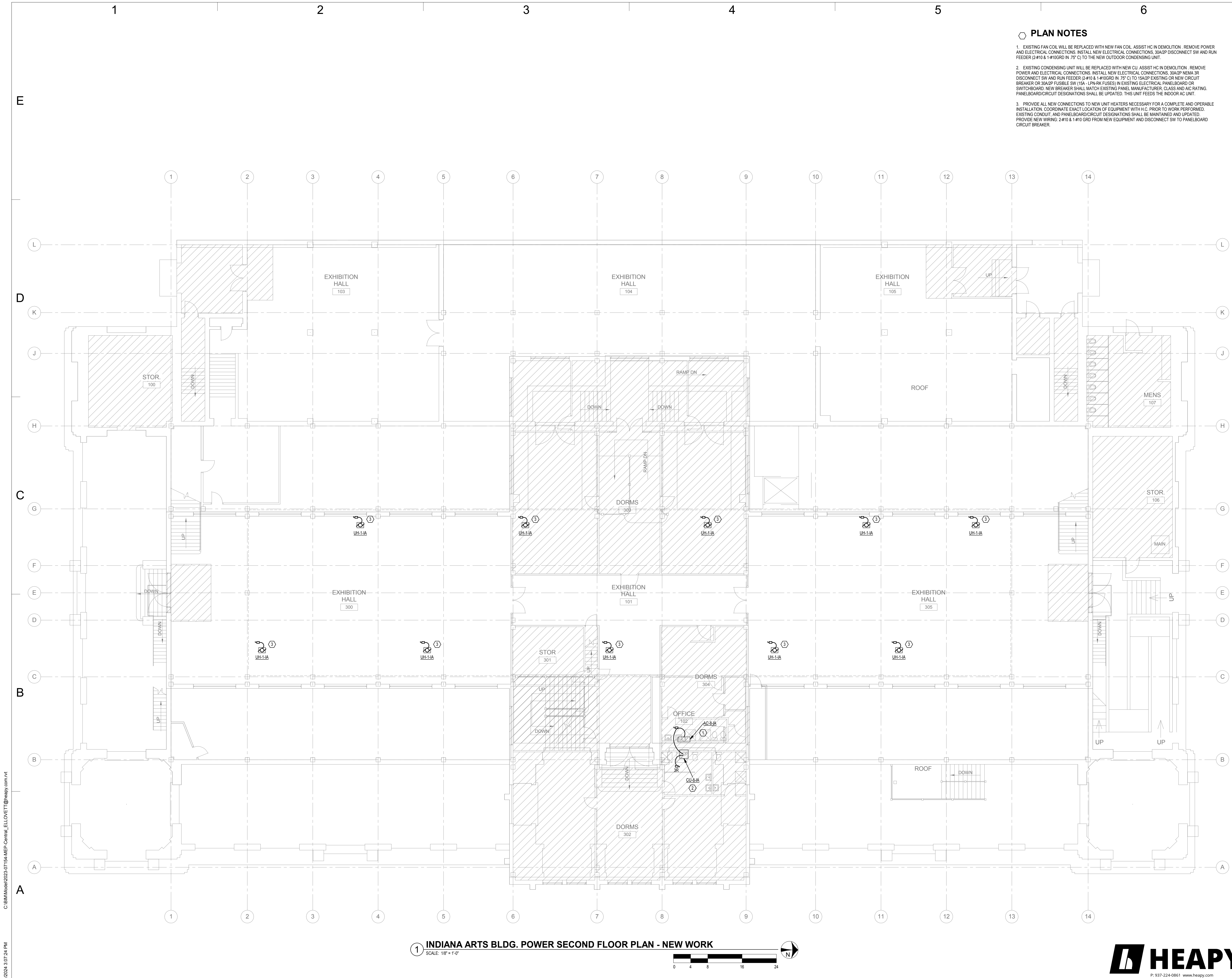
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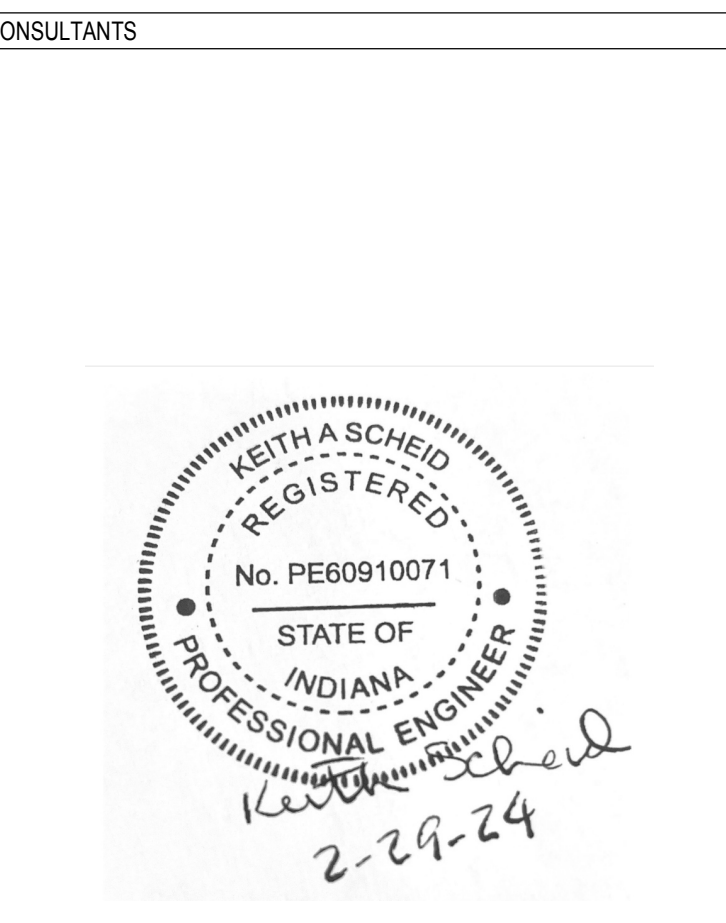
SHEET TITLE  
**WEST PAVILION FLOOR PLAN - NORTH**

E109.2



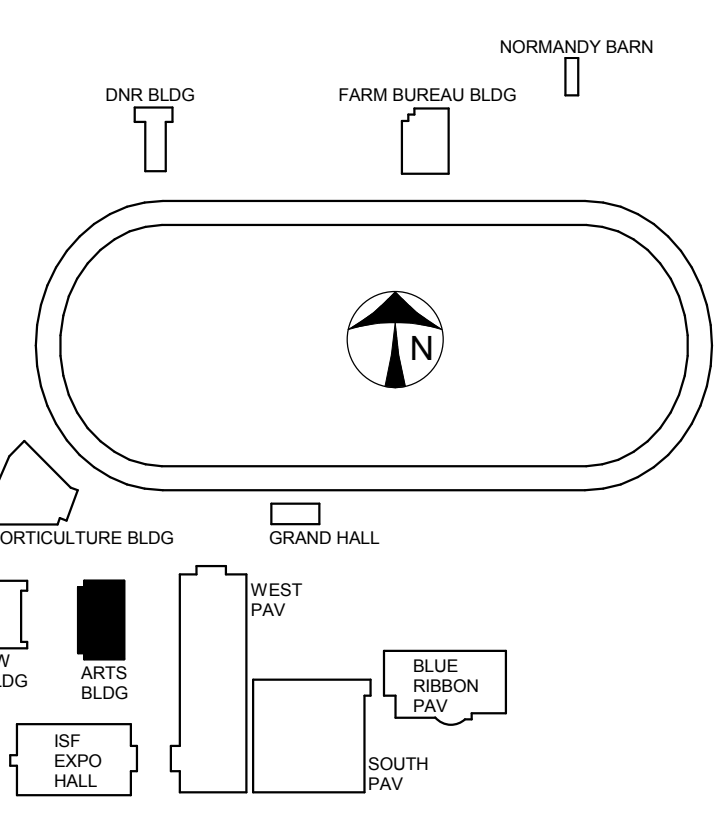


- PLAN NOTES**
- EXISTING FAN COIL WILL BE REPLACED WITH NEW FAN COIL. ASSIST HC IN DEMOLITION. REMOVE POWER AND ELECTRICAL CONNECTIONS. INSTALL NEW ELECTRICAL CONNECTIONS. 30A2P DISCONNECT SW AND RUN FEEDER (2#10 & 1#10GRD IN 75° C) TO THE NEW OUTDOOR CONDENSING UNIT.
  - EXISTING CONDENSING UNIT WILL BE REPLACED WITH NEW CU. ASSIST HC IN DEMOLITION. REMOVE POWER AND ELECTRICAL CONNECTIONS. INSTALL NEW ELECTRICAL CONNECTIONS. 30A2P NEMA 3R DISCONNECT SW AND RUN FEEDER (2#10 & 1#10GRD IN 75° C) TO 15A2P EXISTING OR NEW CIRCUIT BREAKER OR 30A2P FUSIBLE SW (15A - LPN/RK FUSES) IN EXISTING ELECTRICAL PANELBOARD OR SWITCHBOARD. NEW BREAKER SHALL MATCH EXISTING PANEL MANUFACTURER, CLASS AND AIC RATING. PANELBOARD/CIRCUIT DESIGNATIONS SHALL BE UPDATED. THIS UNIT FEEDS THE INDOOR AC UNIT.
  - PROVIDE ALL NEW CONNECTIONS TO NEW UNIT HEATERS NECESSARY FOR A COMPLETE AND OPERABLE INSTALLATION. COORDINATE EXACT LOCATION OF EQUIPMENT WITH H.C. PRIOR TO WORK PERFORMED. EXISTING CONDUIT AND PANELBOARD/CIRCUIT DESIGNATIONS SHALL BE MAINTAINED AND UPDATED. PROVIDE NEW WIRING: 2#10 & 1#10 GRD FROM NEW EQUIPMENT AND DISCONNECT SW TO PANELBOARD CIRCUIT BREAKER.



INDIANA STATE FAIRGROUNDS HVAC REPLACEMENTS  
 OWNER: INDIANA STATE FAIRGROUNDS  
 1202 E. 38TH ST,  
 INDIANAPOLIS, IN 46205

**KEY PLAN  
 NOT TO SCALE**



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CHKD BY:	GLC	
PROJECT STATUS:	FOR PERMIT	
ISSUE DATE:	02/29/2024	
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SHEET TITLE  
**INDIANA ARTS BUILDING  
 ELECTRICAL SECOND  
 FLOOR PLAN - NEW  
 WORK** E110.1

**INDIANA ARTS BLDG. POWER SECOND FLOOR PLAN - NEW WORK**  
 SCALE: 1/8" = 1'-0"  
 0 4 8 16 24



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 PROJECT NO. 2023-07154

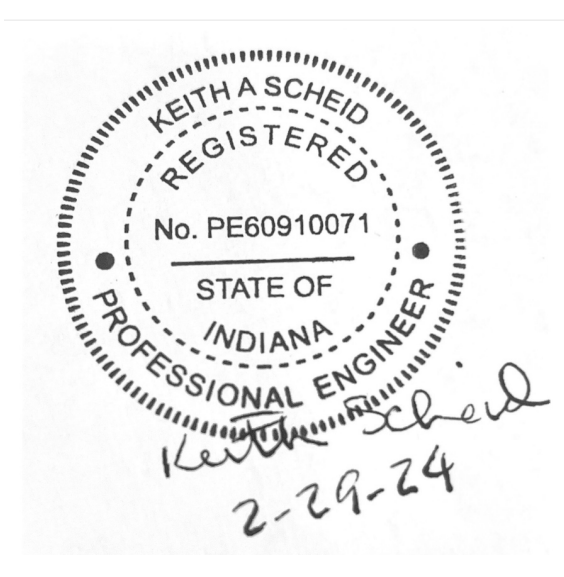


**PLAN NOTES**

1. EXISTING FAN COIL WILL BE REPLACED WITH NEW FAN COIL. ASSIST HC IN DEMOLITION. REMOVE POWER AND ELECTRICAL CONNECTIONS. INSTALL NEW ELECTRICAL CONNECTIONS. 30A/2P DISCONNECT SW AND RUN FEEDER (2-#10 GRD IN 75°C) TO 15A/2P EXISTING OR NEW CIRCUIT BREAKER OR 30A/2P FUSIBLE SW (35A - LFN-RK FUSES) IN EXISTING ELECTRICAL PANELBOARD OR SWITCHBOARD. NEW BREAKER SHALL MATCH EXISTING PANEL MANUFACTURER, CLASS AND AIC RATING. PANELBOARD/CIRCUIT DESIGNATIONS SHALL BE UPDATED.
2. EXISTING CONDENSING UNIT WILL BE REPLACED WITH NEW CU. ASSIST HC IN DEMOLITION. REMOVE POWER AND ELECTRICAL CONNECTIONS. INSTALL NEW ELECTRICAL CONNECTIONS. 30A/2P NEMA 3R DISCONNECT SW MOUNTED ON UNISTRUT SUPPORT ATTACHED TO ROOF STRUCTURE THROUGH ROOF PITCH POCKET OR OTHER APPROVED MEANS BY ROOF CONTRACTOR, AND RUN FEEDER (2-#8 & 1-#10GRD IN 75°C) TO 35A/2P EXISTING OR NEW CIRCUIT BREAKER OR 60A/2P FUSIBLE SW (35A - LFN-RK FUSES) IN EXISTING ELECTRICAL PANELBOARD OR SWITCHBOARD. NEW BREAKER SHALL MATCH EXISTING PANEL MANUFACTURER, CLASS AND AIC RATING. PANELBOARD/CIRCUIT DESIGNATIONS SHALL BE UPDATED.
3. EXISTING FAN COIL WILL BE REPLACED WITH NEW FAN COIL. ASSIST HC IN DEMOLITION. REMOVE POWER AND ELECTRICAL CONNECTIONS. INSTALL NEW ELECTRICAL CONNECTIONS. 30A/2P DISCONNECT SW AND RUN FEEDER (2-#10 & 1-#10GRD IN 75°C) TO UNIT #CU-5-1A TERMINAL BLOCK.
4. EXISTING CONDENSING UNIT WILL BE REPLACED WITH NEW CU. ASSIST HC IN DEMOLITION. REMOVE POWER AND ELECTRICAL CONNECTIONS. INSTALL NEW ELECTRICAL CONNECTIONS. 208V/1PH 30A/2P NEMA 3R DISCONNECT SW MOUNTED ON UNISTRUT SUPPORT ATTACHED TO ROOF STRUCTURE THROUGH ROOF PITCH POCKET OR OTHER APPROVED MEANS BY ROOF CONTRACTOR, AND RUN FEEDER (2-#8 & 1-#10GRD IN 75°C) TO 30A/2P EXISTING OR NEW CIRCUIT BREAKER OR 30A/2P FUSIBLE SW (30A - LFN-RK FUSES) IN EXISTING ELECTRICAL PANELBOARD OR SWITCHBOARD. NEW BREAKER SHALL MATCH EXISTING PANEL MANUFACTURER, CLASS AND AIC RATING. PANELBOARD/CIRCUIT DESIGNATIONS SHALL BE UPDATED. THIS CONDENSING UNIT SUB-FEEDS TWO FAN COIL UNITS #AC-5-1A.

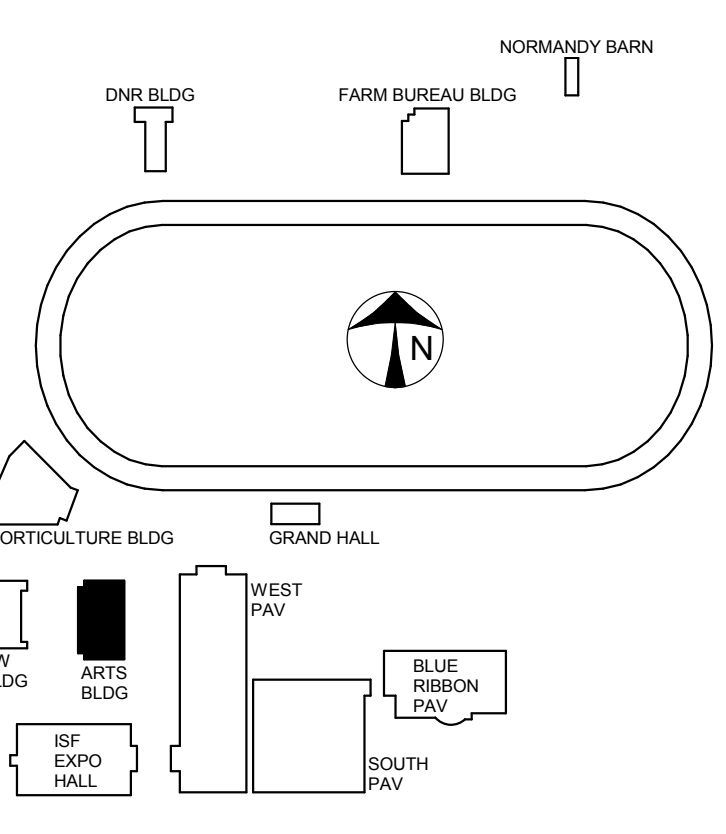


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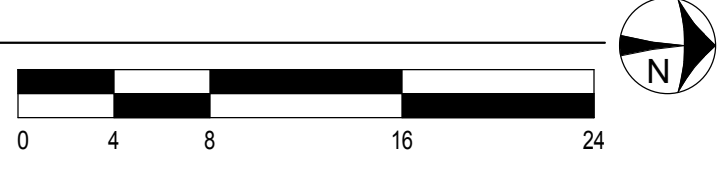


INDIANA STATE FAIRGROUNDS HVAC REPLACEMENTS  
 OWNER  
 INDIANA STATE FAIRGROUNDS  
 1202 E. 38TH ST,  
 INDIANAPOLIS, IN 46205

**KEY PLAN NOT TO SCALE**



**INDIANA ARTS BLDG. POWER THIRD FLOOR PLAN - NEW WORK**  
 SCALE: 1/8" = 1'-0"



MARK	DATE	DESCRIPTION

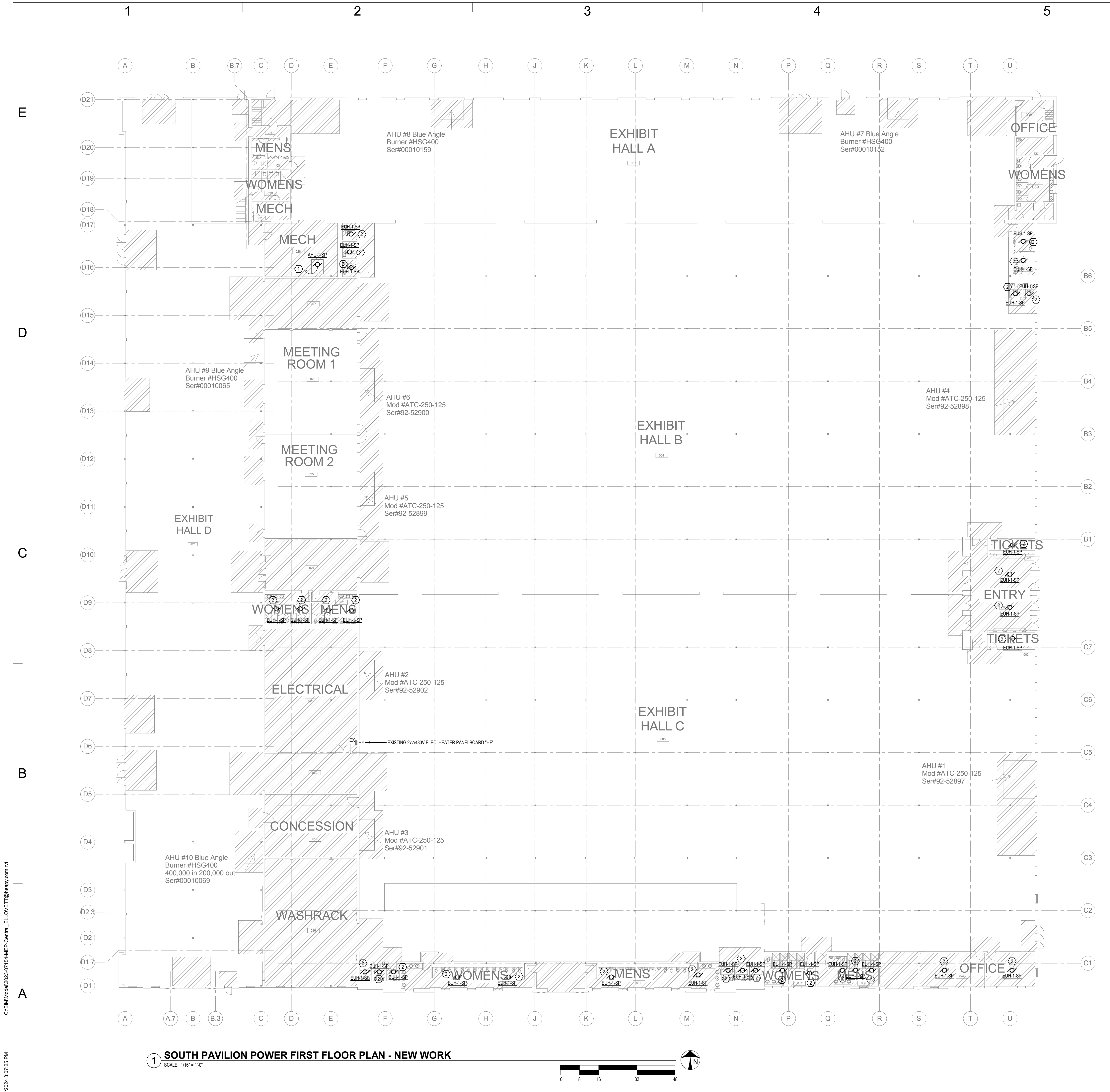
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SHEET TITLE  
**INDIANA ARTS BLDG. ELECTRIC THIRD FLOOR PLAN**  
 E110.2



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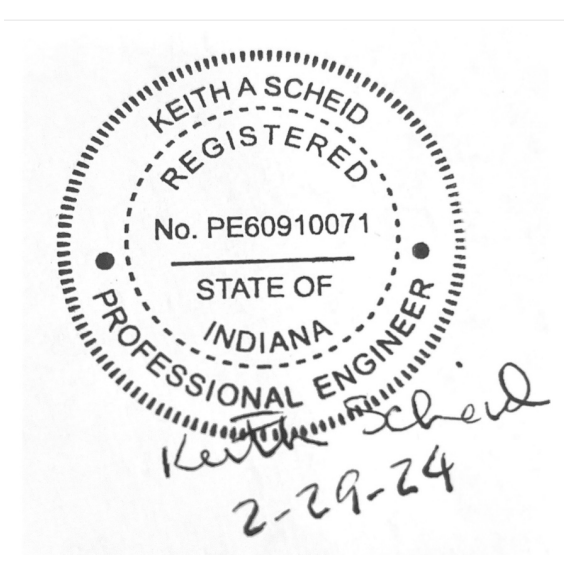
**PLAN NOTES**

1. EXISTING AIR HANDLING UNIT WILL BE REPLACED WITH NEW AHU ASSIST HC IN DEMOLITION. REMOVE POWER AND ELECTRICAL CONNECTIONS. INSTALL NEW 480V/3PH ELECTRICAL CONNECTIONS. 30A/3P DISCONNECT SW AND RUN FEEDER (3-#10 & 1-#10GRD IN 7" CI) TO 20A/3P EXISTING OR NEW CIRCUIT BREAKER IN EXISTING ELECTRICAL PANELBOARD. NEW BREAKER SHALL MATCH EXISTING PANEL MANUFACTURER, CLASS AND AIC RATING. PANELBOARD/CIRCUIT DESIGNATIONS SHALL BE UPDATED.

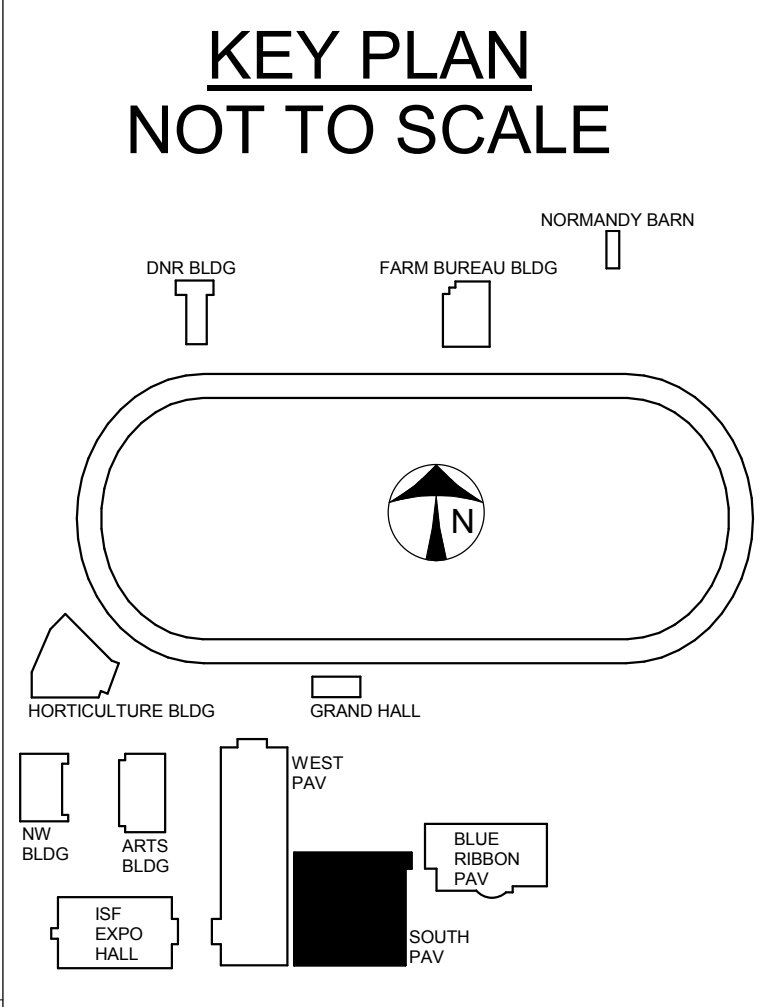
2. EXISTING ELECTRIC UNIT HEATER WILL BE REPLACED WITH NEW E.U.H. ASSIST HC IN DEMOLITION. REMOVE POWER AND ELECTRICAL CONNECTIONS. INSTALL NEW 277V/1PH ELECTRICAL CONNECTIONS AND RUN FEEDER (2-#10 & 1-#10GRD IN 7" CI) TO 20A/1P EXISTING OR NEW CIRCUIT BREAKER IN EXISTING ELECTRICAL PANELBOARD. NEW BREAKER SHALL MATCH EXISTING PANEL MANUFACTURER, CLASS AND AIC RATING. PANELBOARD/CIRCUIT DESIGNATIONS SHALL BE UPDATED.



CONSULTANTS



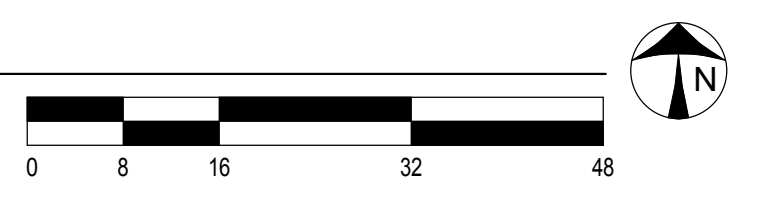
INDIANA STATE FAIRGROUNDS HVAC REPLACEMENTS  
 OWNER  
 INDIANA STATE FAIRGROUNDS  
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SHEET TITLE  
**SOUTH PAVILION – NEW WORK**  
 E111

**1 SOUTH PAVILION POWER FIRST FLOOR PLAN - NEW WORK**  
 SCALE: 1/16" = 1'-0"



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